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Do stimulant medications improve educational and behavioral outcomes for children with ADHD?

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ABSTRACT

We examine the effects of a policy change in the province of Quebec, Canada which greatly expanded insurance coverage for prescription medications. We show that the change was associated with a sharp increase in the use of stimulant medications commonly prescribed for ADHD in Quebec relative to the rest of Canada. We ask whether this increase in medication use was associated with improvements in emotional functioning or academic outcomes among children with ADHD. We find little evidence of improvement in either the medium or the long run. Our results are silent on the effects on optimal use of medication for ADHD, but suggest that expanding medication in a community setting had little positive benefit and may have had harmful effects given the average way these drugs are used in the community.

1. Introduction

Over the past twenty years, mental disabilities have overtaken physical disabilities as the leading cause of activity limitations in children. Today, ADHD is three times more likely than asthma to be contributing to childhood disability in the United States (Currie and Kahn, 2012). Recent research indicates that children with ADHD have lower standardized test scores than others (including their own siblings) and are more likely to be placed in special education, to repeat grades, and to be delinquent (Miech et al., 1999; Nagin and Tremblay, 1999; Currie and Stabile, 2006, 2009; Fletcher and Wolfe, 2008, 2009). Moreover, untreated children with ADHD impose significant costs on their classmates by disrupting learning and/or diverting teacher resources (Aizer, 2009).

According to the most recent data from the Centers for Disease Control and Prevention, approximately eleven percent of U.S. children aged 4–17 have ever been diagnosed with ADHD and more than half of them are taking stimulant medications such as Ritalin for their condition (Schwarz and Cohen, 2013; Centers for Disease Control and Prevention, 2005).[1] Both diagnosis and treatment rates are lower outside the U.S., but have been rapidly increasing (Polanczyk et al., 2007).

Despite, or perhaps because of the millions of children taking stimulants, drug treatment for ADHD remains controversial. The National Institute of Mental Health recommends treatment with stimulants and says that they are safe if used under medical supervision (U.S. NIMH, 2012). However, concerns continue to surface about both short-term side effects, and possible side effects due to long-term use. For example, the U.S. Food and Drug Administration voted in 2006 to recommend a warning label describing the cardiovascular risks of stimulant drugs for ADHD (Nissen, 2006). Other side effects can include decreased appetite, insomnia, headache,

[1] Schwarz and Cohen tabulate data from the 2011–2012 wave of the National Survey of Children's Health. Methylphenidate (sold under the trade names Ritalin, Biphentin, and Concerta) is the most commonly used central nervous system stimulant for ADHD. Others include: dextroamphetamine (Dexedrine); and mixed amphetamine salts (Adderall) (Therapeutics Initiative, 2008).

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stomachache, dizziness and mood changes including anxiety and depression (Schachter et al., 2001; National Institute of Mental Health, 2012). Some studies have also found growth deficits in treated children (Joshi and Adam, 2002). Aside from the possibility of physical side effects, inappropriate use of stimulant medication could also harm children by stigmatizing them or by crowding out other interventions that might be more helpful.

Lack of evidence regarding long-term benefits of stimulant medications is a key element of this controversy. Drugs are often prescribed with the goal of helping children to be successful in school. If the drugs do not actually lead to scholastic benefits in the medium and long run, then the case for subjecting children to even a small risk of side effects is weakened. The main problems involved in assessing the long-run efficacy of stimulant medication are first, that most drug trials follow children only for a short time – between one and two months after treatment (Griffin et al., 2008) – and second, that families (and children) choose whether or not to seek treatment for ADHD, and whether to take medication if it is prescribed.

Our paper assesses the medium and long run benefits of treatment for ADHD with stimulant medication using longitudinal data from the National Longitudinal Survey of Canadian Youth (NLSCY), and a unique policy experiment which expanded insurance coverage for drugs in Quebec in 1997. Our study improves on the previous literature in many respects. First, we have a large sample of children who have been followed from 1994 to 2008. We are able to observe medium term outcomes such as grade repetition and math scores, as well as long term outcomes like graduation from high school and whether children ever attended college. Moreover, we know whether children were taking stimulant medication as of each wave. An important feature of the NLSCY is that all children were assessed for ADHD symptoms, so we do not have to deal with selection into diagnosis. A third innovation is that we are able to exploit exogenous variation in the availability of drugs due to the policy experiment. Fourth, in our analysis of medium term outcomes we are able to use individual fixed effects to control for unobservable differences between children that might influence both treatment and outcomes.

We find that the introduction of the prescription drug insurance program increased the use of stimulants in Quebec relative to the rest of Canada. However, we find no evidence that the performance of children with ADHD improved. In fact, the increase in medication use among children with ADHD is associated with increases in the probability of grade repetition, lower math scores, and a deterioration in relationships with parents. When we turn to an examination of long-term outcomes, we find that increases in medication use are associated with increases in the probability that a child has ever suffered from depression and decreases in the probability of post-secondary education among girls.

The rest of the paper is laid out as follows. Section 1 reviews the previous literature about the consequences of ADHD for child outcomes and the controversy surrounding ADHD medications. Section 2 discusses our data and Section 3 discusses methods. The results appear in Sections 4 and Section 5 concludes.

2. Background

In view of the importance of ADHD and the fact that stimulant medications have been used for many years, it is perhaps surprising that most of the evidence regarding their efficacy relates to short time horizons. Controlled studies suggest that medication improves attention, short-term memory, performance on quizzes, homework completion, and note-taking (Douglas, 1999; Bedard et al., 2007; Pelham et al., 1993; Evans et al., 2001). It is often assumed that these improvements will translate into future academic gains, but few studies actually track children longer than a few months. Moreover Schachter et al. (2001) argue that the positive short-run effects on attention and behavior may be over-estimated given publication bias toward positive findings. An additional concern is that the doses that yield the most desirable behavior may not be calibrated to achieve the greatest possible improvement in cognitive functioning (Wigal et al., 1999).

One of the most widely known longer term studies of the effects of medication for ADHD is based on the U.S. National Institute of Mental Health 14 month Multimodal Treatment study (MTA). It is important to note that this study did not compare medication to non-treatment; instead, the MTA compared different types of treatment. Specifically, the MTA randomized 579 children with ADHD into four arms: stimulants alone; behavioral therapy alone; stimulants plus behavioral therapy; or usual community care, which involved treatment with stimulants but with possibly less than optimal dosages. Blinded classroom observations did not find any significant differences in behavior between the four groups. At the end of 14 months, 49.8% of children reported mild side effects, 11.4% reported moderate side effects, and 2.9% reported severe side effects (The MTA Cooperative Group, 1999).

Molina et al. (2009) discuss a long-term follow up of children from the MTA study which included 436 of the original study children and 261 "controls" who were randomly selected from the same schools and grades 24 months after the original study began and matched with treatment children by age and gender. They find that 6–8 years following the initial intervention, there were still no differences between the children in the four treatment groups. They also find that the treatment children were worse off than the "controls" on virtually every measure but it is important to note that these controls were not part of the original randomized design so this comparison does not constitute an experimental evaluation of the long term benefits of drug treatment compared to non-treatment. Of those originally assigned to take medications, 62% had stopped taking them by the time of the follow up which is remarkable in itself since it suggests dissatisfaction with the drug regimen. However, adjusting for this attrition did not affect the differences between treated children and control children.

Barbaresi et al. (2007) follow 370 children with ADHD from a 1976–1982 birth cohort study. They obtained the complete school record, as well as medical records with information about stimulant use for each child. They found that in this sample of children with ADHD diagnoses, longer duration of stimulant use was associated with reductions in absences and retention in grade but had no effect on school dropout. However, endogeneity of stimulant use makes these results difficult to interpret. If the children with the worst attention difficulties were most likely to take medication, then any positive effects of medication would be biased toward zero. Alternatively, if children from the best backgrounds were most likely to take stimulants properly, then this might bias the analysis toward finding a positive effect.

Zoega et al. (2012) use registry data from Iceland, which has a measured prevalence of ADHD and a usage of stimulant medication that is similar to the U.S. They linked information from medical records to a data base of national scholastic examinations for children born between 1994 and 1996 who took standardized tests at fourth and seventh grade. In order to deal with the endogeneity of treatment, they include only children who were "ever treated" between the ages of 9 and 12, and focus on whether they were treated sooner or later. They find that children with ADHD suffered declines in test taking relative to other children, but that ADHD children who started medication earlier experienced slower declines than those who started medication later. Again, this design suffers from endogeneity, this time in terms of the choice of when