

# Neurodevelopmental versus Functional Tics: The State of the Art

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## Abstract

Tic disorders of neurodevelopmental origin are the most common hyperkinetic disorder in childhood. In cases where both multiple motor tics and at least one vocal tic are present, with a chronic course, a diagnosis of Tourette syndrome can be confirmed. Functional movement disorders are a common type of functional neurological disorder, which has previously been referred to as hysteria and conversion, among other diagnostic labels. Functional tics have long been considered a rarer phenotype of functional movement disorder, compared to functional tremor or functional dystonia. However, during the COVID-19 pandemic, there have been multiple reports worldwide of an unexpected increase in the number of adolescents and young adults presenting with acute-onset functional tics. The differential diagnosis between neurodevelopmental and functional tics can be challenging, but a few demographic and clinical features have proven useful in assisting clinicians. Neurodevelopmental tics present with the gradual onset of simple motor and vocal tics in a rostrocaudal evolution, starting in early childhood, more commonly in boys. Conversely, functional tics often have an abrupt and explosive presentation of severe symptoms, with a later age of onset and a female gender predominance. Moreover, it has been reported that a proportion of patients with functional tics developed their symptoms after being exposed to social media content of influencers displaying similar manifestations. The etiology of the recent “pandemic within the pandemic” is likely to be multifactorial, with increased exposure to social media possibly playing a role alongside the psychosocial impact caused by the COVID-19 pandemic.

**Keywords:** Functional neurological disorder, functional tics, neurodevelopmental tics, tic disorders, tics, Tourette syndrome

## NEURODEVELOPMENTAL TICS AND TIC DISORDERS

Tic disorders are the most common hyperkinetic disorder in childhood, with transient tics affecting up to 3% of children, and chronic tic disorders such as Tourette syndrome (TS) affecting up to 1% of children worldwide.<sup>[1-3]</sup> In the current version of the classification system developed by the American Psychiatric Association (DSM-5-TR), tics are defined as sudden, repetitive, nonrhythmic movements (motor tics) or vocalizations (vocal tics).<sup>[4]</sup> Tic disorders are classified within the neurodevelopmental disorder category, as hyperkinetic manifestations of neurodevelopmental origin. The distinction between motor and vocal tics is somewhat arbitrary, as vocal tics are also generated by movements (e.g., diaphragm contractions) accompanied by the emission of sounds. Moreover, it has been argued that vocal tics should be more appropriately referred to as phonic tics, because the vocal cords are not

involved in all tics that produce sound by moving air through the nose, mouth, or throat.<sup>[5,6]</sup>

Motor tics of neurodevelopmental origin can be either simple or complex, according to the involvement of single or multiple muscular districts.<sup>[5,6]</sup> The most commonly reported simple motor tics include eye blinking, facial grimacing, mouth movements, neck stretching, and shoulder shrugging. Complex motor tics are less common and include palipraxia (repeating own gestures), echopraxia (mirroring others' gestures), and

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copropraxia (rude gestures as tics), among other complex movements. Vocal tics of neurodevelopmental origin can also be either simple (sounds) or complex (words). Examples of commonly reported simple vocal tics include grunting, sniffing, coughing, and throat clearing. Complex vocal tics can include palilalia (repeating own words), echolalia (repeating others' words), and coprolalia (swear words as tics), as well as random words or socially inappropriate sentences. The prevalence of coprolalia can be as low as 10% in the general community (or 30% in specialist clinics), despite its disproportionate over-representation in popular culture.<sup>[7]</sup>

The onset of neurodevelopmental tics is typical during childhood (on average, between 4 and 7 years of age). Eye tics are often the first manifestation of a primary tic disorder, with subsequent spreading of further tics according to a rostrocaudal distribution.<sup>[8]</sup> Neurodevelopmental tics have consistently been shown to be three-to-four times more common in boys than girls. A considerable proportion of patients report a positive family history of neurodevelopmental tics, although multiple vulnerability genes seem to be involved (genetic heterogeneity).<sup>[9]</sup>

From a subjective point of view, tics are not consistently perceived as entirely involuntary, but semi-voluntary or “unvoluntary:” patients often report a voluntary response (willful capitulation) to a build-up of premonitory urges to tic. Such premonitory urges are described as distressing sensory experiences of physical tension, which can be either generalized or localized to the body region involved in tic expression.<sup>[10,11]</sup> Prolonged suppression of neurodevelopmental tics is characteristically accompanied by mounting inner tension, which becomes unbearable and inevitably results in tic expression.<sup>[12]</sup> Although the exact pathophysiology of neurodevelopmental tics has not been fully elucidated, there is evidence for alterations within dopaminergic frontostriatal pathways, as well as involvement of other neurotransmitters.<sup>[13-15]</sup> Moreover, the results of functional neuroimaging studies on the neural correlates of the premonitory urge have revealed abnormal activation patterns within additional brain structures, such as the supplementary motor cortex, the anterior cingulate cortex, and the insula.<sup>[16,17]</sup>

The natural course of neurodevelopmental tics is characterized by a waxing and waning pattern over time. Tic severity typically reaches its peak in early teenage years (sometimes a few years earlier), after which tics gradually subside, with a considerable chance of improvement by late adolescence or early adulthood.<sup>[5,6]</sup> Moreover, neurodevelopmental tics are typically modulated by both internal and external factors. Anxiety and excitement are among the most common tic-exacerbating factors, whereas external focus of attention and engagement in distracting activities can temporarily ameliorate tics.<sup>[5,6]</sup> High rates of comorbidity with tic-related obsessive-compulsive behaviors, as well as other neurodevelopmental disorders (attention-deficit and hyperactivity disorder and autism spectrum disorder), have consistently been reported.<sup>[18-20]</sup> Patients with

neurodevelopmental tics are also prone to develop impulse control disorders, anxiety, and affective symptoms, and their health-related quality of life can be severely affected by both tic severity and psychiatric comorbidities.<sup>[21-23]</sup>

Tic disorders are currently classified as movement disorders within the “Neurodevelopmental disorders” section of the DSM-5-TR.<sup>[4]</sup> Separate diagnostic codes capture the different neurodevelopmental tic disorders according to the types of tics (motor, vocal, or a combination of both), as well as their duration. The DSM-5-TR stipulates specific diagnostic criteria for TS (referred to as “Tourette’s disorder”), the condition originally described in 1885 by Georges Gilles de la Tourette with the clinical triad of motor tics, echolalia, and coprolalia.<sup>[24]</sup> The diagnostic criteria of TS evolved with time and are currently considerably broader: presence of multiple motor tics and at least one vocal tic at some time during the illness (not necessarily concurrently), persistence of tics for more than 1 year since first tic onset (irrespective of the duration of tic-free periods), and onset before the age of 18 years.<sup>[4]</sup> Finally, it is acknowledged that neurodevelopmental tics are not attributable to the physiological effects of a substance or a general medical condition: for example, secondary tics have been reported in the context of Huntington’s disease or different forms of postviral encephalitis.<sup>[25]</sup>

Persistent (chronic) motor or vocal tic disorder is diagnosed when either motor or vocal tics (but not both motor and vocal tics) are present for at least 1 year, and the diagnostic criteria for TS are not fully met.<sup>[4]</sup> As in TS, the onset of the neurodevelopmental tics is before the age of 18 years and the tics themselves are not due to the physiological effects of a substance or a general medical condition. A specifier is used to distinguish between patients with motor tics only and patients with vocal tics only, who are thought to have a truncated form of TS. The DSM-5-TR diagnostic category of provisional tic disorder captures patients with any type of neurodevelopmental tics that have been present for <1 year in a row since their onset.<sup>[4]</sup> Again, the age at tic onset is before 18 years and the tics are not due to the physiological effects of a substance or a general medical condition. Finally, the “other specified tic disorder” category and the “unspecified tic disorder” category should be applied when full criteria for a tic disorder are not met and when there is insufficient information to make a more specific diagnosis in patients with neurodevelopmental tics who do not meet the full criteria for a tic disorder, respectively.<sup>[4]</sup>

Neurodevelopmental tics also feature in the current edition of the World Health Organization’s International Statistical Classification of Diseases and Related Health Problems (ICD-11),<sup>[26]</sup> which was officially implemented at the beginning of 2022. ICD-11 codes for TS and other neurodevelopmental tic disorders closely match their DSM-5-TR categorization [Table 1]. Despite evidence that psychiatric comorbidities are present in the vast majority of patients with TS, neurodevelopmental tics have been included

within the “Movement disorders” subgroup of the “Diseases of the nervous system” ICD-11 category.

### FUNCTIONAL TICS AND FUNCTIONAL NEUROLOGICAL DISORDER: THE “PANDEMIC WITHIN THE PANDEMIC”

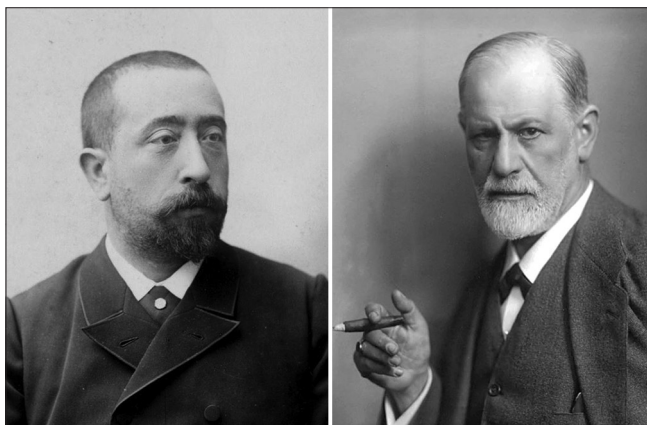
The existence of tics or tic-like behaviors of functional (psychogenic) – rather than neurodevelopmental – origin has long been recognized. Functional tics might have been portrayed in a short story by Guy de Maupassant titled “Le tic” and appeared in the French journal *Le Galois* in 1884, 1 year before Gilles de la Tourette’s original description of the condition that bears his name.<sup>[27]</sup>

Functional movement disorders are currently listed in the DSM-5-TR as a specifier of functional neurological symptom disorder, which is also referred to as conversion disorder.<sup>[4]</sup> The older name reflects the Freudian theory that hysteria arises in response to stress or an ongoing mental health condition, which is “converted” into functional neurological symptoms. Incidentally, Freud might also be credited with one of the first clinical descriptions of functional tics, as his case study of Frau Emmy von N.’s repetitive tics and vocalizations, published in his “Studies on hysteria,” (1895) seems to be consistent with functional neurological symptoms<sup>[28]</sup> [Figure 1].

**Table 1: Neurodevelopmental tic disorders in the current (2022) editions of the DSM and ICD**

DSM-5-TR	ICD-11
Tourette’s disorder	Tourette syndrome
Persistent (chronic) motor or vocal tic disorder (specify motor or vocal)	Chronic motor tic disorder Chronic phonic tic disorder
Provisional tic disorder	Transient motor tics
Other specified tic disorder (specify reason)	Other specified primary tics or tic disorders
Unspecified tic disorder	Primary tics or tic disorders, unspecified

DSM-5-TR: Diagnostic and Statistical Manual of Mental Disorders. 5<sup>th</sup> ed., text revision, ICD-11: International Classification of Diseases. 11<sup>th</sup> ed.



**Figure 1:** Georges Gilles de la Tourette (1857–1904) (left) and Sigmund Freud (1856–1939) (right), the fathers of neurodevelopmental tics (Tourette syndrome) and functional tics (conversion), respectively

The term “conversion” – unlike other denominations such as “hysteria” or “psychogenic” – has been retained (in brackets) in the current edition of the DSM.<sup>[4]</sup> According to DSM-5-TR diagnostic criteria, clinical findings provide evidence of incompatibility between the symptom (s) of altered voluntary motor function and recognized neurological or medical conditions. Moreover, the symptom (s) are not better explained by another medical or mental disorder and cause clinically significant distress or impairment in social, occupational, or other important areas of functioning, or warrant medical evaluation. Two further specifiers provide details about duration (acute: symptoms present for less than 6 months; persistent: symptoms present for 6 months or more), as well as presence of a psychological stressor.<sup>[4]</sup> There is a considerable degree of overlap with the ICD-11 coding system, where functional movement disorders are listed as a specifier of dissociative neurological symptoms disorder [Table 2].<sup>[26]</sup> According to ICD-11 diagnostic criteria, dissociative motor symptoms imply an involuntary discontinuity in the normal integration of motor functions and are not consistent with a recognized disease of the nervous system, other mental or behavioral disorder, or other medical condition. Moreover, these symptoms do not occur exclusively during another dissociative disorder and are not due to the effects of a substance or medication on the central nervous system (including withdrawal effects), or a sleep-wake disorder. Finally, they result in significant impairment in personal, family, social, educational, occupational, or other important areas of functioning.<sup>[26]</sup>

Up until recently, functional tics had been reported more rarely than other functional movement disorders, such as functional tremor or dystonia.<sup>[29-34]</sup> In one of the largest reported series ( $n = 1245$ ), functional tics accounted for only 2% of all functional movement disorders.<sup>[35]</sup> Likewise, historically they have accounted for <5% of new referrals to specialist TS clinics.<sup>[36]</sup>

Functional neurological symptoms often present with an abrupt onset and are characterized by a higher gender preponderance of females.<sup>[37]</sup> The pathophysiology of functional movement disorders remains elusive; however, a plausible model is multifactorial and includes several components such as attention dysregulation with impaired awareness of body sensations that translate into motor abnormalities.<sup>[38,39]</sup> Preliminary findings neuroimaging and neurophysiological studies have revealed functional abnormalities at the level of brain networks connecting motor and limbic structures, potentially resulting in increased awareness of the movements, the perception of them as involuntary, and the impaired emotional regulation.<sup>[40]</sup> Patients with functional movement disorders have been shown to present an altered response to emotional stimuli.<sup>[41]</sup> It is possible that physically and/or psychologically traumatic events combined with individual genetic susceptibility lead to a cumulative load that crosses the threshold to induce functional motor abnormalities in this patient population. However, it has to be noted that the

**Table 2: Functional neurological disorders (including functional tics) in the current (2022) editions of the DSM and ICD**

	DSM-5-TR	ICD-11
Name	Functional neurological symptom disorder (conversion disorder)	Dissociative neurological symptoms disorder
Criteria	<p>One or more symptoms of altered voluntary motor or sensory function</p> <p>Clinical findings provide evidence of incompatibility between the symptom and recognized neurological or medical conditions</p> <p>The symptom or deficit is not better explained by another medical or mental disorder</p> <p>The symptom or deficit causes clinically significant distress or impairment in social, occupational, or other important areas of functioning or warrants medical evaluation</p>	<p>Motor, sensory, or cognitive symptoms that imply an involuntary discontinuity in the normal integration of motor, sensory, or cognitive functions</p> <p>The symptoms are not consistent with a recognized disease of the nervous system, other mental or behavioral disorder, or other medical condition</p> <p>The symptoms do not occur exclusively during another dissociative disorder and are not due to the effects of a substance or medication on the central nervous system (including withdrawal effects), or a sleep-wake disorder</p> <p>The symptoms result in significant impairment in personal, family, social, educational, occupational, or other important areas of functioning</p>
Specifiers	<p>With abnormal movement</p> <p>Acute (symptoms present for less than 6 months)/ persistent (symptoms present for 6 months or more)</p> <p>With/without psychological stressor</p>	With movement disturbance

DSM-5-TR: Diagnostic and Statistical Manual of Mental Disorders. 5<sup>th</sup> ed., text revision, ICD-11: International Classification of Diseases. 11<sup>th</sup> ed.

presence of previous trauma is not consistently reported prior to the onset of functional symptoms.<sup>[42]</sup>

Since early 2020, during the COVID-19 pandemic, the medical community has witnessed an unprecedented surge in the number of referrals for the acute onset of functional movement disorders, including functional tics, among adolescents and young adults.<sup>[36,43-48]</sup> Specifically, there have been several reports, mainly in the form of case series, regarding this abrupt increase in referrals of patients with a similar presentation in multiple countries, including Canada,<sup>[36]</sup> the United Kingdom,<sup>[46]</sup> Germany,<sup>[47,49]</sup> Australia,<sup>[50]</sup> and the United States.<sup>[44,45]</sup> Often, these patients have been referred to specialist TS clinics with a presumptive diagnosis of severe, late-onset forms of TS. It has been estimated that such referrals have risen on average from 1%–2% to 20%–35% in locations as disparate as Calgary, London, Sydney, and Los Angeles.<sup>[36]</sup> The clinical and psychosocial factors responsible for this “pandemic within the pandemic” have not yet been fully elucidated.<sup>[51]</sup> However, it has been proposed that this global phenomenon can be at least partially explained as an effect of social isolation and distress driven by the pandemic and its related restrictions, together with an increased exposure time to and influence of social media in the affected age group.<sup>[52,53]</sup> Of note, preliminary reports indicated that the effects of the pandemic-related changes in lifestyle might have been associated with a more profound impact on functional tics than neurodevelopmental tics.<sup>[54]</sup>

The growing interest in social media influence on the rise of functional tic disorder presentation has resulted in recent articles from the media and journal articles, with reference to popular concepts such as the “pandemic within the pandemic” and “TikTok tics.”<sup>[51]</sup> There have been suggestions that social media use might have played an important role as a possible spread vector for functional tics. A number of profiles in popular social media applications are dedicated to delivering

video content of behaviors that fit the phenomenology of functional tics. Interestingly, a significant proportion of patients with functional tics reported exposure to social influencers portraying themselves as having TS, and in some cases had posted personal videos of their own abnormal movements.<sup>[36,45,47]</sup> For example, #Tourette, #Tourettesyndrome, and #Tic are among the hashtags more commonly tagged in these videos. A recent study showed that the TS symptom portrayals on highly viewed TikTok videos are predominantly not representative or typical of neurodevelopmental tics, and are more consistent with functional tics.<sup>[55]</sup> The term “mass social media-induced illness” has been proposed for an outbreak that was apparently initiated by a “virtual” index case, the second most successful YouTube creator in Germany at his peak of popularity.<sup>[49]</sup> Affected teenagers presented with the acute onset of functional tics that closely resembled those displayed by the same influencer.<sup>[47]</sup> Patients presenting with functional tics that are identical to those displayed by the popular influencers have been reported in other countries.<sup>[36,43]</sup>

Increased social media exposure and increased reports of functional tics at the time of the COVID-19 pandemic are likely to be associated phenomena. Importantly, the popularity of a social media platform like TikTok has increased significantly since the pandemic, with 5.8 billion views of videos with keywords such as #tourette and #tic in March 2021 alone.<sup>[51]</sup> Moreover, the existence of an independent role of social media is confirmed by the observation that the increase in the referrals in Germany began a few months before the outbreak of the COVID-19 pandemic. These findings indicate that being exposed to virtual contents on functional tics may produce a similar pathological effect even without the pandemic factor.<sup>[49]</sup> However, it has to be highlighted that only a fraction of viewers of relevant social media content develop functional tics, and that in selected studies, only a fraction of patients who presented with functional tics reported social media exposure.<sup>[50]</sup> According to a more nuanced, multifactorial

etiologically model, social media’s overwhelming capacity for dissemination of their contents, in combination with the psychological distress and isolation brought by the COVID-19 pandemic, might have been responsible for the “perfect storm” that triggered the unprecedented rise in functional tics in teenagers with neuropsychiatric vulnerability.<sup>[50]</sup>

### NEURODEVELOPMENTAL TICS VERSUS FUNCTIONAL TICS

Although the characteristics of functional tics are different from the typical presentation of neurodevelopmental tics, the differential diagnosis between these conditions can be challenging because of overlapping clinical features and the need for a comprehensive and sometimes sequential evaluation.<sup>[56]</sup> Clinical examination alone might not be conclusive in discriminating between neurodevelopmental and functional tics, in marked contrast to the differentiation of other functional movement disorders, such as functional tremor and functional dystonia. Symptom variability, distractibility, and suggestibility are notoriously useful in differentiating other functional movement disorders and functional weakness, but are not reliable tests to diagnose functional tics, because neurodevelopmental tics may also have these qualities.<sup>[34]</sup> Neurophysiological testing may not help either, as motor readiness potentials (*Bereitschaftspotentials*) can be present in both neurodevelopmental and functional tics, although they are less commonly detected before neurodevelopmental tics.<sup>[56]</sup>

The main demographic and clinical features deemed to be helpful in the differential diagnosis between neurodevelopmental tics and functional tics are summarized in Table 3.

The onset of symptoms has consistently been reported as a key discriminator. Neurodevelopmental tics typically start insidiously in early childhood, more commonly in boys,<sup>[5,6]</sup> while functional tics are often characterized by an explosive onset in female adolescents.<sup>[34,36]</sup> Specifically, the clinical picture of TS initially presents with subtle, intermittent simple movements (e.g., repetitive eye blinking, facial grimacing, or mouth opening) and noises (e.g., grunting or sniffing). Neurodevelopmental tics can subsequently progress to more

complex and persistent manifestations, involving other body parts and multiple muscular districts, in a rostrocaudal pattern of spread from face to arm.<sup>[5,6]</sup> More complex vocalizations typically develop in adolescence, often improving by early adulthood. Conversely, in functional tics, upper-limb involvement tends to predominate.<sup>[34]</sup> The onset is more abrupt and, at a later age, typically ranging from adolescence to early adulthood. There is a striking prevalence in female patients, although certain reports of functional tics associated with social media exposure have documented variability, depending on the gender of the index case or popular influencer. Complex tics and coprolalia appear either around the time of onset or early in the course of the condition, rather than a few years after the development of simple tics, which can be absent.<sup>[36]</sup> The typical waxing and waning course of neurodevelopmental tics can also be absent.<sup>[34,46]</sup> Coprophenomena, forced touching, and self-injurious behaviors have all been documented, but are less common in the context of TS, whereas they are reported in a considerable proportion of patients with functional tics, often from an early stage of the disorder.<sup>[7,43,49,51,53,55]</sup>

Functional tics have also been noted to commonly lead to significant disability,<sup>[34]</sup> possibly including both emergency admission to hospital and interference with school or occupational activities. An important feature to consider is the report of prolonged episodes of continuous and sometimes violent tics or “tic attacks.” Tic attacks are described as a burst of severe uncontrolled movements that usually last several minutes and cause significant distress to the patient.<sup>[57]</sup> It has been hypothesized that these episodes are related to the complex interplay between anxiety and functional tics, leading in a vicious cycle that results in a rapid escalation of symptoms feeding each other.<sup>[57]</sup> Moreover, tic attacks share similar features with nonepileptic attacks of the hyperkinetic type (functional seizures), which are characterized by prominent motor manifestations and retained awareness.<sup>[58]</sup>

It has been observed that in patients with functional tics, the premonitory urge is either absent or described in a rather nonspecific manner compared to neurodevelopmental tics.<sup>[45,47,59]</sup> Distractibility and suggestibility can be associated

**Table 3: Main demographic and clinical features deemed to be helpful in the differential diagnosis between neurodevelopmental tics and functional tics**

Characteristics	Neurodevelopmental tics	Functional tics
Gender	Male preponderance	Female preponderance
Age at onset	Typically 4-7 years	Typically 12-25 years
Type of onset	Typically gradual	Typically acute or subacute
Tic type	Predominantly simple motor and/or vocal tics	Predominantly complex motor and/or vocal tics
Tic distribution	Predominantly rostrocaudal spread	Predominantly (upper) limb involvement
Premonitory urge	Specific	Absent or nonspecific
Family history of neurodevelopmental tics	Frequent	Rare
Comorbid neurodevelopmental disorders	Frequent	Rare
Comorbid functional neurological disorders	Rare	Frequent
Response to alpha-2 agonists/antidopaminergic agents	Frequent and gradual	Absent or immediate
Influence of social media	Not reported	Reported

Neurodevelopmental and functional tics can also coexist in the same individual (e.g., Tourette syndrome with functional overlay)

with either type of tics, whereas suppressibility seems to be more commonly reported by patients with neurodevelopmental tics.<sup>[36,45]</sup> It has also been reported that the overall sense of agency might be reduced in youngsters with functional tics.<sup>[60]</sup>

Consistently with the nature of the condition, functional tics are less likely to show a hereditary pattern than neurodevelopmental tics. However, clinicians should always consider the possibility of dual diagnosis – i.e., cases where there is an overlap with previously diagnosed neurodevelopmental tics (e.g., TS with functional overlay). Although comorbid psychiatric pathology is often present in both conditions, the characteristics of the comorbidity profile can differ significantly. Unlike functional tics, neurodevelopmental tics typically co-occur with tic-related obsessive-compulsive behaviors, as well as other neurodevelopmental conditions such as attention-deficit and hyperactivity disorder and autism spectrum disorder. Anxiety and affective disorders are also part of the neuropsychiatric presentation; however, these conditions seem to be more commonly diagnosed in patients with functional tics.<sup>[19,43,50]</sup> Likewise, co-occurrence with other functional neurological symptoms is suggestive of functional rather than neurodevelopmental tics. For example, functional tics are commonly seen alongside other functional movement disorders (including functional weakness) and functional seizures.<sup>[58]</sup>

The existence of phenomenological similarities between the functional tics (and tic attacks) reported by a proportion of patients and the manifestations portrayed in popular videos of influencers seems to confirm the influence of social media.<sup>[51]</sup> A previous outbreak had been reported in 2012 in Le Roy, United States, where 19 high school teenagers developed rapid-onset, severe functional tics and other functional neurological symptoms as part of mass sociogenic illness caused by psychosocial stressors following exposure to neurodevelopmental tics from two children (index cases).<sup>[61,62]</sup> More recently, Giedinghagen explored the phenomenon of adolescents presenting *en masse* with symptoms seemingly acquired from viewing illness-related content posted by social media influencers.<sup>[63]</sup> This author proposed the overarching construct of “social media associated abnormal illness behavior” that incorporates both functional tics (conceptualized as “mass social media-induced illness”)<sup>[49]</sup> and “Munchausen by Internet,” whereby medically well individuals fake recognized illnesses in virtual environments, such as online support groups.<sup>[64,65]</sup>

First-line anti-tic medications such as alpha-2 agonists and antidopaminergic agents can be effective in the treatment of neurodevelopmental tics, with gradual improvements in tic severity. There are preliminary observations that patients with functional tics can display either a complete lack of response to these agents or an unrealistic rapid resolution, which is likely to be related to placebo effect.<sup>[36,45]</sup>

Little is known about the prognosis and treatment of functional tics, but there is agreement about the usefulness of psychoeducation and implementation of strategies to help

divert abnormally focused attention away from tics (including limiting exposure to relevant social media content, where appropriate).<sup>[36,57]</sup> Although evidence-based approaches to the treatment of functional tics are currently lacking, it has been suggested that management strategies using/including cognitive-behavioral therapy and selective serotonin reuptake inhibitors have been associated with improvement, especially in patients with co-occurring anxiety and affective symptoms.<sup>[43,56,57,59]</sup>

Historical shifts and inconsistencies in the meaning of widely used diagnostic labels, such as “functional,” should be taken into consideration. The distinction between neurodevelopmental and functional tics has proven particularly helpful in assisting clinicians in the process of differential diagnosis during the COVID-19 pandemic. However, it has been argued that the “organic-versus-functional” dichotomy might be less applicable to tic disorders, as “organic” tics (neurodevelopmental tics) are diagnosed solely based on behavioral characteristics, and, in fact, diagnostic criteria specifically require the exclusion of “underlying neurological disorder.”<sup>[66]</sup> According to David, “it is clear that the line of demarcation between organic and nonorganic psychiatric disorders is not hard and fast, and in a substantial number of cases, there can be continuing uncertainty;” however, this is not an excuse to abandon “very real distinctions between classes of disorder.”<sup>[67]</sup>

Areas for future research include the validation of standardized criteria for the differential diagnosis between neurodevelopmental and functional tics and the identification of the (likely multifactorial) causes of the recent pandemic of functional tics in youth. In addition to better characterizing the neuropsychiatric and neurocognitive phenotype (s) of functional tics, it would be useful to investigate the natural course of this condition, in order to develop interventions that have the potential to affect the outcome in a positive way. In the meantime, it is important to raise awareness of the marked increase in the number of cases presenting with functional tics, in order to empower health-care providers with up-to-date information on a challenging condition.

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There are no conflicts of interest.

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