



# Increased Number of Functional Tics Seen in Danish Adolescents during the COVID-19 Pandemic

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## Abstract

**Background** Global increase in functional tics in adolescents has been observed. Differentiating functional from classic tics is important since pathophysiology and treatment differ. We investigated possible triggers for development of functional tics and discuss the possible role of the coronavirus disease 2019 (COVID-19) pandemic and social media exposure in cases of functional tics seen during this period. Moreover, the treatment, and its efficacy is discussed.

**Methods** Medical records of 28 Danish adolescents diagnosed with functional tics at the National Tourette Clinic, Department of Pediatrics, Herlev University Hospital, Denmark, from May 2020 to June 2021 have been retrospectively reviewed. Descriptive statistical analyses were used to analyze the data.

**Main Findings** A total of 28 patients diagnosed with functional tics were included, 96.4% girls and 3.6% boys, mean age 14.4 years. Tic phenomenology differed from classic tics with more complex tics and no rostrocaudal progression. Note that 69.2% reported harmful tics. Also, 78.6% had trauma/precipitating event and 40% denounced lockdown related to the COVID-19 pandemic as trigger, both prior to onset of functional tics. Note that 60.7% reported psychiatric symptoms/diagnoses, 42.9% had a first-degree family member with psychiatric symptoms/diagnoses, and 96.4% were exposed to tics on social media prior to onset. Treatment consisted of psycho-education, elements from cognitive behavioral therapy, and focus on psychiatric symptoms. All patients responded to the treatment.

**Conclusion** The vulnerability of the adolescents is characteristic. Treatment strategy has shown immediate positive effect. Consequences of the COVID-19 pandemic in combination with exposure to tics on social media could be part of the cause for the increase in number of functional tics.

## Keywords

- ▶ functional tics
- ▶ functional movement disorder
- ▶ COVID-19
- ▶ social media
- ▶ adolescents
- ▶ Tourette syndrome

## Introduction

Since 2020 there has been a remarkable global increase in the numbers of adolescents who present with tics that do not appear classic in their nature, as seen in chronic tic disorders like Tourette syndrome.<sup>1</sup> It has been suggested that these tics

are functional tics, which previously have only rarely been reported and account for 2% of functional movement disorders in total.<sup>2</sup> The recent high number of adolescents with acute onset of functional tics globally, has not been observed before.<sup>3</sup>

The phenomenology of functional tics is different from classic tics.<sup>4</sup> Functional tics have a higher age at onset of

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symptoms (teenage rather than 5–6 years), mostly female sex, no rostrocaudal progression (from head to tail) or waxing/waning of tics, and a significant greater ratio of complex tics and coprolalia is seen compared with classic tic.<sup>2,5,6</sup>

The coronavirus disease 2019 (COVID-19) pandemic has shown to have had a significant impact on children and adolescents' well-being.<sup>7</sup> Furthermore, a striking similarity has been seen between the patients' tics and tics shown on social media, like TikTok, Instagram, and YouTube.<sup>8,9</sup> During the last year, the views on the hashtag *#Tourettes* have exploded and this has led to speculation as to whether social media content could be a determining factor of the sudden increase of patients with functional tics.<sup>10</sup> It has even been suggested to call this phenomenon Mass Social Media-induced Illness (MSMI).<sup>8</sup> Several new studies have recently been published on the subject of functional tics and the possible relation to COVID-19 and social media.<sup>11–13</sup>

It is important to differentiate functional tics from typical classic tics as seen in chronic tic disorders, since pathophysiology and treatment differ. In functional tics, stress and other psychological and psychiatric triggers are believed to be causing factors, while imbalance in neurotransmitters is proposed to be the pathophysiology behind classic tic disorders.<sup>14</sup> Therefore, classic tic disorders can be treated pharmacologically, whereas pharmacological treatment is not recommended nor has it been found to be effective in functional tics.<sup>5,15</sup>

In this case series we provide data from Danish adolescents diagnosed with functional tics during the COVID-19 pandemic. Some case series on functional tics have been published recently, but we will provide new information on possible triggering events and family history of the adolescents presenting with functional tics.<sup>16</sup> Furthermore, the naturalistic course of symptoms will be described and the treatment and its effect will be expounded. Finally, it will be discussed how the combination of the COVID-19 pandemic and social media exposure may play an essential role in the cases of functional tics seen during this certain period. This article is relevant in pursuing the gathering of information from different cohorts of adolescents presenting with functional tics during this certain period, and to help find the optimal treatment strategy.

## Methods

Medical records of 28 Danish adolescents diagnosed with functional tics at the National Tourette Clinic, Department of Pediatrics, Herlev University Hospital, Denmark, from May 2020 to June 2021 have been retrospectively reviewed. The patients were referred from general practitioners, private practitioners (e.g., psychiatrist or pediatrician) as well as other pediatric departments and child and adolescent psychiatric departments.

The patients were examined by experienced neuropediatricians and went through a physical neurological examination where detailed information on their tics was obtained.

Some underwent further paraclinical examinations, such as blood tests or lumbar puncture, to exclude any somatic causes to the tics. Most of the patients have specifically been interviewed about exposure to tics on social media and consequences of COVID-19 pandemic on their daily life. Possible triggers and precipitating events were discussed with all patients and their parents. To ensure the right diagnosis, each patient was reviewed by the multidisciplinary team and consensus was reached on interpretation of symptoms and on distinguishing between functional and classic tics.

Among other parameters, age at onset, phenomenology of tics, triggers, and stressors (both psychosocial stressors, family history, and comorbidities) have been collected. Treatment and effect were scrutinized as well.

Descriptive statistical analyses were used to analyze the data retrieved from the medical records. The Danish Data Protection Agency has approved collection of data (HGH-2017–092).

## Results

### Patients

Medical records of 28 patients diagnosed with functional tics at the Tourette Clinic, among them 27 girls and 1 boy, were included. Mean age at first visit was 14.7 years (ranging from 11.0 to 18.9 years), and mean age at onset was 14.4 years (ranging from 10.9 to 18.3 years). Note that 32.1% ( $n=9$ ) of the patients remembered the exact date for the onset of the tics, while a total of 46.4% ( $n=13$ ) had abrupt onset within 72 hours. Fifty percent ( $n=14$ ) of the patients reported to have experienced tics earlier in their life with a mean age of 9.1 years at onset of tics.

### Tics Phenomenology

Only 2/17 (11.8%) of the patients who were asked about urge (commonly defined as a feeling of tension or excessive energy building up preceding tics) did not feel any urge at all. Note that 90.9% of the patients, when asked about suppression ( $n=20/22$ ), were able to suppress their tics. None described rostrocaudal progression of tics. Note that 64.3% ( $n=18$ ) experienced simple motor tics (e.g., eye blinking), while 92.9% ( $n=26$ ) had complex motor tics. The complex motor tics typically reflected advanced series of movements with several extremities involved at the same time, throwing things that are nearby, and striking out. Also, 69.2% ( $n=18/26$ ) of the patients reported self-harming behavior or harming others in their vicinity with their tics. Simple vocal tics were seen in 35.7% ( $n=10$ ) of the patients and were typically throat clearing or sniffing, while 71.4% ( $n=20$ ) had complex vocal tics such as whistling, long differing sentences related to the context the patients found themselves in. Note that 32.1% ( $n=9$ ) hereof experienced coprophenomena. Some of the patients presented with a few almost identical tics, which seemed easily recognizable. A certain whistle, words beginning with “w” like “wuhuu,” click-sounds, violent/harmful tics, and complex sentences recurred in many patients.

**Stressors, Precipitating Events, and Triggers**

Note that 78.6% ( $n = 22$ ) of all patients had a known trauma or a precipitating event prior to the onset of functional tics. Most precipitating events were at least 1 year before the onset of functional tics, for example, disease or death in close family or friends, bullying, and serious family conflicts. Triggers related in time (happening a few months before or parallel) to onset of functional tics were COVID-19 pandemic consequences (61.9%), exams (5%), mentally worsening in general (10%), and other reasons (20%). In total 95.2% ( $n = 20/21$ ) had experienced a trigger (beside a trauma or precipitating event) before functional tics.

Additionally, 60.7% ( $n = 17$ ) reported psychiatric symptoms before onset of functional tics (→ Fig. 1). The most frequent were obsessive compulsive disorder (47.1%), attention deficit hyperactivity disorder (ADHD) (41.2%), anxiety (35.3%), and depression (35.3%). Furthermore, five patients were diagnosed with a psychiatric disease after onset of functional tics. In total, 78.6% of the patients had psychiatric symptoms and/or diagnoses.

Regarding family history, 42.9% had a first-degree family member with psychiatric symptoms and/or diagnoses (→ Fig. 2). The most dominant were anxiety (41.7%), ADHD (33.3%), depression (33.3%), and tics or Tourette syndrome (25%).

Also, 71.4% of our patients had already been seen by a psychologist or psychiatrist before onset of functional tics. Furthermore, 28.6% ( $n = 8$ ) had sleep disruptions and 17.9% ( $n = 5$ ) dyslexia.

**COVID-19 and Social Media**

Forty percent ( $n = 8/20$ ) indicated the lockdown due to the COVID-19 pandemic had stressed them, while 25% ( $n = 5/20$ )

reported the lifting of restrictions being stressful. All the included patients were homeschooled during lockdown. When asked directly, 27 patients (96.4%) reported having seen people with tics on social media including Instagram, TikTok, YouTube, and Facebook, before the onset of functional tics.

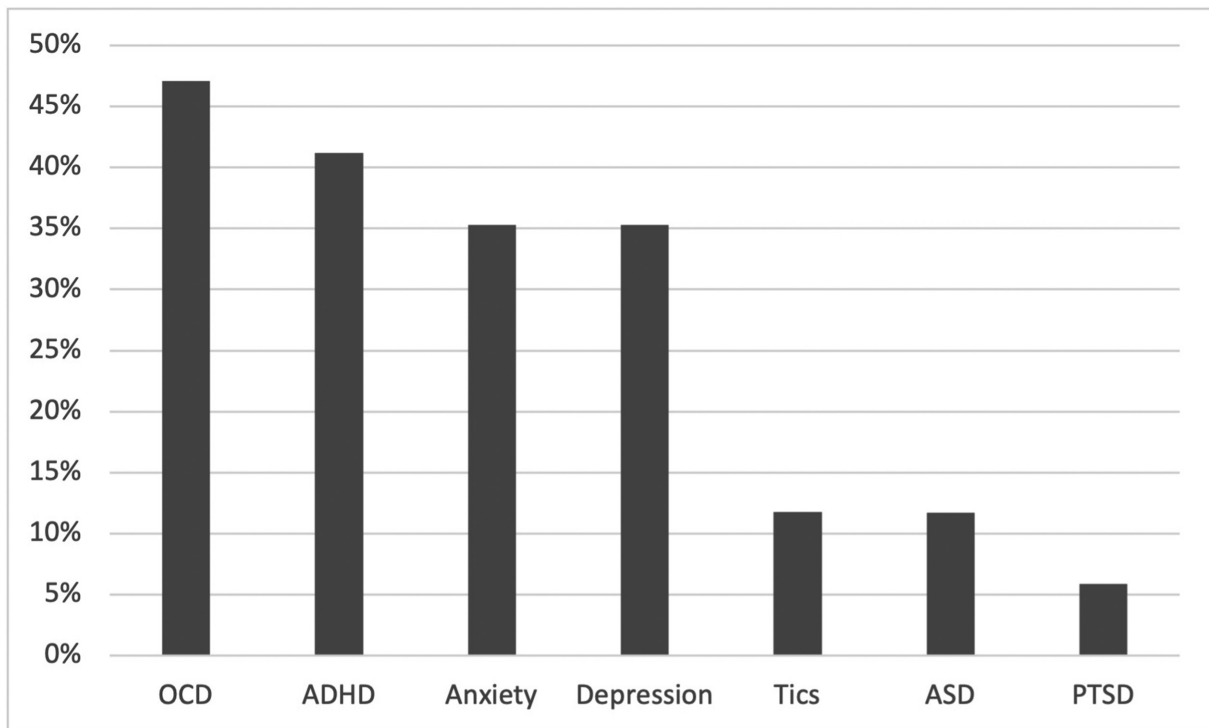
**Treatment**

The treatment consisted of psychoeducation as well as elements from cognitive behavioral therapy (CBT), like habit reversal training. The patients got psychoeducation through the explanation that functional tics might be a stress-response of their bodies just as other people can experience a headache or stomach pain as stress-responses. Furthermore, we discussed possible precipitating events and/or triggers with the patients and their parents. Five patients were referred to a psychologist from our clinic, five patients were referred to an adolescent psychiatric center, and two patients were referred to a psychologist and a social worker.

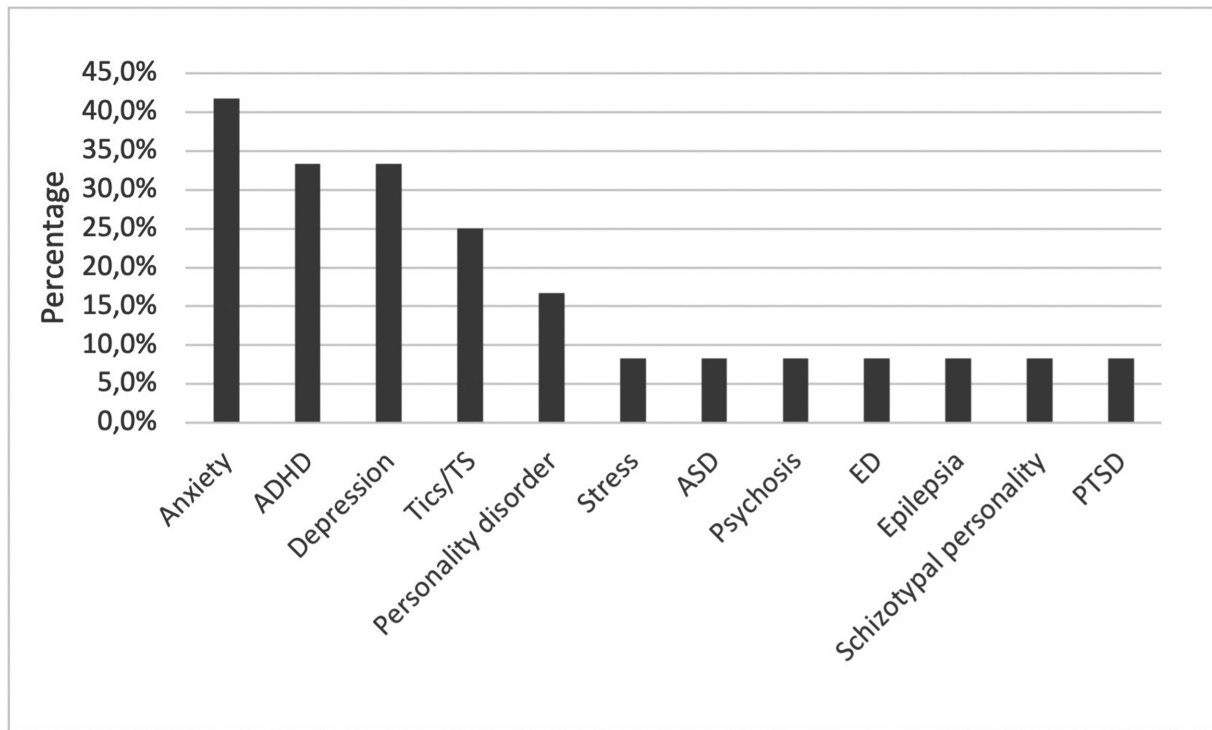
Apart from psychoeducation and help with the underlying stressors, the patients were given tools to stop or at least reduce their functional tics, like distraction and competing response (e.g., removing themselves from the situation or doing exercises like squats, pushups, or taking a walk). They were also encouraged to stop following influencers who show tics on social media.

Follow-up appointments were performed either by telephone or in person, and all patients reported to have experienced positive effect of the treatment with either reduction in tic severity or total disappearance of functional tics.

Fifty percent ( $n = 14$ ) of the patients had had their last appointment at the National Tourette Clinic, when these data



**Fig. 1** Psychiatric symptoms and diagnoses in patients diagnosed with functional tics before onset of functional tics. ADHD, attention deficit hyperactivity disorder; ASD, autism spectrum disorder; OCD, obsessive compulsive disorder; PTSD, posttraumatic stress disorder.



**Fig. 2** Psychiatric symptoms and diagnoses in first-degree family members of patients diagnosed with functional tics. ADHD, attention deficit hyperactivity disorder; ASD, autism spectrum disorder; ED, eating disorder; PTSD, posttraumatic stress disorder; TS, Tourette syndrome.

were collected. The mean duration time from referral to final appointment of those was 127 days (ranging from 14 to 266 days).

## Discussion

The aim of this study was to describe Danish adolescent patients with functional tics referred to the National Tourette Clinic during the COVID-19 pandemic and discuss the possible causation for this aberrantly high numbers of cases precisely during the period of COVID-19 lockdown. Compared with other case series, we found a high frequency of precipitating events or trauma and a positive family history of psychiatric symptoms and diagnoses in many adolescents. Furthermore, we can report a positive effect from the provided management of psychoeducation and elements from CBT.

### Functional versus Classic Tics

It is essential to differentiate functional tics from classic tics to initiate the right treatment without delay and to thereby decrease the negative impact on the patients' quality of life. The short timespan between onset of functional tics and referral to the clinic could indicate that the tics had such a degree of severity and influence on quality of life that the families sought medical help relatively quickly.

As described in other studies on differences between classic tics and functional tics, our patients presented with a more acute onset of tics and at a higher age at onset of tics than seen in classic tics/Tourette syndrome.<sup>8</sup> Similar to the characteristics of adults presenting with functional tics, our

patients were predominantly of female sex and presented with complex and stereotyped tics dominantly, with a wide range of complex vocal tics.<sup>17</sup> Also, no rostrocaudal progression was seen in any of our patients.

In earlier studies, the immediate lack of premonitory urge and presence of coprophenomena have been used to distinguish functional tics from classic tics. Seventy-three percent of individuals with Tourette syndrome are described to experience premonitory urge, and with even higher prevalence in those with complex tics (78.6%) than in those with simple tics (68.9%).<sup>18</sup> It is estimated that less than 3% of Danish patients with Tourette syndrome present with coprophenomena (personal communication). However, in our cohort of patients with functional tics only 11% did not experience urge and 32.1% presented with coprophenomena. Coprolalia in functional patients is described as differing from coprolalia in patients with Tourette syndrome by having longer and more complex words and even sentences, as well as by a greater variation of swearwords.<sup>6</sup>

Fifty percent of the patients in our cohort evidently reported to have had tics earlier in their lives. Regardless the nature of those tics experienced earlier (mean age being 9.1 years compared with the mean age of 14.4 years for onset of functional tics), it is important to keep in mind, that patients diagnosed with Tourette syndrome can experience functional tics as well.<sup>19</sup>

### Vulnerability

In our cohort, many patients had comorbidities and psychiatric symptoms both before and after the onset of functional

tics, which may reflect a vulnerability. Other studies also found that psychiatric symptoms, such as anxiety, seemed to play a role in the development of functional tics in adolescents.<sup>5,20</sup> Demartini et al described anxiety or depression as comorbidities in 8/11 patients, while Pringsheim and Martino found that 44% of their cohort of young adults with functional tics has a depression diagnosis compared with 8% in their cohort of patients with primary tic disorders.<sup>2,17</sup> Comorbidity is also seen in up to 85% of children with Tourette syndrome and therefore, the presence of comorbidity alone cannot be used to distinguish between classical tics and functional tics. The tic phenomenology and history of patients are very important to take into consideration as well.<sup>14</sup> Further studies are needed to examine if the comorbidity profile in patients with Tourette syndrome is different than in persons with functional tics.

It is noteworthy that 42.9% of the patients in our cohort were genetically disposed to psychiatric symptoms and illness through a first-degree family member. This could indicate that the onset of functional tics in our patients might to some extent be genetically susceptible. However, it can also be a stressor to have a family member who is challenged by psychiatric symptoms and/or diagnoses. To our knowledge, this is the first study to describe prevalence of psychiatric symptoms and illnesses in first-degree family members in a clinical cohort of adolescents with functional tics.

Moreover, our data show that 71.4% of the patients had experienced a stressor prior to the onset of functional tics. The vast majority (78.6%) had a precipitating event or trauma, and especially death or serious disease in family or close friends, unhappiness in school, bullying, moving residence, and conflicts in the family were shown to be frequent. Demartini et al found in their study of adult patients (mean age 37.2 at onset of functional tics), that 10/11 patients with functional tics also had a clear precipitating event before onset.<sup>2</sup> Interestingly, seven of those patients reported the precipitating event to be physical such as back injury or pneumonia.<sup>2</sup> As none of our patients reported physical events, it can be discussed whether the triggering of functional tics may differ with age and environmental and societal circumstances.

Surprisingly, 17.9% of the patients in our cohort had dyslexia (usually estimated to less than 10% in the general population) and 28.6% experienced sleep disturbances.<sup>21</sup> The latter could be related to ruminations, anxiety, or, as suggested in other studies, excessive use of technological devices at night.<sup>7</sup> Other studies have found that changes in neurophysiological mechanisms of sleep can result in greater risk of poor school performance and loss of self-control.<sup>7</sup> Both dyslexia and sleep disturbances could potentially contribute to the perceived stress of the adolescents and might also complicate online homeschooling during the COVID-19 pandemic.

All of the above contributes to the hypothesis that functional tics might be triggered by stress and stressful events in already vulnerable adolescents.

## COVID-19

COVID-19 lockdown may have contributed to an increase in stress for the adolescents.<sup>7,8</sup> Note that 46.4% of our patients reported events (lockdown or lifting of restrictions) related to the COVID-19 pandemic as triggers and stressful events. It could be in the form of conflicts in the family, reduced social contact with friends and family, or increased stress on the individual due to homeschooling. It is known that self-isolation and social distancing influence adolescents considerably, and that fear and anxiety has been widely present during lockdown, which we presume counts for our patient group as well.<sup>7</sup> Interestingly, an Italian study found that the lockdown resulted in reduced tic severity in patients with Tourette syndrome and chronic tic disorders, but that the prolonged social distancing at the same time led to new neuropsychiatric symptoms.<sup>22</sup>

## The Significance of Tics on Social Media

Studies have shown that Italian adolescents increased their use of social media noticeably during the quarantine.<sup>7</sup> We presume that this might be the case for Danish adolescents as well, and this could be a contributive factor to discuss social media and influencers showing tics with regard to the massive increase in adolescents presenting with functional tics.

Since a total of 96.4% ( $n = 27/28$ ) of the adolescents had been exposed to tics on social media prior to the onset, in combination with the fact that we noticed similarities in the patients' functional tics, this could be interpreted as functional tics being inspired by the same sources. A source might be certain influencers on social media. It would have been beneficial to have had information on the patients' time spent on social media as well as which certain influencers they might have followed.

According to Müller-Vahl et al the prerequisites enabling what they call a current outbreak of MSMI involve people on Instagram/TikTok/YouTube claiming to suffer from Tourette syndrome, but showing videos of both motor and vocal tics, that are not classic in their nature, but on the contrary functional.<sup>8</sup> Many of the tics shown by certain influencers on social media have specific situational context. Often long sentences with swear words and obscenities that are not seen in patients with Tourette syndrome. Also, the symptoms are presented as a huge range of different tics that constantly change, which is also very uncommon for Tourette syndrome.<sup>18</sup> We did, however, find some similarities in the tics of our patients.

The role of social media in development of functional tics is difficult to determine. It might not be a direct cause of functional tics, but in adolescents with stressors and precipitating events, seeing tics on social media might be a trigger for the development of functional tics.

## Treatment

In several studies it is reported that a sustained response to anti-tic medication is lacking in patients with functional tics.<sup>5,15</sup> Behavioral methods like teaching patients a competing response or distracting maneuvers, stress management, a multidisciplinary approach, and family involvement were

shown to be effective in the treatment of functional tics.<sup>5,15,23</sup>

The success rate of the treatment in our cohort was immediately high, but to determine the effect further, a longitudinal follow-up study is necessary.

The short mean duration time for being followed at the clinic, indicate that the strategy used was effective. Nevertheless, it is important to emphasize that the involvement of the adolescents' parents probably is crucial to identify and reduce the stressors causative for the development of functional tics. Furthermore, it is important that the patients get the right treatment and support by a psychologist or psychiatrist.

### Symptom or Diagnosis?

Although the incidence of functional tics has exploded and the phenomenon has been discussed internationally, no diagnostic criteria for functional tics have yet been defined, which makes it difficult to compare studies internationally. Tourette syndrome and functional tics do share some overlapping similarities, which makes it even more difficult to ensure the right diagnosis of patients presenting with tics.<sup>24</sup>

We suggest that a further study should discuss whether functional tics are symptoms of underlying psychological or psychiatric diseases rather than a diagnosis.

### Study Limitations

This study is based on a retrospective review of medical records of a clinical cohort in a naturalistic setting. We have not used any structural interviews or clinical interventions. Also, it would have been relevant to do neuropsychological evaluation of the patients. The cohort is small, which influences the statistical power. Future studies should explore the course of functional tics and treatment in a longitudinal follow-up design. Furthermore, future studies could include a control group of patients with classical tics to compare possible differences between the presentation of tics, as well as to explore the role of precipitating events or possible effects of social media in more detailed.

### Conclusion

This study has investigated possible triggering events for the high numbers of adolescents presenting with functional tics. Characteristic for our cohort of Danish adolescents with functional tics is the vulnerability of the adolescents due to precipitating events, trauma, psychiatric symptoms, and family history of psychiatric symptoms and illness. The tic phenomenology in the adolescents included complex motor and vocal tics and harmful tics.

Our treatment strategy (psychoeducation, elements of behavioral therapy, and support for the psychological and psychiatric symptoms) seems to be effective in our small cohort, but future studies with larger cohorts are needed to examine this treatment strategy further.

It is possible that the consequences of the COVID-19 pandemic for the daily life of already vulnerable adolescents

in combination with exposure to tics on social media, could be part of the cause for the increase in number of adolescents presenting with functional tics.

### Conflict of Interest

None declared.

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