

*TESTING THE ABILITY OF CHILDREN WITH
ATTENTION DEFICIT HYPERACTIVITY DISORDER TO
ACCURATELY REPORT THE EFFECTS OF MEDICATION ON
THEIR BEHAVIOR*

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Children with attention deficit hyperactivity disorder (ADHD) are often treated with central nervous system stimulants, making the evaluation of medication effects an important topic for applied behavior analysts. Because assessment protocols emphasize informant reports and direct observations of child behavior, little is known about the extent to which children themselves can accurately report medication effects. Double-blind placebo-controlled procedures were used to examine whether 6 children with ADHD could recognize the effects of their medication. The children were given math worksheets to complete for 15 min during each of 14 sessions while on medication and placebo. Children completed a self-evaluation form at the end of each session, and ratings were compared to observed behavior and academic performance. Results indicated that 3 children were able to accurately report their medication status at levels greater than chance, whereas the accuracy of reports by all children was related to dosage level, differences in behavior, and the presence of adverse effects. The implications of these results for placebo-controlled research, self-monitoring of dosage levels, and accuracy training are discussed.

DESCRIPTORS: attention deficit hyperactivity disorder, methylphenidate, dextroamphetamine, self-evaluation, adverse effects

Pharmacological treatments for the behavioral symptoms of attention deficit hyperactivity disorder (ADHD) have been documented for over 25 years. The majority of children diagnosed with ADHD are treated by central nervous system stimulants, with methylphenidate (MPH), dextroamphetamine (Dexedrine), and magnesium pemoline (Cylert) being the most frequently prescribed (Barkley, 1998). MPH is also one of the most frequently studied treatment modalities of all childhood behavior problems, and its use for behavior management purposes appears to be increasing (Barkley, 1998; Barkley, McMurray, Edelbrock, & Robbins, 1990; Pelham, 1993).

Given the prevalence of stimulant medication as a treatment for children with ADHD, applied behavior analysts have become increasingly concerned with evaluating

medication effects and using this information to identify the lowest therapeutic dose that produces the maximum therapeutic gain (e.g., Stoner, Carey, Ikeda, & Shinn, 1994). In practice, physicians tend to make this decision based on caregiver report or behavior rating scales completed by teachers and parents (Copeland, Wolraich, Lindgren, Milich, & Woolson, 1987; Gadow, 1981). DuPaul (1992) argued that these approaches, as well as teacher interviews, review of school records, and systematic classroom observations should be used when making treatment decisions in school settings. Finally, Stoner et al. found that curriculum-based measurement (CBM) probes in reading and math were sensitive to different doses of MPH when used in conjunction with brief medication trials.

Although a variety of informants (e.g., pediatricians, teachers, parents) have been used to evaluate medication effects in children with ADHD, little is known about the ex-

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tent to which children themselves can accurately report their medication status. Research in this area has suggested that some children with ADHD may be sensitive to medication effects or can be trained to identify these effects under certain conditions (DuPaul, Anastopoulos, Kwasnik, Barkley, & McMurray, 1996; Kollins, Shapiro, Newland, & Abramowitz, 1998).

DuPaul et al. (1996) conducted one of the few studies that experimentally examined children's awareness of the effects of stimulant medication on their behavior. On a weekly basis, children completed a 14-item rating scale consisting of symptoms of ADHD (American Psychiatric Association, 1987), the Piers Harris Self-Concept Scale (Piers, 1984), and a questionnaire assessing the adverse effects of MPH. The children's parents and teachers also completed two rating scales on a weekly basis. Results suggested that although children reported fewer symptoms of ADHD than did their parents and teachers, self-evaluations were sensitive to medication effects. There were also significant improvements in the children's ratings of self-concept when on the low dose of MPH compared to placebo. Furthermore, whereas teachers reported more adverse effects during the placebo condition, children reported more adverse effects when on active medication.

Kollins et al. (1998) examined the ability of children with ADHD to discriminate MPH ($n = 12$) and dextroamphetamine ($n = 5$) from placebo. They found that some children with ADHD could discriminate MPH from placebo under certain conditions: (a) when they were told explicitly to pay attention to the drug effects during a sampling phase; (b) when they were given feedback immediately following the discrimination response; and (c) when they were provided the cue to attend at a time that corresponded with the peak behavioral effects of the drug.

It is not clear what categories of stimuli children are attending to when asked to report their medication status. Some possibilities include changes in behavior likely to be affected by central nervous system stimulants (e.g., attentiveness, hyperactivity, impulsivity, social interactions, and academic performance), the behavior of others with whom children interact, or the adverse physiological effects of medication (Buhrmester, Whalen, Henker, MacDonald, & Hinshaw, 1992; Murphy, Pelham, & Lang, 1992; Pelham, 1986; Pelham, Bender, Caddell, Booth, & Moorer, 1985; Pelham et al., 1990; Solanto & Conners, 1982; Whalen & Henker, 1991; Whalen, Henker, Collins, Finck, & Dotemoto, 1979; Whalen, Henker, & Dotemoto, 1981). Barkley et al. (1990) systematically assessed the adverse effects of MPH using low-dose (0.3 mg/kg b.i.d. MPH), high-dose (0.5 mg/kg b.i.d. MPH), and placebo conditions. Results suggested that the most common adverse effects of MPH were decreased appetite, insomnia, abdominal aches, and headaches. Other adverse effects of MPH have included dryness of mouth and exacerbation of tics and other dyskinetic movements (Barkley et al., 1990; *Physicians Desk Reference*, 1995).

The goals of this study were (a) to collect repeated measures of academic performance and behavior of students with ADHD during medication and placebo trials; (b) to evaluate whether these children could accurately state their medication status each day; and (c) to examine some possible sources of accuracy or inaccuracy concerning receipt of medication.

Children's ability to accurately report their medication status has several implications. First, an inability to detect medication status is assumed in placebo-controlled studies; thus, some determination that children are inaccurate reporters may be important for procedural integrity. Second, should students be able to detect the effects of MPH,

Table 1
Participant Characteristics

Participant	Full-scale IQ	Age (years, months)	Age began taking stimulant (years)	Medication taken prior to sessions
Kyle	104	13, 1	10	20 mg MPH (sustained release)
Earl	119	11, 1	6	20 mg dextroamphetamine (sustained release)
Mary	112	11, 9	6	15 mg dextroamphetamine (sustained release)
Joe	102	12, 9	8	15 mg MPH (standard release)
Chase	112	13, 0	7	10 mg dextroamphetamine (standard release)
Jude	81	10, 10	10	10 mg MPH (standard release)

they could self-monitor dosage levels and inform pediatricians, teachers, and others about when in the day their medication was no longer effective. Third, knowing what stimuli children with ADHD attend to when evaluating medication effects may be helpful in teaching them to accurately report their medication status.

METHOD

Participants and Setting

Five male students and 1 female student between the ages of 10 and 13 years participated in the study. All children had been previously diagnosed with ADHD and had taken a central nervous system stimulant for a minimum of 1 academic school year (see Table 1 for participant characteristics). The children were recruited through a mailing distributed by their pediatrician that described the procedures and purpose of the study and that offered free tutoring. All children were seen by one of two pediatricians.

Sessions were conducted in the primary experimenter's university office (4 m by 5 m). The children sat at typical classroom desks with the experimenter seated behind them. A video recorder was situated in a corner approximately 3 m away from the participants.

Medication and Placebo

Prescriptions for placebos and medication were written by the children's pediatrician

and filled by a university pharmacist. The placebo and medication capsules were emptied into a pill crusher and ground into powder form. The medication powder was then placed into green capsules to create an appearance identical to that of each child's placebo. Medication and placebo capsules were then placed into separate containers and given to each child's parent. The order of conditions was quasirandomized for each participant, with no condition occurring on more than 2 consecutive days. Parents were given a sealed envelope indicating which capsule they were to administer to their child each day of the study. Parents were explicitly instructed not to allow their child to witness from which container the capsule was taken. Participants, observers, and the experimenter were blind to the participants' medication status. At the conclusion of the study, parents returned the medication schedule and confirmed that they had given the appropriate pill to their child prior to each session.

Measures

Academic performance. Research has shown that instructional-level CBM probes in reading and math can be used to evaluate the dose effects of MPH (Roberts & Landau, 1995; Stoner et al., 1994). Due to their technical adequacy and sensitivity to the effects of MPH and because stimulant effects have been shown to be greater on arithmetic tasks than reading (Carlson & Bunner,

1993), CBM math computation probes were administered to participants.

Each probe contained 36 math computation problems, arranged vertically in six rows and six columns on a single worksheet. Computation problems were developed using a random digit table. Four types of math probes were developed: (a) addition of two two-digit numbers; (b) multiplication facts 0 through 12; and (c) multiplication of a double-digit by a single-digit number. Before the first session, participants' instructional level was determined by allowing them 2 min to complete each probe. A student's instructional level was considered to be that level at which the student completed 20 to 39 digits correct per minute (DCPM) and 3 to 7 digits incorrect per minute (Shapiro, 1996). Once a participant's instructional level was determined, worksheets at that level were developed for the remainder of the experiment. Each worksheet contained equivalent numbers and types of computation problems. Worksheets for Earl and Jude were comprised of 36 multiplication facts with numbers 0 through 12. The worksheets for Kyle, Joe, and Mary were comprised of 36 single-digit by double-digit multiplication problems. Chase's worksheets were comprised of 36 two-digit by two-digit addition problems.

The number of DCPM for each 15-min session was scored as the measure of academic performance. Interscorer agreement was assessed on all of the administered CBM probes. Agreement was calculated by dividing the total number of digits agreed upon by the total number of agreements plus disagreements and multiplying by 100%. Mean agreement for the number of DCPM was 99% (range, 99% to 100%).

Behavioral observations. Observers recorded those behaviors considered to be most frequently seen in children with ADHD (Barkley, Fischer, Newby, & Breen, 1988). Behaviors recorded were off task, fidgeting,

vocalization, plays with objects, and out of seat. *Off task* was defined as any interruption of the child's attention from the task to engage in another behavior. The behavior was scored any time a child raised his head and therefore broke eye contact with the worksheet. *Fidgeting* was defined as any repetitive, purposeless movement of the legs, feet, arms, hands, fingers, buttocks, or trunk that occurred at least twice in succession. *Vocalization* was scored when the participant made any verbal noises. *Plays with objects* was defined as any occasion a participant touched an object that was not directly related to the math task, the desk, or his or her body. *Out of seat* was scored when a participant's buttocks broke contact with the flat surface of his or her seat (Barkley, 1990). The observation system described above was adapted from Barkley's (1990) Restricted Academic Situation. Barkley's observational model has been shown to be sensitive to drug and dose effects of MPH (Barkley et al., 1988) and to discriminate children with ADHD from typical children (Breen, 1985, as cited in Barkley, 1988).

Two undergraduate students were trained in 15-s partial-interval recording procedures. First, they were given the definitions of target behaviors and then were shown examples on video. They were then trained with videotapes until 90% interobserver agreement was reached between observers and the experimenter on three consecutive observations. Interobserver agreement was assessed from videotapes during 35% of the experimental sessions by having two observers record behavior independently but concurrently. Agreement was calculated on an interval-by-interval basis for each coded behavior by dividing the total number of agreements by the total number of agreements plus disagreements and multiplying by 100%. The mean interobserver agreement across all observed behaviors was 98%, with a mean for on-task behavior of 97%

(range, 90% to 100%); fidgeting, 95% (range, 85% to 100%); vocalization, 99% (range, 97% to 100%); and out of seat and playing with objects, 100%.

Self-evaluation questionnaire. Following each session, participants were given a self-evaluation questionnaire (see the Appendix). This questionnaire was developed by the authors, and assessed students' evaluations of their academic performance, observed behaviors, and adverse effects they might have experienced due to their stimulant medication. All questions were developed using the known behavioral effects and possible adverse effects of central nervous system stimulants. Each question was first read by the experimenter and then answered by the participant using a 5-point Likert scale. A final question asked participants whether they had taken a "fake pill," a "real pill," or if they "did not know."

The accuracy of participants' self-evaluations was examined by correlating their self-evaluations after each session with the corresponding observed behavior. Correlations between observed behaviors and self-evaluations were conducted only for those behaviors that occurred at least 5% less on average when on medication. To obtain a correlation between academic performance and self-ratings of academic performance, the three academic performance questions were summed and correlated with DCPM. For observed behavior, ratings on the off-task and fidgeting questions were summed and correlated with the percentage of intervals that each behavior was observed.

Test-retest reliability of the self-evaluation questionnaire was estimated by correlating the self-ratings of academic performance, off task, and fidgeting for each child on 2 days when his or her behavior occurred at similar levels. The quality of a behavioral assessment measure can also be evaluated by examining its accuracy and sensitivity (Hayes, Nelson, & Jarret, 1986). The accuracy and sensitivity

of the self-evaluation questionnaire were evaluated by comparing children's ratings of their academic performance to their DCPM and comparing their ratings of off-task and fidgeting behavior to direct observations.

The reliability coefficient for the self-ratings of academic performance ($r = .96$; $p \leq .01$), off task ($r = .91$; $p \leq .01$), and fidgeting ($r = .96$; $p \leq .01$) suggest that these item sets have adequate test-retest reliability over a 2- to 5-day interval. Furthermore, significant ($p < .05$) correlations between DCPM and ratings of academic performance for 4 children ($M = .65$) and between direct observations of off-task behavior and ratings of off-task behavior for 5 children ($M = .76$) suggest that these two measures can produce accurate data and are sensitive to changes in behavior. Only 1 child's ratings of fidgeting correlated significantly with direct observations (Earl, $M = .72$), making the quality of this measure questionable.

Experimental Design and Procedure

A double-blind placebo-controlled procedure resulting in a multielement design was used to evaluate differences in children's academic performance and behavior when on medication versus placebo. Participants who were taking standard-release MPH and standard-release dextroamphetamine were administered their medication or a placebo 1.5 hr prior to testing sessions. Those participants who were taking sustained-release MPH and dextroamphetamine were administered their placebo or medication 3 hr before testing. These are the times when each form of medication was believed to reach its peak behavioral effects (Barkley, 1998).

After arriving at the university, each child was tutored for 50 min in math (Kyle, Mary, Chase, and Joe), reading (Earl and Jude), and handwriting (Jude), was allowed to read a story for 10 min, and then was given a set of five randomly selected CBM math com-

putation worksheets at their instructional level. They were told to try their best to complete as many problems as possible during the 15-min session, but that they were not expected to complete all problems. Following each session, the math sheets were removed from their desk and the examiner read the self-evaluation questionnaire. Each session was videotaped and later scored by an observer who was unaware of the child's medication status. All sessions were conducted with only an experimenter and the child in the room.

RESULTS

Behavior

As shown in the left column of Figure 1, Kyle's DCPM and off-task and fidgeting behaviors differed when he was on medication or placebo. Kyle's behavior did not differ when he was on medication or placebo on the measures of vocalizations, plays with objects, and out of seat (not depicted). Mean DCPM and percentage of intervals of behavior as well as differences when on medication or placebo are presented for each child in Table 2.

Figure 1 shows higher levels of DCPM for Earl when on medication than on placebo. Earl's off-task and fidgeting behaviors were also improved by medication. Although the mean difference for Earl's vocalization behavior was 16.43, it is apparent that this difference was due largely to two sessions. During these two sessions, Earl stated repeatedly that he could not complete the math problems and grunted. Earl's out of seat and plays with objects behavior did not differ when on medication or placebo (not depicted).

Mary withdrew from the study after the eighth session. The three left panels of Figure 2 show that Mary's medication increased DCPM and decreased off-task and fidgeting behavior. Mary's vocalizations, out of seat,

and plays with objects behavior did not differ substantially (not depicted). The right panel of Figure 2 suggests that medication was not effective for Joe and that his behavior was variable. Furthermore, the mean number of DCPM for Joe on medication was slightly less than when he was on placebo.

The left panels of Figure 3 indicate that Chase's medication increased his DCPM and decreased his off-task and fidgeting behavior. Chase's vocalizations, out of seat, and plays with objects behavior did not differ substantially (not depicted). The top right panel of Figure 3 illustrates that medication had no apparent effect on DCPM for Jude. The effects of medication were also minimal for his off-task and fidgeting behaviors. Jude's medication did not affect the observed behaviors of vocalizations, plays with objects, or out of seat (not depicted). These results suggest that differences in behavior may have provided information about medication status for Kyle, Earl, Mary, and Chase.

Adverse Effects

As shown in Figure 4, there were no differences in Kyle's and Joe's reporting of adverse effects while on medication as compared to placebo. There were, however, differences among the other students when on medication or placebo. Earl's mean rating for the adverse effect "headaches" was higher for placebo sessions (3.0) in comparison to medication sessions (1.6). Mary's mean rating of the adverse effect "stomach" was greater when she was on medication (2.0) as compared to placebo (1.0). Chase's mean ratings for the adverse effect "fingers" was lower on medication days (2.4 vs. 3.1), whereas the mean rating for "mouth" was higher on medication days (3.4 vs. 3.0). Jude's mean ratings on the adverse effect questions of "fingers" and "head" were higher for medication sessions (2.9 vs. 2.3 and

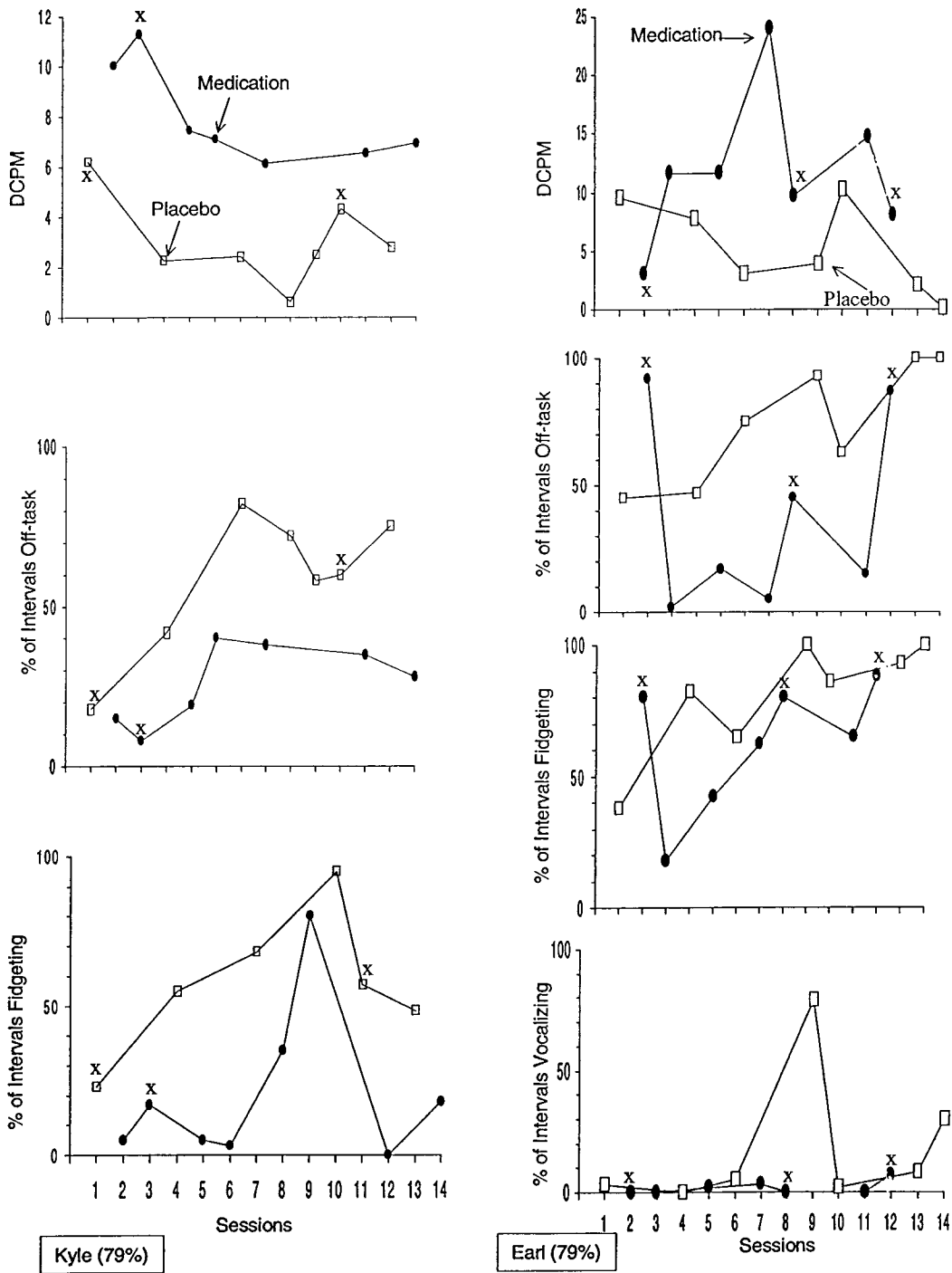


Figure 1. Digits correct per minute (DCPM) and percentage of intervals of off task, fidgeting, and vocalization on medication and placebo for Kyle and Earl (x = inaccurate report of medication status, ? = child reported "don't know"). The value in parentheses indicates the total percentage accuracy of medication status reports.

Table 2
Mean Levels of Behavior on Medication Versus Placebo

Behavior	Kyle	Earl	Mary	Joe	Chase	Jude
Academic performance						
Medication	7.61	11.79	11.83	7.55	15.49	33.13
Placebo	3.01	5.21	4.92	7.59	9.08	27.47
Mean difference	4.59	6.58	6.89	-0.04	6.41	5.66
Off task						
Medication	11.86	37.57	19.50	45.29	17.86	9.29
Placebo	59.71	74.71	61.50	53.86	47.86	18.57
Mean difference	47.85	37.14	42.00	8.57	30.00	9.28
Fidgeting						
Medication	26.14	62.14	24.00	86.29	31.57	42.71
Placebo	63.00	80.57	66.75	70.29	47.29	54.14
Mean difference	36.86	18.43	42.75	-14.00	15.72	11.43
Vocalization						
Medication	1.86	1.71	1.00	1.86	5.29	3.14
Placebo	0.29	18.14	2.25	10.00	4.29	2.71
Mean difference	-1.56	16.43	1.25	9.86	-1.00	-0.43
Plays with object						
Medication	0	0.29	5	0.29	0	0
Placebo	0.43	2.57	3	4.57	2.43	0
Mean difference	0.43	2.29	-2	4.29	2.43	0
Out of seat						
Medication	0	0	0	0	0.43	0
Placebo	0	0.29	0.5	0.29	1.57	0.71
Mean difference	0	0.29	0.5	0.29	1.14	0.71

Note. Values indicate DCPM for academic performance and percentage of intervals for all other categories.

1.4 vs. 1.0), and the mean rating for “stomach” was higher for placebo sessions (1.4 vs. 1.0). These differences in ratings suggest that Earl, Mary, Chase, and Jude may have used the presence or absence of adverse effects when evaluating their medication status.

Accuracy

When asked what type of pill he had taken, Kyle accurately reported “fake pill” or “real pill” on 79% of the sessions. As indicated in Figure 5, Kyle accurately stated his medication status on 83% of medication sessions and on 71% of placebo sessions. On the two placebo sessions that he inaccurately stated he had taken a “real pill,” the behaviors of DCPM, off task, and fidgeting were near the levels of medication sessions (see

Figure 1). Although Kyle accurately stated his medication status on 79% of the overall sessions, he did not accurately report his behavior, as indicated by the lack of significant correlations between his ratings and the recorded behaviors of DCPM ($r = .00$), off task ($r = .38$), and fidgeting ($r = .38$). Although Kyle may not have accurately rated his behavior, the relationship between his behavior and statements of medication status suggest that he may have been attending to his behavior as a means of assessing medication status.

On 79% of the 14 sessions, Earl provided an accurate answer to the question of whether he had taken a “fake pill” or a “real pill” (Figure 5). The three inaccurate statements of medication status occurred when he was on medication and when his behaviors of

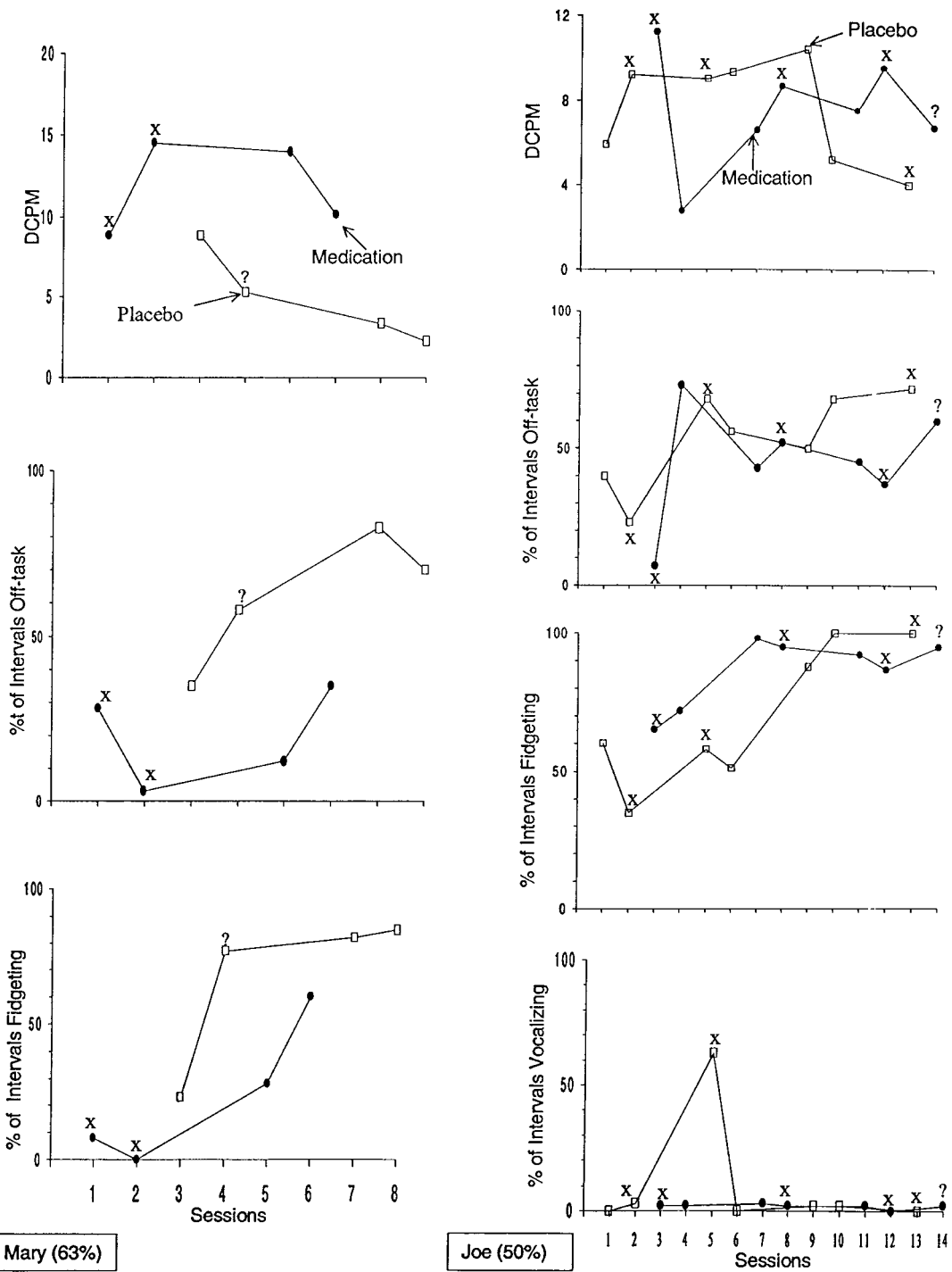


Figure 2. Digits correct per minute (DCPM) and percentage of intervals of off task, fidgeting, and vocalization on medication and placebo for Mary and Joe (x = inaccurate report of medication status, ? = child reported "don't know"). The value in parentheses indicates the total percentage accuracy of medication status reports.

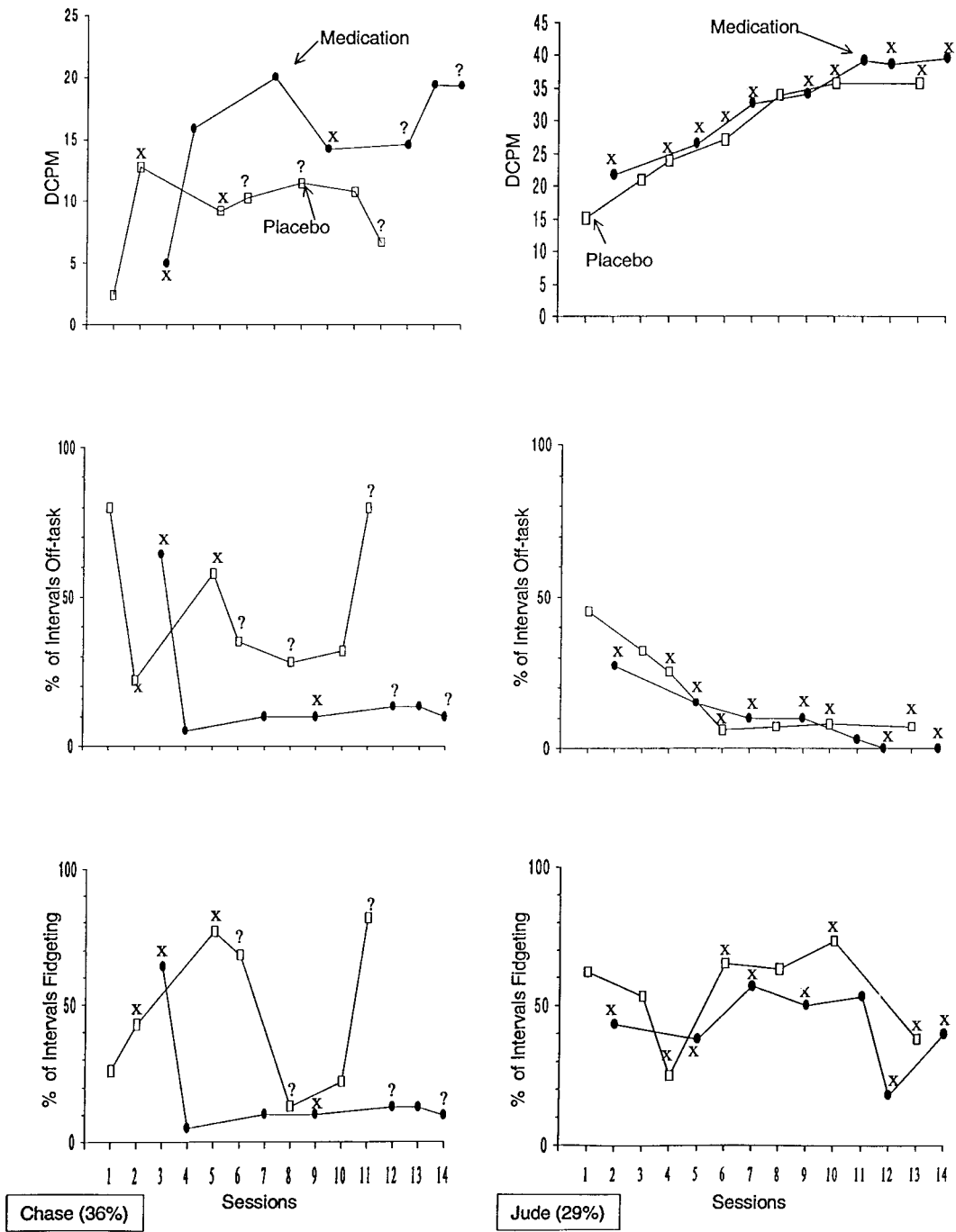


Figure 3. Digits correct per minute (DCPM) and percentage of intervals of off task, fidgeting, and vocalization on medication and placebo for Chase and Jude (x = inaccurate report of medication status, ? = child reported "don't know"). The value in parentheses indicates the total percentage accuracy of medication status reports.

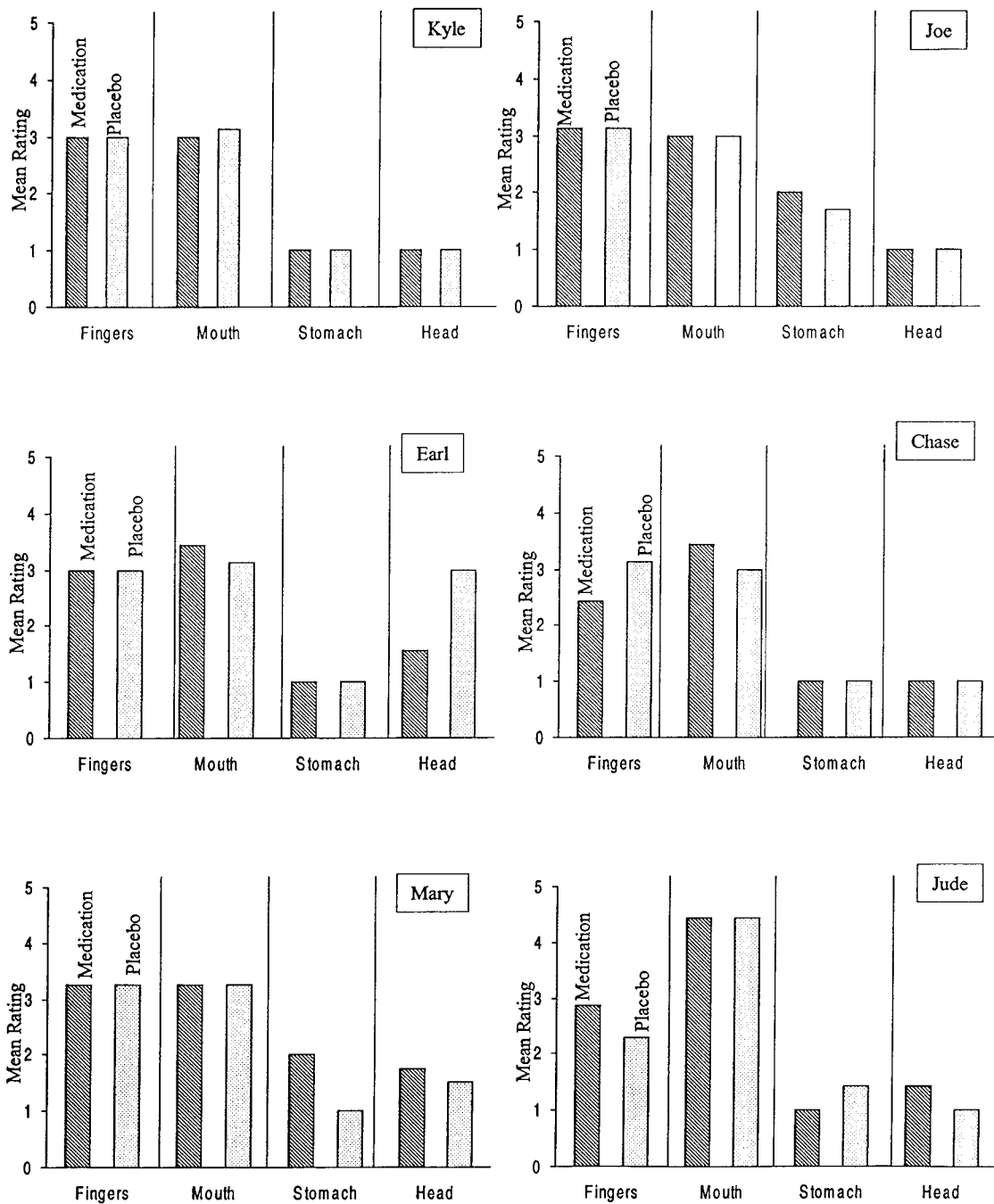


Figure 4. Students' mean rating for each adverse-effect item on medication and placebo sessions.

DCPM, off task, and fidgeting were nearest placebo levels (see Figure 1). Earl was also an accurate self-reporter of his behaviors, as evidenced by the significant ($p < .01$) cor-

relations between his self-ratings and DCPM ($r = .76$), off task ($r = .85$), and fidgeting ($r = .72$). As shown in Figure 4, the mean rating for the adverse effect "headaches" was

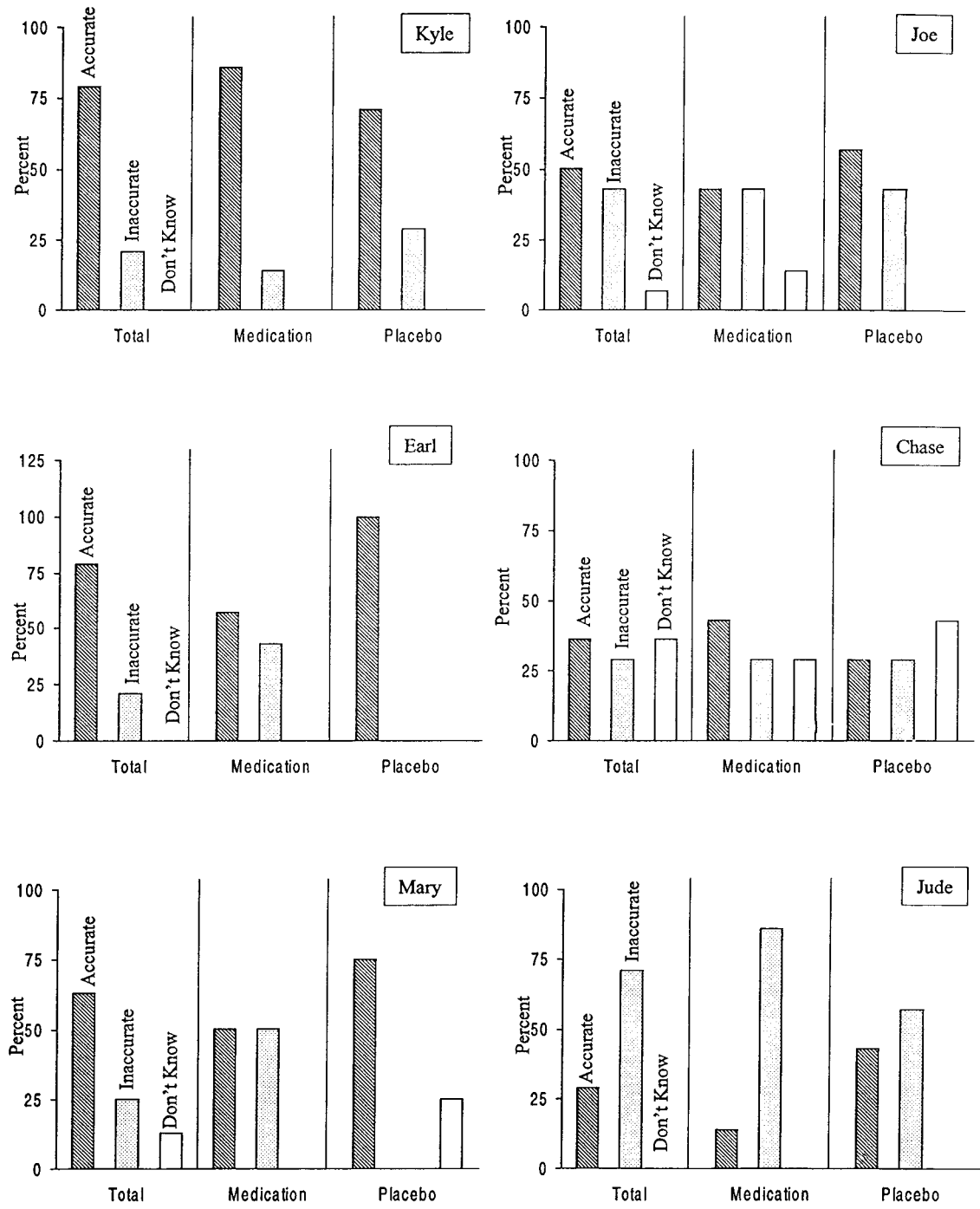


Figure 5. The percentage of sessions on which students accurately and inaccurately stated their medication status or “don’t know” across all sessions and following medication and placebo sessions.

higher for placebo sessions (3.0) in comparison to medication sessions (1.6). Differences in Earl's ratings of the side effect "headaches" and the relationship between his ratings and his behavior suggest that Earl may have based statements of his medication status on differences in his behavior or the presence of headaches when not medicated.

When Mary was asked whether she knew if she had taken a "fake pill" or a "real pill," she provided an accurate response on 63% of the sessions and responded that she didn't know on one session (13%). Although Mary accurately stated her medication status a greater number of times when on placebo (75%) than on medication (50%) (Figure 5), the two sessions when she inaccurately stated that she had taken a "fake pill" were the first two sessions (see Figure 2). It may have been that Mary's accuracy improved as a function of comparing stimuli to previous sessions. Mary was an accurate reporter of her off-task behavior ($r = .91, p < .01$), in that her ratings correlated significantly with observed levels. However, her ratings of DCPM ($r = .31$) and fidgeting ($r = .32$) did not correlate significantly with the corresponding observed behaviors. The differences in Mary's rating of the side effect "stomach" and the relationship between her ratings and behavior suggest that Mary may have attended to levels of her behavior, stomach aches, or both when stating her medication status.

When asked whether he knew if he had taken a "fake pill" or a "real pill," Joe provided an accurate response on 50% of the sessions and reported "don't know" on 7% of the sessions. Joe was more accurate in reporting his medication status on placebo (57%) than on medication days (43%) (Figure 5). In an interview prior to the first session, Joe stated that his medication made him perform worse academically. It may have been for this reason that Joe inaccurately stated that he had taken a "fake pill"

after the three sessions when his academic performance was the highest of all medication sessions. Joe was moderately accurate in his self-reports of behavior based on significant correlations ($p < .05$) with his self-ratings of DCPM ($r = .55$) and off-task behavior ($r = .62$). Joe's rating of fidgeting did not correlate significantly with the observed behavior ($r = .30$).

Chase accurately stated his medication status on only 36% of the sessions and stated that he did not know his medication status on 36% of the sessions. In addition, his accuracy was higher on medication (43%) than on placebo days (29%) (Figure 5). He was, however, able to accurately rate his DCPM ($r = .73, p < .01$) and off-task behavior ($r = .72, p < .01$) but not his fidgeting behavior ($r = .01$).

Jude provided an accurate response when asked his medication status on only 29% of the sessions. Jude was more accurate in reporting his medication status on placebo (43%) than on medication days (14%) (Figure 5). Although he was not an accurate evaluator of his medication status overall, he did provide accurate self-ratings of his behavior. Jude's ratings correlated significantly ($p < .05$) with his academic performance ($r = .56$) and off-task behavior ($r = .71$) but not fidgeting ($r = .01$).

A Kendall's tau-b correlation coefficient was calculated to examine whether age or IQ was related to the children's ability to accurately report their medication status. Results did not reveal a significant relationship between age and accuracy ($r = -.08; p > .05$); however, the relationship between IQ and accuracy was significant ($r = .60; p < .05$).

DISCUSSION

The goals of this study were to collect repeated measures of academic performance and behavior while students were on medication and placebo, to evaluate whether the

students could accurately state their medication status, and to examine what stimuli they might use to evaluate their medication status. Overall, the academic performance and behavior of 4 children differed when they were on medication versus placebo, but only 3 of these children (Kyle, Earl, and Mary) accurately stated their medication status at a percentage greater than chance. These 3 children had two characteristics in common. First, they were on the highest levels of medication, and all were on sustained-release prescriptions. Second, they showed the greatest differences in academic performance and observed behavior as a result of medication.

When Kyle and Earl reported inaccurately on their medication status, levels of behavior were similar to those observed under the other condition. Mary incorrectly reported her medication status only during the first 2 days (both placebo), but was accurate with exposure to subsequent medication and placebo sessions. Although differences in adverse effects ratings were found for 4 children, these differences were greatest for Mary and Earl. A final similarity between Mary and Earl was sensitivity to daily variations in their behavior, as evidenced by significant correlations between self-ratings and observational data.

All 3 of the children who were inaccurate in reporting their medication status (Joe, Jude, and Chase) were on standard release prescriptions. It may have been that our estimates of when these medications reached peak effectiveness were inaccurate, or perhaps the dosage levels were less than optimal for these children. These explanations seem plausible given that Joe and Jude evidenced overlapping data series for all behavior categories across the two conditions. Although medication appeared to improve Chase's behavior, the data were extremely variable during placebo sessions. This may have explained why Chase was unsure of his medi-

cation status (i.e., reported "don't know") a high percentage of the time (36%).

Several implications can be drawn from the results of this study. First, the results suggest that some children are able to detect their medication status reasonably well (e.g., Kyle and Earl), thereby suggesting caution for the assumptions made in placebo-controlled studies. Second, although some students may not be able to state their medication status, the results suggest that they can recognize differences in their academic performance and off-task behavior. During double-blind medication trials, these children may be able to provide their pediatrician with information concerning how much time they remained off task, how much work they completed, or which level of medication made their work the easiest. Third, it seems that some children are able to report the presence or absence of adverse effects even after having been medicated for an extended period of time. This finding suggests that the self-evaluation questionnaire may be useful in assessing the effects of medication that occur as private events, and further emphasizes the need for children to participate in evaluating their medication. Fourth, the results suggest that some children can recognize differences in their behavior, and this information could be helpful in teaching them to accurately report their medication status.

The present study is limited in that only 6 children participated and all were between the ages of 10 and 13 years, thus decreasing the generalizability of the study. In addition, a multimethod, multisource assessment was not used to confirm the pediatricians' diagnoses of ADHD. However, the children's behavior during placebo sessions was consistent with that of children with ADHD. Providing children with longer sessions and thus larger samples of behavior may also have enhanced their ability to state their medication status.

There are also limitations associated with the medication procedures. First, the types and levels of medication varied across participants, resulting in different latencies between ingestion and the experimental sessions. It is also possible that the methods used to form the capsules (i.e., crushing the sustained release medication) may have altered their efficacy.

This research could be extended if it were replicated in a school setting, examining whether children with ADHD can evaluate differences in their interactions with peers and teachers and providing children with an extended period of time over which to examine their behavior. Future research might also examine (a) whether children with ADHD can report medication effects in relation to difficulty sustaining attention or impulsivity and (b) how best to train children to discriminate their medication status.

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STUDY QUESTIONS

1. How do physicians typically assess medication effects in children? Describe an advantage and disadvantage of this approach, and give an example of a more rigorous assessment procedure.
2. What variables may influence children's ability to accurately report their medication status?
3. Describe steps taken by the authors to insure that the type of pill delivered (i.e., medication or placebo) was unknown to the children, observers, and experimenters.
4. What were the two general types of behavioral data that were used to evaluate medication effects?
5. Briefly summarize the effects of medication on the participants' behaviors.
6. Which students appeared to accurately report their medication status, and what characteristics did these students have in common?
7. What do the data in Figure 4 show, and what do they suggest about the variables that control accurate reporting of medication status?
8. What are the implications of children being able to accurately report their medication status?

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