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Trends in ADHD medication use in children and adolescents in five western countries, 2005–2012

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Abstract
Over the last two decades, the use of ADHD medication in US youth has markedly increased. However, less is known about ADHD medication use among European children and adolescents. A repeated cross-sectional design was applied to national or regional data extracts from Denmark, Germany, the Netherlands, the United Kingdom (UK) and the United States (US) for calendar years 2005/2006–2012. The prevalence of ADHD medication use was assessed, stratified by age and sex. Furthermore, the most commonly prescribed ADHD medications were assessed. ADHD medication use prevalence increased from 1.8% to 3.9% in the Netherlands cohort (relative increase: +111.9%), from 3.3% to 3.7% in the US cohort (+10.7%), from 1.3% to 2.2% in the German cohort (+62.4%), from 0.4% to 1.5% in the Danish cohort (+302.7%), and

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from 0.3% to 0.5% in the UK cohort (+56.6%). ADHD medication use was highest in 10–14-year olds, peaking in the Netherlands (7.1%) and the US (8.8%). Methylphenidate use predominated in Europe, whereas in the US amphetamines were nearly as common as methylphenidate. Although there was a substantially greater use of ADHD medications in the US cohort, there was a relatively greater increase in ADHD medication use in youth in the four European countries. ADHD medication use patterns in the US differed markedly from those in western European countries.

1. Introduction

Attention-deficit/hyperactivity disorder (ADHD) is a psychiatric disorder with a male preponderance and a worldwide prevalence estimate of 3.4% in childhood and adolescence (Polanczyk et al., 2015), with European studies reporting lower prevalences (Döpfner et al., 2008; Green et al., 2005; Kvist et al., 2013; Meltzer et al., 2000; Russell et al., 2014) and US studies reporting higher prevalences (8.7%–10.6% (Visser et al., 2014; Wolraich et al., 2014)). Generally, studies employing DSM-IV ADHD criteria yield higher prevalences than those based on ICD-10 criteria (Döpfner et al., 2008; Ford et al., 2003). This is due to the fact that the ICD-10 equivalent of ADHD, the so-called "hyperkinetic disorder", is a narrower and more severe subtype of the DSM-IV "attention-deficit/hyperactivity disorder". For the sake of brevity, in the following text both disorders will be subsumised under the term "ADHD".

In school-age children, most international clinical guidelines on the management of ADHD recommend a stepwise approach to treatment, starting with non-pharmacological interventions (Thapar and Cooper, 2016) and, if this is not successful, pharmacological treatment should be initiated. In contrast, US guidelines recommend an individual treatment plan that can include pharmacotherapy, behavioral therapy and/or psychosocial interventions, but which is not designed in a stepwise fashion (Pliszka, 2007). In preschool children with ADHD, parent training should be given priority, and – with the exception of the US (Pliszka, 2007) – prescription of ADHD medication is not encouraged (National Institute for Health and Care Excellence, 2008).

In recent years, the prevalence of ADHD medication use has increased in several countries (Burcu et al., 2016; Dalsgaard et al., 2013; Visser et al., 2014). These increases have been seen across all age groups, from young children to adolescents, and the use is increasingly continued into adulthood (Dalsgaard et al., 2013; Johansen et al., 2015).

For decades, methylphenidate has been the most commonly prescribed drug for treatment of ADHD symptoms, however, use of other drugs for the treatment of ADHD (e.g. atomoxetine, lisdexamfetamine) is increasing (Health and Social Care Information Centre, 2015). According to international treatment guidelines, methylphenidate or dexamfetamine are recommended as first-line pharmacological treatment and atomoxetine as second line in both children and adolescents (Thapar and Cooper, 2016). Long-term effectiveness and safety data are lacking, and there are concerns about safety aspects of prescribing ADHD medication in the pediatric population (Zito and Burcu, 2016). Despite largely similar treatment guidelines, the use of medication and psychosocial treatment for ADHD varies significantly between countries (Hinshaw et al., 2011; Setyawan et al., 2015). Therefore, an international comparison of medication trends is useful in order to compare medication use patterns.

In this study, we aimed to compare trends in prevalence of ADHD medication use in children and adolescents (0–19 year-olds) in Denmark, Germany, the Netherlands, the United Kingdom (UK), and the United States (US), stratified by sex and age. Additionally, we aimed to assess the most commonly prescribed ADHD medications.

2. Experimental procedures

2.1. Data sources

2.1.1. Denmark

This study was performed using data from the Danish Registry of Medicinal Products Statistics (RMPS). The RMPS constitutes a national prescription database of all outpatient pharmacy-dispensed prescription medications for the 5.5 million Danish inhabitants. Each prescription record contains detailed information on the drug dispensed (including ATC code). The prevalence of ADHD medication use was calculated using an estimation of the underlying population of 0- to 19-year olds as denominator.

2.1.2. Germany

We used administrative data of the BARMER GEK, which is the largest German health insurance company (9.1 million insurees, representing more than 10% of the German population). In comparison to the total German population, the BARMER GEK insures a higher proportion of females, but there are no differences regarding the socioeconomic status (as measured by education level) (Hoffmann and Bachmann, 2014). Each year's cohort consisted of all insurees who were insured at least 1 day in all four quarters. Each prescription record contains detailed information on the drugs dispensed including ATC code.

2.1.3. The Netherlands

We used pharmacy dispensing data from the IADB.nl (Visser et al., 2013). Dutch patients usually register at a single community pharmacy, so a single pharmacy provides an almost complete listing of each subject's dispensed prescriptions. The IADB database includes all prescription drug dispensing data from 59 pharmacies since 1997 for about 600,000 persons in the northern and eastern parts of the Netherlands. With the exception of over-the-counter drugs and in-hospital prescriptions, all prescriptions, regardless of prescriber, reimbursement status, or insurance, are covered by the