INTRODUCTION

Since the second wave of the COVID-19 pandemic, clinicians worldwide have reported an influx of young people, predominantly female teenagers, presenting with the rapid first onset of complex motor and vocal tic-like behaviours [1]. These tic-like behaviours develop and peak in severity within hours to days, cause significant functional impairment, and display phenomenological similarities to popular TikTok video content of individuals with tics or tic-like behaviours [2,3]. In January 2021, we launched our Adult Tic Disorders Clinical Registry, a prospective cohort study enrolling all adults seen in our program with tics. The goal of the registry is to document...
clinical characteristics of adults with tic disorders, their comorbidit
and impairment profiles, and the evolution of tic symptoms over a
12-month period. The rise in tic-like behaviours during this period
allowed us to enrol into the registry several young people presenting
for the first time with these symptoms. In this short communication,
we contrast clinical features present at the registration visit in adults
with rapid onset tic-like behaviours to those seen in adults with
Tourette syndrome (TS), persistent motor tic disorder (PMTD) or
persistent vocal tic disorder (PVTD), with the goal of identifying clini-
cal features to help clinicians differentiate between these disorders.

METHODS

All patients referred to and followed by the Calgary Movement
Disorders Program for tics are invited to participate in the Adult
Tic Disorders Clinical Registry. The registry was approved by the
Calgary Health Research Ethics Board, and all participants pro-
vided written informed consent. The Calgary Movement Disorders
Program is the only specialized clinic for adults with tic disorders
in southern Alberta. At registration, participants complete several
self-report questionnaires, including the Obsessive-Compulsive
Inventory (OCI), the Adult Self-Report Scale (ASRS) for ADHD,
the Patient Health Questionnaire (PHQ9) for depression, the
Generalized Anxiety Disorder–7 items (GAD7), the Tobacco,
Alcohol, Prescription Medications, and Other Substance Tool, the
Premonitory Urge for Tics Scale, and the Gilles de la Tourette Quality
of Life Scale (GTSQOL). The clinician collects demographic and clini-
cal information from the patient through clinical interview, confirms
diagnoses, and performs the Yale Global Tic Severity Scale (YGTSS).
For comparison, we grouped patients into two categories (i) primary
tic disorder or (ii) rapid onset tic-like behaviours. The primary tic dis-
order category included patients with TS, PMTD, or PVTD who were
diagnosed based on fulfilment of Diagnostic and Statistical Manual
of Mental Disorders, 5th edition criteria and a clinical history con-
gruent with these disorders. Categorization into the rapid onset
tic-like behaviours group was based on history of abrupt onset of
complex tic-like behaviours with escalation to peak severity within
hours to days. All diagnoses were made by two movement disorders
specialists with expertise in tic disorders. Continuous variables were
compared between groups using a two-sample t-test; categorical
variables were compared using the Fisher exact test. As this was an
exploratory analysis, p-values <0.05 were considered statistically
significant.

RESULTS

Between 5 January and 5 June, 33 adults were enrolled in the Adult
Tic Disorders Registry, 24 with TS/PMTD and nine with rapid onset
tic-like behaviours. All 24 adults with TS/PMTD had onset of tics
in childhood. Of the nine adults with rapid onset functional tic-like
behaviours, seven presented with the first ever onset of tic-like
movements during the COVID-19 pandemic, and two had a history
of mild simple motor or vocal tics in childhood with sudden and dra-
matic onset of complex tic-like behaviours during the pandemic. In
all nine of these patients, symptom onset occurred between May
2020 and April 2021. Table 1 provides the demographic and clinical
characteristics of each group.

All participants with rapid onset tic-like behaviours reported
symptom onset over a period of hours to days, with many able to
give a precise date of onset. All endorsed the presence of premoni-
tory urges prior to tics, suggestibility, and distractibility, and sup-
pressibility was present in six of nine cases. Participants with rapid
onset tic-like behaviours were significantly younger but with later
age of onset, were more likely to be female, were more likely to be
diagnosed with depression, were more likely to have complex arm/
hand tics, complex vocal tics, and coprolalia, and had significantly
higher scores on the ASRS, OCI, GAD7, PHQ9, GTSQOL, and YGTSS.
Several patients with rapid onset complex tic-like behaviours dis-
played the same repertoire of complex motor tics, including tapping,
clapping, thumping the chest, and hitting objects, and the same com-
plex phonic tics, including “beans,” “knock knock,” and “woo hoo.” All
nine adults with rapid onset functional tic-like behaviours reported
exposure to social media with #Tics and #Tourettes. Exposure to
social media prior to or around onset was not assessed formally in
adults with TS/PMTD, as all patients had a >10-year history of typ-
ical TS/PMTD.

DISCUSSION

In this prospective cohort study, we found several clinical charac-
teristics that differentiated adults with rapid onset functional tic-
like behaviours from adults with TS/PMTD/PVTD, despite a small
sample size of only 33 participants. These distinctive characteristics
are similar to the clinical features previously proposed as charac-
terizing functional tic-like behaviours [4]. Tics and functional tic-like
behaviours share phenomenological traits and may coexist [4] mak-
ing this differential diagnosis challenging, especially for nonexpert
clinicians. The most distinguishing clinical features for the diagnosis
of functional tic-like behaviours, besides the rapid onset of symp-
toms, were the high frequency of upper limb involvement, complex
vocalizations and coprophrenomena, female gender, and later age
of onset. The dramatic course of these rapid onset tic-like behav-
ious is reflected by higher symptom severity ratings on the YGTSS,
and a greater impact on quality of life on both the YGTSS and the
GTSQOL. The rapid progression of complex tic-like behaviours over
hours to days is inconsistent with the known clinical course of pri-
mary tic disorders [5] which typically begin insidiously with simple
motor tics in early childhood, wax and wane in frequency and se-
verity, demonstrate a rostrocaudal progression over time [6] and
increase in complexity over a period of years. Most patients in the
rapid onset group demonstrated no simple motor tics of the face or
simple vocal tics, which are the most common tics in patients with
primary tic disorders.
Functional tic-like behaviours have been described in the past by others but are infrequently reported. In a large case series of functional movement disorders, functional tics accounted for only 2% of cases [7]. Previous reports include in 2012, when 19 teenagers at Le Roy High School in New York state developed sudden onset of tic-like movements, with dramatic jerking movements involving one or both arms and their head and neck, which was ultimately diagnosed as conversion disorder with mass psychogenic illness [8]. Demartini et al. [7] presented a case series of 11 adult patients with the abrupt onset of functional tics seen over a period of nearly 3 years at a national referral centre. In contrast to our cases, patients were older, with a mean age at onset of 37 years, and more males were affected than females. None of the patients presented with palil-, echo-, or coprophenomena. Ganos et al. [9] presented a case series of 13 adolescents and adults with coprolalic and other functional tic-like complex vocalizations collected from a sample of 1500 patients over a 20-year period. Although there were very few cases, the authors believe that the prevalence of functional coprolalia increased in their sample over the past decade due to raised awareness of TS.

Self-reported symptoms on measures of ADHD, anxiety, depression, and obsessive–compulsive behaviours were significantly higher in adults with rapid onset tic-like behaviours compared to adults with primary tic disorders in our sample. Despite the greater report of symptoms, the only significant difference in comorbid mental health diagnoses between groups was for depression. Although more than half of patients in the rapid onset tic-like behaviour group were diagnosed with an anxiety disorder, 25% of our primary tic disorder patients have also been diagnosed with an anxiety disorder, so the difference between groups was not significant. Although patients in the rapid onset tic-like behaviour group reported more ADHD symptoms and obsessive– compulsive behaviours, in-depth clinical interview did not reveal a symptom history congruent with the diagnosis of these disorders.

We believe the increase in functional tic-like behaviours during this time period is related to pandemic-induced psychosocial stress, social isolation, and disease modelling through social media. Over the course of the COVID-19 pandemic, there has been a significant increase in mental health symptoms and demand for mental health services [10,11]. Pandemic-related restrictions on social gatherings have significantly curtailed opportunities for face-to-face interactions, and a dramatic increase in use of social media platforms has occurred [12]. Relatedly, there has been dramatic growth in video material of youth manifesting tic disorders shared on social

### TABLE 1  Clinical characteristics of Adult Tic Disorders Registry participants

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Rapid onset tic-like behaviours, n = 9</th>
<th>Primary tic disorders [TS, PMTD, PVTD], n = 24</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years, mean (95% CI)</td>
<td>19.9 (18.8–21.0)</td>
<td>38.6 (30.7–46.5)</td>
<td>0.003</td>
</tr>
<tr>
<td>Gender, proportion</td>
<td>Female 100%</td>
<td>Female 25%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Age at onset, years, mean (95% CI)</td>
<td>15.3 (10.7–20.0)</td>
<td>10.1 (9.0–11.3)</td>
<td>0.0099</td>
</tr>
<tr>
<td>ADHD diagnosis, proportion</td>
<td>22%</td>
<td>25%</td>
<td>1.00</td>
</tr>
<tr>
<td>ASRS score, mean (95% CI)</td>
<td>17.3 (13.9–20.6)</td>
<td>11.8 (9.2–14.3)</td>
<td>0.01</td>
</tr>
<tr>
<td>OCD diagnosis, proportion</td>
<td>0%</td>
<td>33%</td>
<td>0.07</td>
</tr>
<tr>
<td>OCI score, mean (95% CI)</td>
<td>60.5 (18.2–102.8)</td>
<td>30.4 (18.3–42.6)</td>
<td>0.02</td>
</tr>
<tr>
<td>Anxiety diagnosis, proportion</td>
<td>56%</td>
<td>25%</td>
<td>0.12</td>
</tr>
<tr>
<td>GAD7 score, mean (95% CI)</td>
<td>14.0 (8.3–19.7)</td>
<td>9.6 (7.3–11.9)</td>
<td>0.04</td>
</tr>
<tr>
<td>Depression diagnosis, proportion</td>
<td>44%</td>
<td>8%</td>
<td>0.03</td>
</tr>
<tr>
<td>PHQ9 score, mean (95% CI)</td>
<td>19.0 (14.1–23.9)</td>
<td>9.0 (6.3–11.6)</td>
<td>0.0002</td>
</tr>
<tr>
<td>Substance use disorder, proportion</td>
<td>11%</td>
<td>4%</td>
<td>0.47</td>
</tr>
<tr>
<td>No psychiatric comorbidity, proportion</td>
<td>11%</td>
<td>42%</td>
<td>0.21</td>
</tr>
<tr>
<td>GTSQOL, mean (95% CI)</td>
<td>90.4 (72.1–108.6)</td>
<td>60.1 (50.2–69.9)</td>
<td>0.001</td>
</tr>
<tr>
<td>PUTS, mean (95% CI)</td>
<td>25.8 (19.6–31.9)</td>
<td>23.0 (19.2–26.7)</td>
<td>0.21</td>
</tr>
<tr>
<td>YGTSS Motor Tic Severity Score, mean (95% CI)</td>
<td>16.9 (13.7–20.1)</td>
<td>10.7 (8.8–12.6)</td>
<td>0.0005</td>
</tr>
<tr>
<td>YGTSS Vocal Tic Severity Score, mean (95% CI)</td>
<td>14.6 (10.2–18.9)</td>
<td>8.1 (5.7–10.5)</td>
<td>0.004</td>
</tr>
<tr>
<td>YGTSS Impairment Score, mean (95% CI)</td>
<td>33.8 (22.0–45.5)</td>
<td>19.1 (14.4–23.8)</td>
<td>0.003</td>
</tr>
<tr>
<td>Presence of complex arm/hand motor tics, proportion</td>
<td>89%</td>
<td>13%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Presence of complex vocal tics, proportion</td>
<td>89%</td>
<td>8%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Presence of coprolalia, proportion</td>
<td>67%</td>
<td>4%</td>
<td>0.0004</td>
</tr>
</tbody>
</table>

Abbreviations: ADHD, attention-deficit hyperactivity/impulsivity disorder; ASRS, Adult Self-Report Scale; CI: confidence interval; GAD7, Generalized Anxiety Disorder–7 items; GTSQOL, Gilles de la Tourette Quality of Life Scale; OCD, obsessive– compulsive disorder; OCI, Obsessive-Compulsive Inventory; PHQ9, Patient Health Questionnaire for depression; PUTS, Premonitory Urge for Tics Scale; PVTD, persistent vocal tic disorder; TS, Tourette syndrome; YGTSS, Yale Global Tic Severity Scale.
networks, generating millions of views. It is impossible to ignore the similarity of the repertoire of tic-like behaviours between our rapid onset cases and those seen on the social media channels of the most prolific influencers.

Differentiating between tics and functional tic-like movements is important as the approach to treatment is distinct, with prioritization of functional behavioural interventions in the latter. As we believe that individuals with rapid onset functional tic-like behaviours have a functional neurological disorder, we do not expect the pharmacological treatments used for individuals with primary tic disorders to be effective for these cases. Our treatment approach for these patients has included psychoeducation with patients and families to improve acceptance and understanding of the diagnosis, appropriate treatment of anxiety and/or depression if present, and behaviour therapy for tic-like behaviours. We have favoured the use of the Comprehensive Behavioural Intervention for Tics, [13] but with greater emphasis on the functional behavioural assessment and intervention than habit reversal therapy. The functional behavioural assessment focuses on identifying and addressing the internal and external antecedents and consequences of functional tic-like behaviours. We have had preliminary success with many patients using this approach and are currently collecting data as part of our prospective cohort study on short-term and long-term outcomes.

In conclusion, we propose that rapid onset tic-like behaviours are a distinct subtype of functional neurological disorder. The incidence of this functional neurological disorder phenotype has increased in young people since 2020, possibly related to the COVID-19 pandemic.

CONFLICT OF INTEREST
Neither of the authors has any conflict of interest to disclose.

AUTHOR CONTRIBUTIONS
Tamara Pringsheim: Conceptualization (lead), data curation (lead), formal analysis (lead), investigation (lead), methodology (lead), project administration (lead), writing—original draft (lead). Davide Martino: Conceptualization (supporting), investigation (supporting), methodology (supporting), project administration (supporting), writing—review & editing (equal).

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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