Attention-deficit/hyperactivity disorder: variation by socio-economic deprivation

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What is known about this topic

Attention-deficit/hyperactivity disorder (ADHD) affects 3 to 5% of children and young people in the community in the United Kingdom.

There is a discrepancy between the community prevalence of ADHD and the clinically recorded prevalence, which is less than 1%.

Estimates of how the clinically recorded prevalence of ADHD varies by deprivation and region are lacking.

What this study adds

The clinically recorded prevalence of ADHD in children and young people was twice as high in the most compared to the least deprived areas.

The greatest inequality in recorded prevalence of ADHD was in the East of England and the least inequality was in London.

There is a greater need for health and educational services for children with ADHD in more disadvantaged areas.

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Competing Interest

None declared

Abstract

Background In England, there is a discrepancy between the prevalence of Attention-deficit/hyperactivity disorder (ADHD) ascertained from medical records and community surveys. There is also a lack of data on variation in recorded prevalence by deprivation and geographical region; information that is important for service development and commissioning.

Methods Cohort study using data from the Clinical Practice Research Datalink comprising 5,196 children and young people aged 3-17 years with ADHD and 490,016 without, in 2012.

Results In 2012, the recorded prevalence (95%CI) of ADHD was 1.06 (1.03-1.09) %. Prevalence in the most deprived areas was double that of the least deprived areas (prevalence rate ratio (PRR) 2.58 (2.36-2.83)), with a linear trend from least to most deprived areas across all regions in England.

Conclusions The low prevalence of ADHD in medical records may indicate considerable under-diagnosis. Higher rates in more disadvantaged areas indicates greater need for services in those areas.

Introduction

The community prevalence of attention-deficit/hyperactivity disorder (ADHD) is 3-5% in England[1]. However, the clinically recorded prevalence is much lower (<1%)[2 3]. Estimates of how this varies by deprivation and region are lacking. This cohort study aims to address this gap and inform development of health and education services.

Methods

Data source

We used the General Practice (GP) medical records linked to hospital episodes statistics (HES) data from the Clinical Practice Research Datalink (CPRD) from 370 GP practices, which represents approximately 4% of the UK population[4]. These data are broadly representative of the UK population and contain information on consultations with GPs, hospital admissions, diagnoses and prescriptions[4].

Defining the population with ADHD

We extracted medical records for children and young people (CYP) aged 3-17 years registered before June 2013 with at least one diagnosis code or prescription for ADHD. We took the latest of the date of: third birthday; diagnosis; registration with the practice (in CYP diagnosed before registration); or 1st January 1998 (the first full year of the CPRD-HES link) as the date when ADHD was first known to the GP. We took the earliest of the date when the: CYP left the practice or died; practice stopped participating in the CPRD; CYP turned 18 years; or 31st December 2012 (the last complete year that CPRD-HES linked data were available), as the last date of follow-up.

Estimating prevalence – numerators

To calculate the frequency of recorded ADHD in 2012, CYP were required to have received the diagnosis on or prior to 1st July and to be registered with the GP on 1st July. The number of CYP known to have ADHD by 1st July in 2012 was counted overall and by: age, sex, strategic health authority region and social deprivation quintile (English index of multiple deprivation (IMD) score 2010, at lower super output area level, based on home postcode). The IMD score comprises seven domains: income, employment, health and disability, barriers to housing and services, living environment and crime.

Denominators

We extracted medical records from the CPRD for CYP registered before 31st December 2012. CYP who were: aged from 3-17 years old; registered with the practice and alive, between 1st January 2012 and 31st December 2012 were counted in the denominator. The number of CYP registered in the CPRD on 1st July in 2012 was counted overall and by age, sex, region and deprivation).

Prevalence estimates

Prevalence rates for 2012 were estimated assuming a Poisson distribution and described overall, by sex, age, region and deprivation. We assessed whether prevalence by age varied by sex and whether deprivation gradients varied by region by adding interaction terms to the model assessing significance using a likelihood ratio test (LRT).

Sensitivity analyses and subgroup analyses

To explore how altering the definition of ADHD affects estimates of recorded prevalence, we described subgroups reflecting at least one drug code or at least one diagnosis code; at least two drug codes and at least two diagnosis codes; at least one drug code; no drug codes.

Ethics

Approval was obtained from CPRD's independent scientific advisory committee (ISAC) (Protocol reference 12_128R).

Results

There were 5,196 CYP with ADHD and 490,016 without (Table 1). In 2012, the recorded prevalence (95%CI) of ADHD was 1.06 (1.03-1.09) %. Boys had a five-fold higher prevalence than girls (1.74 % vs. 0.35 %, PRR 4.98 (4.62-5.36) %). The prevalence was highest in 15 to 17-year-olds (1.91 (1.82-1.99) %) and lowest in 3 to 4-year-olds (0.01 (0.002-0.02) %). The relationship between prevalence and age did not differ significantly by sex (LRT p=0.09). Prevalence rates increased with increasing deprivation, being two-fold higher in CYP from the most compared with the least deprived areas (1.38 % vs 0.73 %, PRR 2.58 (2.36-2.83) %; test for linear trend p<0.001). There was considerable geographic variation, with higher prevalence in the South East and East regions, compared to Yorkshire and Humber (1.55 % and 1.34 % vs. 0.56 %, PRR 3.13 (2.46-3.99) and 2.80 (2.19-2.00)), respectively. Varying definitions of ADHD did not alter prevalence patterns by sex, age, deprivation or region (online supplementary table).

Table 1: The recorded prevalence, crude and adjusted prevalence rate ratio (PRR) of ADHD in 2012

Characteristic		£ADHD	£No ADHD	Prevalence %	(95% CI)	PRR	95% CI	$Adjusted PRR	95% CI	P-value
Overall		5,196	490,016	1.06	(1.03 -1.09)	-		-		-
Sex	Female	841	240,034	0.35	(0.33 -0.37)	1		1		**p<0.001&**
	Male	4,355	249,982	1.74	(1.69 -1.79)	4.97	(4.62 -5.35)	4.98	(4.62 -5.36)	
Age group	3-4	$$	69,713	0.01	(0.002 -0.02)	1		1		**p<0.001#**
	5-9	830	163,834	0.51	(0.47 -0.54)	70.6	(29.3 -170.1)	71.7	(29.8 -173)	
	10-14	2,467	157,090	1.57	(1.51 -1.63)	219	(91.1 -527)	226	(93.9 -543)	
	15-17	1,894	99,379	1.91	(1.82 -1.99)	266	(110 -639)	275	(114 -662)	
Deprivation	Least deprived	870	118,422	0.73	(0.69 -1.79)	1		1		**p<0.001#**
	2nd least deprived	926	99,463	0.93	(0.87 -0.99)	1.27	(1.16 -1.39)	1.36	(1.23 -1.49)	
	Medium deprivation	908	86,374	1.05	(0.98 -1.12)	1.43	(1.30 -1.57)	1.58	(1.44 -1.74)	
	2nd most deprived	1,169	90,230	1.30	(1.22 -1.37)	1.76	(1.62 -1.93)	2.10	(1.92 -2.30)	
	Most deprived	1,211	87,564	1.38	(1.31 -1.46)	1.88	(1.73 -2.05)	2.58	(2.36 -2.83)	
	Data missing	112	7,963	1.41	(1.16 -1.69)	1.91	(1.57 -2.33)	2.53	(2.08 -3.08)	
Region	East Midlands	79	7,480	1.06	(0.84 -1.32)	1.90	(1.38 -2.62)	1.95	(1.42 -2.69)	**p<0.001&**
	East of England	698	51,995	1.34	(1.24 -1.45)	2.41	(1.89 -3.08)	2.80	(2.19 -2.00)	
	London	630	83,266	0.76	(0.70 -0.82)	1.36	(1.06 -1.74)	1.36	(1.06 -1.74)	
	North East	111	11,165	0.99	(0.82 -1.20)	1.79	(1.33 -2.41)	1.54	(1.15 -2.08)	
	North West	717	80,541	0.89	(0.83 -0.96)	1.60	(1.25 -2.04)	1.48	(1.16 -1.89)	
	South Central	860	67,269	1.28	(1.19 -1.37)	2.30	(1.80 -2.93)	2.70	(2.12 -3.44)	
	South East Coast	1,046	67,691	1.55	(1.45 -1.64)	2.78	(2.18 -3.53)	3.13	(2.46 -3.99)	
	South West	534	54,875	0.97	(0.89 -1.06)	1.75	(1.37 -2.24)	1.79	(1.39 -2.29)	
	West Midlands	450	52,969	0.85	(0.77 -0.93)	1.53	(1.19 -1.96)	1.56	(1.21 -2.00)	
	Yorkshire & Humber	71	12,765	0.56	(0.43 -0.70)	1		1		

£Number of children and young people in 2012

$Adjusted for the other variables in the table

&P value for likelihood ratio test comparing the adjusted model with the variable to a model without

$$Frequencies less than 10 not displayed to protect anonymity

#P value for test for linear trend adjusting for other variables in the table

The social gradient in ADHD prevalence was evident within all regions and also varied significantly between regions (Figure 1, test for interaction $p<0.001$). The steepest social gradient (comparing most to least deprived areas) was in the East of England (PRR 3.43 (2.70-4.37)) and the smallest gradient in London (PRR 1.38 (1.04-1.83)).

Discussion

The recorded prevalence of ADHD in CYP (1.06%) in 2012 was considerably lower than community prevalence estimates[1]. Recorded prevalence estimates worldwide vary from 0.06% to 13%, with higher estimates originating from the USA[5]. The prevalence was double in the most compared to the least deprived areas with a linear trend across all regions in England. The greatest inequality was within the East of England region and the least within London.

Our low prevalence estimate suggests that there are many CYP in the population with undiagnosed ADHD. This is supported by findings from the British Child and Adolescent Mental Health Survey[1], which reported ADHD prevalence amongst 5-15 year-olds of 2.23%. Under-diagnosis is important as it precludes receipt of appropriate child and parental support, educational support and behavioural and pharmacological treatment for ADHD. This may be particularly relevant as children transition from primary to secondary school and independent learning is increasingly required. As recorded prevalence of ADHD increases with age, and we included children aged under five, this may partly explain our low prevalence estimate. It is also possible that secondary care ADHD diagnoses are not being recorded in primary care records. However, systematic reviews demonstrate accurate recording of secondary care diagnoses in primary care records and high validity across a wide range of diagnoses, so this is unlikely to explain much of the difference in prevalence rates[6 7].

Worldwide studies of community prevalence of ADHD suggest CYP from disadvantaged families are 1.5 to 4 times more likely to have ADHD symptoms compared to those from more advantaged families[8]. This is consistent with Millennium Cohort Study (MCS) findings of strong associations between multiple measures of socio-economic disadvantage and parent-reported diagnosed prevalence of ADHD[9]. This may represent true differences in the

prevalence of ADHD, differential symptom reporting or differential access to services to diagnose and treat ADHD. The MCS found similar associations between parent or teacher reported ADHD symptoms and socio-economic disadvantage, suggesting that clinical labelling bias does not explain the social gradient[9]. Potential explanations for the social gradient, include differential exposures to multiple material, psychosocial and environmental risk factors before or around the time of birth or in childhood, as well as genetic or developmental contributions[9]. Genetic susceptibility may also play a role, with some individuals being more susceptible to adverse, or supportive, environmental exposures[10].

Our findings suggest greater need for health and educational services for CYP with ADHD in more disadvantaged areas and can inform the development and commissioning of appropriate services, with our figures being understood as conservative estimates. Future research is needed to explore under-diagnosis or under-recording of ADHD in CYP and mechanisms by which socio-economic disadvantage impacts on ADHD prevalence.

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Figure 1 Prevalence of ADHD by area-level deprivation for each region