The Prevalence of Tourette Syndrome and Other Tic Disorders in Saudi Arabia

ABSTRACT

Background: Tic disorders (TD), including Tourette syndrome, are considered as one of the prevalent neurological conditions across the world which affects pediatric population. Tourette syndrome (TS), also called Gilles de la Tourette syndrome or Tourette disorder, a clinical subtype of TD with the most severe and persistent symptoms, is a complex multifaceted neurodevelopmental disorder characterized by multiple motor and at least one phonic tic starting before the age of 18 and lasting for at least 1 year.

Objectives: Our study is designed to assess the prevalence of Tourette syndrome and other tic disorders among Saudi population and examine the sociodemographic factors including age, sex, education, and birthplace.

Methods: A cross-sectional survey study conducted in Saudi population. An online questionnaire utilized to collect information from the population via various social media applications. The required minimum sample size is determined to be 384 participants. For statistical analyzation, the Statistical Package of Social Science Software (SPSS) program, version 20 (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.) was used.

Results: The study sample consisted of 2793 participants, 73% of them were females and 27% were males. 43.6% aged between 20- 30 years old and 33.4% aged less than 20 years old. 9.7% of participants suffer from Tourette syndrome while 5.7% of participants have a child who suffer from Tourette syndrome. Regarding co-morbid diseases, 23.7% suffer from anxiety disorder, 16.7% have sleeping disorder, 16.2% have depression, 10.8% eating disorder and 9.9% have obsessive-compulsive disorder. As for children with Tourette syndrome, 20.3% suffer from anxiety disorder, 19.5% have sleeping disorder, 18% have attention deficit hyperactivity disorder, 13.5% eating disorder and 7.9% have obsessive-compulsive disorder.

Conclusion: Prevalence of TS among adults and children is higher than reported in previous figures. TS is associated with psychological and neurological diseases especially among children. TS should no longer be considered merely a motor disorder and, most importantly, that TS is no longer a unitary condition, as it was previously thought. Clinical assessment of children with chronic tic disorders warrants examination of other problems such as ADHD, disruptive behavior and anxiety.

Keywords: Tourette Syndrome, Tic Disorders, Saudi population.

1. INTRODUCTION

Movement disorders (MD) are central nervous system disorders that lead to abnormal, unwanted, and unpleasant movements; moreover, they are usually not linked to weakness or spasticity. MD has two types: hypokinetic and hyperkinetic. In fact, tic disorders (TD) which are part of hyperkinetic disorders are considered as one of the prevalent neurological conditions across the world which affects pediatric population during their development. [1] Tics are defined as a sudden, nonrhythmic, twitch-like, involuntary, stereotyped, repetitive motor movements and vocalization of varying degrees of complexity. [2] Furthermore, tics have often been reported in the early life at age 4-6 years, with a maximum severity at 10 to 13 years on average and resolution after 21 years of age. [5]

Tourette syndrome (TS), also Gilles de la Tourette syndrome or Tourette disorder, a clinical subtype of TD with the most severe and persistent symptoms, is a complex multifaceted neurodevelopmental disorder characterized by multiple motor and at least one phonic tic starting before the age of 18 and lasting for at least 1 year. [4] TS was named after French neurologist Gilles de la Tourette who published clinical series in 1885. [9] The exact pathophysiology of TD remains unclear despite many years of research. However, many studies have shown that neurobiological, genetic, non-genetic, and psychosocial factors collectively play a significant role in the development and severity of TD. [7] Clinical manifestations of TS considerably vary reaching from simple motor and phonic tics including, eye blinking, mouth pouting, throat clearing, or sniffing to complex movements or vocalizations such as body turning or squatting, or the utterance of single words or phrases. [3] Several TS patients experience co-morbid neuropsychiatric disorders; indeed, the lifetime prevalence rate is 85.7%. [7]

Comorbidities including deficit hyperactivity disorder, anxiety disorders, and obsessive compulsive, which may lead to more distress and disability than tics. [3] Tic disorders (TD) are divided into primary and secondary TD. Primary TD is nevertheless regarded as more common than secondary TD, caused by other conditions, such as neurodegenerative disorders, strokes or substances. According to DSM-5 and ICD-10, primary tic disorders include TS (= combined phonic and motor tic disorder), chronic motor tic disorder (CMTD), chronic phonic tic disorder (CPTD), and provisional (or transient) tic disorder (PTD). Many individuals do not differentiate between TS and CMTD. The formal way to differentiate them apart is by the symptoms, in TS, multiple motor tics and at least one phonic tic must be present, whereas in CMTD, only motor tics are present. Furthermore, both disorders cannot be distinguished from each other by the number, severity, or complexity of the motor tics, or the kind/number of comorbidities. [8]

A recent research study has estimated the prevalence rates of pediatric TS and the results has shown that it ranges from 0.3 to 0.9%. [12] However, when the clinical manifestations last for a year or more, which is called persistent TS, then it is suspected that the prevalence rate was 3-4%. [7] Furthermore, in a previous study the prevalence rate in adolescents, whose age range between 12 to 17, was 3.33 per 1,000; whereas, the prevalence in adults ,whose age was 18 and older, was 0.66 per 1,000. [10] Indeed, TS presents with male predominance in comparison to female 3–4:1. [11] This study sought to address the gaps and limitations in TS prevalence by distributing a survey to a large sample using internet sampling methods. There are various obstacles to obtaining an accurate assessment for the prevalence of TS. firstly, there is no objective test available to determine the diagnosis. Secondly, biases can influence who seeks medical help. As a result, counting clinically ascertained cases is not a proper method of calculating the prevalence because undiagnosed cases in the community was missed. In fact, a study has reported that the

actual community prevalence of TS is underestimated by at least 10-fold if we depend on clinically confirmed cases only. [4]

Therefore, a valid trustworthy estimate of the prevalence relies on community surveys. An additional benefit of community sampling is that associations of TS identified in these samples can confirm or contradict the observed associations in clinical samples. Results from community samples may help to settle the matter on the association of TS and ADHD. Furthermore, TS prevalence lacks statistics in Saudi Arabia. Determination of an accurate TS prevalence is critical for understanding the overall disease significance and burden. [13] The purpose of this paper is to describe the prevalence of TS in the community.

Our study is designed to assess the prevalence of Tourette syndrome and other tic disorders among Saudi population and examine the sociodemographic factors including age, sex, education, and birthplace.

2. MATERIAL AND METHODS

2.1 Study design: This is a cross-sectional survey study that was conducted in Saudi population. An online questionnaire was utilized to collect information from the population via various social media apps.

2.2 Subject: Participants, recruitment and sampling procedure: Male and female participants diagnosed with tic disorders live in regions of KSA are the material of the present study.

2.3 Sample size: The estimated number of subjects that are needed in the study was calculated using Qualtrics calculator. Therefore, the required sample size was estimated at the 95 percent confidence level and 5 percent margin of error. The required minimum sample size is determined to be 384 participants.

2.4 Inclusion criteria: The inclusion criteria were as follow: 1- male and female of all ages 2- who lives in KSA. 3- who agrees to participate.

2.5 Exclusion criteria: The exclusion criteria were as follow:1- Who is Not known to have tic disorder or Tourette syndrome 2- who does not live in KSA. 3- Those who are diagnosed with seizure, Huntington disease, and Parkinson's disease.

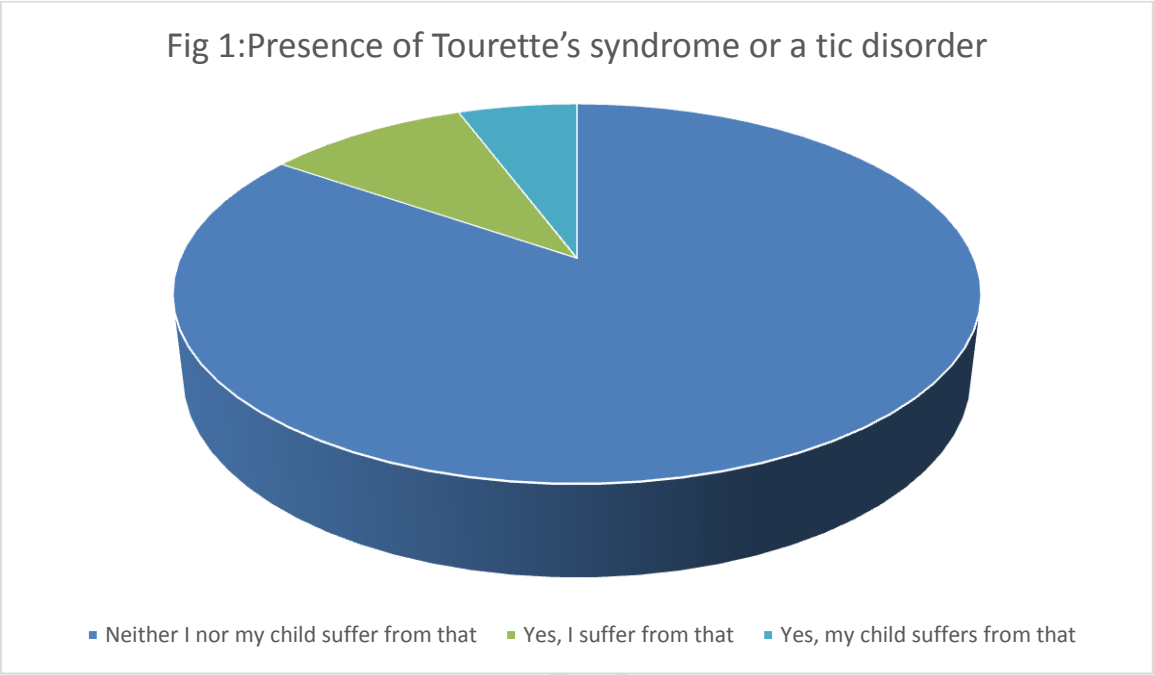
2.6 Method for data collection and instrument: The data analyzation was done through entering the data on the computer using the "Microsoft Office Excel Software" program (2016) for windows. For statistical analyzation, Data was then transferred to the Statistical Package of Social Science Software (SPSS) program, version 20 (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.)

3. RESULTS AND DISCUSSION

The study sample consisted of 2793 participants, 73% of them were females and 27% were males. 43.6% aged between 20- 30 years old and 33.4% aged less than 20 years old. 94.5% were Saudi. 58.3% of participants had bachelor degree while 28.6% had secondary school education. 9.7% of participants suffer from Tourette syndrome while 5.7% of participants have a child who suffer from Tourette syndrome.

Table (1): Sociodemographic characteristics of participants (n=2793)

Parameter		No.	%
Gender	**Male**	754	27.0
	Female	2039	73.0
Age	**Less than 20**	934	33.4
	20 - 30 years old	1218	43.6
	31 - 40 years old	319	11.4
	41 – 50 years old	192	6.9
	51 - 60 years old	96	3.4
	More than 60	34	1.2
Nationality	**Saudi**	2640	94.5
	Non-Saudi	153	5.5
Residence	**Northern region**	382	13.7
	Southern region	695	24.9
	Central region	454	16.3
	Eastern region	819	29.3
	Western region	443	15.9
Education level	**Not educated**	29	1.0
	Elementary education	67	2.4
	Intermediate Education	128	4.6
	Secondary education	800	28.6
	Bachelor's degree	1628	58.3
	Postgraduate degree	141	5.0
Presence of Tourette's syndrome or a tic disorder	**Neither I nor my child suffer from that**	2362	84.6
	Yes, I suffer from that	272	9.7
	Yes, my child suffers from that	159	5.7



Regarding signs and symptoms, 58.5% of participants who have Tourette syndrome reported repeated noises and sounds, 40.1% have repeated words or phrases, 70.6% repeated movements of parts of the face and head, 66.9% have repeated movements of the neck, shoulder or trunk, 35.7% repeated movements of arms, hands, legs, or feet, 43.4% reported involuntary touching objects, other people, or parts of his or her body repeatedly, 65.8% reported that these movements/sounds fluctuate over time, and 61.4% reported a sense of ‘‘urgency’’ before making the sound/movement. 53.3% of participants can suppress symptoms for a short period of time. 63.2% reported a feeling of relief when the tic movements are made. 33.1% had tics that caused them pain or physical damage .

Table (2): Signs and symptoms of Tourette syndrome among diagnosed participants (n=272)

	Yes	**No**
Repeated noises and sounds	159 58.5%	113 41.5%
Repeated words or phrases	109 40.1%	163 59.9%
Repeated movements of parts of the face and head	192 70.6%	80 29.4%
Repeated movements of the neck, shoulder or trunk	182 66.9%	90 33.1%
Repeated movements of arms, hands, legs, feet	97 35.7%	175 64.3%

Involuntary touching objects, other people	118 43.4%	154 56.6%
These movements/sounds, despite being repetitive, change	127 46.7%	145 53.3%
These movements/sounds fluctuate over time	179 65.8%	93 34.2%
Sense of ''urgency'' before making the sound/movement	167 61.4%	105 38.6%
Ability to suppress symptoms for a short period of time	145 53.3%	127 46.7%
Feeling of relief when the tic movements are made	172 63.2%	100 36.8%
Tics cause pain or physical damage	90 33.1%	182 66.9%

20.6% of participants were strongly affected and 44.5% were mildly affected by the tics interfering with their social life. 20.2% and 30.9% reported that tics strongly and mildly affected their ability to work respectively. 21% and 27.6% reported that tics strongly and mildly affected their academic life.

Table (3): Effect of Tourette syndrome on patients' lives (n= 272)

	Strongly affected	***Mildly affected***	***Not affected***
Tics interfere with social life	56 20.6%	121 44.5%	95 34.9%
Tics interfered with ability to work	55 20.2%	84 30.9%	133 48.9%
Tics interfered with academic life	57 21.0%	75 27.6%	140 51.5%

Regarding co-morbid diseases, 23.7% suffer from anxiety disorder, 16.7% have sleeping disorder, 16.2% have depression, 10.8% eating disorder and 9.9% have obsessive-compulsive disorder. 12.9% suffer from Seizure, Huntington disease, or Parkinson disease. 34.8% were medically diagnosed with any form of tic disorders. 26.8% take medication for the tics.

Table (4): Comorbid diseases with Tourette syndrome in diagnosed patients (n=272).

Parameter		**No.**	**%**
Psychiatric Comorbidities	**Anxiety Disorder**	129	23.7
	Eating disorder	59	10.8
	Sleeping Disorder	91	16.7
	Depression	88	16.2
	Obsessive-compulsive disorder	54	9.9
	Attention Deficit Hyperactivity Disorder	49	9.0

	Not suffering from that	74	13.6
First tic	**1- 5 days**	15	5.5
	6 - 10 days	45	16.5
	11 - 15 days	78	28.7
	16 - 20 days	71	26.1
	21 - 25 days	7	2.6
	26 - 30 days	5	1.8
	2 months	6	2.2
	3 months	10	3.7
	1 year	6	2.2
	5 years	3	1.1
	8 years	3	1.1
	Do not remember	22	8.1
Medically diagnosed with any form of tic disorders	**Yes**	93	34.8
	No	174	65.2
If yes, what is the diagnosis	**Chronic tic disorder**	12	4.4
	Non-specific tic disorder	16	5.9
	Tourette syndrome	47	17.3
	Transient tic disorder	22	8.1
	Not medically diagnosed	174	64.2
Medication for the tics	**Yes**	73	26.8
	No	199	73.2

Regarding signs and symptoms, 74.7% of children who have Tourette syndrome reported repeated noises and sounds, 36.7% of children have repeated words or phrases, 73.4% have repeated movements of parts of the face and head, 57% have repeated movements of the neck, shoulder or trunk, 53.8% repeated movements of arms, hands, legs, or feet, 49.4% reported involuntary touching objects, other people, or parts of his or her body repeatedly, 60.8% reported that these movements/sounds fluctuate over time, and 58.2% reported a sense of ‘‘urgency’’ before making the sound/movement. 53.3% of children can suppress symptoms for a short period of time. 41.1% of children reported a feeling of relief when the tic movements are made. 39.9% had tics that caused pain or physical damage to the child.

Table (5): Signs and symptoms of Tourette syndrome among diagnosed children (n=158).

	Yes	**No**
Repeated noises and sounds	118 74.7%	40 25.3%
Repeated words or phrases	58 36.7%	100 63.3%
Repeated movements of parts of the face and head	116	42

	73.4%	26.6%
Repeated movements of the neck, shoulder or trunk	90 57.0%	68 43.0%
Repeated movements of arms, hands, legs, feet	85 53.8%	73 46.2%
Involuntary touching objects, other people	78 49.4%	80 50.6%
These movements/sounds, despite being repetitive, change	89 56.3%	69 43.7%
These movements/sounds fluctuate over time	96 60.8%	62 39.2%
Sense of ''urgency'' before making the sound/movement	92 58.2%	66 41.8%
Ability to suppress symptoms for a short period of time	65 41.1%	93 58.9%
Feeling of relief when the tic movements are made	90 57.0%	68 43.0%
Tics cause pain or physical damage	63 39.9%	95 60.1%

20.6% of participants were strongly affected and 44.5% were mildly affected by the tics interfering with their social life. 20.2% and 30.9% reported that tics strongly and mildly affected their ability to work respectively. 21% and 27.6% reported that tics strongly and mildly affected their academic life.

Table (6): Effect of Tourette syndrome on children lives (n=158).

	Strongly affected	**Mildly affected**	**Not affected**
Tics interfere with child social life	**49** **31.0**	**87** **55.1**	**22** **13.9**
Tics interfered with child academic life	**83** **52.5**	**46** **29.1**	**29** **18.4**

Regarding co-morbid diseases in children with Tourette syndrome, 20.3% suffer from anxiety disorder, 19.5% have sleeping disorder, 18% have attention deficit hyperactivity disorder, 13.5% eating disorder and 7.9% have obsessive-compulsive disorder. 70.2% were medically diagnosed with any form of tic disorders. 55.7% take medication for the tics.

Table (7): Comorbid diseases with Tourette syndrome in diagnosed children (n=158)

Parameter		**No.**	**%**
Psychiatric comorbidities	**Attention Deficit Hyperactivity Disorder**	48	18.0
	Eating disorder	36	13.5
	Obsessive-compulsive disorder	21	7.9
	Anxiety Disorder	54	20.3

	Depression	27	10.2
	Sleeping Disorder	52	19.5
	Not suffering from any of that	28	10.5
Seizure, Huntington disease, or Parkinson disease	**Yes**	63	39.9
	No	95	60.1
Child 1st tic	**1 -5 days**	53	33.5
	6 - 10 days	70	44.3
	11 - 15 days	11	7.0
	16 - 20 days	8	5.1
	8 months	1	6.
	1 year	4	2.5
	two years	4	2.5
	5 years	3	1.9
	8 years	1	6.
	13 years	1	6.
	Do not know	2	1.2
Child medically diagnosed with any form of tic disorders	**Yes**	111	70.2
	No	47	29.8
If yes, choose child diagnosis	**Chronic tic disorder**	24	15.2
	Non-specific tic disorder	27	17.1
	Tourette syndrome	27	17.1
	Transient tic disorder	33	20.9
	Not medically diagnosed	47	29.7
Child take any medication for the tics	**Yes**	88	55.7
	No	70	44.3

There was a significant association between prevalence of Tourette syndrome with female gender, age, residence, and educational level (P= 0.001).

Table (8): Association between prevalence of Tourette syndrome with sociodemographic characters of participants

		Presence of Tourette's syndrome or a tic disorder			Total (N=2793)	P value
		Adult	A child	No		
Gender	**Male**	53	651	20	754	**0.001**
		33.3%	27.6%	37.0%	27.0%	
	Female	106	1711	34	2039	
		66.7%	72.4%	63.0%	73.0%	
Age	**Less than 20**	100	42	792	934	**0.001**
		36.8%	26.4%	33.5%	33.4%	
	20 - 30 years old	116	27	1075	1218	
		42.6%	17.0%	45.5%	43.6%	
	31 - 40 years old	27	31	261	319	
		9.9%	19.5%	11.0%	11.4%	
	41 – 50 years old	13	33	146	192	
		4.8%	20.8%	6.2%	6.9%	
	51 - 60 years old	8	19	69	96	
		2.9%	11.9%	2.9%	3.4%	
	More than 60	8	7	19	34	
		2.9%	4.4%	0.8%	1.2%	
Nationality	**Saudi**	265	152	2223	2640	**0.063**
		97.4%	95.6%	94.1%	94.5%	
	Non-Saudi	7	7	139	153	
		2.6%	4.4%	5.9%	5.5%	
Place of residence	Central region	64	12	378	454	**0.001**
		23.5%	7.5%	16.0%	16.3%	
	Eastern region	75	72	672	819	
		27.6%	45.3%	28.5%	29.3%	
	Northern region	22	12	348	382	
		8.1%	7.5%	14.7%	13.7%	
	Southern region	67	33	595	695	
		24.6%	20.8%	25.2%	24.9%	
	Western region	44	30	369	443	
		16.2%	18.9%	15.6%	15.9%	
Education level	**Not educated**	1	9	19	29	**0.001**
		0.4%	5.7%	0.8%	1.0%	
	Elementary education	2	24	41	67	
		0.7%	15.1%	1.7%	2.4%	
	Intermediate Education	18	12	98	128	
		6.6%	7.5%	4.1%	4.6%	
	Secondary education	83	23	694	800	
		30.5%	14.5%	29.4%	28.6%	

Bachelor's degree	164	83	1381	1628
	60.3%	52.2%	58.5%	58.3%
Postgraduate degree	4	8	129	141
	1.5%	5.0%	5.5%	5.0%

Discussion:

Tourette syndrome (TS) is a neurodevelopmental disorder characterised by multiple motor and one or more vocal/phonic tics. The epidemiology of Tourette syndrome is difficult to characterise because there is no definitive diagnosis. Symptom intensity and frequency decrease with age and in social situations, and affected individuals are frequently unaware of their tics. In our study, 9.7 percent of participants have Tourette syndrome, and 5.7 percent have a child who has Tourette syndrome. This was much higher than the 0.52 percent pooled TS population prevalence estimate reported in the 21 population-based prevalence studies. [14] A meta-analysis of 13 paediatric studies found a 0.77 percent prevalence of Tourette syndrome. Boys are more likely to be affected than girls: 1.06 percent of boys were affected compared to 0.25 percent of girls [15]. According to another study, both the TS Narrow and TS Intermediate definitions produced prevalence estimates (0.3 percent and 0.7 percent, respectively) that fall within the range of 0.3 percent to 0.8 percent reported by most population-based TS prevalence studies of school-age children over the past decade [16-18]. Although some recent studies reported significantly higher TS rates of 3% [19] and 3.8 percent [20], these findings were hampered by small sample sizes and low participation rates, respectively.

The wide range of symptoms associated with TS is one of its distinguishing features. Motor, vocal, and sensory tics typically begin during childhood/adolescence and progress in a waxing and waning pattern, with exacerbations during times of emotional stress; however, periods without such obvious symptoms are also common. Other than tics, symptoms such as echolalla and echopraxia, palilalia, coprolalia, mutilations, and disturbed impulse control are common, but they are not required for the diagnosis of TS [4]. Most patients describe a premonitory urge as a vague sense that they need to perform the movement, followed by a sense of relief after the tic. Around 20% of patients report a sensory component to the urge, which usually manifests as itching, tingling, or aching. Patients consistently report that this premonitory urge is the factor that is most bothersome in Tourette syndrome [19]. In our study, 58.5% of participants who have Tourette syndrome reported repeated noises and sounds, 40.1% have repeated words or phrases, 70.6% repeated movements of parts of the face and head, 66.9% have repeated movements of the neck, shoulder or trunk, 35.7% repeated movements of arms, hands, legs, or feet, 43.4% reported involuntary touching objects, other people, or parts of his or her body repeatedly.

For unknown reasons, younger children do not report this desire as frequently as older children. The movements themselves are involuntary in the sense that they are mostly subconscious and cannot usually be completely stopped by a patient, but they are influenced by the patient. The majority of patients claim to be able to suppress their tics for varying periods of time. This active suppression, on the other hand, can necessitate a great deal of concentration and energy. Patients report that suppressing tics increases the premonitory urge to a distressing level. Some patients are hesitant to try to suppress their tics because doing so may result in worsening tics or a sense that they are losing control of

their tics [5, 6]. Children in our study reported symptoms as 74.7% have repeated noises and sounds, 36.7% of children have repeated words or phrases, 73.4% have repeated movements of parts of the face and head, 57% have repeated movements of the neck, shoulder or trunk, 53.8% repeated movements of arms, hands, legs, or feet, 49.4% reported involuntary touching objects, other people, or parts of his or her body repeatedly.

Furthermore, in clinically ascertained samples, TS is frequently associated with multiple co-occurring neuropsychiatric conditions, particularly OCD and ADHD. Our findings show that 23.7 percent of patients have anxiety disorder, 16.7 percent have a sleeping disorder, 16.2 percent have depression, 10.8 percent have an eating disorder, and 9.9 percent have obsessive-compulsive disorder. In the largest clinical study of 3,500 TS patients from 64 international clinics, OCD was present in 27% (range 2–66%), while ADHD was present in 60% (range 33%–91%) [21]. Furthermore, only 12% of TS patients (range: 2%–35%) had tics without any other co-occurring disorders [21]. Another more recent survey of clinician-diagnosed TS in the United States discovered that 64% of children with TS had ADHD and 79% had at least one co-occurring neuropsychiatric disorder [22]. Even though these hospital-based estimates are useful for informing clinical practice, due to referral bias, they may overestimate the true rates of co-occurring disorders with TS in the general population. Several studies [23- 30] investigated the prevalence of TS-related OCD and/or ADHD in the general population. Some of these studies suggest that community-based TS subjects have lower rates of OCD [23, 29] (0 percent –19 percent) and ADHD [25] (8 percent) than clinic-based cases, while others are consistent with rates found in clinical populations: 42 percent for OCD [25] and 36 percent –100 percent for ADHD.

Using the National Health Insurance Research Database of Taiwan, Chen et al. [31] assessed the risk of traumatic brain injury in 2261 TS patients and 20349 non-TS controls (TBI). During follow-up, TS patients had a significantly higher risk of TBI compared to controls. Traditional comorbidities such as ADHD, OCD, and depression increased the risk of TBI, whereas regular antipsychotic medication use decreased it. These findings have important therapeutic implications because they highlight the importance of providing proper and sustained anti-tic treatment in patients, even if these treatments are sedative, as is the case with antipsychotics.

Comorbid neurobehavioral disorders are common in children with Tourette syndrome. The majority of patients have ADHD or OCD. Anxiety, sleep problems, poor impulse control, and other behavioural issues are common in children with GTS. These comorbid neurobehavioral disorders frequently cause the child more psychosocial impairment than the severity of the tics. For many years, children with TS have had higher-than-expected rates of ADHD, disruptive behavioural problems, obsessive-compulsive disorder (OCD), and anxiety. [32]. In our study, 20.3% of diagnosed children suffer from anxiety disorder, 19.5% have sleeping disorder, 18% have attention deficit hyperactivity disorder, 13.5% eating disorder and 7.9% have obsessive-compulsive disorder. There is ongoing debate whether these conditions are part of TS, due the burden of chronic illness, or simply unfortunate coincidence [33]. The early reports on concomitant disorders in samples of children with TS came from specialized clinical centers and are likely to be biased [34].

4. CONCLUSION

In conclusion, prevalence of TS among adults and children is higher than reported in previous figures. TS is associated with psychological and neurological diseases especially

among children. TS should no longer be considered merely a motor disorder and, most importantly, that TS is no longer a unitary condition, as it was previously thought. Clinical assessment of children with chronic tic disorders warrants examination of other problems such as ADHD, disruptive behavior and anxiety. Recognition of TS in children, especially minority children, is inadequate. Parents, educators, healthcare professionals, and administrators should be aware of the frequency with which tic disorders occur, and ensure proper access to appropriate care.

Consent

Informed consent was obtained from all participants included in the study.

Ethical approval

Ethical approval was obtained from Research Ethics Committee at Prince Sattam Bin Abdulaziz University.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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