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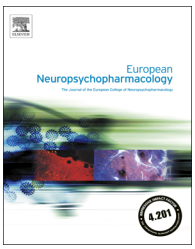

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Pharmacological treatment and demographic characteristics of pediatric patients with Attention Deficit Hyperactivity Disorder, Sweden

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Abstract
The aim of this study was to describe the pediatric population with ADHD and their pharmacological treatment. Using the Swedish National Patient Register and the Prescribed Drug Register we identified individuals below 19 years of age who were diagnosed or medically treated for ADHD for the first time 2006–2007. The unique patient identifiers were used to link information from the two registers to describe demographic characteristics, hospital care and drug treatments. Logistic regression model estimated the association between age, sex, frequency of hospitalization, diagnosis or treatment for other mental disorders and risk of gap in the treatment. Totally the study included 7931 patients of whom 74% were males. The mean age at first diagnosis was 12 years. Some 84% were medically treated for ADHD and approximately 90% received methylphenidate as the first substance. Combination therapy was rare and the most common combination was methylphenidate and atomoxetine. More than 55% of the patients, which could be followed up for two years after start of treatment, had at least one treatment gap of six months. Older age at diagnosis, lower number of hospitalizations and comorbidity with other mental disorders increased risks of gaps in medication. Approximately one fifth of the patients recorded in the National Patient Register as diagnosed with ADHD did not receive pharmacological treatment. Medication adherence seems to be low, when measured as gaps in treatment.

1. Introduction

Attention Deficit Hyperactivity Disorder (ADHD), characterized by concentration difficulties, hyperactivity and impulsivity,

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affects 5–10% of children and adolescents and approximately 4% of adults (Biederman, 2005). In Sweden 3–6% of children in school age are diagnosed with this disorder and it seems that males have 2–3 fold higher risks (Socialstyrelsen, 2004).

Patients with a diagnosis of ADHD have increased risks for other psychiatric morbidity and social problems. The children with ADHD are at higher risk of becoming drug abusers later in life (Yoshimasu et al., 2012). Approximately 80% of children and adults with ADHD reported to have at least one additional mental disorder, such as oppositional defiant disorder, anxiety disorder and depression (Kadesjo and Gillberg, 2001; Rodriguez et al., 2007).

Pharmacological treatment of ADHD should be considered when psychological treatments are insufficient alone or if the criteria for Hyperkinetic Disorder according to ICD-10 criteria are fulfilled (Taylor et al., 2004). According to the European recommendation methylphenidate should be the first choice (Taylor et al., 2004). A recent study (Zoega et al., 2011) showed that a considerable national variation in use of ADHD drugs exists between the Nordic countries. However, the study found that methylphenidate was the most commonly used ADHD drug in all countries. Zetterqvist et al. (2013) in a population-based Swedish study reported an increase in the number of prescriptions dispensed for ADHD drugs from 2006 to 2009 and a high rate of treatment discontinuation among these patients. Recently, Janols et al. (2009) described the use of central stimulants in ADHD in Sweden using information from the Medical Products Agency's database on named patient use. Information on demographic characteristics, such as age, sex, and concomitant drug treatment was, however, not addressed.

1.1. Aims of the study

The aims of this study were to describe pharmacological treatment and factors influencing medically treatment in pediatric patients diagnosed with ADHD. In particular, we investigated (A) association between some important characteristic factors – including age, frequency of hospital contact, diagnosis of other psychiatric disorders, and use of other classes of psychotropic medications – on the one hand and initiation of pharmacological treatment for ADHD and gap in treatment on the other (B) type of medication received by the patients, combination therapy and lack time between diagnosis and pharmacological treatment (C) proportion of patients in the cohort who are treated with psychotropic drugs other than ADHD drug.

2. Experimental procedures

All patients who, for the first time, received a diagnosis of ADHD or treatment for ADHD before 19 years of age in Sweden between January 1st, 2006 and December 31st, 2007 were identified using the National Patient Register and the Prescribed Drug Register. The patients were followed until December 31st, 2009. The National Patient Register held by the National Board of Health and Welfare includes data on all individual hospitalizations, since 1987, and information on hospital based outpatient care, since 2001. Each record contains information on sex, age, place of residence, hospital, dates of admission and discharge or visits and diagnoses. The diagnoses were coded according to the International Classification of Diseases (ICD) 10th revision during the study period and the code F90.0 was used to identify patients with a diagnosis of ADHD. In Sweden, patients with ADHD are mainly diagnosed and treated by psychiatrists, pediatric psychiatrists and pediatric neurologists, and the DSM-IV criteria for diagnosis of ADHD are used. In case of an indistinct diagnosis the diagnosis for hyperactivity (ICD-10 code R46.3) might be used.

The Swedish Prescribed Drug Register, established in July 2005 is updated monthly and contains information on dispensed medicines including dates of prescription and dispensing and certain information concerning the prescriber (Wettermark et al., 2007). We obtained information on purchases of all drugs used for treatment of ADHD (methylphenidate, atomoxetine, amphetamine and dexamphetamine recorded with the ATC-codes N06BA04, N06BA09, N06BA01 and N06BA02, respectively) and other psychotropic medications for the cohort. Both registers include information on the Swedish National Registration Number, an individually unique personal identifier assigned to every Swedish resident from birth or immigration, which enables linkages between the registers.

For deceased individuals we retrieved information on date of death form the National Board of Health and Welfare.

By including subjects with a first time ADHD diagnosis or treatment after January 1st, 2006 we identified 7931 patients of whom 5380 were included in the National Patient Register and an additional 2551 in the Swedish Prescribed Drug Register.

2.1. Statistical analyses

We estimated the incidence of ADHD during the study period and prevalence of pharmacological treatment in the Swedish population below 19 years of age (n=2,055,847). Pharmacological treatment was assessed by substance. We also performed stratified analyses by sex, age (age groups: <5, 5–9, 10–14, 15–18), ward level (in-patient versus out-patient) and residential place (the six Swedish healthcare regions i.e. Uppsala-Örebro, Stockholm-Gotland, South, Southeast, West and North).

The prevalence of combination therapies, and gaps in pharmacological treatment were also investigated. Combination therapy was defined as having a dispensing of two or more ADHD drugs during a period of six-month. Gap in treatment was defined as no purchase during a period of six-month followed by a resume of medication. The gaps were counted during a period of two years among children and adolescents who had at least two years follow-up after the start of pharmacological treatment (n=5985). The cumulative incidence of pharmacological treatment – the probability of receiving pharmacological treatment – after a diagnosis of ADHD was also estimated. Moreover, we investigated if the patients in the cohort had any record of other psychiatric disorders or treatment with other classes of psychotropic medications from July 2005 to the end of the study period.

Logistic regression models were used to investigate the association between demographic factors and risk of initiating ADHD treatment. As demographic factors we included sex, age (age groups: <5, 5–9, 10–14, 15–18), frequency of hospital contact (number of records: 1, 2–3, >3), history of other psychiatric disorders (yes, no; ICD-10 codes: F00–F99 or the corresponding codes according to the earlier versions of ICD, and excluding the codes for ADHD) and treatment with other classes of psychotropic medications (yes, no). For those who received pharmacological treatment we studied the association between these factors and risk of having a gap in medication. We used univariate models to estimate the crude relative risks and multivariate analyses to estimate adjusted relative risks.

As the diagnostic accuracy of ADHD could be a concern we reanalyzed the data restricted to those who had at least two recorded episodes with a diagnosis of ADHD in the Patient Register. Moreover, we studied characteristics of the individuals who filled