Examining the relationship between childhood health conditions and health service utilisation at school entry, and subsequent academic performance in a large cohort of Australian children.

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What is already known on this topic?

1. Associations have been found between some chronic health conditions and academic performance of school age children.
2. Children with poor health status have poorer academic performance compared to healthier children.
3. Parental social economic status affects academic performance of primary school children.

What does this paper add?

1. When starting school, approximately half of the children had some form of health condition, with dental problems, speech and language problems, and asthma the most commonly reported.
2. A range of these chronic health conditions subsequently impacted on the numeracy and literacy level of the children when tested in year 3.
3. Children's attendance at specialist health services to address their health condition did not improve academic performance in year 3.

Abstract

Aim

Chronic health conditions are associated with poor academic outcomes. This study examines the relationship between health conditions, specialist health service utilisation and academic performance in Australian children.

Methods

This was a quasi-longitudinal study where School Entrant Health Questionnaire (a survey tool with parent report on children's health) data for 24,678 children entering school in 2008 was matched with the 2011 National Assessment Program—Literacy and Numeracy (NAPLAN). Linear and logistic regression were used to examine associations between health conditions, use of a specialist health service and reading and numeracy scores.

Results

The study comprised 24,678 children. Children with allergies, very low birth weight (LBW), developmental delay, diabetes, spina bifida, cystic fibrosis, birth abnormality, speech problems, intellectual disability and ADHD had lower numeracy scores than those without any of these conditions ($p < 0.05$). The same children had higher odds (1.2-5.8) of being at or below the national minimum standard for numeracy. Children with developmental delay, epilepsy, dental problems, speech, intellectual disabilities and LBW had lower reading scores than those without these conditions ($p < 0.05$) and had higher odds of being at (OR: 1.3) or below (OR: 3.7) the national minimum standard for reading. Children with health conditions who had ever accessed specialist health services did not differ in their academic performance from those that had not used specialist health services.

Conclusions

Some health conditions put children at risk of poorer academic performance and interventions to prevent this such as appropriate support services in schools should be considered.

Introduction

Children with chronic health conditions are more likely to perform poorly at school (1-3). Health is postulated to influence academic performance through its effects on activities of daily living, social interactions, school attendance, physiological functions such as concentration and attention in class, memory and general cognitive ability (2, 4-7). More specifically, children with asthma, diabetes, developmental delay, intellectual disability and low birth weight (LBW) have been found to perform worse academically than those without (1, 3). Further, family circumstances and parental socioeconomic status (SES) has been consistently identified as a strong and important predictor of health status and academic performance at all ages (8-11).

To promote the health and wellbeing of children, contemporary evidence of the size of the problem is critical. There is some evidence from a cross sectional study conducted in Victoria, Australia in 2006 that almost half (48.5%) of the children surveyed had a health condition (12). There is also limited evidence that the prevalence of some of these childhood health conditions is changing, with increases in conditions like asthma and other allergic disorders previously reported (13).

It is generally assumed that specialist interventions for chronic health conditions will help children achieve better academic outcomes (14). However, there is currently little longitudinal evidence to support this assumption. This study aims to determine a) the prevalence of childhood health conditions, b) the childhood health conditions associated with poor academic performance, c) associations with family socioeconomic factors, and d) if use of a targeted or specialist health service makes a difference in the academic performance for the affected children.

Methods

Study design and measures

This is a prospective quasi-longitudinal study on Victorian children with data drawn from the School Entry Health Questionnaire (SEHQ) and the National Assessment Program—Literacy and Numeracy (NAPLAN). The SEHQ is a parent's report on children's health status at school entry on conditions such as allergy, sensory, dental, intellectual, behavioural and physical health conditions; use of a specialist health service which is categorized as a child having attended specialist health service once or still attending this service at school entry (15). The NAPLAN is a measure of academic performance where students are assessed on numeracy, reading, writing, grammar and spelling using standard tests at years 3, 5, 7 and 9 of school (16). The results are reported in six bands and the national minimum standard is at the second band. Raw scores were used to assess the magnitude of differences between different health conditions and the banded scores to contextualize the results in terms of national minimum standards.

56% of 2008 SEHQ was linked to the year 3 NAPLAN collected in 2011. The data was matched on date of birth, sex, student or school postcode, country of birth and Aboriginal or Torres Strait Islander (ATSI) origin to make a combined longitudinal dataset. The demographic characteristics and prevalence of the matched and unmatched children were very similar. (17).

Statistical methods

The exposure variables were the health conditions on the SEHQ and the outcome variables were the raw NAPLAN scores on numeracy and reading and the binary variable about whether or not a child was at/below or above national minimum standard in reading and numeracy. Demographic variables including age, sex, region type, child living arrangements, whether child was born in Australia, does the child speak English, is English the main language at home, Aboriginal or Torres Strait Islander origin, attendance of

preschool and father and mother's education level and occupation were used as potential confounders in the analysis.

Univariable and multivariable linear regression was used to assess associations between the demographic characteristics and the health conditions with the raw reading and numeracy scores. Univariable and multivariable logistic regression was used to examine association of health conditions with being at/below the national minimum standard in both reading and numeracy. Stratified linear regression analyses were used to examine the effect of service utilisation on NAPLAN outcomes for those with specific health conditions. All statistical analyses were performed using Stata 12 SE (StataCorp, College Station, TX, USA).

Results

Table 1 summarises the study sample, which consisted of 24,678 participants with males and females equally represented. Most of the children who entered school in 2008 were four to five years of age with the majority also born in Australia, living in the metropolitan area and having previously attended preschool (year before starting school). Most of the parents had some form of academic certificate. Almost all fathers were employed but only half the mothers.

Associations between demographic characteristics and reading and numeracy scores

Table 2 shows that demographic characteristics at school entry were associated with a difference in mean scores for both reading and numeracy on the NAPLAN in Year 3. Females scored higher in reading but males scored higher in numeracy. Children in single parent homes scored lower than those who lived with both parents. Those who were born in Australia did better in numeracy but not reading. The language

spoken at home and by the child was only significant in reading but not on numeracy scores. Those who attended preschool had higher scores in both reading and numeracy.

Prevalence of the health conditions and their association with numeracy and reading

Tables 3 to 5 show the prevalence of the different health conditions and their associations with numeracy and reading scores. Approximately half of the children had some form of health condition with dental problems, speech and language problems and asthma as the most commonly reported problems. The rarely reported (<100 children) conditions were diabetes, arthritis, cystic fibrosis, epilepsy, arthritis, cerebral palsy, intra-ventricular shunt and spina bifida. In table 3, regression coefficients and odds of being at or below the national minimum standard for numeracy and reading are shown for common chronic health conditions. Children with LBW and birth abnormality had a lower mean numeracy score than that of those without the condition or had higher odds of being at or below the national minimum standard in numeracy after adjusting for confounders. Those with birth abnormality had higher odds of being below the national minimum standard for reading.

Table 4 shows the associations for the rare health conditions. Children with diabetes and epilepsy had lower scores than children without these conditions. Children with diabetes, epilepsy, cystic fibrosis, spina bifida and chronic lung problems had higher odds of being below the national minimum standard for numeracy. Only children with epilepsy also had higher odds for being below national minimum in reading.

Table 5 shows the associations for the neurodevelopmental disorders. Children with speech problems, intellectual/ learning disability and developmental delay had lower scores in both numeracy and reading and had higher odds of being at or below the national minimum standard. Children with ADHD had lower scores and higher odds of being below national minimum standard in numeracy.

Use of a specialist health service and reading and numeracy scores

Mean reading and numeracy scores attained by children with a health conditions that either used a specialist health service, continued to use this service or did not use such a service are shown in table 6. Adjusted regression coefficients are also shown in this table. Only a small proportion of children with a health condition (<50%) used a specialist health service and less than one third continued to attend at school entry. There was no difference in the mean scores for both reading and numeracy among these groups of children. However, this was not statistically significant.

Discussion

The aim of this longitudinal study with over 24,000 school age children in Victoria, Australia was to examine whether paediatric health conditions were associated with poorer academic performance and also to assess whether the academic performance of children with such health conditions is improved if they used a specialist health service. Strong positive associations were identified between demographic factors with subsequent NAPLAN scores in both reading and numeracy. After adjusting for these factors, 11 of the 23 health conditions were associated with lower NAPLAN scores for numeracy and six for reading. No difference was found in the reading and numeracy scores among children with a health condition that had ever used a specialist health service or continued to use such a service at school entry and those who had not.

The prevalence estimates for the various health conditions among Victorian children found for this study are comparable with findings from a cross-sectional study of over 5000 children aged 5 to 18 conducted in 2006 (12). This used parent and child self-report of health conditions to determine the prevalence of chronic conditions and their effect on health and wellbeing. Although their sample was older, the same highly

prevalent conditions such as asthma and allergies were found. The number of children with a health condition in this study was found to be 52% which is consistent with 48.5% found in 2006 (12). It is also higher than the 4-18% found in another population study; this data was drawn from teachers (4, 18). The prevalence of asthma in the current study was 14.5%. This is lower than that found in a prospective cohort study among 5-7 year olds in New Zealand, which reported a prevalence of 18.5%. However, New Zealand is known to have a high prevalence of asthma (19). The rate is higher than that reported in a 2012 trend analysis by the National Centre for Health Statistics (USA) which is 9% for 0 to 17 year olds (13). This could be because the sample used was older and asthma has been known to resolve as children get older (20).

Association between demographic characteristics and reading and numeracy scores

Predictors of parental SES such as region of residence, education and occupation, which were the main confounders in this study, impact on a child's academic status four years later. This is consistent with what has been found elsewhere where socioeconomic status is a predictor of both health and academic status (9,10, 21).

Associations between NAPLAN scores and health conditions

Some health conditions were associated with low scores on reading, others with numeracy and others such as LBW, developmental delay, epilepsy, speech/language problems and intellectual/learning disability with low scores in both. This is comparable to a very recent three year retrospective cohort study conducted from 2007 to 2010 with over 22,000 children and adolescents in California where parents completed a health questionnaire and academic performance was assessed by standardised tests in English and Maths (3). Chronic health conditions were found to be independently associated with low scores on standardized tests

and the children had 25% increased odds of being below average. Another literature review of 200 studies of children with health conditions showed that not all are associated with poor academic performance (22).

We found that developmental delay, epilepsy, intellectual disability and ADHD are all associated with lower scores on the NAPLAN. This finding is consistent with the results of the Californian study, which found neurodevelopmental and seizure disorders to be independently associated with lower academic performance (3). Another cohort study conducted from 1994 to 2000 on Canadian and American children aged 4 to 11 years also had similar findings, suggesting these disorders might be stronger predictors of low academic performance than those that affect the physical alone (3, 23). Our findings on ADHD are consistent with these studies where these children have been shown to perform worse on standardized tests (23, 24). In our study, children with cystic fibrosis were found to have increased odds of being below the national minimum in numeracy, although did not have significantly lower raw scores in reading or numeracy. The lack of difference in scores is consistent with the results of a recent systematic review which reviewed nine studies of children aged 16-21 with cystic fibrosis and found no difference in scores from other children in reading and arithmetic (25).

Our current study also found an association between spina bifida and low numeracy scores, although not in children with intra-ventricular shunt. A cross-sectional study conducted with 180 children aged 7 to 18 years from USA and Canada with intra-ventricular shunts and spina bifida reported worse performance on reading and math tests than their peers (26).

Children with LBW also scored poorly in both reading and numeracy in the current study. This is consistent with a birth cohort study conducted in the Netherlands assessing school outcomes among five year olds who

had very low birth weight which found that these children had more developmental problems and required extra academic assistance to catch up with their peers (27).

Association between use of a specialist health service and reading and numeracy scores

The second objective of this study was to determine if ever or continued use of a specialist health service made a difference in academic performance of the affected children. There was no evidence that for those with specific health conditions that use of a specialist health service resulted in improved NAPLAN scores. To the best of our knowledge, this is the first study to use stratified analysis to look for an association between utilization of a specialist health service and academic performance among children who are just starting school. Therefore, we have no studies to directly compare our findings with. We speculate that the lack of evidence of an association between using a specialist service and academic performance seen in this study could be because the children who continue to use a specialist service are more severely affected and appear to do worse than those who attended the service only once or had no need to continue to use the service. It is also possible that use of the specialist service may have improved other aspects of the child's life. Both qualitative and further quantitative studies may assist to determine why use of specialist health services does not appear to have an impact on the academic performance of the affected children.

Strengths and Limitations

This prospective study with children enabled us to determine the effect of health conditions present at school entry on academic performance four years later. With over 24,000 students, the sample size is large and powerful in terms of finding associations. However, there are a number of limitations; only 56% of the children were successfully matched, NAPLAN scores on only reading and numeracy were utilised as a measure of academic performance, and children may have performed better in other areas. Further, the study sample comprises only students from government schools and not religious or independent schools. There

could also be residual confounding by other factors such as severity and chronicity of the health conditions that were not measured.

Conclusions

We have found a longitudinal relationship between some health conditions and subsequent academic performance among a large cohort of children attending government schools in Victoria, Australia. These findings demonstrate that a child entering school with certain health conditions is at increased risk of poorer academic performance. Early identification is important and clearly possible though strategies such as the SEHQ, however additional measures are required to close the gap in academic performance observed in later years.

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Table 1 Demographic characteristics of the participants (Total N=24,678)

Demographic characteristics*	Number (%)
Child's age (years)	
4 -5	15,355(62.2)
6-7#	9,316(37.8)
Child's sex	
Male#	12,660(51.4)
Female	11,982(48.6)
Region where child lives	
Metro	16, 979(68.8)
Non-metro#	7,699(31.2)
Child lives at home with	
Both Parents	20,398 (87.3)
One parent#	2,975(12.7)
Child born in Australia	
Yes#	23,150 (93.9)
No	1,510(6.1)
Does child speak English	
Yes	24,277 (98.6)
No#	354 (1.4)
English as main language at home	
Yes	21,789 (88.7)
No#	2,765 (11.3)
Aboriginal/Torres Strait Islander	
Yes	374 (1.6)
No#	23,618 (98.4)
Attended preschool	
Yes	23,526 (96.8)
No#	784 (3.2)
Family stress levels	
High	8,149(34)
Low#	15,812(66)
Father's occupation	
Senior management#	3,873(18.1)
Business managers	5,014(23.4)
Tradesmen/women	5,477(25.6)
Machine operator/labourer	4,700(21.9)
Unemployed	2,360(11.0)
Father's education	
Bachelor degree or above#	5,289 (27.1)
Advanced diploma/diploma	2,188 (11.2)
Certificate I-IV/ trade cert	6,840 (35.1)
No post-school qualification	5,184 (26.6)
Mother's occupation	
Senior management#	3,128(12.8)
Business managers	3,651(15)
Tradesmen/women	4,054(16.6)
Machine operator/labourer	3,682(15.1)
Unemployed	9,913(40.6)
Mother's education	
Bachelor degree or above#	6,536(29.4)

Advanced diploma/diploma	3,182(14.3)
Certificate I-IV/ trade cert	4,976(22.4)
No post-school qualification	7,530(33.9)

*Number of values varies due to missing or incomplete data, # Referent category Preschool refers to early learning in the year before formal school.

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Table 2 Summary of reading and numeracy regression coefficients according to demographic characteristics of the participants. (N=24,678)

Demographic characteristic	Reading regression coefficient (95% CI)	Numeracy regression coefficient (95% CI)
Child's age (years)		
4-5	8.2(5.8,10.5) ¹	10.3 (8.3,12.3) ¹
6-7#		
Child's sex		
Male#	-13.9(-16.2,-11.7) ¹	13.7 (11.8,15.6) ¹
Female		
Region where child lives		
Metro	-17.8(-20.3,-15.4) ¹	-16.9(-18.9, -14.9) ¹
Non-metro#		
Child lives at home with		
Both Parents	-27.2(-30.8,-23.7) ¹	-23.8 (-26.8,-20.8) ¹
One parent#		
Child born in Australia		
Yes#	-14.3(-19.0,-9.5) ¹	-7.3 (-11.3,-3.3) ¹
No		
Does child speak English		
Yes	-18.4(-28.2,-8.7) ¹	-5.3 (-13.5,2.9)
No#		
English as main language at home		
Yes	-9.2(-12.8,-5.5) ¹	-2.2(-5.2,0.9)
No#		
Aboriginal/Torres Strait Islander		
Yes		
No#	-53.1(-62.7,-43.6) ¹	-44.2(-52.3,-36.1) ²
Attended preschool		
Yes		
No#	-36.1 (-42.7,-29.5) ¹	-25.7(-31.3,-20.2) ¹
Family stress levels		
High	-4.4(-6.8, -1.9) ¹	-4.2(-6.3,-2.2) ¹
Low#		
Father's occupation		
Senior management#		
Business managers	-31.3(-34.9,-27.7) ¹	-24.9 (-27.9, -21.8) ¹
Tradesmen/women	-51.6(-55.2,-48.0) ¹	-40.6 (-43.6, -37.5) ¹
Machine operator/labourer	-73.4(-77.1,-69.7) ¹	-55.9 (-59, -52.7) ¹
Unemployed	-67.5(-71.9,-62.9) ¹	-51.5 (-55.3, -47.7) ¹
Father's education		
Bachelor degree or above#		
Advanced diploma/diploma	-29.0(-33.3,-24.7) ¹	-25.5 (-29.2,-21.9) ¹
Certificate I-IV/ trade certificate	-52.9(-56.0,-49.8) ¹	-42.9(-45.6,-40.3) ¹
No post-school qualification	-64.9(-68.2,-61.5) ¹	-51.8 (-54.6,-48.9) ¹
Mother's occupation		
Senior management#		
Business managers	-24.8(-29.0,-20.6) ¹	-20.1 (-23.6,-16.5) ¹
Tradesmen/women	-46.2(-50.3,-42.1) ¹	-37.6 (-41.0 -34.1) ¹
Machine operator/labourer	-64.3(-68.5,-60.1) ¹	-49.9 (-53.5,-46.4) ¹
Unemployed	-52.9(-56.5,-49.4) ¹	-41.9 (-44.9,-38.9) ¹
Mother's education		

Bachelor degree or above[#]		
Advanced diploma/diploma	-35.9(-39.6,-32.3) ¹	-30.8 (-33.9,-27.7) ¹
Certificate I-IV/ trade certificate	-57.0(-60.2,-53.9) ¹	-46.5(-49.2,-43.8) ¹
No post-school qualification	-62.9(-65.8,-60.0) ¹	-51.1 (-53.5,-48.7) ¹

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#Referent category ¹ P value <0.001, ² P value <0.05

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Table 3 Summary of regression coefficients and the odds of having a score at or below national minimum standard in both numeracy and reading for the common chronic health conditions.

Health condition	Number (%)	Regression coefficient for numeracy (95% CI)	Odds of having score at or below national minimum in numeracy (95% CI)	Regression coefficient for reading (95% CI)	Odds of having score below national minimum standard in reading (95% CI)
Child has health condition					
No	11,292(48)	-5.6(-7.8,-3.4) ¹	1.4(1.2,1.6) ²	-8.3(-11.9,-4.7) ₁	1.3(1.1,1.4) ¹
Yes	12,248(52)				
Number of health conditions					
Has one	6,300(47.1)	-6.8(-9.8,-3.8) ¹	1.4(1.2,1.6) ²	-8.7(-11.4,-6.1) ₁	1.5(1.3,1.8) ²
Has 2 or more	7,086(52.9)				
Child have allergies					
Yes	2,731(11.3)	3.6(0.2,6.9) ²	1(0.8,1.2)	1.2(-2.8,5.3)	0.9(0.7,1.1)
No	21,460(88.7)				
Asthma					
Yes	3,533(14.5)	-2.6(-5.7,0.5)	1.1(0.9, 1.3)	-0.3(-4,3.5)	1.1(1,1.3)
No	20,895(85.5)				
Very low birth weight					
Yes	373(1.5)	-24.2(-30.2,-18.3) ¹	1.9(1.3,2.9) ¹	-8.5(-20.6,3.6)	1.8(1.2,2.7) ²
No	23,928(98.5)				
Birth abnormality					
Yes	626 (2.6)	-2.1(-8.9,4.7)	1.6(1.2,2.3) ²	-1.4(-9.7,6.8)	1.0(0.7,1.5)
No	23,646 (97.4)				
Stomach/intestinal problems					
Yes	187 (0.8)	3.8(-9.2,16.4)	1.2(0.6,2.5)	9.1(-6.4,24.5)	0.8(0.3,1.9)
No	24,212 (99.2)				
Serious accidents or injuries					
Yes	523 (2.2)	0.5(-7.2,8.1)	0.0(0.6,1.4)	-4.8(-13.9,4.2)	1.2(0.8,1.8)
No	23,717 (97.8)				
Serious infections					
Yes	290 (1.2)	6.6(-3.8,16.9)	1.1(0.6,2)	3.4(-8.9,15.8)	1.1 (0.6,1.9)
No	23,694 (98.8)				

CI – confidence interval, ¹ P value <0.001, ² P value <0.05

Table 4 Summary of regression coefficients and the odds of having a score at or below national minimum standard in both numeracy and reading for the rare chronic health conditions (N=24,678)

Health condition	Number (%)	Regression coefficient for numeracy (95% CI)	Odds of having score at or below national minimum in numeracy (95% CI)	Regression coefficient for reading (95% CI)	Odds of having score below national minimum standard in reading (95% CI)
Diabetes					
Yes	22 (0.1)	-44.3(-79.4,-9.3) ²	3.6(1.1,11.5) ²	1.6(-39.7,42.8)	0.6(0.1,4.7)
No	24,449 (99.9)				
Arthritis					
Yes	17 (0.1)	-19.2(-79.9,41.4)	2.3(0.2,21.9)	-47.6(-119,23.8)	1 (omitted)
No	24,438 (99.9)				
Epilepsy					
Yes	79 (0.3)	-27.3(-47.1,-7.5) ¹	2 (0.8,4.5)	-45.9(-70.8,-20.9) ¹	3.7(1.8,7.7) ¹
No	24,378 (99.7)				
Cystic fibrosis					
Yes	11 (0.04)	-7.82 (-55.8,40.1)	5.8(1.3,25.3) ²	-9.8(-66.2,46.6)	2.9(0.6,14.8)
No	24,439 (99.9)				
Cerebral palsy					
Yes	36 (0.2)	-4.7(-38.6,29.2)	3.2(0.9,10.4)	15.3(-26,56.6)	0.6 (0.1,4.5)
No	24,418 (99.8)				
Spina bifida					
Yes	6 (0.02)	-48.5(-116.3,19.3)	8.6(1.2,62.1) ²	-64.5(-144.2,15.3)	7 (0.9, 51.5)
No	24,432 (99.9)				
Intra-ventricular shunt					
Yes	20 (0.1)	19.5(-21.4,60.4)	1.2(0.2,10.1)	23.6(-26.8,74.1)	1.5(0.2,12.8)
No	24,170(99.9)				
Chronic bone problems					
Yes	91 (0.4)	-18.7(-38.9,1.6)	2.1(0.9,4.7)	-15.2(-39.9,9.4)	2.2(1,4.9)
No	24,348 (99.6)				
Chronic respiratory problems					
Yes	96 (0.4)	-18.3(-36.9,0.4)	2.4(1.1,5.2) ²	-12.1(-34.7,10.5)	1.9(0.8,4.2)
No	24,328 (99.6)				

CI – confidence interval, ¹ P value <0.001, ² P value <0.05

Table 5 Summary of regression coefficients and the odds of having a score at or below national minimum standard in both numeracy and reading for dental, sensory and neurodevelopmental health conditions (N=24,678)

Health condition	Number (%)	Regression coefficient for numeracy (95% CI)	Odds of having score at or below national minimum in numeracy (95% CI)	Regression coefficient for reading (95% CI)	Odds of having score below national minimum standard in reading (95% CI)
Dental problems					
Yes	3,683 (15.1)	-3.1(-6.3,0.1)	1.2(0.9,1.4)	-6.4(-10.3,-2.6) ¹	1.1(0.9,1.3)
No	20,655 (84.9)				
Speech/language problems					
Yes	3,561 (14.7)	-15.0(-18.2,-11.8) ¹	1.8(1.6,2.1) ¹	-22.9(-26.7,-19.1) ¹	1.8(1.6,2.1) ¹
No	20,648 (85.3)				
Hearing concerns					
Yes	1,423 (5.8)	-2.4(-7.2,2.4)	1.2(0.9,1.5)	-0.5(-6.2,5.2)	1.1(0.8,1.4)
No	22,996 (94.2)				
Vision problems					
Yes	1,469 (6)	1.8(-2.9,6.5)	1.1(0.9,1.5)	-3.2(-8.8,2.4)	1.3(1,1.6)
No	23,007 (94)				
Intellectual/learning disability					
Yes	939 (3.8)	-25.6(-32.2,-19.1) ¹	2.7(2.1,3.5) ¹	-29.0(-36.9,-21.1) ¹	2.2(1.7,2.8) ¹
No	23,603 (96.2)				
ADHD					
Yes	131 (0.5)	-34(-56,-11.9) ¹	2.5(1.1,5.6) ¹	-23.3(-49.9,3.3)	0.9 (0.3,2.7)
No	24,194 (99.5)				
Developmental delay					
Yes	1,049 (4.3)	-24.2(-30.2,-18.3) ¹	2.4(1.9,3.1) ¹	-32.4(-39.6,-25.1) ¹	2.1(1.6,2.6) ¹
No	23,223 (95.7)				

CI – confidence interval, ADHD - Attention Deficit Hyperactivity Disorder, ¹ P value <0.001, ² P value <0.05

Table 6 Summary of specialist service used, those still attending service and the reading and numeracy regression coefficients for children with a health condition that had used a specialist health service (N=12,248)

Health condition (number)	Kind of specialist service used	Number of children still attending service at school entry	Fully adjusted reading regression coefficient for those who used service (95% CI)	Reading regression coefficient for those still attending service	Fully adjusted numeracy regression coefficient for those who used service (95% CI)	Numeracy regression coefficient for those still attending a service
Allergy	Paediatrician					
	Yes 526 (20.9)	Yes 84 (16)	-6.7(-16.5,3.1)	-6.6 (-31.7,18.6)	-11.6(-20.0,-3.2) ¹	-12.8(-34,8.3)
	No 1,987 (79.1)	No 442 (84)				
Asthma	Paediatrician					
	Yes 662 (20.6)	Yes 117(17.7)	-5.3(-14.3,3.7)	-9.9 (-32.1,12.3)	-1.2(-8.7,6.2)	-10.4(-29.4,8.6)
	No 2,554(79.4)	No 545 (82.3)				
Very low birth weight	Paediatrician					
	Yes 98 (29.4)	Yes 26 (26.5)	-11.1(48.3,26.1)	10.7(-82.1,103.5)	-9.2(-34.3,15.9)	-3.3 (-58.1,51.5)
	No 236 (70.6)	No 72 (73.5)				
Developmental delay	Specialist children's services					
	Yes 301 (32.4)	Yes 14 (4.6)	-2.3(-19.3,14.6)	-25.8(-97.4,45.9)	4.3(-11.5,20.1)	-12.2(-80.0,55.6)
	No 627 (67.6)	No 287 (95.4)				
Epilepsy	Paediatrician					
	Yes 42 (60.9)	Yes 14 (33.3)	38(-62.6,138.5)	N/A	49.8 (-52.9,152.5)	N/A
	No 27 (39.1)	No 28 (66.7)				
Chronic bone/joint problems	Bone and joint doctor					
	Yes 46 (57.5)	Yes 13 (28.3)	-20.6(180.8,139.6)	13.4(991,1017.2)	-18.5(-112,75.1)	100.5(-121.8,322.7)
	No 34 (42.5)	No 33 (71.7)				
Stomach/intestinal problems	General surgeon					
	Yes 24 (14.5)	Yes 2 (8.3)	-15.9(-72.2,40.4)	N/A	23.1 (-31.9,78)	N/A

	No 142 (85.5)	No 22 (91.6)				
Speech/language problems	Speech pathologist					
	Yes 1,836 (55.3)	Yes 164 (8.9)	-11.6 (-19.4,-3.8) ¹	-16.7 (-34.2,0.8)	-9.5(-16.2,-2.8) ¹	-18.0(-33.2,-2.9) ²
	No 1485 (44.7)	No 1,672 (91.1)				
Hearing concerns	Hearing services					
	Yes 458 (35.6)	Yes 76 (16.6)	2.7(-9.8,15.2)	14.2 (-11.5, 39.9)	1.6 (-9.3,12.5)	17.8 (-5.3,40.8)
	No 830 (64.4)	No 382 (83.4)				
	ENT doctor					
	Yes 462 (35.9)	Yes 111 (24.0)	-4.1 (-16.4,8.3)	6.9 (-15.1,28.9)	-4.59 (-15.3,6.13)	13.7(-6.6,34.1)
	No 823 (64.1)	No 351 (76)				
Intellectual/learning disability	Psychologist/psychiatrist					
	Yes 300 (36.5)	Yes 32 (10.7)	-10.5(-29.5,8.5)	13.3(-37.4,64.1)	-4.7(-21.7,12.3)	7.5 (-36.0,51.1)
	No 522 (63.5)	No 268 (89.3)				
	Specialist Children's services					
	Yes 301(37.4)	Yes 12 (4)	-6.6(-25.5,12.3)	N/A	4.2(-13.2,1.4)	N/A
	No 504 (62.6)	No 289 (96)				
ADHD	Psychologist/psychiatrist					
	Yes 45 (39.1)	Yes 7 (15.6)	69.4(-54.9,193.7)	N/A	-5.1(-97.8,87.6)	N/A
	No 70 (60.9)	No 38 (84.4)				

CI – confidence interval, ADHD - Attention Deficit Hyperactivity Disorder, ENT - Ear Nose Throat doctor

¹ P value <0.001, ² P value <0.05

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