Journal of Psychiatric Research 47 (2013) 1013–1018

Contents lists available at SciVerse ScienceDirect

Journal of Psychiatric Research

journal homepage: www.elsevier.com/locate/psychires

Factors associated with newly diagnosed tic disorders among children in Taiwan: A 10-year nationwide longitudinal study

Chuan-Yu Chen [a,b,1], Hsin-Yi Liang [c,1], Chia-Ming Chang [c], Ju-Hwa Lin [d], Tsung-Kai Chang [e], Hui-Ju Tsai [e,f,*]

[a] Institute of Public Health, School of Medicine, National Yang-Ming University, Taiwan
[b] Center of Neuropsychiatric Research, National Health Research Institutes, Taiwan
[c] Department of Psychiatry, Chang Gung Memorial Hospital, Lin-Kou & Chang Gung University, Taiwan
[d] Department of Biological Science and Technology, China Medical University, Taiwan
[e] Division of Biostatistics and Bioinformatics, Institute of Population Health Sciences, National Health Research Institutes, Taiwan
[f] Department of Pediatrics, Feinberg School of Medicine, Northwestern University, Chicago, IL, USA

ARTICLE INFO

Article history:
Received 11 October 2012
Received in revised form
20 March 2013
Accepted 11 April 2013

Keywords:
Tic disorders
Incidence
Gender difference
Comorbidity

ABSTRACT

Increased attention has been paid to tic disorders clinically, yet relatively few studies have probed potential factors that account for the occurrence of tic disorders in the general population. In this study, we used data derived from the Taiwan's National Health Insurance Research Database to examine an array of factors related to the diagnosis of tic disorders and to further probe gender heterogeneity in clinical manifestation. Poisson regression analyses were applied to model the effects of birth cohort, period, and age, separately, on tic disorders. A total of 880 newly diagnosed tic disorders were identified from 2002 to 2009 among 100,516 youngsters in the study dataset who were born between 1997 and 2005. The results showed that a significant increase in the adjusted incidence rate ratio (IRR) was observed when age increased, with the highest adjusted IRR found at age 8–9 years. Compared to the time period from 2002 to 2005, an elevated IRR was found in the time period from 2006 to 2009 (adjusted IRR: 1.37; 95% CI: 1.05–1.80). Boys tended to be more likely to receive their initial diagnosis from psychiatrists and have higher comorbid attention-deficit/hyperactivity disorder (ADHD), as compared with their girl counterparts. In conclusion, the findings indicate that the effects of age and period, respectively, influence the occurrence of newly diagnosed tic disorders. Gender difference and higher frequent comorbid ADHD in boys than in girls were observed in this study.

1. Introduction

Tic disorders are complex neuropsychiatric disorders and composed of four syndromes including: chronic tic disorder (CTD), transient tic disorder (TTD), Gilles de la Tourette disorder (GTD) and tic disorder not otherwise specified (NOS) (American Psychiatric Association, 2000). The common phenomena of tic disorders include repetitive involuntary movements of phonic tics and motor tics, and behavior problems (Swain and Leckman, 2003). The reported prevalence of tic disorders ranges widely from 0.5% to 24.4% (Nomoto and Machiyama, 1990; Robertson, 2006a; Robertson et al., 2009). The variation of reported prevalence in tic disorders may be due to methodological differences such as different sample populations, different study designs, various diagnosis assessments, and different study age groups, etc. For example, a survey conducted in Swedish school children aged 7–15 years showed that the prevalence rate of tic disorders was 6 per 1000 (Khalifa and von Knorring, 2005). However, Olfson and collegaues, using claims data in the U.S., reported that the estimated annual prevalence rate of any tic disorder was 1.19 per 1000 in publicly insured youths and 1.04 per 1000 in privately insured youths (Olfson et al., 2011).

It has been reported that tic disorders are more common in childhood than in adulthood. Age of onset of tic disorders generally occurs between 4 and 6 years and the worst period is between 10 and 12 years (Leckman et al., 1998). Clinical symptoms of tic disorders often wax and wane over time while clinical manifestations begin to decline as an individual enters early adulthood (Bloch and Leckman, 2009). In addition to age of onset, both clinical and

* Corresponding author. Division of Biostatistics and Bioinformatics, Institute of Population Health Sciences, National Health Research Institutes, 35, Keyan Road, Zhunan Town, Miaoli County 350, Taiwan. Tel.: +886 37 246 166x36150; fax: +886 37 583 467.
E-mail addresses: tsaihj@nhri.org.tw, h-tsai@northwestern.edu (H.-J. Tsai).
[1] These authors contributed equally.

0022-3956/$ – see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.jpsychires.2013.04.009

epidemiological studies demonstrate that male gender is predominant in tic disorders across different countries (Robertson, 2008a; Khalifa and von Knorring, 2003; Jin et al., 2005), with estimated male-to-female ratio of tic disorders approximately from 2:1 to 4:1 (Swain and Leckman, 2003; Snider et al., 2002).

It has also been noted that subjects with tic disorders were often comorbid with other psychiatric disorders such as attention-deficit/hyperactivity disorder (ADHD), obsessive–compulsive behaviors (OCB) and disorder (OCD), and depression (Robertson, 2000, 2006b). In particular, ADHD, the most frequently encountered psychiatric condition in children and adolescents, has been reported to co-occur in 30% of subjects with tic disorders (Sukhodolsky et al., 2003; Rothenberger et al., 2007; Simpson et al., 2011). Other than psychiatric disorders, previous studies have linked tic disorders to some physical disorders such as allergic diseases (Ho et al., 1999; Chang et al., 2011). For example, Chang et al. have suggested that children with tic disorders have an increased risk of asthma, atopic dermatitis and allergic conjunctivitis, respectively (Chang et al., 2011).

At present, most previous studies of tic disorders have reported prevalence rates mainly from western countries (Martino et al., 2009; Knight et al., 2012); limited population-based studies have been conducted to investigate incidence rates and possible explanatory factors (such as age, gender, period and birth cohort), particularly in non-western societies. In addition, evidence pertaining to clinical profiles of children with tic disorders was mainly from clinical sample, such information for those with newly diagnosed tic disorders, which may provide a better understanding of help-seeking process and healthcare needs, is generally lacking. In the present study, an attempt has been made to examine factors related to the occurrence of newly diagnosed tic disorders among a group of children born between 1997 and 2005 over a 10-year study period, and to probe potential gender variation in the clinical profile.

2. Methods

2.1. Study population

The data used in this study were obtained from Taiwan's National Health Insurance Research Database (NHIRD). The NHIRD is derived from the National Health Insurance Program (NHIP). In detail, the NHIP was launched in 1995 and provided mandatory comprehensive medical care service to the residents in Taiwan. Since 1995, the NHIRD has been established and has collected data on all ambulatory care (including outpatient services) and all inpatient medical claims from the enrollees, which represent over 98% of the total population in Taiwan (Chen et al., 2007). Therefore, the NHIRD provides a valuable resource, a unique opportunity and sufficient sample size to undertake the objectives that are addressed in this study. Specifically, the data used in this study are from years 2000–2009, derived from the Longitudinal Health Insurance Database 2005 (LHID2005) of the NHIRD. Detailed information regarding the sampling method representative of the LHID2005 is provided in the following link (http://w3.nhri.org.tw/nhird/date_cohort.htm#1). Briefly, in the LHID2005, a total of 1,000,000 representative individuals (approximately 5% of the total population in Taiwan) was randomly sampled from the NHI Registry for Beneficiaries in 2005. In particular, further comparison found no significant differences in either the distribution of gender or age or in the average insured payroll-related amounts between individuals in the LHID2005 and the original NHIRD. For this study, the analyses were primarily focused on the NHI enrollees who were born between 1997 and 2005 ($n = 100{,}516$). This study protocol was approved by the Institutional Review Board at the National Health Research Institutes. All of the research meets the ethical guidelines, including adherence to the legal requirements of the study country.

2.2. Definition for newly diagnosed tic disorders

The definition for newly diagnosed tic disorders in this study was described as follows: (1) having received a diagnosis of the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes 307.20–307.23 between 2002 and 2009; and (2) having no medical claim diagnostic record of tic disorders in the two years preceding 2002 (i.e., 2000–2001) for either inpatient or outpatient medical services. A total of 880 children with incident tic disorders among 100,516 youngsters born between 1997 and 2005 in the study dataset were identified for subsequent analysis in this study.

2.3. Assessed and measured factors

The factors potentially related to the occurrence of newly diagnosed tic disorders include age (ranging from 0 to 12 years), birth cohort, gender, enrollee category (EC), time period (2002–2005 and 2006–2009), region (northern, central, southern and eastern) and urbanicity (urban, suburban and rural). Specifically, the birth cohort in this study included children born from 1997 to 2005. Two time periods (2002–2005 and 2006–2009) were defined to reflect variation in clinical practice and public awareness pertaining to tic disorders. With respect to EC, since most of the study subjects were dependents of the insured beneficiaries (those paying the insurance fee such as child's parents, grandparents or social welfare institutions), this study used EC as a proxy measure to represent the study subject's socio-economic status (SES). A detailed description of EC classification can be obtained elsewhere (Chen et al., 2008). Briefly, the insurance premium was determined based on enrollees' wage in the NHIP. Therefore, EC classified enrollees into 4 categories (EC I–EC IV), accordingly. Wage amount of enrollees in the first group of EC (EC I) was higher than those in subsequent EC groups (EC II–EC IV).

In addition, childhood-onset psychiatric disorders examined in this study included: pervasive developmental disorders (ICD-9-CM code: 299), mental retardation (ICD-9-CM codes: 317.00–319.99), mood disorders (ICD-9-CM codes: 296.00–296.23, 296.25–296.82, 296.89–296.99, 313.10–313.19, 301.11–301.13), obsessive compulsive disorder (ICD-9-CM code: 300.3), anxiety disorder (except for obsessive compulsive disorder) (ICD-9-CM codes: 300.00–300.09, 300.2, 300.90–300.99) and attention deficit hyperactivity disorder (ICD-9-CM codes: 314.00–314.99); and physical disorders included: epilepsy (ICD-9-CM code: 345), cerebral palsy (ICD-9-CM codes: 343.0–343.3, 343.8, 343.9), atopic dermatitis (ICD-9-CM code: 691), allergic rhinitis (ICD-9-CM code: 477) and asthma (ICD-9-CM code: 493).

2.4. Statistical analyses

We first calculated incidence density and the corresponding 95% confidence interval (CI) of the children with incident tic disorders in years 2002–2009 for the selected socio-demographic characteristics described above including: birth cohort, gender, EC, region and urbanicity. Since the properties of linear regressions (the assumptions of normality and constant variance) do not hold due to the relatively low incidence rate of tic disorders and potential variance fluctuation in incidence over time, we applied Poisson regression models in this study (Frome and Checkoway, 1985). We first regrouped the data into different categories based on the following variables: birth cohort, period, age, gender, EC, region and urbanicity, respectively. We then performed Poisson regression models to estimate the effects of each of those variables (birth cohort, period, age,