Misdiagnosis of attention deficit hyperactivity disorder: 'Normal behaviour' and relative maturity

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Ford-Jones PC. Misdiagnosis of attention deficit hyperactivity disorder: 'Normal behaviour' and relative maturity Paediatr Child Health 2015;20(4):200-202.

Attention deficit hyperactivity disorder (ADHD) is one of the most frequently diagnosed disorders in children, yet it remains poorly under-stood. Substantial controversy exists regarding correct diagnosis of ADHD, and areas of subjectivity in diagnosis have been identified. Concerns for appropriate diagnosis are critical in terms of children's educational outcomes, as well as health concerns associated with the use and potential overuse of stimulant medications. There exists a relative-age effect in which children who are relatively younger than their peers and born closest to the school start age cut-off are more frequently diagnosed and treated for ADHD. Additionally, substantial variation exists in ADHD diagnosis between boys and girls, with boys often presenting with more stereotypical symptoms. Both the relative-age effect and variation in sex diagnosis, as well as the challenges of early preschool diagnosis, emphasize the importance of considering relative maturity in ADHD diagnosis of children. Implications and knowledge translation strategies for practitioners, parents and the education system are presented.

Key Words: *ADHD; Misdiagnosis; Relative maturity; Relative-age effect; Sex*

Attention deficit hyperactivity disorder (ADHD) is one of the most frequently diagnosed disorders in children (1-3). Despite being an extensively studied condition, the causes of ADHD remain poorly understood (2,4), and substantial controversy exists regarding its correct diagnosis (5). There is no pathognomonic marker for ADHD, leading to challenges in diagnosis (4). The prevalence of ADHD worldwide is identified to be 5.29% (6); however, prevalence rates have been found to vary according to study and region, and are between 8% and 12% in Organisation for Economic Co-operation and Development countries (1). Whether these variations are real or due, in part, to differences in diagnosis or cultural norms is not well understood and, accordingly, has generated considerable concern and debate (6).

Appropriate diagnosis of the disorder is of significant concern given the substantial social and economic costs (7); children with ADHD are at high risk for problems throughout schooling, and increased risk for substance use, motor vehicle accidents and other psychiatric conditions (4). ADHD is found to affect individuals beyond childhood and into adulthood (4), and has potential long-term consequences for education, health and general well-being. Given these potential negative outcomes, it is essential that ADHD is diagnosed and treated to mitigate these risks. There is however, also significant concern for overdiagnosis followed by unnecessary medicating, with associated risk for side effects (4).

OBJECTIVE

The present article aims to review findings in the literature surrounding the misdiagnosis of ADHD in children. Given the magnitude of a diagnosis of ADHD, the present review will seek to identify the existent evidence for misdiagnosis and the domains in which misdiagnosis are most frequently understood to occur. Implications and potential knowledge translation tools will be discussed.

SYNTHESIS OF FINDINGS

Relative age and diagnosis among school- and preschool-age children

A prominent subject of concern for misdiagnosis among the literature is the relative age of school-age children. With school start cut-offs, in a kindergarten class one child may have just turned five years of age while another child is almost six years of age, creating an almost 20% age difference at that stage (4). It has been shown that children who are relatively younger than their peers and are born closest to the school start age cut-off are more frequently diagnosed and treated for ADHD (1,2,4). In a study involving a large sample of children for whom the school-age cut-off is December 31, it was found that boys born in December were 30% more likely to be diagnosed and 41% more likely to be treated for ADHD than those born in January, and that girls born in

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Accepted for publication Match 17, 2015

December were 70% more likely to be diagnosed and 77% more likely to be treated for ADHD than those born in January. Additionally, children born on the last three days of the year were at significantly higher risk for diagnosis and treatment than those born on the first three days of the new calendar year (2). This significant difference in risk occurs within a span of six days. Given that ADHD is a neurological condition whose prevalence should not differ significantly based on birth date (4), this finding indicates a failure to account for the developmental immaturity of a child relative to peers and suggests that diagnoses of ADHD are not solely based on biological factors but rather, on other potentially subjective factors.

While ADHD research involving children has focused largely on school-age children, another concern for relative age and developmental immaturity in ADHD diagnosis is early preschool diagnosis. Much behaviour consistent with ADHD, including inattention, impulsivity and overactivity, may be normal for the developmental age of a preschooler (8). Current screening tools and measures for ADHD are designed for school-age children (9) and investigations of whether ADHD can manifest in preschool children are limited (10). Many symptoms in preschoolers are found to be transient, and there is a significant challenge in distinguishing between the majority of preschoolers whose symptoms will pass and the 5% to 10% who will develop persistent ADHD; this has significant implications for the decision to medicate (8). Findings suggest limited agreement among parents, teachers and clinicians on ratings of ADHD behaviour in preschoolers (11), an additional challenge given the need to assess child behaviour in multiple settings.

Sex, behaviour and diagnosis

The male:female prevalence ratio of ADHD has been shown to range from 3:1 up to 9:1, depending on whether measurements were obtained from a population-based or clinical sample. It has been suggested that the considerable difference in rates between boys and girls occurs because girls diagnosed with ADHD show less behavioural symptoms compared with boys, with less aggressive, disruptive and hyperactive behaviour (4,12-15). Particularly in an educational setting (often the origin of suggestion for ADHD assessment), this may at least partially indicate why boys are more frequently diagnosed than girls.

It is hypothesized that boys and the symptoms they present may represent a more prototypical representation of ADHD and be more frequently diagnosed (12). Girls may exhibit less hyperactivity and externalized behaviours and may show greater intellectual impairment than boys (13). In a case vignette study (12), in which therapists did not strictly adhere to diagnostic criteria, the patient's sex significantly affected diagnosis. While girls' symptoms may present less disruptively, this is not to suggest that the diagnosis and management of ADHD in girls is any less important for their well-being and outcomes. Conversely, given their perceived prototypical symptoms and sex, legitimate concerns exist for overdiagnosis of ADHD in boys.

IMPLICATIONS OF FINDINGS

These findings emphasize the critical role of social institutions and perceptions, and call into question assessments of 'normal' and relatively appropriate behaviour across relative age and sex. What is considered to be appropriate behaviour has significant implications for children's education and health outcomes as well as costs to society.

Higher risk for academic difficulty emphasizes the importance of appropriate ADHD diagnosis in the educational setting. In more than one-half of ADHD cases, it is the educator who requests that a child be assessed for ADHD (4). As such, the education system is an important setting for carefully assessing how children's behaviour is understood and how teachers understand the behaviour of less mature students. Appropriate accommodation must be made for children with varying maturity levels such that expectations for the child are fair, and neither those older nor younger are disadvantaged by relative maturity difference.

In terms of overdiagnosis, there is concern of unnecessary medication of children whose behaviour may be managed through other means or may be reflective of their relative maturity. Regarding preschool children, studies have been limited and there is evidence that stimulant use has been associated with more severe or varied side effects (8,16,17). Ultimately, the long-term effects of stimulants on children at this early developmental stage are unknown. The influence of the pharmaceutical industry in overdiagnosis and stimulant prescription as a means to medicalizing child behaviour is an important concern (18). The ability of the pharmaceutical industry to influence physician decision making by providing resources and information surrounding behaviour management with stimulants is well documented (19).

Further implications of misdiagnosis involve the cost for families that have a child assessed and treated for ADHD as well as costs within the health care system (1). While families with health benefits and medication coverage may be less affected, those without benefits and from lower-income families may be significantly impacted by these costs. Additional costs may exist as a result of children not meeting their full potential as a result of misdiagnosis, and who are ultimately not able to reach their full potential in education, employment and other future life prospects.

KNOWLEDGE-TRANSLATION STRATEGIES

At the parental level, a strategy may be to provide parents with an information sheet describing factors affecting behaviour and maturity in the classroom, outlining differences related to birth date and sex, for parents whose children are identified as disruptive and who are potentially being referred for ADHD assessment. Given parents' key role in ultimately deciding whether to medicate their child, it is crucial that they be well informed when making this decision.

At the level of educators, educational sessions on factors affecting children's behaviour and maturity in the classroom as well as methods for managing differences in maturity level are recommended. Given the challenges that exist in managing different maturity levels, this may offer stimulus for discussion of revision of the education system in terms of grade placement based on age.

At the level of practitioners, a suggestion of 'reminders and prompts' is recommended, such that when contemplating a diagnosis of ADHD, practitioners are provided with a series of questions and 'red flags' are presented for children with particular birth dates and for a series of sex-based or prototypical symptoms. Such reminders may be a feasible option with the current use of electronic health records systems, and may aid in preventing inappropriate prescription of stimulants given the readily available resources on stimulant use and influencing power of the pharmaceutical industry.

With regard to preschool-age diagnoses of ADHD, a recent study found that a more accurate long-term prediction of ADHD involved lengthier clinician assessments that were performed over a 2 h to 3 h period (11). Given the significant challenge of accurate diagnosis within this age group, and inconsistent reporting of symptoms among clinicians, teachers and parents, advising clinicians to ensure this lengthier assessment time may be warranted. This may aid in ensuring that stimulants are being prescribed to this especially vulnerable population only when absolutely necessary.

CONCLUSION

Concern for inappropriate diagnosis of ADHD in children based on relative age and sex exists. Significantly higher rates of diagnosis among children born just before the school entry cut-off date presents compelling evidence that relative maturity and developmental age are not consistently being considered. Additionally, there is evidence indicating that boys presenting with a certain set of hyperactive symptoms represent the prototypical child with ADHD, potentially leading to significantly higher rates of diagnosis in boys and lower rates in girls. The implications for inappropriate diagnosis are significant for the child's education, health outcomes and future well-being. Noting the ability of medication as well as behaviour management to reduce symptoms and improve outcomes (20), the intent is not to negate the importance of appropriate treatment including stimulant use. The goal is to inform the most promising practices to ensure that through careful, thorough assessment, the appropriate children receive such treatment and experience positive outcomes. With recommendations and knowledge-translation strategies for parents, educators and practitioners, careful review of the assessment of children for ADHD will help to decrease inappropriate diagnosis of ADHD in children and ensure that relative maturity is given appropriate consideration.

ACKNOWLEDGMENT: The guidance of Hannah Wong PhD is appreciated.

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