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SHORT REPORT

Birth month as predictor of ADHD medication use in Dutch school classes

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Several international studies have shown that pupils who are comparatively young within their year group have a greater likelihood of being diagnosed with ADHD and receiving ADHD medication. The findings suggest that comparatively young but age-appropriate behaviour some pupils show in school may be confused with ADHD. This study investigates whether this noted association between birth month and ADHD medication is also found in the Netherlands; and if so, whether GPs (general practitioners) and teachers are aware of this association. Over 2000 birth dates of children between the ages of 5 and 12 were collected from GP client files. The data included whether children are prescribed methylphenidate, the most commonly used medication for ADHD. These data were analysed by descriptive statistics (graphs) and evaluative statistics (logistic regression analysis and relative risk). GPs and teachers were invited by questionnaire to report whether they knew of the association between birth month and ADHD. A significant correlation between birth month and methylphenidate prescription are found. Relatively young pupils are 2.43 times more likely to be prescribed methylphenidate than their older classmates. A majority of GPs and teachers report not being aware of an association between birth month and ADHD medication.

Keywords: ADHD; methylphenidate; medication; diagnosis; relative age

Introduction

ADHD is defined in the DSM-5 (APA 2013) as a neuro-developmental disorder, a persistent behavioural pattern that includes concentration problems, hyperactivity and impulsivity. The behaviours must be uncharacteristic for the developmental age of the child, be manifest in different settings (e.g. at home and at school), have started before the age of 12, be present for at least 6 months, and must furthermore interfere with – or reduce the quality of – social and academic functioning.

In many countries, the rising incidence of ADHD medication prescribed to children has triggered public concern and criticism (Ban et al. 2010; Gumy, Huissoud, and Dubois-Arber 2010; Leslie and Wolraich 2007; Visser et al. 2003). This concern was amplified when various large-scale international studies noted an association between birth date and ADHD or ADHD medication (Elder 2010; Evans, Morrill

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and Parente 2010; Halldner et al. 2014; Morrow et al. 2012; Zoega, Valdimarsdóttir, and Hernández-Diaz 2012). According to these studies, younger children in a year group are much more likely to be diagnosed with ADHD and be prescribed ADHD medication than are elder children in a year group. Evans, Morrill, and Parente (2010) estimate that potentially 1,1 million children have been falsely diagnosed with ADHD in the United States, of whom 800,000 children take medication not prescribed on the basis of ADHD but instead on the basis of their young behaviour. Little is known of the long-term effects of prolonged medication use, further adding to the reasons for concern (Ashton, Gallagher, and Moore 2006; Kociancic, Reed, and Findling 2004).

It has long been known that relatively young pupils are both sooner and more often disadvantaged. In the early '70s, Doornbos (1971) noted that younger pupils are more likely to double a year and are at greater risk of being referred to special education. Later studies have confirmed these findings. For example, according to some researchers schooling greatly stimulates math skills development, leading to a disadvantage among relatively young pupils since in comparison they have received less teaching than their older year group peers (Sharp, Hutchison, and Whetton 1994; Verachtert et al. 2009). Pupils who are relatively young in the classroom – and particularly boys – are more often diagnosed with learning problems (Martin et al. 2004).

Pupils can vary by almost a year in age within one and the same year group. It is therefore reasonable that different expectations apply in relation to the behaviour and learning of relatively young pupils when compared with the older pupils in a year group. The question however remains whether teachers do indeed take age differences that exist within year groups sufficiently into account. Teachers are often the first to suggest a diagnosis of ADHD in a pupil (Sax and Kautz 2003) and it is possible that teachers are prone to pathologising young pupil behaviour as ADHD.

The present study assessed the association between birthdate and ADHD medication use in The Netherlands. In addition, GPs' and teachers' awareness of the noted association was examined.

Method

Respondents

GPs that are registered with ELANN – a Groningen province health care support organisation – were invited to participate in the research. The GPs were asked for two categories of anonymous data from their patient records, namely the birth date of all children aged between 5 and 12, and for each child whether it was or was not prescribed methylphenidate. Of 280 GPs that were approached in Groningen province, 17 GPs agreed to make these data available. Ten of the 17 GPs supplied the promised data. The data pertained to 2218 children in total.

The same 280 GPs were sent a digital questionnaire asking whether they were aware of a noted association between birth month and ADHD. Sixty GP's (22%) completed the questionnaire. In addition to the GPs, 289 teachers working in Groningen province were sent a paper version of the same questionnaire. Eighty of them (28%) returned the questionnaire.

Variables

The prescription of methylphenidate is the dependent measure in this study and birth month is the independent variable. In the Netherlands, the school year starts at

1 September. Traditionally, five-year olds who turned six in September enrolled in primary, whereas five-year olds who turned six in October (or later) continued preschool for another year and enrolled primary when they were six years and 11 months old. Hence, in primary school those born in September are the youngest in class and those born in October are the oldest in class. However, in 2012, the Dutch education inspectorate determined that birth date must not be the primary consideration in whether a child should be enrolled in primary or continue in preschool for another year. Rather, the developmental level of the child should guide enrollment in primary. This means that a preschool child who is thought to be ready for enrollment in Group 3 (the first year of primary) is more likely to be found in Group 3 than would be predicted by their birth date. In all these cases, the oldest pupils in fact become the youngest pupils and so these cases confound the strict school enrollment distribution of birth months in year groups in the data. Data concerning school progress (especially repeat years) were not available to the study; hence all children born in October and November ($N=394$) were omitted from the data-set as precautionary measure.

Statistical analyses

In order to arrive at a measure of the extent to which birth month predicts the prescription of methylphenidate, birth data were sorted into a monthly interval range. The interval range starts with pupils born in September (1stinterval) containing the youngest pupils, then August (2nd), July (3rd), June (4th), May (5th), April (6th), March (7th), February (8th), January (9th) and December (10th and last interval) containing the oldest pupils. We used logistic regression analysis to assess the association between birth month (relative age in class) and methylphenidate prescription. The youngest pupil and oldest pupil are likely to vary by as much as almost one year in age and development and we calculated a Relative Risk ratio, which quantified the risk of medication use in the youngest children in class (born in September of August) compared to the oldest children in class (born in December of January).

Descriptive statistics will reflect awareness of a possible association between birth month and ADHD. Teachers and GPs could choose between yes, partly and no in response to the question whether they were aware of the noted association between birth month and ADHD.

Results

Of the 2218 children included in the study 85 (3.8%) were prescribed methylphenidate.

Figure 1 shows the distribution of the 2133 children not prescribed methylphenidate, by their birth month. The row of columns suggests that a roughly equal number of children are born in each month. Figure 2 shows the same distribution for the 85 children prescribed methylphenidate. What is readily visible in this row of columns is the difference between the months of September and December. The group of children prescribed methylphenidate contains almost three times more children born in December than children born in September. Moreover, the columns shown an overall decline; the older the child is within their year group, the smaller the chance of methylphenidate prescription becomes.

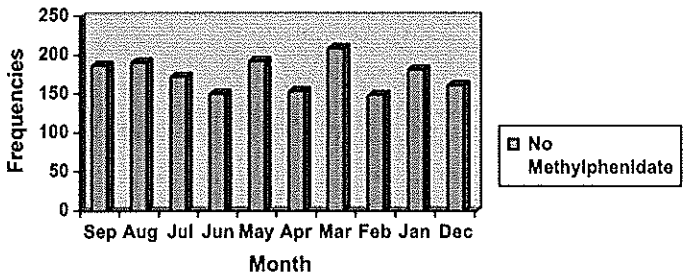

Figure 1. Distribution of the birth month of children not prescribed methylphenidate.

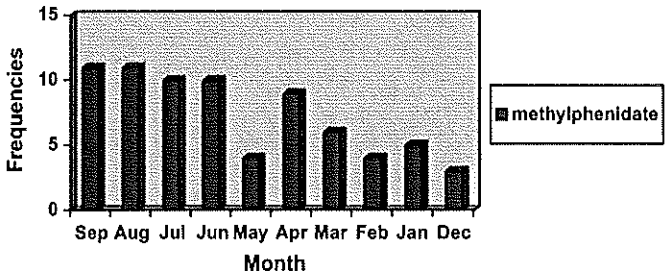

Figure 2. Distribution of the birth month of children prescribed methylphenidate.

Logistic regression analysis (Table 1) revealed that the association between birth month and methylphenidate prescription is significant ($p = .006$). The negative Beta and below 1 Exp(B) show that the likelihood of being prescribed ADHD-medication significantly decreases as the children are older (towards category 10: born in December) in their classes.

In order to determine how much greater the likelihood to be prescribed methylphenidate is for very young pupils compared to the oldest children in class, a Relative Risk (RR) was calculated. Pupils born in September and August have a 2.43 greater likelihood of being prescribed methylphenidate than are pupils born in December and January as follows:

$$\frac{\text{young pupil + methylphenidate/total number of young pupils } 22/400}{\text{older pupil + methylphenidate/total number of older pupils } 8/353} = 2.43$$

An approximating value for the standard error in the natural logarithm of relative risk is SE {log(RR)} .41. The null hypothesis that RR = 1 is assessed via the matching null hypothesis that log(RR) = 0. The test size $T = \log(RR)/SE\{\log(RR)\} = 2.187$

Table 1. Logistic regression analysis of the association between birth month and methylphenidate prescription.

	B	SE	*df*	Sig.	Exp(B)
Birth month	−.118	.043	1	.006	.888
Constant	−2.592	.228	1	.000	.075

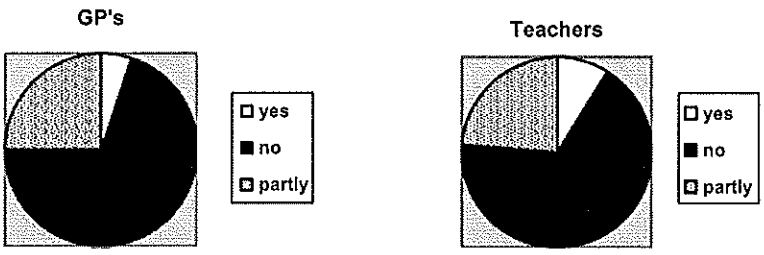

Figure 3. Awareness of the association between birth month and ADHD by GPs and teachers.

approximates normal distribution. Assuming a 95% confidence interval the Relative Risk lies somewhere between $.09 < \log RR > 1.69$, or alternatively $1.09 < RR < 5.42$. In view of a 95% confidence interval the null hypothesis that $RR = 1$ is rejected. This means that the association between being a relatively young pupil and the greater likelihood of being prescribed methylphenidate is significant.

The circle diagrams in Figure 3 suggest that the association between birth month and ADHD is largely unrecognised by both GPs and teachers. Seventy percent of GPs and 67.5% of teachers are not aware of the association.

Conclusion and discussion

Findings

In the Netherlands, we found that relatively young pupils are prescribed methylphenidate significantly more often than the older pupils. The youngest children in class have a 2.43 greater likelihood of being prescribed methylphenidate compared to the oldest children in class. The likelihood of being prescribed methylphenidate increases with each month that a child is younger within their year group. Although it does exist, the association between relatively young pupils and ADHD is by and large not recognised by either GPs or by teachers.

Limitations

The present study is subject primarily to sampling limitations. Questionnaire response rates of both teachers and GP's were relatively low (28% and 22%, respectively). It is conceivable that responders are more interested in the topic of ADHD compared to non-responders, suggesting that the whole population may even be less aware of the association between birth month and ADHD medication prescription.

The data derive from the client files of 10 GP practices that are all located in Groningen province. It remains an open question to what extent the sample reflects the national picture and it would be advisable to conduct further research with a select samples and larger groups of respondents that are geographically spread, so that reliability and generalisability may be strengthened. Another suggestion is to take academic progress or school career into account as mediating variable, so that pupils born in November and October need not be excluded from the data-set. Since especially these pupils are the very youngest and the very oldest pupils in their year group, a further increased effect on the already established association between age

in year group and ADHD medication is then to be expected. This in itself also, by implication, suggests that the effect found in the present study is more likely to err on the conservative side of the actual association.

This study has used methylphenidate prescription as outcome variable. Not only is methylphenidate prescription a more unambiguous and concrete measure than ADHD diagnosis itself, it is moreover a suitable predictor for ADHD diagnosis. There are however children who are diagnosed with ADHD but who are not prescribed medication, while there are also children who are prescribed methylphenidate but not on the basis of an ADHD diagnosis. Nevertheless, whenever relatively young pupils are prescribed methylphenidate because their young behaviour is labelled as a form of autism or a behavioural problem more generally, this is just as worrying as these children being prescribed methylphenidate based on a false suspicion of ADHD. Taking medication without clear warrant perhaps entails even greater risk and possible disadvantage for a child than being burdened with the false diagnosis of a psychiatric disorder.

Discussion

Despite these limitations, it seems reasonable, also in light of comparable findings reported internationally (Elder 2010; Evans, Morrill, and Parente 2010; Halldner et al. 2014; Morrow et al. 2012; Zoega, Valdimarsdóttir, and Hernández-Diaz 2012), to conclude from our data that an association between relatively young pupils and ADHD does exist and this conclusion sends out an important signal. Apparently, health care professionals and teachers tend to mistake relative immaturity for ADHD. Children taking medication not prescribed on the basis of ADHD but instead on the basis of their young behaviour is worrying in itself, but also in light of the fact that much remains unclear about the long-term consequences of methylphenidate use (Ashton, Gallagher, and Moore 2006; Kociancic, Reed, and Findling 2004; Urban and Gao 2014).

The reported prevalence of ADHD and ADHD-medication prescription is rising in several countries (Thomas, Mitchell, and Batstra 2013). Some professionals are particularly concerned about over-diagnosis and under-treatment (Frances 2010; Thomas, Mitchell, and Batstra 2013), while others ascribe the rapid rise in the number of ADHD diagnoses to improved recognition of disorders combined with improved knowledge, also of treatments (Sciutto and Eisenberg 2007). These professionals claim that a situation of under-diagnosis persists, for example in relation to girls, adolescents, children from ethnic minorities and late pupils generally. However, in our opinion, when a fidgety child that has trouble concentrating nevertheless functions well among younger classmates, there is no reason for diagnosing ADHD and start medication-based treatment.

There is no objective or medical test for diagnosing ADHD. All ADHD diagnoses are the net result of subjective reports by parents, children and teachers that are in turn – and unavoidably – subjectively interpreted by a diagnostician. When precisely should having trouble with playing quietly, not being able to sit still and not listening to what the teacher says be classed as ADHD behaviour? Concentration problems, hyperactivity and impulsivity are up to a point definitional of child behaviour and should be pathologised only with great reservation. Not until the behaviours in question are manifest to an extreme degree and with extreme intensity

should they be considered as potentially ADHD-type behaviour (APA 2013). What however is to be regarded as extreme remains in all cases the personal, even if professional and considered, opinion of the person assessing the child.

Implications

When combined with earlier reported findings, the study further underpins the recommendation that all those concerned with children in education be made aware of the influence of birth month on the behaviour of pupils in class. The questionnaire data show that the majority of teachers and GPs are not aware of the association between pupil age and young behaviour in class. Parents, diagnosticians, GPs and others involved in raising children should take the birth month of the child into account when judging the behaviour of primary school pupils. The youngest pupil and oldest pupil are likely to vary by as much as almost one year in age and development and it is perfectly reasonable for younger pupils to show 'younger' – more fidgety and less concentrated – behaviour than older pupils in the same class.

In addition, it seems important that teachers and other professionals involved in the care for children's development and upbringing resist the temptation to measure a child's behaviour against that of classmates and instead compare it to behaviour as might be expected of a child of that age, taking into account that the younger pupils may well have had up to a year less experience of schooling (Sharp, Hutchison, and Whetton 1994; Verachtert et al. 2009). A pupil develops both cognitively and emotionally; youngerpupils have had less opportunity than older pupils to acquire appropriate school behaviour, such as sitting still, keeping focused and having the things they need ready at hand. It therefore matters that relatively young pupils especially are given ample opportunity to catch up with these behaviours rather than have their young behaviour pathologised or be medicalised too soon.

Conflict of interest

We have no conflicts of interest to report.

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