

Impact of Early School-Based Screening and Intervention Programs for ADHD on Children's Outcomes and Access to Services

Follow-up of a School-Based Trial at Age 10 Years

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Objectives: To investigate the impact of early school-based screening and educational interventions on longer-term outcomes for children at risk for attention-deficit/hyperactivity disorder (ADHD) and the predictive utility of teacher ratings.

Design: A population-based 5-year follow-up of a randomized, school-based intervention.

Setting: Schools in England.

Participants: Children between 4 and 5 years of age with high teacher-rated hyperactivity/inattention scores. Follow-up data were collected on 487 children in 308 schools.

Interventions: Following screening, using a 2 × 2 factorial design, schools randomly received an educational intervention (books about ADHD for teachers), the names of children with high hyperactivity/inattention scores between ages 4 and 5 years (identification), both educational intervention and identification, or no intervention.

Outcome Measures: Parent-rated hyperactivity/inattention, impairment in classroom learning, and access to specialist health services for mental health or behavioral problems.

Results: None of the interventions were associated with improved outcomes. However, children receiving the identification-only intervention were twice as likely as children in the no-intervention group to have high hyperactivity/inattention scores at follow-up (adjusted odds ratio, 2.11; 95% confidence interval, 1.12-4.00). Regardless of intervention, high baseline hyperactivity/inattention scores were associated with high hyperactivity/inattention and specialist health service use at follow-up.

Conclusions: We did not find evidence of long-term, generalizable benefits following a school-based universal screening program for ADHD. There may be adverse effects associated with labeling children at a young age.

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ATENTION-DEFICIT/HYPERACTIVITY disorder (ADHD) affects about 5% of children,¹ and at least a further 5% have significant difficulties with inattentive, hyperactive, or impulsive behaviors that are just below the threshold of diagnostic criteria. Attentional and hyperactivity problems may persist over time and are a risk factor for additional difficulties, including conduct disorders, peer relationship difficulties, educational problems and underachievement, employment problems, a lack of involvement in social activities, suicidal behaviors, and criminality.²⁻⁸ These adverse, long-term outcomes provide a strong argument for the early recognition of these children.

In the United Kingdom, less than half of children with ADHD have used special-

ist health services or been clinically diagnosed, but most parents of children with ADHD have discussed their concerns with teachers.⁹ Teachers have daily contact with children and considerable experience about whether behaviors are developmentally appropriate, and they are

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well-placed to identify children at risk of ADHD.^{4,10,11} The identification of these children by teachers and/or parents is the crucial first step in receiving appropriate help. Once they are identified by key adults, clinical guidelines in the United Kingdom recommend that children with ADHD should be seen by specialist health services (pediatric or child and adolescent mental health services) to receive a

diagnosis of ADHD.¹² Hence, improvements in adult identification and management of affected children could facilitate their access to effective intervention and possibly improve their outcomes. However, it is unclear whether the early identification of children with attentional and hyperactivity problems through screening programs and educational interventions for teachers might improve their outcomes. Screening, in particular, is a controversial area that requires further investigation.

This prospective, longitudinal, epidemiological study reports a 5-year follow-up of a school-based cluster randomized controlled trial of screening and an educational intervention for teachers in relation to children with attentional and hyperactivity problems.¹³ Baseline data from teachers were collected when the children were between 4 and 5 years of age. As previously reported, at the 2-year follow-up, the educational intervention led to improvements in behavior as rated by the teacher.¹³ The present study has 2 aims. First, for children with teacher-rated attentional and hyperactivity problems, we investigated whether participation in a school-based screening and intervention program has longer-term implications in terms of improved parent-rated symptoms and impairment (in particular, whether potential benefits from school-based interventions can be generalized to other settings) and access to specialist health services (pediatrician or child and adolescent mental health services) for mental health or behavioral problems. Second, we examined the longer-term predictive utility of baseline teacher ratings for parent-rated symptoms and impairment and service use.

METHODS

DESIGN

Initial Randomized Controlled Trial

From September 2000, through July 2001, 24 Local Education Authority (LEA) areas in England coordinated the administration of the Performance Indicators in Primary Schools system to track children's academic progress through primary (elementary) school.¹⁴ This represents one-sixth of LEAs (school districts) in England. This data monitoring system has been used in longitudinal, epidemiological research on educational attainment.⁴ The first set of assessments takes place at the start and end of the reception year (equivalent to kindergarten) when children are between 4 and 5 years of age. In England, more than 90% of children commence their schooling during this reception year. Data from class teachers, including a validated ADHD rating scale consisting of the 18 *Diagnostic and Statistical Manual of Mental Disorders (Fourth Edition) (DSM-IV)* items, were collected for all children at the end of this reception year.^{4,15} These teacher ratings provided the baseline data for this intervention study. High scoring status was based on *DSM-IV* criteria and reflected the binary outcome of having 6 or more symptoms relating to 1 of the ADHD subtypes (inattentive, hyperactive/impulsive, or combined). Teachers were not aware of the cutoff scores sufficient for ADHD identification. The sample consisted of 68 711 children in 2040 schools, and 7570 children (11.0%) scored above the cutoff point (described as "high baseline scorers").

When the children were aged 5 (at the start of year 1 in school), all schools were sent a newsletter outlining the study.

Using a 2 × 2 factorial design, schools were randomized to 1 of 4 groups:

1. Identification (feedback to the school) of the names of children with high scores on the ADHD rating scale. A letter to the school stated that these children had high levels of inattention and/or hyperactivity/impulsivity and provided a short description of these types of difficulties.

2. Receiving a book containing information about ADHD and evidence-based teaching advice and classroom management strategies for working with affected children.¹⁶ A letter to the school stated that the book related to working with children in years 1 and 2. This book was written for this study, and its contents were in keeping with findings from meta-analyses.^{17,18}

3. Both identification and a book.

4. No-intervention control group.

Hence, a quarter of schools received the names of high scorers, a quarter received the book, a quarter received both, and a quarter received no intervention.

At the 2-year follow-up (when the children were aged 6 to 7 in school year 2), 864 schools provided data on their use of the book, where relevant, and the children's attainment, self-rated attitudes, behavior, and referral to specialist educational services. The full findings have been reported elsewhere.¹³ In brief, compared with the control group, the book (effect size, 0.26) and combined (0.24) interventions were associated with improved teacher-rated behavior. The book was also associated with more positive attitudes to reading and school. However, the combined intervention was associated with some negative effects involving lower attainment in mathematics and reading.

Present Study

We followed up a sample of children from the randomized schools at the age of 10 to 11 years, using a 2-stage design. This article mainly reports findings from the first stage in which parent ratings and service use information were elicited through mailed questionnaires. Informed consent was obtained from participating parents and approval was received from research ethics committees at Durham and Bristol Universities.

PROCEDURE AND SAMPLING

Selection of LEAs

To obtain similar numbers of pupils from each LEA area, we excluded 4 LEA areas with very few participating schools. Hence, this follow-up study took place in 20 LEA areas that had at least 20 schools participating in the initial intervention. By sampling a similar number of schools across a large number of LEA areas, we aimed to minimize the impact of local differences in service availability and organization on the findings. These areas cover a range of socioeconomic conditions and service models, which aids the generalizability of the findings. Their school attendance rates, academic attainment scores, and identification levels of special education needs are comparable to the rest of England.¹⁹ Within any particular area, children in the intervention and control groups have had access to the same range of health service provision because health care is free at the point of delivery.

Sampling of Schools and Pupils

Our sample size calculation was based on national data that 13% of children with teacher-rated hyperactivity/inattention receive specialist health services²⁰ and on unequal size groups, reflecting the 3:1 proportions in intervention and control groups. We calculated that a sample of 638 high baseline scorers (on

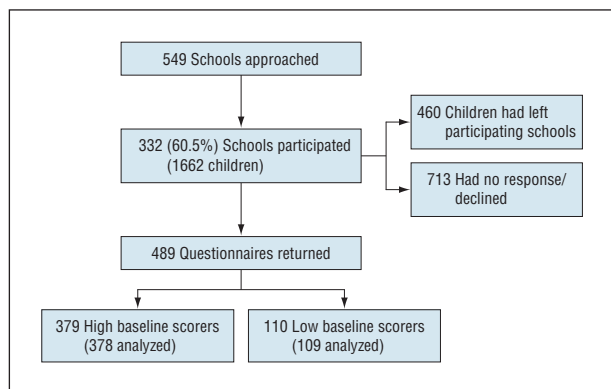


Figure. School and student participation.

the ADHD rating scale in the reception year) would detect a 2-fold difference in service use between the intervention and control groups (power, 80%). This strategy aims to detect a clinically significant difference at the population level.

We aimed to randomly sample and invite 2000 high and 500 low baseline scorers to account for anticipated school and parent response rates of 80% and 40%, respectively.

Low baseline scorers were sampled to investigate the long-term utility of teacher ratings. Up to 27 schools were randomly sampled in each LEA area. To oversample high baseline scorers and ensure blinding at the school level, only schools with at least 1 high scorer were approached. Hence, each invited school had both high and low baseline scorers. Up to 6 high and 1 low baseline scorers were randomly sampled from each school.

A letter outlining the study and inviting participation was initially sent to 476 schools. If the head teacher declined the invitation, where possible, another school was randomly selected. In total, 549 schools were approached. If a positive response was received from the school, then parents were sent a letter (via the school) outlining the study, inviting their participation, and asking them to complete a questionnaire. Reminder letters were sent to nonresponding schools. If no response was received following this reminder, schools were sent the parent invitation letter and questionnaire and were asked to forward these on. If, following this, no response was received from the school and/or there was no indication that the parent letters had been forwarded, the school was deemed to be nonparticipating. Parents who did not respond to the initial contact were also sent a reminder. (The **Figure** provides details about participant recruitment.)

Measures

Baseline. Sociodemographic measures included child's sex and, as a measure of deprivation, the Underprivileged Area scores for the school postal code, based on national census sociodemographic data.²¹ The school intervention status and child high or low baseline scorer status were taken from the initial randomized controlled trial data.

Follow-up. Parent ratings and service use information were collected through the extended version of the well-validated Strengths and Difficulties Questionnaire (SDQ).²²⁻²⁴ We used the SDQ as our main outcome measure instead of the previously used ADHD rating scale because it provides information on hyperactivity/inattention problems (United Kingdom national reference values, <http://www.sdqinfo.com>), other problems, and service use:

1. Severity of problems: There are 5 items relating to hyperactivity/inattention ("restless, overactive, cannot stay still

for long"; "constantly fidgeting or squirming"; "easily distracted, concentration wanders"; "thinks things out before acting"; and "sees tasks through to the end, good attention span") as well as 5 items each on conduct problems, emotional symptoms, peer relationships, and prosocial behavior (all scored 0-10). A total score (range, 0-40) is based on the first 4 subscales. The cutoff score of 7 for hyperactivity/inattention was chosen because it reflects the top 10% of children and is associated with a 32-fold increased probability of having ADHD.²⁴ This is described as "high SDQ hyperactivity/inattention" in the article.

2. Impairment: The impact measure inquires about distress, home life, friendships, classroom learning, and leisure activities. As an indication of impact at school, we also looked specifically at the presence of "quite a lot" or "a great deal" of classroom learning problems because it has been shown that parents of elementary schoolchildren are able to accurately report the impact of hyperactivity/inattention difficulties at school.²⁵

3. Service use: We asked about the sources of help used since the reception year in relation to the child's emotions, concentration, or behavior difficulties.²³ For specialist health services, parents were asked whether they had seen someone specializing in child mental health (eg, a child psychologist or psychiatrist) or a physician specializing in children's general health (eg, a pediatrician or school physician). Parental reports about service use obtained from the extended SDQ yield similar information to detailed interviews, and parents have been shown to provide valid reports of specialist health service use when compared against service records.^{23,26}

The second stage of our follow-up focused on a subsample of 162 high baseline scorers and consisted of interviews with parents of all specialist health service users and a sample of non-users. Using the Children's Services Interview²⁶ and checking parents' descriptions against the type and locations of services, we established that 95.1% of interview respondents (154/162) had given accurate specialist service use information on the questionnaire.

We also obtained teacher SDQs for the interviewed subsample of high baseline scorers with a response rate of 93.2% (151/162). These data were used to describe the long-term predictive utility of baseline teacher ratings.

Analyses. Responders were initially compared with nonresponders using existing data. The relationships between potential predictive child (sex, intervention group, and high or low baseline scorer status) and school (Underprivileged Area score) factors and outcomes were then investigated using regression methods. The data were analyzed using multilevel modeling (MLwiN statistical software, version 2.02^{27,28}), which is similar to ordinary multiple regression but adjusts for the hierarchical structure of the data, allowing for the correlation between children within each school (and/or LEA area) and explicitly modeling how observations are grouped within schools (and/or LEA area). We used logistic regression models and expressed predictions as odds ratios. Variability at school and LEA levels were investigated and retained in the models if $P < .05$. Because there was little variability at the LEA level but variability between schools in some models, school was included in every model. Two-way interactions were specified a priori; there were no interactions between sex and outcome variables.

The following analyses were performed:

1. Effects of the intervention: Among the high baseline scorers, we examined whether the intervention was associated with parent-rated SDQ hyperactivity/inattention scores, impairment in classroom learning, or specialist health service use at follow-up.

2. Prediction of later outcomes: High and low baseline scorers were initially compared in terms of their SDQ scores

Table 1. Comparison of Intervention Groups for 378 High Baseline Scorers

Parent Information	No. (%) of Participants				χ^2 Score	P Value
	Book Only (n=81)	Identification Only (n=114)	Book and Identification (n=99)	No Intervention (n=84)		
High SDQ hyperactivity/inattention	35 (43)	55 (48)	31 (31)	28/83 (34)	8.08	.04
Classroom learning problems	32/79 (41)	48 (42)	25/98 (26)	28/82 (34)	7.53	.06
Specialist service use	28 (35)	33 (29)	22 (22)	20 (24)	4.08	.25

Abbreviation: SDQ, Strengths and Difficulties Questionnaire.

Table 2. Intervention Group Regression Model Outcomes for 378 High Baseline Scorers

Factor	Odds Ratio (95% Confidence Interval)		
	High SDQ Hyperactivity/Inattention	Classroom Learning Problems	Specialist Service Use
Male sex	2.17 (1.28-3.71)	1.85 (1.07-3.20)	1.21 (0.64-2.29)
P value	.004	.03	.57
Book vs no intervention	1.61 (0.78-3.31)	1.38 (0.66-2.88)	1.80 (0.78-4.04)
P value	.20	.39	.16
Identification vs no intervention	1.95 (1.00-3.81)	1.39 (0.71-2.76)	1.15 (0.54-2.44)
P value	.05	.34	.72
Book and identification vs no intervention	0.98 (0.48-2.00)	0.67 (0.32-1.40)	1.01 (0.45-2.26)
P value	.92	.28	.99
Current hyperactivity/inattention score (0-10)	1.61 (1.43-1.80)
P value	<.001

Abbreviations: ellipses, not applicable; SDQ, Strengths and Difficulties Questionnaire.

and specialist health service use. In the entire sample, we then examined whether teacher ratings in the reception year predicted which children have high levels of parent-rated SDQ hyperactivity/inattention, impairment in classroom learning, or specialist health service use 5 years later. We adjusted for the intervention group as a design variable by including group in each model. Finally, using multiple imputation with chained equations, we explored whether missing data might have biased our findings.²⁹ This involves the creation of multiple data sets using baseline data to replace missing outcome values with imputed values. Using the MICE package in R statistical software (version 2.10.0),³⁰ the regression analysis was repeated on each imputed data set and the results combined.

RESULTS

SCHOOL AND PARENT PARTICIPATION

In total, 332 schools (60.5%) agreed to participate (Figure). Participation levels across the LEA areas ranged from 45.0% to 88.0%. School participation was not associated with Underprivileged Area score or intervention group. Of 1662 sampled children in the participating schools, 460 (27.7%) had left the schools. Questionnaires were sent to the parents of the remaining children, of whom 40.7% responded (489/1202). The participants came from 308 schools. Participants were more likely than nonrespondents and children who moved away to be low baseline scorers ($\chi^2=8.78$; $P=.01$) and attending schools in less deprived areas ($F=5.01$; $P=.007$). However, among high baseline scorers, participation rates were not associated with sex or the type of intervention

received. The main analyses were restricted to 487 children (378 high baseline [77.6%] and 109 low baseline [22.4%] scorers); 1 child each from 2 pairs of siblings was randomly omitted to reduce family clustering.

EFFECT OF INTERVENTION

The 4 intervention groups of high baseline scorers were similar at baseline in terms of child sex ($\chi^2=4.23$; $P=.24$), total number of symptoms on the ADHD rating scale ($F=0.78$; $P=.50$), and school-level Underprivileged Area score ($F=0.55$; $P=.65$). On bivariate analyses, more children who had received the identification-only or book-only intervention had high SDQ hyperactivity/inattention scores at follow-up than did the combined and no-intervention groups. There was a similar pattern for classroom learning difficulties (**Table 1**).

After adjusting for sex and school-level variability, children in schools receiving the identification-only intervention were nearly twice as likely to have high SDQ hyperactivity/inattention scores at follow-up compared with the control group (**Table 2**). There were no associations between the interventions and classroom learning or service use.

PREDICTIVE UTILITY OF TEACHER RATINGS FROM THE RECEPTION YEAR

These analyses provide information about the long-term outcomes of children rated by teachers as being hyperactive or inattentive between the ages of 4 and 5. High baseline scorers were more likely than low baseline scor-

Table 3. Parent-Rated SDQ Outcomes

Parental SDQ Scale	Mean (SD) Score		t Value	P Value
	High Baseline Scorers (n=378)	Low Baseline Scorers (n=109)		
Hyperactivity/inattention (range, 0-10)	5.53 (2.82) ^a	3.08 (2.44)	8.88	<.001
Emotional problems (range, 0-10)	2.71 (2.49)	2.06 (2.11)	2.68	.008
Conduct problems (range, 0-10)	2.50 (2.26) ^a	1.31 (1.55)	6.28	<.001
Peer problems (range, 0-10)	2.59 (2.41) ^a	1.45 (1.72)	5.50	<.001
Prosocial behavior (range, 0-10) (n=375)	7.83 (2.04)	8.65 (1.51)	-4.58	<.001
Total difficulties (range, 0-40)	13.30 (7.65) ^a	7.91 (5.92)	7.80	<.001

Abbreviation: SDQ, Strengths and Difficulties Questionnaire.

^an=377 (Reflects missing data for 1 participant in all scales except emotional problems).

Table 4. Teacher-Rated SDQ Outcomes for High Baseline Scorers

Teacher SDQ Scale	High Baseline Scorers, Weighted Mean Score (95% CI) (n=151)	National Reference Value, Mean Score
Hyperactivity/inattention (range, 0-10)	5.02 (4.36-5.68)	3.0
Emotional problems (range, 0-10)	1.85 (1.38-2.32)	1.5
Conduct problems (range, 0-10)	1.73 (1.23-2.23)	0.9
Peer problems (range, 0-10)	2.01 (1.47-2.55)	1.4
Prosocial behavior (range, 0-10)	6.89 (6.31-7.47)	7.3
Total difficulties (range, 0-40)	10.61 (9.07-12.15)	6.7

Abbreviations: CI, confidence interval; SDQ, Strengths and Difficulties Questionnaire.

Table 5. Longitudinal Regression Models for Outcomes in the Whole Sample^a

Factor	Odds Ratio (95% Confidence Interval)		
	High SDQ Hyperactivity/Inattention	Classroom Learning Problems	Specialist Service Use
High vs low baseline scorer	4.57 (2.50-8.36)	5.00 (2.38-10.50)	2.79 (1.41-5.58)
P value	<.001	<.001	.004
Male sex	2.14 (1.36-3.37)	2.00 (1.19-3.35)	1.73 (1.03-2.92)
P value	.001	.009	.04
Book vs no intervention	1.52 (0.76-3.01)	1.21 (0.59-2.48)	1.55 (0.77-3.11)
P value	.23	.61	.22
Identification vs no intervention	2.11 (1.12-4.00)	1.51 (0.79-2.95)	1.44 (0.74-2.77)
P value	.02	.22	.28
Book and identification vs no intervention	1.15 (0.58-2.27)	0.74 (0.36-1.53)	1.22 (0.61-2.46)
P value	.69	.41	.57

Abbreviation: SDQ, Strengths and Difficulties Questionnaire.

^aN=487.

ers to be boys (72.5% [274/378]) vs 39.4% [43/109]; $\chi^2=39.2$; $P<.001$), to have used specialist health services (27.2% [103/378] vs 11.0% [12/109]; $\chi^2=11.49$; $P=.001$), and to have a range of difficulties on the SDQ at follow-up, with the greatest effect size for hyperactivity/inattention scores (**Table 3**). In terms of the SDQ hyperactivity/inattention cutoff points, 40% of high baseline scorers had high parent-rated hyperactivity/inattention scores at the 5-year follow-up (compared with 12% of low baseline scorers).

Table 4 shows the mean teacher SDQ scores weighted to reflect the proportions of service users and nonusers in the subsample of high baseline scorers whose parents were interviewed. Their hyperactivity/inattention, conduct problems, and total difficulties scores were higher

than United Kingdom national reference values for 5- to 10-year-olds (<http://www.sdqinfo.com>).

The long-term prediction from baseline teacher ratings in the entire follow-up sample (N=487) was not attenuated by any effect of intervention group. Baseline teacher ratings in the reception year and male sex predicted high SDQ hyperactivity/inattention scores, classroom learning difficulties, and specialist service use at follow-up (**Table 5**). In this larger sample, children who received the identification-only intervention were more than twice as likely to have high SDQ hyperactivity/inattention scores at follow-up compared with the control group, even after adjusting for sex and baseline hyperactivity. The association was of similar magnitude in the imputed analysis (odds

ratio, 2.03; 95% confidence interval, 1.20-3.44; $P=.003$).

COMMENT

Teacher ratings for children between ages 4 and 5 years predicted later high hyperactivity/inattention scores, classroom learning problems, and specialist service use, suggesting that these difficulties persist over time. Teachers are well placed to identify children with hyperactivity/inattention difficulties at a young age. These difficulties have long-term implications in terms of worse outcomes in home and school settings. At an individual level, although 60% of high baseline scorers no longer reached the cutoff point for high parent-rated hyperactivity/inattention scores 5 years later, their persisting high scores on the teacher SDQs suggest that many of these children continued to have some difficulties at school.^{4-6,8}

We found no evidence that a one-off school-based intervention involving screening and feedback of names of high baseline scorers has long-term generalizable benefits. In keeping with other studies investigating the impact of school-based interventions, any earlier positive effects were not sustained over time.³¹ Possible reasons include the length of time elapsed since the educational intervention was delivered, variable use of interventions at the time, and methodological differences with the follow-up study involving selection of LEA areas, smaller sample size, and different raters and measures. Predictors of high hyperactivity/inattention scores at follow-up included high scoring status at baseline, male sex, and receipt of the identification intervention. Among the high baseline scorers, children receiving the identification-only intervention had the highest rates of hyperactivity/inattention at follow-up. These findings were unexpected and may reflect a chance finding. A careful assessment was made for the possibility that selection bias influenced our results. Evidence that this possibility is unlikely is that, among high baseline scorers, intervention group and child sex were not associated with likelihood of response. Deprivation scores were associated with response in the book and identification group only. There were similar results from the regression analyses using unimputed and imputed data suggesting that the response rate was not biasing the findings. Although it is possible that parents were more sensitized to noticing and reporting problems at follow-up, the findings do not appear to reflect possible inflation of parent and teacher ratings. The SDQ hyperactivity/inattention scores (both parent and teacher) in the 2 groups receiving the identification intervention were similar to the 2 groups who did not receive this intervention. Identification seemed to be harmful in this follow-up study and harmful when combined with advice in the first study.¹³ However, it would be prudent to await confirmation from further studies before concluding that the relationship is well established.

THE ROLE OF LABELING

The findings from both follow-up studies of this cohort suggest that, after screening, children who have been identified to schools as having difficulties appear to have an

increased risk of worse outcomes compared with control children with similar levels of difficulties. This might reflect the possible adverse effects of labeling, whereby identifying children as at risk at a young age might lead to adults, such as teachers, dealing with them differently. The effects may be similar to other types of labeling, such as children regarded as having learning or neurodevelopmental difficulties, and may become perpetuated over time, resulting in lower adult expectations for the child and reduced access to opportunities.³² For many children, there may also be mislabeling, with the identified attentional and hyperactivity problems mimicking or overshadowing other learning or behavioral difficulties that might be better addressed in their own right. However, our study does not illuminate how teachers assimilated the identification information and how this was used or possibly shared with parents.

METHODOLOGICAL ISSUES

In considering the findings, the rationale for 3 methodological differences between the original trial and this follow-up is highlighted. First, to enable a focus on specialist service use, we used slightly fewer LEA areas, with each LEA area providing a sufficient number of participating schools. Within each LEA area, we sampled schools to investigate the outcomes of high baseline scorers. Second, we focused on parent-rated outcomes because parents are the main drivers for help-seeking,⁹ and possible improvements in outcomes might have been mediated by specialist service use and access to interventions for ADHD. We were also uncertain how well schools would cooperate with the follow-up study if individual teachers were asked to complete several questionnaires (compared with parents completing 1 questionnaire). We did not want to overly burden schools with data collection. Any outcome data had to be obtained from an informant who differed from the intervention participant (year 1 teacher). We were able to collect some teacher SDQ information from a nested study focusing on a wider range of predictors of service use. For the present investigation, these are only used to provide information on the long-term prediction of teacher ratings (not for the outcomes of the interventions). Third, we chose the SDQ as our main outcome measure because this also provides information about other domains of mental health. The SDQ has been used as an outcome measure in other trials of early interventions for childhood behavior problems.³³ For the purpose of our study, the extended SDQ also provides more comprehensive information on service use over a period of time compared with asking a teacher who might have only known the child well for less than a year.

The original trial reflected a large and representative study of schools in England and provided access to a large cohort of 4- to 5-year-old children. It took advantage of routinely collected data using a validated behavioral measure that relates to the *DSM-IV*. The cluster randomized design enabled the investigation of 2 different interventions and the interaction effect between them. Strengths of this follow-up study include participant recruitment from a nationally representative range of schools. Multilevel mod-

eling was used to account for possible clustering at the LEA and school levels. Our approach of focusing on high scorers at follow-up was in keeping with the approach at baseline. In the subsample with teacher SDQs, parent and teacher hyperactivity scores were moderately correlated (Pearson correlation coefficient: $r=0.38$; $P<.001$), suggesting some level of agreement across raters. When assessed using cut-off points, there was little evidence for discordance ($P=.05$, McNemar test; if the parent score was high, the positive predictive value for a high teacher score was 56%; conversely, the negative predictive value for a low teacher score was 79%). Furthermore, these ratings were provided by different teachers who may not have been aware of the earlier interventions.

A key limitation of the original trial is that fidelity to the intervention and the level of implementation are unclear. It is uncertain how extensively the interventions were used within schools. The outcome data at both phases of these follow-up studies were not provided by the teacher (in year 1) who was most directly involved in the intervention. Earlier data suggest that around 18% of year 2 teachers reported that they had used the book. Equivalent data for the identification intervention were not collected. Hence, it is not certain how the information was used or whether it was shared with other teachers or parents. It is possible that the information could have been passed to the school's special educational needs coordinator who has a broader coordinating role throughout the child's schooling. Given these uncertainties, we conducted analyses that were in keeping with the initial follow-up and are appropriate for an intention-to-treat approach. These analyses assume that the child was assigned the intervention to which the school was randomized. If the worse outcomes associated with identification are a real effect, we might have underestimated its magnitude. If all identification information was ignored at the school level, similar outcomes to the no-intervention group might be expected, particularly given that the groups were similar at baseline in terms of symptom severity, sex, and sociodemographic data.

In terms of other limitations, there were high levels of sample attrition at the school and parental level, although participation was not associated with the type of intervention received. Our sample size calculation was based on existing service use data, and we found that specialist service use by our sample exceeded the expected levels, which may reflect a response bias, with service users being more likely to respond because the study was of greater relevance to them. There is also a possibility of recall bias in retrospectively eliciting service use information from parents.

CLINICAL AND POLICY IMPLICATIONS

Our findings suggest that teachers are in a position to identify children with attention or hyperactivity problems at a young age and that these difficulties have long-term implications across domains. This study reflects possible outcomes following the introduction of a universal school-based screening program for symptoms of ADHD. Based on the findings of this follow-up and the earlier follow-up investigating educational outcomes, we found no

evidence to support universal screening for ADHD problems in primary schools. This is in keeping with United Kingdom policy recommendations.¹² Our findings suggest that solely identifying a child as having features of ADHD and then providing no input to the child or teacher risks the possibility of a worse long-term outcome than doing nothing. If individual schools choose to adopt universal screening approaches, the next step should be a more detailed assessment that considers broader issues including possible associated learning difficulties or comorbid mental health problems because these difficulties might carry the long-term risk. In terms of future research, a range of intervention approaches need to be tested. Targeted intervention approaches may only be of benefit if combined with individualized management strategies³⁴ and may most benefit children when there is already parent or teacher concern about their difficulties or behavior.

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REFERENCES

1. Polanczyk G, de Lima MS, Horta BL, Biederman J, Rohde LA. The worldwide prevalence of ADHD: a systematic review and meta-regression analysis. *Am J Psychiatry*. 2007;164(6):942-948.
2. Taylor E, Chadwick O, Heptinstall E, Danckaerts M. Hyperactivity and conduct problems as risk factors for adolescent development. *J Am Acad Child Adolesc Psychiatry*. 1996;35(9):1213-1226.
3. Fergusson DM, Lynskey MT, Horwood LJ. Attentional difficulties in middle childhood and psychosocial outcomes in young adulthood. *J Child Psychol Psychiatry*. 1997;38(6):633-644.
4. Merrell C, Tymms PB. Inattention, hyperactivity and impulsiveness: their impact on academic achievement and progress. *Br J Educ Psychol*. 2001;71(pt 1): 43-56.
5. McGee R, Prior M, Williams S, Smart D, Sanson A. The long-term significance of teacher-rated hyperactivity and reading ability in childhood: findings from two longitudinal studies. *J Child Psychol Psychiatry*. 2002;43(8):1004-1017.
6. Willoughby MT. Developmental course of ADHD symptomatology during the tran-

- sition from childhood to adolescence: a review with recommendations. *J Child Psychol Psychiatry*. 2003;44(1):88-106.
7. Barbaresi WJ, Katusic SK, Colligan RC, Weaver AL, Jacobsen SJ. Long-term school outcomes for children with attention-deficit/hyperactivity disorder: a population-based perspective. *J Dev Behav Pediatr*. 2007;28(4):265-273.
 8. Galéra C, Bouvard MP, Encrenaz G, Messiah A, Fombonne E. Hyperactivity-inattention symptoms in childhood and suicidal behaviors in adolescence: the Youth Gazel Cohort. *Acta Psychiatr Scand*. 2008;118(6):480-489.
 9. Sayal K, Goodman R, Ford T. Barriers to the identification of children with attention deficit/hyperactivity disorder. *J Child Psychol Psychiatry*. 2006;47(7):744-750.
 10. Sayal K, Hornsey H, Warren S, MacDiarmid F, Taylor E. Identification of children at risk of attention-deficit/hyperactivity disorder: a school-based intervention. *Soc Psychiatry Psychiatr Epidemiol*. 2006;41(10):806-813.
 11. Sax L, Kautz K. Who first suggests the diagnosis of attention-deficit/hyperactivity disorder? *Ann Fam Med*. 2003;1(3):171-174.
 12. National Institute for Health and Clinical Excellence. *Attention Deficit Hyperactivity Disorder: Diagnosis and Management of ADHD in Children, Young People, and Adults*. London, England: NICE; 2008. Clinical Guideline 72.
 13. Tymms PB, Merrell C. The impact of screening and advice on inattentive, hyperactive and impulsive children. *Eur J Spec Needs Educ*. 2006;21(3):321-337.
 14. Tymms P. *Baseline Assessment and Monitoring in Primary Schools: Achievements, Attitudes and Value-Added Indicators*. London, England: David Fulton Publishers; 1999.
 15. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders (Fourth Edition) (DSM-IV)*. Washington, DC: American Psychiatric Association; 1994.
 16. Merrell C, Tymms PB. *Working with Difficult Children in Years 1 and 2: A Guide for Teachers*. Durham, England: Durham University CEM Centre; 2002.
 17. DuPaul GL, Eckert TL. The effects of school-based interventions for attention deficit/hyperactivity disorder: a meta-analysis. *School Psych Rev*. 1997;26(1):5-27.
 18. Purdie N, Hattie J, Carroll A. A review of the research on interventions for attention deficit/hyperactivity disorder: what works best? *Rev Educ Res*. 2002;72(1):61-99.
 19. Department for Children, Schools, and Families. Primary school (key stage 2) achievement and attainment tables, 2006. http://www.dcsf.gov.uk/performance/tables/primary_06.shtml. Accessed September 25, 2009.
 20. Meltzer H, Gatward R, Goodman R, Ford TJ. *Mental Health of Children and Adolescents in Great Britain*. London, England: Stationery Office; 2000.
 21. Jarman B. Underprivileged areas: validation and distribution of scores. *Br Med J (Clin Res Ed)*. 1984;289(6458):1587-1592.
 22. Goodman R, Ford T, Simmons H, Gatward R, Meltzer H. Using the Strengths and Difficulties Questionnaire (SDQ) to screen for child psychiatric disorders in the community. *Br J Psychiatry*. 2000;177(6):534-539.
 23. Ford T, Goodman R, Meltzer H. Service use over 18 months among a nationally representative sample of British children with psychiatric disorder. *Clin Child Psychol Psychiatry*. 2003;8(1):37-51.
 24. Goodman R. Psychometric properties of the Strengths and Difficulties Questionnaire. *J Am Acad Child Adolesc Psychiatry*. 2001;40(11):1337-1345.
 25. Sayal K, Taylor E. Parent ratings of school behaviour in children at risk of attention deficit/hyperactivity disorder. *Acta Psychiatr Scand*. 2005;111(6):460-465.
 26. Ford T, Hamilton H, Dosani S, Burke L, Goodman R. The Children's Services Interview: validity and reliability. *Soc Psychiatry Psychiatr Epidemiol*. 2007;42(1):36-49.
 27. Goldstein H. *Multilevel Statistical Models*. 3rd ed. London, England: Arnold; 2003.
 28. Rasbash J, Steele F, Browne W, Prosser B. *A User's Guide to MLwiN, Version 2.0*. London, England: Institute of Education; 2004.
 29. Rubin DB. *Multiple Imputation for Nonresponse in Surveys*. New York, NY: John Wiley & Sons; 1987.
 30. van Buuren S, Groothuis-Oudshoorn K. Multivariate imputation by chained equations (package "mice" version 2.1); the R project for Statistical Computing; 2009. <http://www.r-project.org>. Accessed December 15, 2009.
 31. Shelton TL, Barkley RA, Crosswait C, et al. Multimethod psychoeducational intervention for preschool children with disruptive behavior: two-year post-treatment follow-up. *J Abnorm Child Psychol*. 2000;28(3):253-266.
 32. Katzenstein JM, Fastenau PS, Dunn DW, Austin JK. Teachers' ratings of the academic performance of children with epilepsy. *Epilepsy Behav*. 2007;10(3):426-431.
 33. Hutchings J, Gardner F, Bywater T, et al. Parenting intervention in Sure Start services for children at risk of developing conduct disorder: pragmatic randomised controlled trial [published online March 9, 2007]. *BMJ*. 2007;334(7595):678-682. doi:10.1136/bmj.39126.620799.5
 34. Corkum PV, McKinnon MM, Mullane JC. The effect of involving classroom teachers in a parent training program for families of children with ADHD. *Child Fam Behav Ther*. 2005;27(4):29-49.

Writing should be the settlement of dew on the leaf.

—Ralph Waldo Emerson