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Increased diagnosis of attention-deficit hyperactivity disorder despite stable hyperactive/inattentive behaviours: evidence from two birth cohorts of Australian children

Luise Kazda,[1] Kevin McGeechan,[1] Katy Bell,[1] Rae Thomas,[2] and Alexandra Barratt[1]

[1]Sydney School of Public Health, Faculty of Medicine and Health, The University of Sydney, Sydney, NSW, Australia; [2]Institute for Evidence-Based Healthcare, Bond University, Gold Coast, Qld, Australia

Background: Globally, ADHD diagnoses have increased substantially and there is concern that this trend does not necessarily reflect improved detection of cases but that overdiagnosis may be occurring. We directly compared ADHD diagnoses with ADHD-related behaviours and looked for changes across time among Australian children in a large, population-based prospective cohort study. **Methods:** We conducted a secondary analysis of the Longitudinal Study of Australian Children, including 4,699 children born 1999/2000 (cohort 1) and 4,425 children born 2003/2004 (cohort 2), followed from 4 to 13 years of age.We compared pre-diagnosis parent-reported hyperactive/inattentive behaviour scores between newly diagnosed (incident cases) and undiagnosed children and fitted Cox's proportional hazards regression models to examine the relationship between birth cohorts 1 and 2 and the risk of incident ADHD diagnosis. **Results:** Cumulative incident ADHD diagnoses increased from 4.6% in cohort 1 (born in 1999/2000) to 5.6% in cohort 2 (born in 2003/2004), while hyperactive/inattentive behaviour scores remained steady. Among ADHD diagnosed children, 26.5% (88/334) recorded pre-diagnosis behaviours in the normal range, 27.6% (n = 92) had borderline scores and 45.8% (n = 153) scored within the clinical range. Children born in 2003/2004 were more likely to be diagnosed with ADHD compared with those born in 1999/2000 (aHR = 1.33, 95% CI = 1.06–1.67, p = .012), regardless of their ADHD behaviour score (p = .972). **Conclusions:** Diagnostic increases were not driven by rises in hyperactive/inattentive behaviours. A quarter of all children with an ADHD diagnosis recorded pre-diagnosis behaviours within the normal range. The increased likelihood of being diagnosed with ADHD for children from the later birth cohort was observed for children across the full range of ADHD-related behaviours. **Keywords:** Attention-deficit hyperactivity disorder; Australia; children; adolescents; epidemiology.

Introduction

Attention-deficit hyperactivity disorder (ADHD) is 'a persistent pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning or development (…) and negatively impacts (…) on social and academic activities' (American Psychiatric Association, 2013). While ADHD diagnosis rates have increased worldwide in recent decades (Chien, Lin, Chou, & Chou, 2012; Giacobini, Medin, Ahnemark, Russo, & Carlqvist, 2018; Visser et al., 2014; Xu, Strathearn, Liu, Yang, & Bao, 2018), hyperactive and inattentive behaviours (H/I behaviours) in populations of children do not seem to follow that trend but have remained relatively stable over time (Polanczyk, Willcutt, Salum, Kieling, & Rohde, 2014; Rydell, Lundstrom, Gillberg, Lichtenstein, & Larsson, 2018; Safer, 2018; Sawyer, Reece, Sawyer, Johnson, & Lawrence, 2018; Thomas, Sanders, Doust, Beller, & Glasziou, 2015). So, where do the additionally diagnosed cases come from? Some US data on parent-reported severity of ADHD indicate a small recent shift towards more children with severe ADHD being diagnosed, which may suggest increases in diagnoses of children with clinically relevant behaviours (Visser et al., 2014).

In contrast, there is clear evidence that at least some of the additional diagnoses observed may be due to mis- or overdiagnosis, for example, in children who are relatively young for their school year, due to their apparent immaturity compared with their peers (Holland & Sayal, 2018) or to the widening of the diagnostic criteria for ADHD over recent years (Fabiano & Haslam, 2020) lowering the threshold for a diagnosis (Kazda et al., 2021).

Few studies have examined this comprehensively, with a general scarcity of studies on this topic from outside the US and Europe. Therefore, the rationale for this study was to investigate whether frequency of children's H/I behaviours were reflected in trends of ADHD diagnoses. In this study, we aimed to (a) examine the relationship between ADHD diagnoses in Australian children and pre-diagnosis H/I behaviours and (b) investigate whether diagnoses increased over time.

Methods

Study design, setting and participants

In our secondary analysis, we used data from the Longitudinal Study of Australian Children (LSAC), which reports on

Conflict of interest statement: See Acknowledgements for full disclosures.

representative, population-based samples of Australian children. Two-stage clustered sampling ensured that children selected from the Medicare enrolment database were representative of all Australian children and used to establish two birth cohorts: in 2004, 4,983 children born in 1999/2000 were recruited into cohort 1 (child cohort) (50.4% recruitment rate of 9,893 children) and 5,107 children born in 2003/2004 started in cohort 2 (infant cohort) (57.2% recruitment rate of 8,921 infants). Full details are published elsewhere (Soloff, Lawrence, & Johnstone, 2005). We used the data from biennial waves of data collection, in which children were aged between 6/7 and 12/13 years old (cohort 1: 2006–2012, cohort 2: 2010–2016). We included the data at age 4/5 to determine the pre-diagnosis behaviours for age 6/7 and for missing data imputation.

Variables

ADHD diagnosis was determined through parent-report by the question: 'Does the study child have attention-deficit disorder or attention-deficit/hyperactivity disorder?' Like others, we used a positive answer as a proxy for ADHD diagnosis (Sciberras et al., 2017). We used only the incident (new)diagnoses at each wave.

Year of birth was determined by parent report. Children from cohort 1 were born 4 years prior to those in cohort 2 (1999/2000 vs. 2003/2004).

Hyperactive/inattentive behaviours were measured using the parent-reported hyperactivity-inattention subscale of the Strengths and Difficulties Questionnaire (H/I SDQ) (Goodman & Goodman, 2009). To avoid confounding by treatment or diagnosis, we used the score from the previous wave (before first diagnosis).

The H/I subscale of the SDQ is a validated screening instrument that combines five Likert-scale items to create a total score between 0 and 10, with higher scores signalling increasing H/I behaviours and risk of ADHD (Goodman & Goodman, 2009). We categorised scores into normal, borderline and clinical range for ADHD, as previously done (Woerner, Becker, & Rothenberger, 2004): we classified scores at or above the 90th percentile of the distribution as clinical-level (scores ≥7), scores between the 80th and 89th percentile as borderline (scores 5 or 6), and those below the 80th percentile as normal (scores ≤4). As the subscale has 11 discrete values, estimated percentiles often fall between these; hence, percentages of children with scores above a percentile could only be approximated (Woerner et al., 2004). We used the nearest lower score to establish proportions below the thresholds (e.g. for the 80th percentile we used a score of 4 or lower, which encompassed only 70% of all observations, compared with a score of 5 or lower, which contained 83% of observations).

Covariates of ADHD were included as potential confounders. Sex, the SEIFA (Socioeconomic Indexes for Areas) advantage/disadvantage score and mother's highest qualifications were included as fixed variables using baseline values. State of residency, remoteness and language spoken at home were included as time-varying variables. However, where values were missing, they were imputed from the nearest available observation.

Statistical methods

Baseline analysis. We conducted independent *t*-tests and chi-square tests to compare means and proportions between cohorts at age 6/7. We adjusted for survey weights and design variables.

ADHD diagnosis and H/I behaviours. We analysed weighted frequencies of incident ADHD diagnosis and H/I SDQ scores (for all children and for diagnosed children) at each wave for each cohort, comparing cohorts adjusted for covariates using linear or logistic regression. Additionally, we stratified results by sex and compared ADHD medication and diagnosis prevalence.

Distribution of H/I behaviours. We calculated and plotted weighted cumulative proportions at each H/I SDQ score for all observations from all children, and among children with incident ADHD diagnosis, by cohort. Additionally, we stratified results by sex.

Sensitivity analyses: In sensitivity analyses, we used alternative informants and time points to measure H/I behaviours: teacher-reported H/I SDQ score at wave before and at wave of first diagnosis, parent-reported H/I SDQ score at wave of first diagnosis and highest available H/I SDQ score from these observations.

Risk of ADHD diagnosis by year of birth

We fitted Cox's proportional hazards regression models accounting for interval censored data to examine the relationship between year of birth and incident ADHD diagnosis. In the multivariable model, we included predetermined predictor variables (see covariates, above). We used the Wald test of the interaction between birth cohort and H/I SDQ score to assess if the relationship between cohort and ADHD diagnosis was modified by H/I behaviours. We excluded children who had a recorded ADHD diagnosis before age 6/7 because pre-diagnosis H/I SDQ scores were not available for these. We also excluded children without complete ADHD diagnosis or H/I behaviour data to avoid misclassification. We conducted all analyses using SAS 9.4 M6 (STAT 15.1).

Ethics requirements

This study was approved by The University of Sydney's Human Ethics Research Committee (2019/574). The study was conducted as a secondary analysis of a cohort study; as such it did not directly recruit any participants.

Role of the funding source

This study was funded by the National Health and Medical Research Council (NHMRC) Program Grant 1113532 and CRE Grant 1104136. The funder had no role in the study design, in the collection, analysis and interpretation of data, in the writing of the report or in the decision to submit the article for publication. We confirm the independence of researchers from funders.

Results

Baseline study characteristics

At age 6/7, there were 4,464 children in cohort 1 and 4,242 children in cohort 2 (Table 1). There were small differences between cohorts, some of which reached statistical significance due to the large sample sizes. In cohort 1, children were less likely to live rural and had slightly lower SEIFA scores. In cohort 2, children were slightly older at the start of school, minimally younger at the age of interview and mothers had higher rates of school completion and non-school qualifications. ADHD diagnosis rates at this age were similar as were the proportions of children medicated for ADHD. Mean parent-rated H/I SDQ scores were slightly higher for cohort 2.

Table 1 Baseline characteristics at age 6/7 (wave d)[a]

	Cohort 1 (born 1999/2000) (n = 4,464)	Cohort 2 (born 2003/2004) (n = 4,242)	p-Value
Main language spoken at home			
English	85.3%[b]	86.8%[b]	.073
Rurality			
Major City	69.2%	67.5%	.049
Rural	29.4%	31.3%	
Remote	1.7%	1.2%	
State of residency			
NSW	33.5%	32.7%	.778
Vic	25.1%	25.6%	
Qld	19.7%	20.2%	
SA	6.7%	6.6%	
WA	9.8%	9.4%	
Tas	2.5%	2.6%	
NT	1.0%	0.8%	
ACT	1.7%	1.9%	
Sex			
Male	51.3%	51.1%	.888
Mean age at interview (*SD*)	6.9 years (0.25)	6.9 years (0.30)	.043
Mean age at start of school (*SD*)	5.2 years (0.39)[c]	5.3 years (0.35)[b]	<.001
Socioeconomic indicator			
Mean SEIFA adv/ disadvantage score (*SD*)	1005.9 (74.07)[b]	1007.0 (76.51)[b]	.029
Mother's school completion			
Year 9 or below	8.5%	6.0%	<.001
Year 10 or equivalent	25.9%	22.2%	
Year 11 or equivalent	16.5%	14.9%	
Year 12 or equivalent	49.0%[b]	56.9%[b]	
Mother's highest non-school qualification			
None	35.6%	26.5%	<.001
Certificate/Diploma/Other	39.9%	43.4%	
Bachelor	13.3%	16.5%	
Graduate/Postgraduate	11.2%	13.6%	
H/I SDQ scores			
Mean parent-rated score (*SD*)	3.4 (2.31)[d]	3.6 (2.37)[b]	<.001
Parent-reported ADHD			
Current diagnosis	1.6%	1.7%[b]	.712
Current medication	1.1%	1.0%	.660

[a]All %s reported are weighted and p-values are adjusted for weighting and study design.
[b]Missing values below 1%.
[c]4.0% missing values (n = 179).
[d]2.8% missing values (n = 123).

Attrition and missing data

There were few missing values at baseline (Table 1). There was good retention over the four main waves of interest (88.6% in cohort 1, 79.7% in cohort 2). Overall, 0.9% of observations (303 of 32,085) were missing information on ADHD diagnosis. Of the 389 children with an incident diagnosis, 56 (14.4%) had missing values for H/I SDQ score. For the Cox model analysis, 15,416 of 16,920 observations were included for cohort 1 (91.1%) and 13,557 of 15,472 for cohort 2 (87.6%).

ADHD diagnosis and H/I behaviours

At ages 6/7 and 8/9, H/I SDQ scores were marginally higher in cohort 2 compared with cohort 1. The effect sizes were too small to be clinically meaningful (Cohen's d .09 and .12) (Table 2). Girls in both cohorts had lower H/I SDQ scores than boys at every age (Table S1).

The percentage of children ever diagnosed with ADHD increased from 4.6% in cohort 1 to 5.6% in cohort 2 (OR >1.50 at all ages, except age 12/13) (Table 2). Boys had a higher incidence at all ages for both cohorts (Table S1). In cohort 1, 4.6% of boys and 0.8% of girls had ever been on ADHD medication compared with 5.8% and 1.3% in cohort 2 (Table S2).

For children with an incident ADHD diagnosis there were no differences between cohorts in H/I SDQ scores, apart from at age 10/11 where later-born children had lower mean scores at the wave before first diagnosis (Table 3). Similar trends could be observed when stratified by sex (Table S3).

Distribution of H/I behaviours

For both cohorts together, across all waves, 70.0% of observations recorded a H/I SDQ score of 4 or lower, while 89.4% had a score of 6 or lower and 10.6% scored at 7 or above (Figure 1). From Figure 1, we

Table 2 Parent-rated H/I SDQ scores and ADHD diagnosis by cohort for all children

	Total (*n*)		Mean H/I SDQ score					% Incident ADHD diagnosis			
Age (wave)	Cohort 1	Cohort 2	Cohort 1 (*SD*)	Cohort 2 (*SD*)	Difference (95% CI)[a]	*p*-Value[a]	Cohen's *d*	Cohort 1 (*n*)	Cohort 2 (*n*)	OR (95% CI)[a]	*p*-Value[a]
6/7 (d)	4,464	4,242	3.4 (2.31)[c]	3.6 (2.37)[b]	0.3 (0.2–0.4)	<.001	.09	0.9% (42)	1.3% (57)[b]	1.53 (1.02–2.29)	.040
8/9 (e)	4,331	4,085	3.3 (2.35)[d]	3.6 (2.51)[c]	0.3 (0.2–0.4)	<.001	.12	1.3% (54)	2.1% (85)[b]	1.74 (1.20–2.53)	.004
10/11 (f)	4,169	3,764	3.3 (2.38)[b]	3.2 (2.44)[c]	0.0 (−0.1–0.1)	.668	.04	1.0% (40)[b]	1.5% (53)[c]	1.56 (1.0–2.4)	.051
12/13 (g)	3,956	3,381	3.0 (2.34)[c]	3.1 (2.38)[b]	0.1 (0.0–0.2)	.065	.04	0.8% (31)[b]	0.8% (27)[c]	0.95 (0.57–1.59)	.857
Cumulative	4,699	4,425						4.6% (215)[e]	5.6% (249)[f]		

[a]From analysis adjusted for covariates.
[b]Missing values below 3%.
[c]Missing values below 4%.
[d]14.8% missing values (n = 640).
[e]Including 48 incident cases from wave c.
[f]Including 27 incident cases from wave c.

Table 3 Parent-rated H/I SDQ scores at and before first diagnosis by cohort for children with incident ADHD

	Total (*n*)		Mean H/I SDQ score before first diagnosis				Mean H/I SDQ score at first diagnosis			
Age (wave)	Cohort 1	Cohort 2	Cohort 1 (*SD*)	Cohort 2 (*SD*)	Difference (95% CI)[a]	*p*-Value[a]	Cohort 1 (*SD*)	Cohort 2 (*SD*)	Difference (95% CI)[a]	*p*-Value[a]
6/7 (d)	42	57	6.0 (2.56)	5.3 (2.37)[b]	−0.7 (−1.7 to 0.4)	.211	8.3 (1.76)	7.8 (1.83)	−0.4 (−1.1 to −0.3)	.235
8/9 (e)	54	85	6.1 (2.24)[d]	6.4 (2.24)[d]	0.5 (−0.3 to 1.3)	.239	7.4 (2.10)[d]	7.7 (1.98)[c]	0.4 (−0.5 to −1.3)	.409
10/11 (f)	40	53	6.8 (2.13)[d]	6.4 (2.68)[d]	−1.2 (−2.0 to −0.3)	.009	7.2 (2.16)[c]	7.0 (2.31)	−0.5 (−1.4 to −0.4)	.243
12/13 (g)	31	27	5.5 (2.83)[c]	6.0 (2.31)[c]	0.8 (−0.5 to −2.1)	.237	6.7 (1.99)	6.8 (2.12)[c]	0.4 (−0.5 to −1.3)	.373

[a]From analysis adjusted for covariates.
[b]Missing values n = 19.
[c]Missing values n < 5.
[d]Missing values n < 10.

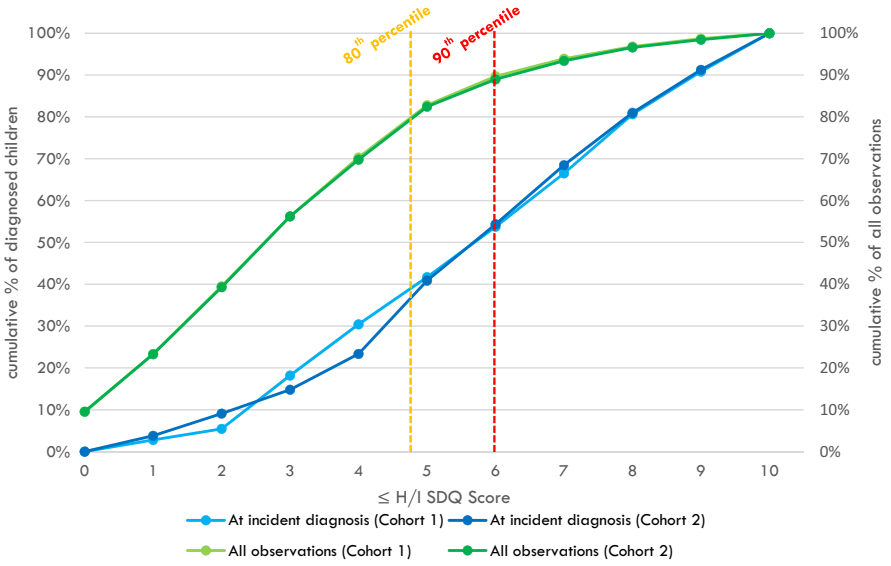

Figure 1 Cumulative distribution of H/I SDQ scores by cohort

Table 4 Proportional hazards models for ADHD diagnosis

	Univariable model				Multivariable model[a]			
Variable	HR for ADHD diagnosis	95% CI Lower	95% CI Higher	*p*-Value	HR for ADHD diagnosis	95% CI Lower	95% CI Higher	*p*-Value
Cohort								
Cohort 2 (born 2003/2004) vs. Cohort 1 (born 1999/2000)	1.40	1.12	1.74	.003	1.33	1.06	1.67	.012
With interaction between Cohort and H/I SDQ score at previous wave								
Interaction Cohort × SDQ score								.972
Cohort 2 vs. Cohort 1								
At score of 0					1.32	0.77	2.36	
At score of 3					1.33	0.94	1.89	
At score of 5					1.34	1.05	1.70	
At score of 7					1.34	1.05	1.70	
At score of 10					1.35	0.89	2.03	

[a]Adjusted for H/I SDQ score, sex, state, remoteness, language spoken, SEIFA score, mother's education H/I SDQ score was treated as a continuous variable.

inferred that the cut-off point for the 80th percentile (normal-range group) would be a score of approximately 4.8 while that for the 90th percentile (borderline group) is around 6.

Applying these thresholds to incident cases, 26.5% of children subsequently diagnosed with ADHD scored 4 or lower and an estimated 38% scored below the population 80th percentile of scores, while around 54% fell below the threshold for clinical-range behaviours (90th percentile). 45.9% of diagnosed children scored in the clinical range (top 10% of H/I behaviours) before first diagnosis.

Of those children without ADHD diagnosis (not shown), between 7.7% (at age 12/13) and 9.5% (at age 10/11) scored more than 6 points, placing them above the population 90th percentile. At all but one wave (age 6/7), this proportion was bigger in cohort 2.

Stratified, approximately 45% of girls and 38% of boys with an incident ADHD diagnosis scored below the 80th percentile (Figure S1). This result reversed (38% vs. 42%) when comparing diagnosed children to sex-specific percentiles as girls on the whole recorded lower scores than boys (Figures S2 and S3).

In sensitivity analysis, we varied the respondent (parent vs. teacher) and time point for measuring H/I behaviours. Results ranged between 18% and 36% of diagnosed children scoring below the 80th population percentile.

Risk of ADHD diagnosis by year of birth

In univariable analysis, year of birth was associated with risk of incident ADHD diagnosis. Children in cohort 2 had a hazard ratio of 1.40 for diagnosis

compared with those in cohort 1 (95% CI = 1.12–1.74, p = .003) (Table 4). While most covariates were associated with an ADHD diagnosis in univariable analysis, some were not (Table S4). We included all covariates in the multivariable model to avoid excluding any minor effects. After adjustment, birth cohort was still associated with risk of diagnosis, with a HR of 1.33 for cohort 2 compared with cohort 1 (95% CI = 1.06–1.67, p = .012).

Including the interaction between cohort and H/I SDQ score in the model showed no differences in the birth cohort effect across H/I behaviours within the normal, borderline or clinically relevant range (p = .972).

Discussion

Despite no differences in ADHD-related behaviours between two birth cohorts separated by 4 years, ADHD diagnoses increased. The adjusted HR for children born in 2003/2004 was 1.33 times than that for those born in 1999/2000. Children with normal, borderline and clinically relevant behaviours were all at higher risk of diagnosis in the later birth cohort. Overall, 26.5% of diagnosed children displayed normal-range H/I behaviours before their first diagnosis.

We used a large dataset from a population-based cohort study, with around 30,000 observations covering the main ages during which ADHD is diagnosed. Consequently, our results are likely applicable to the Australian population more generally. We adjusted our analyses for a series of known covariates, increasing the certainty that observed effects were not due to confounding.

Our study has some limitations. Cohorts were only separated by 4 years, making it difficult to disentangle cohort effects from period effects. Ideally, ADHD diagnoses would be examined over a longer period. However, even within the short timeframe, diagnoses increased. A larger gap between cohorts may have shown a larger increase. Two main variables of interest in our analyses, H/I behaviours and diagnosis, were parent-reported, with H/I score recorded a maximum of 2 years before diagnosis. The potential time lag between H/I score and first diagnosis may have introduced some bias as it is conceivable that a child's ADHD-related behaviour increased or became more notable just before the actual diagnosis was made. However, most children in this study would have been diagnosed according to DSM-IV criteria in which impairing symptoms needed to be present before age 7 (American Psychiatric Association, 1994); combined with our threshold for normal behaviour being set relatively low, it is unlikely that this affects our results in a meaningful way. Importantly, choosing the pre-diagnosis score ensured that measurements were unlikely to be affected by consequent treatment. The parent-report of behaviours may also have had an effect on our results, overestimating the proportion of children with clinical-range behaviours, as parents may report higher prevalence than clinicians (Polanczyk et al., 2014). In sensitivity analysis, using the teacher-reported H/I SDQ scores, we saw similar results. However, due to substantial increases in missing data from teacher-reports, we did not incorporate this in our main analysis. We were unable to account for two main criteria of an ADHD diagnosis: (1) persistent impairment and (2) evidence of this impairment in two settings (American Psychiatric Association, 2013). This may also have led to an overestimation of children with clinical-range behaviours (Polanczyk et al., 2014), that is, the actual proportion of diagnosed children with normal or borderline behaviours is likely higher than our estimate. While the H/I SDQ scale is commonly used as a screening tool to measure ADHD-related behaviours, it is known to have relatively low sensitivity (Madsen et al., 2018). We addressed this issue by focussing our results on the group of children scoring 4 points or lower. Accordingly, our finding of 26.5% of diagnosed children displaying normal-range H/I behaviours is likely a cautious estimate. Limitations applied to both cohorts and are unlikely to have influenced inter-cohort comparisons.

Cumulative incidence of ADHD diagnosis in our study is similar to other worldwide estimates of around 5% of the childhood population (Polanczyk et al., 2014) and Australia-specific ADHD prevalence estimates of 4.2% (Deloitte Access Economics, 2019). While there has been no similar study on diagnosis rates in Australian children, our results confirmed the globally increasing trend in ADHD diagnoses (Kazda et al., 2021). Like our study, others have found that diagnosis rates in girls, while lower than in boys, are increasing at a similar rate (Fairman, Peckham, & Sclar, 2020).

Our results also reinforce findings that H/I behaviours in the general population have not increased over time while diagnosis rates have (Rydell et al., 2018; Safer, 2018). Contrary to another Australian study, we did not find that clinically relevant ADHD symptoms had declined (Sawyer et al., 2018), possibly due to the relatively short time between our cohorts.

Our study was not designed to determine why children with apparently few H/I behaviours are being diagnosed with ADHD or what effect this may have for them. Some children may be misdiagnosed with ADHD when they could meet criteria for other conditions such as autism (Perry, 1998) or obsessive–compulsive disorder (OCD) (Abramovitch, 2016). Overdiagnosis may be occurring due to transient behavioural problems, for example, as a result of relative immaturity (Holland & Sayal, 2018), lowering of diagnostic thresholds for ADHD diagnosis, or giftedness (Mullet & Rinn, 2015).

Regarding the effect of diagnosis, some research indicates that diagnosed children, compared with children with similar behaviours without diagnosis,

may experience worse educational, social and psychological outcomes (Owens, 2020). Others suggest that even children with subthreshold ADHD behaviours experience impairment in various domains and may benefit from additional support (Efron et al., 2020; Zendarski et al., 2020). However, it remains unclear if an ADHD diagnosis can provide or enable such support. More research is needed, focussing on long-term outcomes for children with few ADHD-related behaviours who are diagnosed with ADHD compared with those without diagnosis. The confirmation that girls generally display less observable H/I behaviours (Cuffe, Moore, & McKeown, 2005) and have lower diagnosis rates (Fairman et al., 2020) calls for more studies that include enough girls to enable conclusions on outcomes of an ADHD diagnosis for girls with low frequencies of H/I behaviours.

Clinicians may be surprised by our finding that a large proportion of children who receive a diagnosis do not display clinical-range H/I behaviours and may be mis- or overdiagnosed. Despite an abundance of research in the area, no clear, objective single or combination marker exists to permit a definite diagnostic classification for ADHD, thus placing a significant responsibility for expertise and experience on clinicians when diagnosing (Drechsler et al., 2020). Our findings underscore the need for a cautious clinical approach to ADHD diagnosis in children with subclinical-range H/I behaviours while it remains unclear how diagnosis may affect long-term outcomes in these children.

Conclusion

In this analysis, we found rising ADHD diagnosis rates combined with over a quarter of diagnosed children displaying ADHD-related behaviours within the normal range before their initial diagnosis.

Supporting information

Additional supporting information may be found online in the Supporting Information section at the end of the article:

Table S1. Parent-rated H/I SDQ scores and incident ADHD diagnosis by cohort and sex for all children.
Table S2. Parent-reported current ADHD diagnosis and medication by cohort and sex for all children.
Table S3. Parent-rated H/I SDQ scores at and before first diagnosis by cohort and sex for children with incident ADHD.
Table S4. Univariable Proportional Hazards Models for ADHD diagnosis.
Figure S1. Cumulative distribution of H/I SDQ scores by sex.
Figure S2. Cumulative distribution of H/I SDQ scores for girls.
Figure S3. Cumulative distribution of H/I SDQ scores for boys.

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Author contributions

Luise Kazda: conceptualisation, data curation, formal analysis, investigation, methodology, project administration, validation, writing – original draft, and writing – review and editing. Kevin McGeechan: conceptualisation, formal analysis, methodology, supervision, validation, software, writing – review and editing. Katy Bell: conceptualisation, methodology, supervision, writing – review and editing. Rae Thomas: conceptualisation, supervision, writing – review and editing. Alexandra Barratt: conceptualisation, funding acquisition, methodology, supervision, writing – review and editing.

Data availability statement

Luise Kazda confirms that she had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. The data used in this study are available by application through ADA Dataverse to the National Centre for Longitudinal Data (NCLD), Australian Government Department of Social Services.

Correspondence

Luise Kazda, The University of Sydney, Room 124, Edward Ford Building (A27), Sydney, NSW 2006, Australia; Email: luise.kazda@sydney.edu.au

Key points

- Globally, ADHD diagnoses in children and adolescents have increased while ADHD-related behaviours have not.

- We found that while ADHD-related behaviours were similar across two birth cohorts, children born 4 years later were more frequently diagnosed with ADHD, regardless of the level of hyperactive/inattentive behaviours.
- More than a quarter of diagnosed children recorded pre-diagnosis hyperactive/inattentive behaviours within the normal range.
- Diagnosis of children with clinically relevant ADHD-related behaviours only partially explains the rise in ADHD diagnoses in Australian children, as diagnoses also increased in children whose reported behaviours were within the normal range.
- Practitioners should proceed with care when identifying children with few ADHD-related behaviours, as the long-term effects of a diagnosis for this group remain largely unclear and urgently require rigorous evaluation.

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