A Longitudinal Study of the Achievements Progress and Attitudes of Severely Inattentive, Hyperactive and Impulsive Young Children

Christine Merrell and Peter Tymms,
CEM Centre, Durham University.

Contact: Christine.Merrell@cem.dur.ac.uk

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Abstract

This paper investigates the academic achievement and attitudes of a particular group of children during their time in primary school. The behaviour of children in a sample of just over 4000 pupils was assessed at the end of the Reception year to identify children who were exceptionally inattentive, hyperactive and impulsive, in other words children with symptoms of Attention Deficit Hyperactivity Disorder (ADHD). The achievement and progress of these children were followed up at regular intervals during their time in primary school up to age 11 years and compared with other children with no behavioural problems. The results showed that children with symptoms of ADHD start school with lower reading and mathematics scores than their pupils and continue to fall behind to a significant level over time.

Introduction

Severely inattentive, hyperactive and impulsive behaviour has a major impact on various aspects of the lives of many children. Some of these children are diagnosed as having Attention Deficit Hyperactive Disorder (ADHD). The 4th version of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV), published by the American Psychiatric Association (1994) has a set of diagnostic criteria for ADHD and divides the disorder into three main sub-types:

Combined subtype where individuals display symptoms of inattention, hyperactivity and impulsiveness,

Predominantly Inattentive subtype where individuals mainly display symptoms of inattention,

Predominantly Hyperactive-Impulsive subtype where individuals mainly display symptoms of hyperactivity and impulsiveness.

The DSM-IV recommends that to be diagnosed with ADHD, behavioural problems must be observed in at least two different environments and present before the age of 7 years. The prevalence of children with ADHD has been estimated to be between 3% and 5% of the population (American Psychiatric Association, 1994). The proportion of children observed by their teachers as displaying severe ADHD symptoms in the classroom setting is somewhat higher and has been estimated to be between 8.1% and 17% (Merrell and Tymms, 2001, Gaub and Carlson, 1997, Wolraich, Hannah, Pinnock, Baumgaertel, and Brown, 1996).

Pupils diagnosed as having ADHD are more likely to display delinquent, antisocial behaviour as adolescents, achieve lower grades at school than their peers and have less positive attitudes towards school (Barkley et al., 1991, Nussbaum et al., 1990, Solanto, 1990). Merrell and Tymms (2001) found that some of these trends extended to children with behavioural problems in the classroom but not necessarily a formal diagnosis of ADHD. They reported the size of the differences for reading and mathematics of children who were rated by their teachers as severely inattentive, hyperactive and impulsive against children with no reported problems between the start of Reception and Year 2. Over this period of time, large differences (Effect Sizes of 1 in some cases) were found for reading and mathematics. Children with behavioural problems started Reception with poorer reading and mathematics and continued to fall further behind. Merrell and Tymms argued that much of the evidence about the extent to which children with ADHD fall behind their peers in

academic subjects had been restricted to small sample sizes and the attainment and progress of children who exhibit the types of behaviour associated with ADHD in the classroom setting, but had not been formally diagnosed as having the disorder, merited investigation and comparison with studies of children who had been diagnosed to see if they were at risk of similar outcomes. They did indeed find evidence that such pupils were at risk of falling behind their peers academically. This paper extends that work by following up the reading and mathematics attainment, progress and attitudes of children from their start in school to the end of primary school, (Year 6, age 11 years). The 2001 paper used a sample of children that was nationally representative, however the analysis in this paper spans a far longer period and due to sample attrition over time, it was decided to include more children in the initial sample. The measures were the same as those used by Merrell and Tymms in 2001 with the addition of further assessments in later years.

This paper also investigated differences and variation across schools.

Sample and Measures

The data were routinely collected as part of the Performance Indicators in Primary Schools (PIPS) project run by the CEM Centre at Durham University. Schools, and in some cases whole local education authorities, pay to join the project which is intended to monitor the attainment, progress and attitudes of children throughout primary school. Schools complete PIPS assessments at specified times of year and then return all the assessment information to the CEM Centre for analysis. They receive pupil-level standardised feedback and as a result of that system the CEM Centre holds large longitudinal datasets that form a valuable resource for research (Tymms, 1999, www.pipsproject.org).

Measures

Pupils were assessed at the start and end of Reception (their first year of formal school, aged 4 – 5 years) with the PIPS On-entry baseline assessment. This included measures of handwriting, English vocabulary, concepts about print, phonological awareness, letter and word identification, reading, ideas about mathematics, counting and numerosity, informal sums, digit identification and more difficult mathematics problems. The assessment was administered on an individual basis and took 15 – 20 minutes to complete at both the beginning and end of the year. From this assessment, scores for reading and mathematics were calculated.

At the end of the Reception Year, class teachers assessed the behaviour of each pupil using a rating scale that was based on the 18 criteria for the diagnosis of ADHD in DSM IV. (See Merrell and Tymms, 2001 for a full list of items.) This was an optional part of the PIPS assessment that could be completed in addition to the main components of reading and mathematics. Teachers were advised to consider a criterion met if the behaviour had persisted for at least six months and was considerably more frequent than that of children of the same gender and developmental level. One mark was awarded for each criterion met and the scores for each of the sub-types of ADHD (Combined, Predominantly Inattentive and Predominantly Hyperactive/Impulsive) were calculated using the same cut-off points as the DSM-IV recommends for ADHD i.e. 6 or more criteria relating to inattention for the Predominantly Inattentive subtype, 6 or more criteria relating to Hyperactivity and Impulsivity for the Predominantly Hyperactive/Impulsive subtype, and 6 ore more criteria relating to inattention plus 6 or more relating to hyperactivity and impulsivity for the Combined subtype.

The PIPS assessments administered in Year 2 (January), Year 4 (June) and Year 6 (January) followed the same format. They were all group assessments that included a half-hour assessment of reading, a half-hour assessment of mathematics, a half-hour assessment of science was included in Year 6 only, and a half-hour 'context' section. The context section included assessments of English vocabulary, non-verbal ability and attitudes to reading, mathematics, science (in Year 6 only) and school. The content of the curriculum-based sections was based on the English National Curriculum (Department for Education and Employment, 1995a, b and c).
The measures were the same as those used by Merrell and Tymms in 2001 with the obvious exception of the follow-up assessments at Years 4 and 6. For information about their reliability and predictive validity see Merrell and Tymms, 2001, Tymms, 1999 and www.pipsproject.org.

Sample

5569 pupils (52.3% boys and 47.7% girls) from 208 schools in England were assessed at the start and end of reception and selected for this study on the basis of their teachers having completed the optional behaviour rating scale for all pupils in the class. For the analysis in this paper, children were then assigned to an ADHD subtype on the basis of their score on the behaviour rating scale. Children in the 'Zero scores' group had met no criteria and children in the Combined, Predominantly Inattentive or Predominantly Hyperactive/Impulsive groups had met criteria equal to or higher than the cut-off points described in the previous section. Some children completed PIPS assessments at all time-points but others did not. Table 1 shows the number of pupils at each time-point for reading and mathematics respectively.

Table 1 Pupil numbers

	Start Reception	End Reception	Year 2	Year 4	Year 6
Combined	150 (79% boys)	150 (79% boys)	150 (79% boys)	74 (77% boys)	27 (78% boys)
Inattentive	324 (65% boys)	323 (65% boys)	322 (65% boys)	180 (68% boys)	71 (68% boys)
Hyperactive/ Impulsive	164 (68% boys)	163 (68% boys)	163 (68% boys)	82 (76% boys)	37 (73% boys)
Zero scores	2544 (45% boys)	2544 (45% boys)	2544 (45% boys)	1548 (45% boys)	767 (47% boys)

Results

Reading and Mathematics Attainment

The reading and mathematics scores of the entire population of pupils completing PIPS assessments at each time-point were normalised before the analysis in this paper was carried out. There were always more boys than girls with high scores in each subtype of ADHD. The ratio of pupils meeting each ADHD subtype and the ratio of boys to girls were consistent with previous studies of children with ADHD symptoms in the classroom (Baumgaertel *et al*. 1995, Gaub and Carlson, 1997, Merrell, 2001).

The differences in attainment between the 'zero scores' group and each ADHD group were expressed as Effect Sizes, which were calculated using the following formula:

$$\frac{\text{Mean score of the experimental group} - \text{Mean score of the control group}}{\text{Pooled standard deviation}}$$

(Experimental group is each ADHD group, Control group is the 'zero scores' group.)

The Effect Sizes are summarised in Tables 2 and 3 for reading and mathematics respectively.

Table 2 Effect Sizes for reading attainment

	Start Reception	End Reception	Year 2	Year 4	Year 6
Combined	-0.69	-0.83	-1.07	-1.18	-1.23
Inattentive	-0.79	-0.92	-1.04	-1.15	-1.19
Hyperactive/Impulsive	-0.19	-0.34	-0.45	-0.65	-0.52

Table 3 Effect Sizes for mathematics attainment

	Start Reception	End Reception	Year 2	Year 4	Year 6
Combined	-0.86	-0.88	-0.99	-1.03	-1.23
Inattentive	-0.89	-1.05	-1.05	-1.12	-1.21
Hyperactive/Impulsive	-0.24	-0.2	-0.3	-0.5	-0.49

Clear trends are apparent within each ADHD group of children starting Reception with lower mean scores than their peers who didn't have behavioural problems and that difference increasing with time. This is illustrated in Figures 1 and 2 where the

Effect Sizes with 95% Confidence Intervals are shown for reading and mathematics respectively.

Figure 1 Reading Effect Sizes

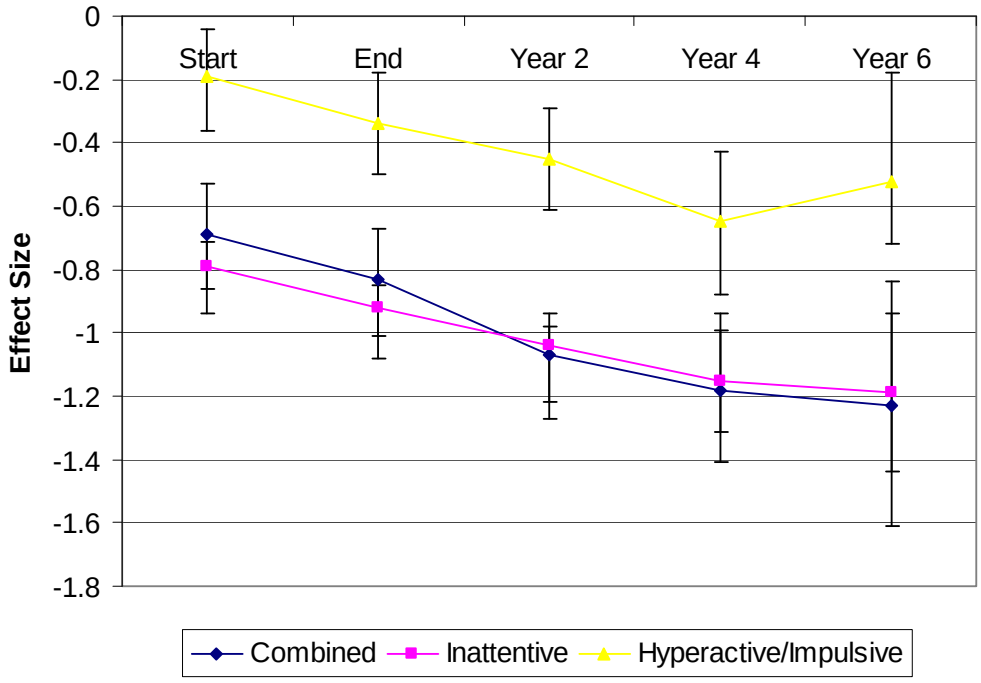
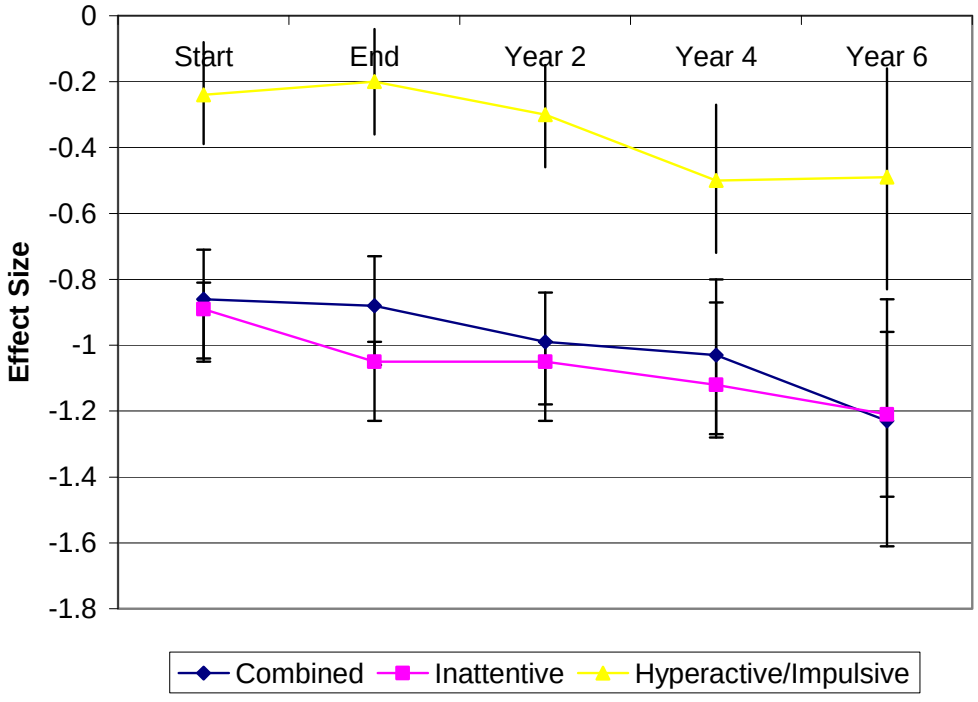


Figure 2 Mathematics Effect Sizes

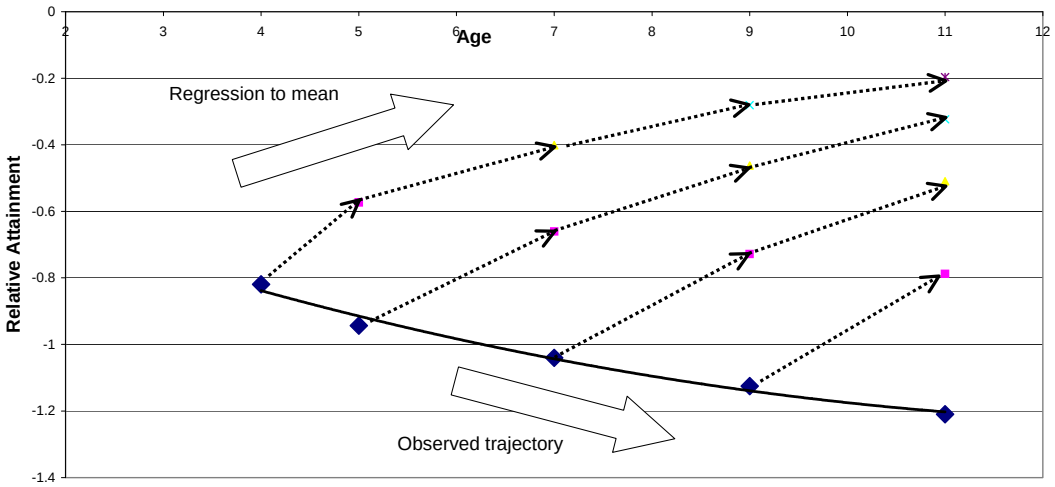


The Effect Sizes show a general trend towards increasing differences between the ADHD groups and the Zero Scores group over time. The confidence intervals show that as the sample sizes decrease the level of uncertainty around the true-score increases and so the trend is not entirely clear. However, even if the true score of each ADHD group lies at the upper boundary of the confidence interval, the difference between those groups and the Zero Scores group is still significant and large in educational terms for those children in the Combined and Predominantly Inattentive groups.

Figure 3 gives an alternative perspective on the impact of ADHD symptoms on children's attainment. Tables 1 and 2 give very similar effects for mathematics and reading and so the average has been used to represent school-based attainment. Further, Figures 1 & 2 show almost coincidental patterns for the inattentive and combined groups and since the definition of combined group included inattention the two groups were joined together and weighted averages for their attainments were calculated.

Figure 3 shows how the attainment of these children has fallen relatively speaking from the age of 4 to 11. The line shows a gentle downward curve.
If the children in each of the ADHD groups did not have any behavioural problems but did have low attainment scores compared with their peers, they would be expected to regress to the mean over time and the difference between their score and the sample average would decrease. The way in which they would regress to the mean is shown by dotted lines on the chart. Two points can be made from the chart. The first is that when the children reach the end of primary school, at the age of 11, their attainment is a full standard deviation behind the level that might be expected of children without such symptoms. The second is that an extrapolation of the line back towards birth would suggest that the hypothetical attainment levels would be in line with the average child at around that time.

Figure 3 Impact of Inattentiveness ADHD Symptoms on Attainment



Variation between classes

Analysis using multi-level models in which pupils were nested within schools found that there was no significant variation between schools in the amount of progress made by the pupils in the ADHD groups. In other words, some teachers did not appear to be particularly effective with these kinds of children compared with other teachers.

Attitudes

Table 4 reports differences in attitudes towards reading, mathematics and school between children in the ADHD groups compared with the Zero Scores group. Children responded on a 3-point scale in Years 2 and 4, and a 5-point scale in Year 6 towards a series of statements. Typically there were 5 items for each domain and an example of a statement is 'I like reading'. A mean score for each child was calculated for each subject.

Table 4 Attitudes

	Reading	Mathematics	School
Year 2			
Combined	p= 0.040 E.S. = - 0.2	p= 0.004 E.S. = - 0.3	p= 0.042 E.S. = -0.2
Inattentive	p= 0.014 E.S. = -0.2	p= 0.044 E.S. = -0.1	p= 0.030 E.S.=0.2
Hyperactive/Impulsive	p= 0.560 E.S. = -0.04	p= 0.358 E.S. = -0.08	p= 0.981 E.S. = 0.00
Year 4			
Combined	p= 0.031 E.S.= -0.3	p= 0.031 E.S. = -0.2	p= 0.071 E.S. = -0.29
Inattentive	p=0.379 E.S. = -0.09	p=0.966 E.S. = 0.00	p= 0.109 E.S. = -0.12
Hyperactive/Impulsive	p=0.195 E.S. = -0.17	p=0.485 E.S. = -0.07	p= 0.011 E.S. = -0.3
Year 6			
Combined	p= 0.849 E.S. = -0.04	p= 0.232 E.S. = -0.20	p= 0.728 E.S. = -0.06
Inattentive	p= 0.005 E.S. = -0.3	p= 0.984 E.S. = 0.00	p= 0.179 E.S. = -0.15
Hyperactive/Impulsive	p= 0.264 E.S. =- 0.19	p= 0.939 E.S. = 0.00	p= 0.074 E.S. = -0.28

In Year 2, children in the Combined and Predominantly Inattentive groups were significantly more negative towards reading, mathematics and school than the comparison Zero Scores group although the Effect Sizes were quite small. As the children grew older, many of the earlier differences were no longer statistically significant although some of the Effect Sizes, for example attitudes to reading and to school of the hyperactive and impulsive children were actually similar to those seen in younger children. If the attitudes of the Combined and Predominantly Inattentive groups are combined to give an overall attitude score at ages 7, 9 and 11, the Effect Sizes for the differences between that group and the Zero Scores group were -0.10, -0.13 and -0.13 for the three ages respectively. A possible influential factor, for which there are no data available in this study, is that some of the children in the ADHD groups might have been prescribed Ritalin as they grew older. This could well have an impact on their attitudes but not necessarily their attainment.

Discussion

The analysis reported in this paper build upon the earlier work of Merrell and Tymms (2001), following up the attainment and attitudes across the whole primary phase of a large, single cohort of children with and without ADHD symptoms. The size of the school-based sample of children with severe ADHD symptoms in English schools and the longitudinal nature of the study make its findings important. This is the first time that the attainment over time of such a group has been quantified and the extent to which the ADHD groups of children fall behind their peers gives reason for concern and intervention. A recent intervention study (Tymms and Merrell, 2004) found that providing teachers with advice about how to teach and manage the behaviour of children with severe ADHD behaviour had a positive impact on their behaviour and attitudes and although it did not impact on attainment at a significant level, there was evidence that increased attainment was associated with the more teachers reported using the booklet. Further large-scale evaluations of intervention programmes are essential if the long-term outcomes of children with severe ADHD behaviour are to be improved.

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