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The youngest get the pill: ADHD misdiagnosis in Germany, its regional correlates and international comparison☆

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ABSTRACT

Attention Deficit/Hyperactivity Disorder (ADHD) is a leading diagnosed health condition among children in many developed countries but the causes underlying these high levels of ADHD remain highly controversial. Recent research for the U.S., Canada and some European countries shows that children who enter school relatively young have higher ADHD rates than their older peers, suggesting that ADHD may be misdiagnosed in the younger children due to their relative immaturity. Using rich administrative health insurance claims data from Germany we study the effects of relative school entry age on ADHD risk in Europe's largest country and relate the effects for Germany to the international evidence. We further analyze different mechanisms that may drive these effects, focusing on physician supply side and demand side factors stemming from the production of education. We find robust evidence for school-entry age related misdiagnosis of ADHD in Germany. Within Germany and internationally, a higher share of misdiagnoses are related to a higher overall ADHD level, suggesting that misdiagnoses may be a driving factor of high ADHD levels. Furthermore, the effects in Germany seem to be driven by teachers and parents in an attempt to facilitate and improve the production of education.

1. Introduction

ADHD has been rising dramatically among school children over the past decade and it is now the leading diagnosed health condition in Germany and other Western countries like the U.S. ADHD treatment has the potential to help children with ADHD – as well as their peers – focus in class and reduce risky behavior outside of school (Aizer, 2008; Dalsgaard et al., 2014; Chorniy and Kitashima, 2014). But the psychoactive medication also alters the brain function and might have negative short- and long-term effects on human capital development (Gould et al., 2009; Cascade et al., 2010; Currie et al., 2014). It is therefore an important question whether the increases in the diagnosis of ADHD are due to an actual deterioration in mental health among recent generations of children or whether some of it is driven by an increase in cases of misdiagnosis. And if there is misdiagnosis, it is important to know which factors are driving it. For example, it could be driven by doctors who overtreat in response to a more competitive health care environment or by teachers and parents who seek to improve the teaching environment and children's educational outcomes?

One way to identify potential cases of ADHD misdiagnosis in observational health care data is to study ADHD rates around school entry cutoff dates (Elder, 2010; Evans et al., 2010). Children who are born right before the cutoff date will enter school a year earlier than those born right after the cutoff and will be almost a year younger than the oldest (those born right after the cutoff in the year before) in their class. Relatively younger students are less mature and often less disciplined than their older classmates. But being born right before a cutoff date should not be correlated with the risk of ADHD, a largely genetically determined condition (Faraone et al., 2005; Tarver et al., 2014). Hence, jumps in ADHD prevalence between cohorts born just before and just after school entry cutoff dates are an indicator of misdiagnosis. Previous studies have found such evidence of misdiagnosis around the age cutoffs for the U.S., Canada, the Netherlands, Sweden, and Iceland (Elder, 2010; Evans et al., 2010; Morrow et al., 2012; Halldner et al., 2014; Krabbe et al., 2014; Zoëga et al., 2012), while no effects have been found for Denmark (Dalsgaard et al., 2012; Pottegård et al., 2014). Overall, drivers behind the ADHD jumps around cutoff dates remain uncertain, though plausible explanations have been proposed (e.g. Dalsgaard et al., 2012).

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In this paper we use data on more than 7 million German children to analyze ADHD rates around school entry cutoff dates in unprecedented detail for one of the largest countries of the developed world. The data is based on the universe of outpatient health insurance claims for publicly insured children (about 90% of all children in Germany) over the years 2008–2011. The German education system is organized at the level of 16 states and there are various different cutoff dates. The variation in cutoff dates together with the large sample size provides us with sufficient statistical power to estimate jumps around age cutoffs non-parametrically and conduct subgroup analyses across cohorts, ages, gender and districts. We further merge information on regional physician supply, schooling environment and parental background to our data in order to investigate factors associated with the cutoff jumps.

We find large jumps in ADHD rates around cutoff dates, amounting to 22% for children aged 9 to 13 (1 percentage point at a baseline ADHD rate of about 5% in that age range). These jumps occur at different months across states in accordance with the different cutoff dates, indicating that the jumps in prevalence rates represent misdiagnoses rather than actual differences in children's health which are unlikely to be spuriously correlated with the different cutoff dates across states. The cutoff dates also impact medical treatment of ADHD. Moreover, there is no comparable pattern for the prevalence of diabetes or for hay fever, a condition with similar prevalence rates as ADHD. This indicates that jumps in ADHD rates around cutoffs are not driven by seasonality in students' health or a general effect of relative age on physicians' diagnosing behavior but that they are specific to ADHD. There is also no effect of relative age on injury rates among children without ADHD diagnosis. This finding supports the notion that misdiagnoses around age cutoffs are driven by overdiagnoses among younger students rather than underdiagnoses among older students who should – if lacking required ADHD treatment – suffer from higher injury rates.

Misdiagnosis rates around cutoff dates are strongly correlated with the average level of ADHD rates, both across regions as well as within regions over time. Remarkably, this relationship of misdiagnosis rates and average ADHD levels is very similar to the relationship that we find when comparing the estimates across the countries that have been analyzed in the existing literature. This result suggests that misdiagnosis rates around cutoff dates are an explanatory factor of the high ADHD rates observed in many countries, perhaps proxying for a general tendency to overdiagnose ADHD. An important question therefore is: Which factors are driving these misdiagnoses?

Merging the ADHD data to district level characteristics we find that jumps in ADHD prevalence around the cutoff dates are weakly negatively related to the density of pediatricians, psychiatrists or psychologists. This finding rejects the hypothesis that a more competitive health care environment characterized by a higher physician density induces physicians to overdiagnose. If anything a larger supply of physicians leads to a decrease in misdiagnoses. However, we do find that misdiagnosis rates within regions increase over time with the share of foreign students and class sizes as well as with a region's average income and education. These results suggest that jumps might be driven by teachers and parents in an attempt to facilitate and improve the production of education.[1] On the teacher side, the relative immaturity of younger students might become more apparent in difficult schooling environments and teachers might be more inclined to interpret disruptive behavior as pathological. Well-educated parents, on the other hand, might be particularly concerned about their children's education and thus try to counteract the possible disadvantages in performance if their children are particularly young for their grade level. Whether such potential ADHD overtreatment can actually lead to improvements in educational outcomes for a misdiagnosed child or for her or his peers remains an open question.

Our paper makes three main contributions. First, we show the existence and relevance of ADHD misdiagnoses around age cutoffs in one of the world's largest developed countries. This result is unexpected since no effects have been found in Denmark, a neighboring country of Germany with a similar health care system. Second, we unify a broad range of estimates from the literature and show that the previously unexplained variability in observed cutoff jumps is closely linked to countries' levels of ADHD prevalence. Third, we quantitatively explore potential mechanisms, relating average cutoff jumps to district-level characteristics.

Previous studies have found a wide range of estimates for jumps in ADHD rates around school entry age cutoffs, ranging from zero in Denmark (Dalsgaard et al., 2012) to 50% in Iceland (Zoëga et al., 2012) and the U.S. (Elder, 2010; Evans et al., 2010). Our estimates of about 20% are in the mid-range and closest to the cutoff jumps found in Canada (Morrow et al., 2012). We show that this cross-country variation in cutoff jumps is highly predictive of a country's average ADHD level and that this positive relationship is remarkably linear. Moreover, it is very similar to the relationship observed across German states. In other words, countries and regions with strong jumps in ADHD rates around age cutoffs have also higher overall ADHD rates, perhaps because the cutoff jumps proxy for a general tendency to mis- and overdiagnose ADHD. This finding does not only unify the wide range of estimated cutoff jumps from previous studies, it also underlines the importance of the literature on cutoff jumps to help the understanding of the high ADHD rates in the Western world.

Whether jumps in ADHD rates around age cutoffs represent misdiagnoses and – in case they do – whether they are driven by over- or underdiagnoses is a central question in the literature that has not yet been explored extensively. Elder (2010) provides evidence that jumps represent misdiagnoses, based on the comparison of how teachers and parents assess students' behavior. However, in principle these misdiagnoses might not only stem from overdiagnoses (i.e. false positives) among younger students but could also be driven by underdiagnoses (i.e. false negatives) among older students (Evans et al., 2010). Our analysis of injury data supports the notion that these misdiagnoses actually represent false positives.

Another central question of the literature is which factors drive the observed jumps in ADHD rates around cutoff dates. Dalsgaard et al. (2012) suggest that one factor leading to low misdiagnosis rates in Denmark could be the supply of physicians with good diagnostic skills. In Denmark only specialist physicians are allowed to diagnose ADHD and these doctors might be less prone to misdiagnoses. Our findings are in line with the hypothesis of Dalsgaard et al. (2012). We find that a greater per-capita density of those doctors who are typically diagnosing ADHD in Germany is associated – if anything – with *lower* misdiagnosis rates and this is also true when looking at changes over time.

Elder (2010) provides evidence for the U.S. – with high misdiagnosis rates at the other end of the ADHD spectrum – that teachers might be a driving force behind cutoff jumps. Our finding of increasing misdiagnoses rates in areas with increasing class sizes and rising shares of foreign students is in line with Elder's (2010) hypothesis that teachers' demand for ADHD medication of their students might be part of the story. However, we find that parents may also play a role as areas with rising shares of employees with higher education and increasing labor income have increasing rates of misdiagnoses.

The paper proceeds as follows: Section 2 discusses the school and health care system in Germany. Section 3 provides an overview of our data and methods. Section 4 presents the results, and a conclusion follows in Section 5.

[1] Both teachers and parents can influence ADHD diagnoses. As in the U.S., ADHD diagnosis guidelines in Germany require that doctors take parents' and teachers' assessment of a child's behavior into account.

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