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ORIGINAL ARTICLE

Tourette syndrome and socioeconomic status

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Abstract Tourette syndrome (TS) is a neurodevelopmental disorder characterised by multiple motor and vocal tics. Co-morbid behavioural problems are common and include obsessive–compulsive disorder, attention-deficit and hyperactivity disorder, depression and anxiety. Both tics and behavioural symptoms tend to have a chronic course and can affect patients' health-related quality of life; however, little is known about the relationship between TS, social status and occupation. We conducted an exploratory study on a clinical sample of 137 adult patients with TS to investigate the association between the core features of TS (both tic severity ratings and behavioural co-morbidities) and socioeconomic class. Both clinician- and patient-reported tic severity ratings were significantly higher amongst unemployed patients, compared to patients in the highest socioeconomic class ($P = 0.004$ and $P < 0.001$, respectively). There were no significant differences in socioeconomic class distribution between patients with TS and co-morbid behavioural problems ('TS plus', $n = 88$) and patients with uncomplicated TS ('pure TS', $n = 49$) ($P = 0.205$). Our findings suggest that higher tic severity can have far-reaching consequences on patients' life, as it appears to be selectively associated with unemployment and lower socioeconomic status. These observations prompt further research into the complex relationship between TS and social status.

Keywords Behavioural co-morbidities · Occupation · Tics · Tourette syndrome · Social class · Socioeconomic status

Introduction

Tourette syndrome (TS) is a childhood-onset neuropsychiatric disorder characterised by multiple motor tics and one or more vocal/phonic tics [1]. TS is three-to-four times more common in males, and is thought to affect up to 0.3–1 % of school-age children [2, 3]. Patients with TS show a wide spectrum of clinical severity, with variation in tic frequency, complexity (ranging from simple muscle contractions to complex echo- and coprophenomena) and associated distress [4–6]. Behavioural co-morbidities are common [7], especially obsessive–compulsive disorder (OCD) and attention-deficit and hyperactivity disorder (ADHD) [8–10], followed by depression, anxiety and impulsivity [11, 12]. Studies conducted both in specialist clinics and in the wider community have consistently shown that about 90 % of patients present with at least one co-morbid disorder ('TS plus'), as opposed to the remaining 10 % of patients with uncomplicated ('pure') TS [13–17].

Previous research has largely focused on tic severity and its impact on the multidimensional construct of health-related quality of life [6]. Although socioeconomic status is known to be a key factor for overall wellbeing and satisfaction with life in patients with neuropsychiatric

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conditions [18], the relationship between TS, tic severity, social status and occupation has been relatively under-researched. The UK Office for National Statistics has published guidelines for the classification of occupation level and socioeconomic class (SEC) [19]. A recent study by Miller et al. [20] on a large cohort of UK families suggested that lower parental socioeconomic status increases the risk of having offspring with TS by up to two times. In the present study, we set out to explore this association from a different perspective, examining whether the presence of TS (with or without co-morbidities) and tic severity can affect socioeconomic status in a large sample of adult patients in the setting of a specialist clinic.

Methods

Patients

One hundred and ninety-two patients with a confirmed diagnosis of TS were enrolled from a specialist outpatient clinic at the Department of Neuropsychiatry, BSMHFT and University of Birmingham, United Kingdom. Of these, 55 patients were excluded from the analysis due to their student status, leaving a total of 137 patients eligible for inclusion in the present study. This cohort was further divided into two subgroups, depending on the presence ('TS plus' group: $n = 88$) or absence ('pure TS' group: $n = 49$) of behavioural co-morbidities. The study was approved by the local Ethics Committee and written informed consent was obtained from all participants prior to enrolment.

Procedure

Patient information was collected according to a standardised protocol by trained clinicians using the National Hospital Interview Schedule, a comprehensive semi-structured diagnostic interview for patients with TS [21]. The Diagnostic Confidence Index (DCI) was used to systematically assess the lifetime presence of features that are highly characteristic of TS [22]. This index, which is scored out of 100, was designed to provide an estimate of the diagnostic certainty of TS. To determine whether tic severity is associated with SEC, we first characterised our patient population using general demographical data (including age, gender, ethnicity and marital status) and clinical parameters (including the presence of psychiatric co-morbidities and pharmacotherapy). SEC was categorised according to the Office for National Statistics (NS-SEC) classification system [19]. The NS-SEC was originally developed from the Goldthorpe Schema, a widely used sociological classification system. The NS-SEC has been validated and used across many fields (including the 2011 UK Census) to provide a framework for occupational stratification [23]. This classification system categorises all types of occupations into five classes (Table 1), based on service relationship, labour contracts, and degree of authority and control at work.

We retrospectively analysed our TS database, extracted occupational information and classified all patients according to this objective and structured framework (using the self-coding method outlined in the Office for National Statistics NS-SEC user manual) [19]. Patients who were unemployed were added to the occupation groups as a separate category.

Measures

Validated clinician-reported instruments (Yale Global Tic Severity Scale) [24] and patient ratings (Motor tic, Obsessions and compulsions, Vocal tic Evaluation Survey) [25] were used to objectively characterise the clinical severity of the study sample.

Yale Global Tic Severity Scale (YGTSS)

The YGTSS is a clinician-rated measure of tic severity that assesses five dimensions: tic number, frequency, intensity, complexity and interference [24]. Both motor and vocal tic severity scores range from 0 to 25 and their sum gives the total tic severity (out of 50). This latter score is added to an overall impairment factor (also out of 50) to provide a total score ranging from 0 to 100, with higher scores indicate greater severity. The psychometric properties of the YGTSS have been extensively investigated and this instrument is routinely used as a measure of tic severity in clinical studies [26].

Motor tic, Obsessions and compulsions, Vocal tic Evaluation Survey (MOVES)

The MOVES is a patient-reported severity scale designed to be easily completed by patients with TS of all ages [25]. The score is comprised of five domains: motor tics, vocal tics, obsessions, compulsions and associated features (complex tics such as echopraxia and coprolalia). Total MOVES scores range from 0 to 60, with higher scores indicating greater perceived severity. The scale has been validated and shown to correlate with clinician-reported tic severity measures [25].

Data analysis

Baseline (demographical) data were analysed to ensure minimal variation amongst our total TS, 'pure TS' and 'TS

Table 1 Socioeconomic classes categorised according to the Office for National Statistics (NS-SEC) classification system, with examples of occupations for each category

NS-SEC classes	Criteria
1	Managerial, administrative and professional (senior managers, professionals)
2	Intermediate occupations (secretaries, office clerks)
3	Small employers and self-employed (under 25 employees, freelance workers)
4	Lower supervisory and technical occupations (craft roles—mechanics, plumbers)
5	Semi-routine and routine occupations (postal workers, security guards, waiters)
Not classified	Students, occupation not stated, inadequate description

plus' groups (using Mann–Whitney *U* test, *t* test, Chi-square and Fisher's exact test, depending on the data involved). SEC distributions were compared across the different TS groups using the Chi-square test. We subsequently tested the association between tic severity (using both YGTSS and MOVES scores) and SEC in the total study population using the *t* test for parametric data, and Mann–Whitney *U* test for non-parametric data. SPSS for Windows, version 21 was used for all statistical analyses.

Results

The demographic and clinical characteristics of the research sample are presented in Table 2. No significant difference was found for any of the relevant variables, with the exception of marital status, as there were significantly more single individuals in the 'TS plus' group (52.3 %) compared to the 'pure TS' group (28.6 %) ($P = 0.010$).

Frequencies of patients in SEC graded from 1 to 5 (with an additional sixth category for unemployed patients) were analysed by proportion of the total sample (Table 3).

Visual inspection of the graphical representation of the data showed the proportions to be similar across the TS groups (Fig. 1), and Chi-square test revealed no significant difference in the SEC distribution when 'pure TS' and 'TS plus' were compared ($P = 0.205$).

Table 4 presents the results of the analysis on clinician-rated tic severity and SEC data in the total TS population. The lowest clinician-rated tic severity (YGTSS scores) was reported in SEC 1 (average score of 48.2/100 from 33 patients). The highest tic severity scores were found in the unemployed category (average score of 59.0/100 from 40 patients). A *t* test on the parametric data revealed a significant association between YGTSS scores and SEC category (SEC 1 versus SEC 6; $P = 0.004$).

Fourteen out of 137 patients with TS returned incomplete MOVES scores and were therefore removed from the analysis of patient-rated tic severity and SEC data (Table 5). The lowest patient-rated tic severity (MOVES scores) was reported in SEC 3 (median score of 12.0/60 from 7 patients). Patients in SEC 1 had a similarly low median score of 15.0/60. The highest tic severity scores were again found in the unemployed category (median score of 24.0/60 from 40 patients). A Mann–Whitney *U* test on the non-parametric data revealed a significant association between patient-rated tic severity and SEC category (SEC 1 versus SEC 6; $P < 0.001$).

Discussion

We conducted a large study at a single specialist TS centre to explore the impact of TS on SEC in a working age patient population, using validated psychometric instruments. The NS-SEC provided a standardised tool for the allocation of occupational stratification. High levels of unemployment were observed in our overall study sample of adult patients with TS (29.2 %), as well as in both subgroups of patients with 'TS plus' (31.8 %) and 'pure TS' (24.5 %). By comparison, 2011 UK census data for Birmingham and the West Midlands in an age-matched population showed an unemployment rate of 7.5 % [19]. Although different racial, educational and gender profiles cannot be ruled out, this difference suggests that TS has a negative impact on employability. There are several possible explanations for this observation, as implied by a study by Lewin et al. [27] in a female-only TS population, which found high rates of job interview avoidance and employment termination due to tics.

Our findings suggest that tic severity and SEC may be related. Specifically, we found that both clinician- and patient-reported tic severity ratings were significantly higher amongst unemployed patients when compared to those in the highest SEC (managerial and professional roles). This raises the possibility that more severe tics affect patients' employment prospects both directly in the workplace, and through lower educational achievement at an earlier stage. A recent study by Conelea et al. [28] investigated the impact of TS on income and occupation, amongst other markers of interference with physical, social and psychological wellbeing. Although this study did not look at SEC directly, the authors found that a significant proportion of patients reported symptoms causing interference with work relationships and productivity, and these

Table 2 Demographic and clinical data of the research sample

	Total sample ($n = 137$)	'TS plus' ($n = 88$)	'Pure TS' ($n = 49$)	*P*
Age				
Median age, years (IQR)	30 (25–44)	28 (25–44)	31 (25–45)	0.750
Gender				
Male, *n* (%)	97 (70.8)	59 (67.0)	38 (77.6)	0.195
Ethnicity				
White, *n* (%)	126 (92.0)	80 (90.9)	46 (93.9)	0.746
Black, *n* (%)	1 (0.7)	1 (1.1)	0 (0.0)	
Asian, *n* (%)	10 (7.3)	7 (8.0)	3 (6.1)	
Education				
University degree, *n* (%)	24 (17.5)	15 (17.0)	9 (18.4)	0.379
A levels, *n* (%)	23 (16.8)	18 (20.5)	5 (10.2)	
Technical/vocational training, *n* (%)	17 (12.4)	10 (11.4)	7 (14.3)	
GCSE/O levels, *n* (%)	48 (35.0)	27 (30.7)	21 (42.9)	
Left school without qualification, *n* (%)	25 (18.2)	18 (20.5)	7 (14.3)	
Marital status				
Currently married/cohabiting, *n* (%)	75 (54.7)	41 (46.6)	34 (69.4)	**0.010**
Separated/divorced, *n* (%)	2 (1.5)	1 (1.1)	1 (2.0)	
Never married/single, *n* (%)	60 (43.8)	46 (52.3)	14 (28.6)	
Medication				
Total on medication, *n* (%)	79 (57.7)	56 (63.6)	23 (46.9)	0.058
Neuroleptics, *n* (%)	13 (9.5)	8 (9.1)	5 (10.2)	
Atypical antipsychotics, *n* (%)	41 (29.9)	27 (30.7)	14 (28.6)	
Alpha2 agonists, *n* (%)	25 (18.2)	16 (18.2)	9 (18.4)	
Serotonergic agents, *n* (%)	39 (28.5)	31 (35.2)	8 (16.3)	
Clinical characteristics				
Presence of coprolalia, *n* (%)	43 (31.4)	32 (36.4)	11 (22.4)	0.093
Presence of echopraxia, *n* (%)	54 (39.4)	34 (38.6)	20 (40.8)	0.802
Presence of echolalia, *n* (%)	58 (42.3)	38 (43.2)	20 (40.8)	0.788
Presence of palilalia, *n* (%)	62 (45.3)	40 (45.5)	22 (44.9)	0.950
Disease duration (years), mean (SD)	25.9 (13.3)	25.8 (13.2)	26.1 (13.5)	0.366
DCI score, mean (SD)	65.7 (18.2)	66.5 (17.5)	64.2 (19.5)	0.241

Significant differences are indicated in bold

TS Tourette syndrome, *IQR* interquartile range, *SD* standard deviation, *DCI* Diagnostic Confidence Index

Table 3 Socioeconomic class distribution in a clinical sample of 137 adult patients with Tourette syndrome

NS-SEC category	Total sample ($n = 137$)	'TS plus' ($n = 88$)	'Pure TS' ($n = 49$)
SEC 1, *n* (%)	33 (24.1)	22 (25.0)	11 (22.4)
SEC 2, *n* (%)	14 (10.2)	11 (12.5)	3 (6.1)
SEC 3, *n* (%)	7 (5.1)	2 (2.3)	5 (10.2)
SEC 4, *n* (%)	16 (11.7)	8 (9.1)	8 (16.3)
SEC 5, *n* (%)	27 (19.7)	17 (19.3)	10 (20.4)
SEC 6 (unemployed), *n* (%)	40 (29.2)	28 (31.8)	12 (24.5)

TS Tourette syndrome, *NS-SEC* Office for National Statistics socioeconomic classification system

problems were positively associated with tic severity. Interestingly, reports of avoiding job advancement and new interviews because of tics were identified among the main factors mediating this association. The abovementioned study by Lewin et al. [27] also identified a significant correlation between tic severity and interference with occupation.

Interestingly, the results of our analyses indicate that the presence of psychiatric co-morbidity in TS may not have a significant impact on SEC. Previous research has yielded conflicting results about the impact of co-morbid OCD and ADHD on health-related quality of life [6], and in the present study we observed significantly higher rates of

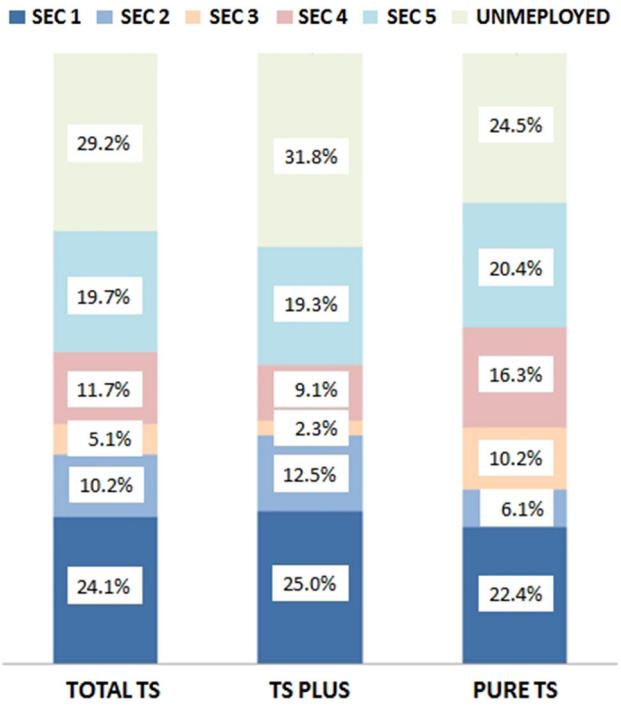

Fig. 1 Homogeneous socioeconomic class distribution across the total sample of patients with Tourette syndrome (TS; $n = 137$) and the two subgroups of patients with 'TS plus' ($n = 88$) and 'pure TS' ($n = 49$)

living alone circumstances (never married or single) in the 'TS plus' group of patients. It is possible that the effects of these common co-morbidities on the likelihood of marriage or cohabiting do not necessarily exert a significant influence on occupational status.

There are a number of limitations which could have affected our results. Importantly, participants were recruited from a population of patients with TS attending a single specialist clinic. Although patients are referred to this clinic from a large geographical area, the sample may not be representative of the general population of patients with TS. Many patients with TS are managed in the community, particularly if their symptoms are mild and do not interfere with functioning. This may mean that our sample included more patients with severe or complex clinical pictures, as opposed to the full spectrum of TS, and for this reason our results may not be generalizable to community populations. In fact, both DCI and YGTSS scores were consistently high in our study sample, suggesting significant disease burden. Several studies have also shown increased health-seeking behaviour amongst higher social classes [29]. Moreover, the reported male:female ratio of patients with TS is 3–4:1 [7, 13] however, in our sample 70.8 % of participants were male, with a male:female ratio of approximately 2.5:1. Again, the disparity in gender distributions between our sample and the general population of patients with TS may reduce the generalizability of our study. Finally, we did not have access to data about the SEC of the parents of the recruited patients. Based on the results of the study by Miller et al. [20], it cannot be ruled out that lower parental SEC might have increased the risk for TS as well as unemployment in the offspring: as a psychological stressor, unemployment might have in turn contributed to increase patients' tic severity. Theoretically, it could have been possible to disentangle the causal relationship between these threads using more sophisticated/extensive interview batteries to fully capture the educational and work-related trajectories of the recruited patients (and their parents) and/or by devising a long-term longitudinal cohort study.

In conclusion, taken together with previous findings [20], our data suggest that tic severity per se can have a significant impact on the position within social hierarchy.

Table 4 Clinician-rated tic severity and socioeconomic status (data available for $n = 137$ patients)

NS-SEC category	Motor tic severity (mean)	Vocal tic severity (mean)	Total tic severity (mean)	Total impairment (mean)	Total YGTSS (mean)	*P*
SEC 1 ($n = 33$)	14.8	10.3	25.1	23.3	48.2	–
SEC 2 ($n = 14$)	17.1	11.2	29.1	25.7	54.8	0.177
SEC 3 ($n = 7$)	17.3	11.4	28.7	28.6	57.3	0.139
SEC 4 ($n = 16$)	14.4	9.6	24.1	20.6	44.8	0.454
SEC 5 ($n = 27$)	16.6	12.8	29.9	25.6	55.4	0.055
SEC 6 (unemployed) ($n = 40$)	16.6	13.1	29.7	29.3	59.0	**0.004**

As YGTSS scores had a parametric distribution, the *t* test was used to compare total YGTSS scores in SEC 1 with the other SEC categories
Significant differences are indicated in bold

TS Tourette syndrome, *YGTSS* Yale Global Tic Severity Scale, *NS-SEC* Office for National Statistics socioeconomic classification system

Table 5 Patient-rated tic severity and socioeconomic status (data available for $n = 123$ patients)

NS-SEC category	Motor tics (median)	Vocal tics (median)	Obsessions (median)	Compulsions (median)	Complex tics (median)	Total MOVES (median)	*P*
SEC 1 ($n = 31$)	2.0	7.0	3.0	3.0	0.0	15.0	–
SEC 2 ($n = 14$)	3.0	7.0	3.5	5.0	0.5	19.5	0.238
SEC 3 ($n = 5$)	3.0	7.0	0.0	1.0	0.0	12.0	0.291
SEC 4 ($n = 14$)	2.5	10.0	3.5	3.5	0.5	21.0	0.179
SEC 5 ($n = 24$)	4.5	7.0	4.0	3.0	2.0	18.0	0.139
SEC 6 (unemployed) ($n = 35$)	5.0	9.0	5.0	5.0	1.0	24.0	**<0.001**

As MOVES scores had a non-parametric distribution, the Mann–Whitney *U* test was used to compare total MOVES scores in SEC 1 with the other SEC categories

Significant differences are indicated in bold

TS Tourette syndrome, *MOVES* Motor tic, Obsessions and compulsions, Vocal tic Evaluation Survey, *NS-SEC* Office for National Statistics socioeconomic classification system

These preliminary observations prompt further research, including qualitative studies, into the complex relationship between TS and socioeconomic class.

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Conflict of interest The authors declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Ethical standard The study was approved by the local Ethics Committee and written informed consent was obtained from all subjects prior to enrolment. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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