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Effects of Methylphenidate and Expectancy on Children With ADHD: Behavior, Academic Performance, and Attributions in a Summer Treatment Program and Regular Classroom Settings

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Pharmacological and expectancy effects of 0.3 mg/kg methylphenidate on the behavior and attributions of boys with attention-deficit/hyperactivity disorder were evaluated. In a within-subject, balanced-placebo design, 136 boys received 4 medication–expectancy conditions. Attributions for success and failure on a daily report card were gathered. Assessments took place within the setting of a summer treatment program and were repeated in boys' regular classrooms. Expectancy did not affect the boys' behavior; only active medication improved their behavior. Boys attributed their success to their effort and ability and attributed failure to task difficulty and the pill, regardless of medication and expectancy. Results were generally equivalent across the two settings; where there were differences, beneficial effects of medication were more apparent in the school setting. The findings were unaffected by individual-difference factors.

Psychostimulant medications have been widely used for children diagnosed with attention-deficit/hyperactivity disorder (ADHD). Beneficial effects of stimulant treatment for these children have been documented in different domains of functioning, including classroom behavior, peer relations, and mother–child interactions (see Swanson, McBurnett, Christian, & Wigal, 1995, for a review). Despite the empirical evidence showing the efficacy of stimulant medication, however, little information exists regarding whether children with ADHD accurately perceive differences in their behavior between drug and placebo states and whether pharmacotherapy affects the ways in which the children explain their behavior.

Many concerns have been raised about the causal explanations and motivational states that may result from children's perceptions of and beliefs about medication. Prominent researchers (e.g., Brown, 1995; Henker & Whalen, 1980, 1989; K. D. O'Leary, 1980; Whalen & Henker, 1976, 1997) have argued that taking medication for behavioral control could encourage the children to

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believe that success in their daily activities is based on medication rather than their own efforts. Questions have been raised regarding whether these beliefs could be detrimental to the effort that children exert in situations that pose difficulties for them. In addition, it has been argued that medication would teach children to believe that they must rely on pills to succeed (Whalen & Henker, 1976), an outcome that might have untoward long-term consequences given that children with ADHD are at risk for the development of later substance abuse (Molina, Smith, & Pelham, 1999).

Most recent empirical studies, however, have not shown that medication produces detrimental causal attributions. For example, a series of laboratory studies using a learned helplessness paradigm (Carlson, Pelham, Milich, & Hoza, 1993; Milich, Carlson, Pelham, & Licht, 1991; Pelham, Hoza, Kipp, Gnagy, & Trane, 1997) showed that stimulant medication improves the task persistence of children with ADHD and that medication-produced success may have salutary effects on the causal attributions of children with ADHD. Fewer studies have addressed stimulant-related beliefs in nonlaboratory settings. Pelham, Murphy, et al. (1992) found that boys with ADHD selected their own efforts as the explanation for their behavior on their good days in a summer treatment program. Conversely, they blamed the pill (or no pill) for their behavior on bad days. This self-serving attributional style—internal attributions for success and external attributions for failure—has been found among normal populations to serve as a commonly used tool for preserving one's self-esteem (Blaine & Crocker, 1991; Bradley, 1978; Miller & Ross, 1975). In Pelham, Murphy, et al., the boys also reported themselves to be happier and to like themselves more on days when they received methylphenidate (MPH) compared with placebo days. This apparent salutary impact of stimulant medication on children's happiness and self-esteem runs counter to concerns regarding putative dysphoric stimulant effects (Whalen, Henker, Collins, McAuliffe, & Vaux, 1979). Using a different set of measures and methodology, Ialongo, Lopez, Horn, Pascoe, and Greenberg (1994) showed that MPH caused neither decrements in self-esteem or mood nor negative effects on the children's global attributions. Taken together, these studies suggest that medication does not produce general dysphoric effects.

Anecdotal reports suggest that children with ADHD are aware of the salutary effects that medication has on them (Sleator, Ullmann, & von Neumann, 1982) and that they need the medication (Whalen & Henker, 1976). However, studies that have measured whether children actually believed they were receiving active medication or placebo have shown that children do not make this distinction accurately (Dalby, Kapellus, Swanson, Kinsbourne, & Roberts, 1978; Pelham, 1990). For example, in one study children accurately guessed that they received placebo only 49% of the time (Pelham, 1990). By comparing days on which children received a placebo with days on which they did not take a pill, Pelham, Murphy, et al. (1992) and Carlson et al. (1993) found that there was no effect of ingesting a pill on children's behavior, attributions, or task performance.

None of the studies described above, however, included conditions where the children were told they received medication but received placebo, or were told they received placebo but received medication, to separate medication effects from expectancy effects. Whalen, Henker, Hinshaw, Heller, and Huber-Dressler (1991) studied expectancy effects and found that children predicted better performance and reported performing better when they were told they received active medication than when they were told they received placebo. Following failure on a computerized task, participants receiving placebo attributed their failure to lack of effort more than did medicated boys. However, Whalen et al. did not fully cross medication with expectancy and did not include direct attributions to the pill as a reason for success or failure.

The type of design needed to clearly examine children's perceptions of and beliefs regarding medication is a balanced-placebo design, which allows medication effects to be separated from expectancy effects (Lyerly, Ross, Krugman, & Clyde, 1964). This separation is necessary to rule out the possibility that the pharmacological effects of a substance are evident only when participants think they are ingesting the substance, by including a condition in which participants receive the substance but think they are receiving placebo (see Hull & Bond, 1986, for a review).

We have completed a set of investigations using a balanced-placebo methodology to investigate pharmacological versus expectancy effects in children with ADHD across behavioral, social, and cognitive domains. Two laboratory tasks were used in the academic (Pelham, Hoza, et al., 1997, 2000) and social (Pelham et al., 2001) domains of functioning. These laboratory studies showed no effects of expectancy. Regardless of medication or expectancy, boys attributed success to their efforts and attributed failure to task difficulty, and they did not make strong attributions to the pill for either success or failure. In the current study, we examined whether expectancy influences children's behavior and their attributions for success or failure in the context of medication effects on the activities in which they engage in daily living—the context that is of greatest interest to parents of children with ADHD.

The summer treatment program (STP) offers a naturalistic camp setting for studying medication effects in which the trade-off between experimental control and ecological validity is balanced. Conducting studies of medication effects in the STP allows for the use of methods and measures that have been well validated for the study of medication effects (e.g., Pelham et al., 1990, 1993; Pelham, Aronoff, et al., 1999; Pelham, Gnagy, et al., 1999; Pelham & Hoza, 1987). In addition, because children have daily behavioral goals on which success or failure is clearly operationalized, the STP setting is a particularly useful one in which to measure outcome, a key dimension in studying causal attributions. At the same time, the STP setting has limitations. The program uses a comprehensive behavioral intervention in which children receive continuous feedback and experience consistent consequences for behavior. It could be argued that concurrent behavioral treatments might ameliorate the putative negative effects of medication on cognitive–motivational factors and behavior, thereby limiting the generalizability of previous findings (Pelham, Murphy, et al., 1992). These limitations can be addressed by examining children's response to medication and attributions in a setting without concurrent behavioral treatment in effect, such as children's natural school settings.

The results of the empirical studies described above give strong evidence that, in general, MPH does not produce a negative cognitive schema for children with ADHD as a group. However, we have not prospectively explored individual differences in attributions as a function of medication response. Pelham, Murphy, et

al. (1992) found a subset of boys who attributed success to the pill and attributed failure to poor ability, a depressogenic attributional style (Alloy & Abramson, 1988). It is interesting to note that the boys who attributed success to the pill behaved significantly worse than the boys who did not. However, the sample size was small, and the groupings were post hoc. Therefore, in the current investigation we administered assessments of baseline attributional style, depressive symptomatology, and self-esteem to examine more thoroughly individual differences in attributions for success and failure.

An important individual-difference variable that needs to be considered is age. After reviewing pertinent developmental studies, Licht and Kistner (1986) concluded that younger children tend to view ability as a function of effort (i.e., as changeable) and that as they age, they begin to view ability as relatively fixed. Children's attribution styles also change with age, as younger children are less able than older children to distinguish different attributions for performance (Eccles, Wigfield, & Schiefele, 1998). An additional factor that may be important to examine is comorbid diagnosis of oppositional defiant disorder (ODD) or conduct disorder (CD). Evidence suggests that children with both ADHD and CD, relative to children with ADHD alone, are more likely to exhibit a hostile attribution bias (Milich & Dodge, 1984) and perhaps attribution bias mediated reactive aggression (Waschbusch et al., 2000). No existing studies of ADHD children's attributions have blocked participants on age or comorbid ODD/CD.

The current investigation used a balanced-placebo design to examine the pharmacological effects of MPH versus the effects of boys' expectancies regarding medication, and how individual differences interact with these effects. We examined children's daily behavior and their explanations for naturally occurring success and failure in two settings: first in the context of our STP (Experiment 1) and then in natural classroom environments (Experiment 2). On the basis of previous work, we expected that (a) MPH would have beneficial effects on children's social behavior and academic performance, (b) expectancy would have no effect on these areas, (c) children would have a self-serving attributional style that was not directly affected by medication or expectancy, and (d) these results would be obtained in both the STP and the natural setting.

Experiment 1

Method

Participants

Participants were 136 boys, ranging in age from 7.6 years to 12.7 years and attending the 1991, 1992, 1993, or 1994 STP at Western Psychiatric Institute and Clinic (WPIC), an intensive 8-week program (Pelham et al., 1996).[1] All participants met the criteria for a *Diagnostic and Statistical Manual of Mental Disorders* (3rd ed., rev; *DSM–III–R*; American Psychiatric Association, 1987) diagnosis of ADHD. We collected diagnostic information using several sources, including the parent and teacher Disruptive Behavior Disorders Rating Scale (Pelham, Gnagy, Greenslade, & Milich, 1992), which assesses the *DSM–III–R* symptoms of the disruptive behavior disorders. In addition, parents completed a structured interview consisting of the *DSM–III–R* descriptors for ADHD, ODD, and CD, with supplemental probe questions regarding situational and severity factors (instrument available from William E. Pelham). Following *DSM* guidelines, diagnoses were made if a sufficient number of symptoms were endorsed (considering information from both parents and teachers) to result in diagnosis. Of the 136 participants, 72 (53%) also met *DSM–III–R* criteria for diagnosis of ODD using the same rating scales, interview, and diagnostic algorithm; another 33 (24%) met criteria for a *DSM–III–R* diagnosis of CD. The sample was 81% Caucasian and 15% African American, and socioeconomic status of the participants' families varied widely (e.g., median yearly family income was $25,000, ranging from under $10,000 to over $100,000). Table 1 presents means and standard deviations for several participant characteristics, including diagnostic measures and other standardized rating scales.

Procedure

Design. The study included a within-subject, balanced-placebo design with daily crossovers among conditions. Following a 2-week medication-free baseline in the STP, each boy received either placebo or 0.3 mg MPH/kg of body weight/dose (b.i.d.) each Monday through Thursday of a 6-week, clinical medication assessment. Boys were told each day that they had received either a real pill or a fake pill. Drug condition was crossed with expectancy: On half of the days, staff members gave the boys accurate information regarding their medication, and on half of the days the information was false. Four within-subject Drug × Expectancy conditions were thus produced: (a) received placebo, told fake pill; (b) received placebo, told real pill; (c) received medication, told fake pill; and (d) received medication, told real pill. Each condition occurred within each week, with the order of the conditions randomized on a daily basis. Thus, each child had approximately 6 days of data in each of the four Drug × Expectancy conditions, with absences accounting for reductions from the planned number of days per condition.

Setting. From 8:00 a.m. until 5:00 p.m. on weekdays, boys attending the STP participated in the following activities: two academic classes and an art class, three group recreational activities (e.g., softball), swimming, lunch, and recess. Children were placed in groups of 12, grouped by age. The boys in this study were distributed across five groups in 1991 and across seven groups in 1992–1994. A lead counselor supervisor and four undergraduate counselors (outside of the classroom) and a teacher and aide (in the classroom) implemented a behavioral point system, in which children earned points for appropriate behavior and lost points for inappropriate behavior. Staff members gave behavioral feedback continually, and children exchanged points earned for backup reinforcers including privileges and honors. During the class period, children worked on assignments individualized according to skill levels; independent observers recorded disruptive behavior and on-task behavior (Atkins, Pelham, & Licht, 1988; Pelham et al., 1993).

The first 2 weeks of the program served as a period of baseline observation and adaptation for the children and staff members, and medication assessments were conducted during the last 6 weeks of the program. Children participated in special activities on Fridays, which were therefore not included in the medication assessment. A more extensive description of the STP is available elsewhere (Carlson, Pelham, Milich, & Dixon, 1992; Pelham, Greiner, & Gnagy, 1997; Pelham & Hoza, 1996; Pelham et al., 1993, 1996).

Medication procedure. Our medication assessment procedure has been described in detail elsewhere (e.g., Pelham & Hoza, 1987; Pelham et al., 1990; Pelham & Smith, 2000). The 0.3 mg/kg MPH dosages were calculated to the nearest 1.25 mg. The average dose administered was 10 mg b.i.d. ($SD = 2.7$), with doses ranging from 6.25 mg b.i.d. to 17.5 mg b.i.d. Active medication and placebo were disguised in opaque gelatin capsules. Program staff members administered medication upon the children's arrival to the program and at midday (7:45 a.m. and 11:45 a.m.). The

[1] Each participant also completed two laboratory tasks (one social and one cognitive) in four sessions, always conducted in the same Drug × Expectancy condition (Pelham, Hoza, et al., 2000; Pelham, Hoza, et al., 1997; Pelham et al., 2001).

Table 1
Means and Standard Deviations for Participant Characteristics

Item	Experiment 1		Experiment 2	
	M	*SD*	*M*	*SD*
Age in years	9.7	1.2	9.7	1.2
Full-scale IQ[a]	104.5	14.2	104.8	14.0
Woodcock–Johnson Reading[b]	105.8	14.0	105.6	13.7
Woodcock–Johnson Arithmetic[b]	108.7	14.8	109.1	14.2
Woodcock–Johnson Written Language[b]	94.1	12.0	94.1	12.5
DSM–III–R ADHD items endorsed in a parent structured interview	11.3	2.7	11.5	2.4
DSM–III–R ODD items endorsed in a parent structured interview	5.4	2.6	5.4	2.5
DSM–III–R CD items endorsed in a parent structured interview	1.2	1.2	1.2	1.2
Abbreviated Conners Rating Scale—Parent[c]	20.1	5.4	20.3	5.3
Abbreviated Conners Rating Scale—Teacher[c]	18.4	6.3	18.6	6.2
IOWA Conners Teacher Rating Scale Inattention–Overactivity[d]	10.6	2.9	10.7	2.8
IOWA Conners Teacher Rating Scale Oppositional–Defiant[d]	6.7	4.7	6.9	4.7
Disruptive Behavior Disorders Parent Rating Scale[e]				
ADHD	1.9	0.5	1.9	0.5
ODD	1.6	0.7	1.6	0.7
CD	0.4	0.3	0.4	0.3
Disruptive Behavior Disorders Teacher Rating Scale[e]				
ADHD	1.8	0.7	1.8	0.6
ODD	1.3	0.8	1.3	0.7

Note. For Experiment 1, $N = 136$; for Experiment 2 (a subset of Experiment 1), $N = 110$. *DSM–III–R* = *Diagnostic and Statistical Manual of Mental Disorders* (3rd. ed., rev.); ADHD = attention-deficit/hyperactivity disorder; ODD = oppositional defiant disorder; CD = conduct disorder.
[a] Wechsler Intelligence Scale for Children—Revised (Wechsler, 1974). [b] Woodcock–Johnson Psychoeducational Battery (Woodcock & Johnson, 1977). [c] Goyette, Conners, and Ulrich (1978). [d] Loney and Milich (1982); Pelham, Milich, Murphy, and Murphy (1989). [e] Pelham, Gnagy, Greenslade, and Milich (1992).

expectancy and medication conditions remained the same for both daily doses of medication.

After the child ingested the pill, a staff member who did not interact clinically with the child told the child whether the pill was real or fake. The staff member then asked the child to point to the correct response on a card on which *real* and *fake* were written, to verify that the child had attended to the expectancy information. After verifying the expectancy condition each morning, the staff member asked the boy to predict, on a scale of 1 (*very poorly*) to 10 (*very well*), how well he would do in meeting his behavioral goals for the day.

As a manipulation check, boys were asked to recall what kind of pill they had received four times throughout the day: immediately after taking morning and midday pills and immediately before the administration of the twice-daily attribution questionnaires (described below). Children correctly recalled the expectancy condition an average of 99% of the time (range = 91%–100%).

Prior to the beginning of the study, the medication assessments were discussed with the children. Children were informed that on some days they would be receiving fake pills to make sure that the medication really helped them, and they were informed that they would be told what type of medication they received. They were not informed that they would be given incorrect information on half of the days.[2] Staff members who administered the pill and informed the children of expectancy conditions were provided with a daily list of conditions to tell the children but were not aware of the individual children's daily medication conditions. Counselors, classroom staff members, and parents knew that the children were undergoing medication assessments but were blind to the children's daily expectancy and medication conditions.

Daily report cards. Each day, the children received feedback regarding individualized target behaviors in each of four domains: classroom behavior (e.g., following rules), classroom performance (e.g., completing assignments accurately), counselor-directed behavior (e.g., noncompliance, verbal abuse), and peer-directed behavior outside of the classroom (e.g., teasing). The mechanism for providing feedback to the children and to their parents and for defining the outcome independent variable (naturally occurring success and failure) was a daily report card (DRC; Pelham, Murphy, et al., 1992; Pelham et al., 1996). Staff members developed individualized target behaviors depending on a child's presenting symptoms determined at intake and by his behavior and performance in the STP. Target behavior criteria (i.e., for the child to earn a "yes" mark on the report card) were adjusted during the summer as necessitated by children's progress to maintain a consistent level of challenge. DRCs were reviewed first with children and then with children and their parents at the end of the day, and parents provided positive consequences at home when children reached their daily goals. Children could earn a "yes" or "no" mark for each of the four domains individually.

Questionnaire procedures. After receiving their DRCs, participants made attributions for their success or failure in each of the four domains. Attributions for the two classroom domains were assessed immediately

[2] The University of Pittsburgh Biomedical Institutional Review Board approved the investigation, and all parents provided consent; children also provided assent. Deception was used in the feedback regarding drug state because there was no other way to conduct the balanced-placebo design. Parents were given a choice whether to have their child debriefed regarding the deception at the end of the study. Very few parents elected this option. Of course, all children were informed by their parents regarding the results of the clinical medication assessment, as it influenced their subsequent medication regimens.

following the classroom period, and attributions for the adult- and peer-directed behavior domains were assessed when children received their DRCs at the end of the day. Prior to the administration of the attribution questions, the staff member who told the child what kind of pill he had received in the morning asked the child to recall whether he had received a real or fake pill that day. If the child responded incorrectly, which happened only 1% of the time, the staff member repeated the condition and asked the child to confirm the condition.

After the child confirmed his expectancy condition, a different research assistant, who did not interact clinically with the child and who was unaware of the child's medication condition and the expectancy manipulation, administered the questionnaire. He or she read the following instructions: "I am going to ask you some questions about your day. This is not a test, so there are no right or wrong answers. I just want to know how you felt about your day." After ensuring that the participant understood the format of the questionnaire and the instructions, and ensuring confidentiality of the child's responses, the research assistant administered the questionnaire.

For each report card domain, the research assistant told the child whether he got a "yes" or "no" and read a set of Likert-scale questions to the child. These questions asked the child to rate the degree to which each of five attribution categories was responsible for his success or failure in that domain: ability, task difficulty, effort, the degree to which the pill helped, and fair treatment by teachers or counselors (or in the peer domain, how nice other children were). The scale for these questions ranged from 1 (*really true*) to 10 (*not true at all*).[3]

Dependent Measures

Prediction of success. Daily morning predictions of success in meeting behavioral goals were used to assess whether the expectancy condition influenced the boys' beliefs about how successful they would be during the day. Because medication had not yet taken effect when the boys answered this question, answers were averaged over expectancy condition only.

Counselor-recorded behavioral measures. Throughout the day, counselors recorded the frequencies with which the children exhibited the behaviors targeted by the point system (Pelham, Greiner, & Gnagy, 1997; Pelham & Hoza, 1996), and these records were summed over the day. Seven point system categories were used as dependent measures: (a) percentage following activity rules, (b) noncompliance, (c) interrupting, (d) complaining, (e) positive peer behaviors (helping, sharing, and ignoring provocations), (f) conduct problems (lying, stealing, destruction of property, and aggression), and (g) negative verbalizations (verbal abuse to staff, teasing peers, and swearing). Each measure was averaged across the 6 days of each child's four drug–expectancy conditions.

Independent observers collected reliability data by watching 25% of the children in a group for an entire day, independently classifying and recording point system behaviors for those children. Observations were sampled across groups and days, for approximately 20% of the available observations. Kappa statistics were calculated for following activity rules, which was recorded in fixed intervals. Reliabilities for the other behavioral categories were determined by computing correlations between the counselors and the observer. Correlations averaged .82 across measures and years, and kappa averaged .75 across years.

Classroom measures. There were five dependent measures from the classroom setting: (a) following classroom rules, (b) observed on-task behavior, (c) observed disruptive behavior, (d) seatwork percentage completion (productivity), and (c) seatwork percentage correct (accuracy). The percentages of points that children kept from the classroom response–cost system served as the measure of rule-following behavior. The percentages of intervals during which children displayed on-task behavior and disruptive behavior were obtained from the classroom observation procedure described above. In addition, teachers recorded the numbers of problems completed and correct each day and computed percentages of assigned work completed and work completed correctly. As an estimate of the test–retest reliability of the following-rules and seatwork measures, scores on even and odd days of the program were correlated. This coefficient approximates a split-half coefficient because medication condition was randomly distributed across days. The resulting correlations, .87 for rule following, .76 for productivity, and .77 for accuracy, are conservative estimates because the scores are from different medication conditions. For the observation measures, reliability observations were conducted on approximately 20% of the classroom periods; average Kappa values for on-task behavior and disruptive behavior, respectively, were .79 and .77.

Counselor and teacher ratings. At the end of each day, counselors and teachers rated each child on the IOWA Conners Rating Scale (Loney & Milich, 1982; Pelham, Milich, Murphy, & Murphy, 1989). The Inattention/Overactivity (I/O) and Oppositional/Defiant (O/D) scores were used as standardized measures of children's daily behavior.

DRCs. Each day, counselors and teachers evaluated the children's target behavior criteria and assigned "yes" or "no" marks for each of the four DRC domains. Children could earn a yes or no mark for each of the four domains individually. The percentages of yes marks earned were used both as dependent measures of medication and expectancy effects, and to determine outcome prior to asking children the attribution measures.

Attribution measures. Participants provided attributions each day of the assessment, or approximately 6 days for each of the Drug × Expectancy conditions. Because report card results were dependent on the child's behavior, however, the number of observations in any one cell of the complete 2 (drug) × 2 (expectancy) × 2 (DRC outcome) design could range from 0 to 6 for any of the domains. To minimize missing data because of unbalanced cells (i.e., children who did not have both positive and negative marks in a domain for all four Drug × Expectancy conditions), we averaged the participants' attributions across the four domains—classroom behavior, classroom work, adult-directed behavior, and peer-directed behavior—for each Drug × Expectancy × Outcome condition and analyzed the resulting averages.

Baseline measures. Prior to the beginning of the study, participants completed a battery of questionnaires assessing cognitive–motivational factors. Several of these measures were used to examine individual differences in children's attributions in this investigation, including the Children's Attributional Style Questionnaire (CASQ; Kaslow, Tanenbaum, & Seligman, 1978), the Children's Depression Inventory (CDI; Kovacs & Beck, 1977), and the Self-Perception Profile for Children (SPPC; Harter, 1985). The CASQ is a measure of children's attributional styles for both good and bad outcomes. A composite score is obtained across dimensions; higher composite scores represent more adaptive attributional styles. The CDI is a self-report measure of depressive symptomatology with higher scores indicating greater depression. The SPPC measures self-perceptions of competence in five specific domains and global self-worth, with higher scores indicating greater self-esteem. For this investigation, only global self-worth scores were used, because boys' attributions were combined across domains.

Results

Overview

Analyses were conducted to assess the effects of medication and expectancy on the boys' behavior and attributions. First, we analyzed the effects of expectancy condition on the boys' predictions for daily success. The effects of drug and expectancy were then examined in 2 × 2 multivariate analyses of variance for the

[3] Participants also rank-ordered each of the attributions in order from most important to least important. Because the results of the rankings were analogous to the rating measures, only the rating measures are presented herein for the sake of brevity.

counselor-recorded behavioral measures, the classroom measures, and the counselor and teacher ratings. We computed effect sizes for all analyses by dividing the difference between the treatment and placebo means by the placebo standard deviation (e.g., Pelham et al., 1993). Two methods were used to evaluate the effects of medication and expectancy on the boys' individualized daily report cards: analysis of variance (ANOVA) on the percentages of positive marks earned in each domain and analysis of odds ratios, or the likelihood that the boys would receive positive marks on medication compared with placebo. For the attribution measures, drug and expectancy were crossed with daily-report outcome to examine the participants' attributions for naturally occurring success and failure. Finally, we performed a series of analyses to examine the effects of age, comorbid symptomatology, baseline characteristics, and other individual differences by adding those factors to the previous analyses.

Prediction of Success

To examine the effects of expectancy on boys' predictions of how well they would do on their daily target behaviors, a repeated-measures ANOVA (with the statistical package BMDP 2V) was conducted, with expectancy (told fake, told real) as the independent variable. Expectancy produced a significant effect, $F(1, 135) = 15.67$, $p < .01$. Boys predicted greater success when they were told the pill was real ($M = 8.4$, $SD = 1.9$) than when they were told it was fake ($M = 8.0$, $SD = 2.1$).

Behavioral Measures

Separate 2 (drug: placebo, 0.3 mg/kg MPH) × 2 (expectancy) multivariate analyses of variance (MANOVAs; BMDP 4V) were conducted for (a) counselor-recorded behavioral measures, (b) classroom measures, and (c) counselor and teacher ratings. The MANOVAs showed significant multivariate effects of drug on the counselor-recorded behavioral measures, $F(8, 128) = 31.77$, $p < .01$; the classroom measures, $F(6, 129) = 30.05$, $p < .01$; and the ratings, $F(12, 122) = 15.81$, $p < .01$. In all three analyses, there were no effects of expectancy or interactions (Fs < 1). Means, standard deviations, effect sizes, and univariate results for the effect of drug are presented in Table 2.

Daily Report Cards

Drug and expectancy effects on children's daily report cards were examined in two ways.[4] First, the percentage of days in each Drug × Expectancy condition on which each boy received a yes in each domain was computed, and these percentages were used as dependent measures in separate 2 (drug) × 2 (expectancy) ANOVAs. Separate analyses were performed for each DRC domain, because not all boys had targets in every domain. Results showed significant drug effects for all four domains and no effects of expectancy or the interaction. Means, standard deviations, and ANOVA results for the drug effect are presented in Table 2.

Second, the data for each child were arranged in a series of 2 × 2 matrices, crossing drug with outcome (positive or negative report). Each of the four DRC domains was assessed independently. From these matrices, the proportion of days on which the participants received a positive outcome was then calculated for both placebo and medication days. This information was then summarized as an odds ratio for each child (i.e., the likelihood that a child would receive a positive report card on medication compared with placebo). The same procedure was conducted to cross expectancy with outcome. Because the frequency of each outcome in each drug condition differed across children, the Mantel–Haenszel procedure (BMDP 4F) was used to combine data across the 136 sets of individual Drug × Outcome (or Expectancy × Outcome) matrices and to compute combined odds ratios. The common odds ratios for the effect of drug, each of which is significantly greater than 1 (where 1 is the expected value under the null hypothesis) are shown in Table 3. Thus, in all domains, participants were significantly more likely to receive a positive report card when they were medicated than when they received placebo. The values of the homogeneity chi-squares indicate that the odds ratios were different across children for all four domains. There were no significant effects of expectancy (all odds ratios < 1.1).

Attribution Measures

The relationship between medication, expectancy, and report card outcome was examined using a repeated measures, 2 (drug) × 2 (expectancy) × 2 (outcome: positive report card, negative report card) MANOVA on participants' rating data collapsed over days within condition.[5] Table 4 presents marginal and cell means, standard deviations, and significance levels for individual dimensions. As noted in Table 4, lower scores indicate a "more true" endorsement. The analysis produced a significant multivariate main effect of outcome, $F(5, 120) = 135.99$, $p < .01$, with large effect sizes (ES, failure M − success M/success SD) for attributions to the task (1.09), effort (4.8), ability (3.8), and fair treatment (2.05) and a moderate ES for the pill (0.36)—much smaller relative to the other dimensions. There was also a significant multivariate main effect of drug, $F(5, 120) = 7.75$, $p < .01$. Expectancy did not produce a multivariate main effect ($F = 2.03$).

The multivariate main effects were qualified by a Drug × Outcome interaction, $F(5, 120) = 10.16$, $p < .01$, and an Expectancy × Outcome interaction, $F(5, 120) = 11.22$, $p < .01$. We followed up these interactions by performing simple effects analyses on each interaction, examining the effects of (a) drug and (b) expectancy for each level of outcome (Table 4).

Simple effects tests of the Drug × Outcome interaction revealed that the effect of drug was only significant in the negative report card condition, $F(5, 120) = 10.33$, $p < .01$ (F for positive report card < 1). Examination of the means in Table 4 shows that when they failed to meet their behavioral criteria, boys reported that it was slightly more true that their effort, ability, and unfair treatment were responsible for their outcome when they received placebo

[4] As part of the ongoing clinical treatment, many children had target behaviors on the daily report cards that were not designed or expected to be responsive to the medication manipulation because they were evaluated before medication took effect or after it wore off (e.g., "greets counselor appropriately upon arrival in the morning"). These target behaviors were eliminated from the analyses.

[5] Eleven cases were eliminated from this analysis because the boys did not have both positive and negative outcomes in each of the Drug × Expectancy cells.

Table 2
Means (and Standard Deviations) and ANOVA Results for Drug Effect on Behavioral Measures in Experiment 1

Measure	Placebo	Drug	*F*	*p*<	ES
Counselor-recorded behavioral measures[a]					
Percentage following activity rules	69.4 (15.3)	80.7 (11.0)	226.75	.01	0.79
Noncompliance	3.1 (4.8)	1.0 (1.5)	42.77	.01	0.58
Interruption	8.6 (14.0)	2.9 (4.7)	39.21	.01	0.45
Complaining	4.9 (8.7)	1.5 (2.7)	36.78	.01	0.42
Positive peer behaviors	7.5 (5.4)	7.4 (5.9)	0.11	*ns*	0.07
Conduct problems	1.4 (3.0)	0.3 (0.9)	29.58	.01	0.60
Negative verbalizations	14.3 (28.1)	2.9 (5.5)	32.73	.01	0.61
Percentage of attention questions correct	76.0 (12.0)	80.3 (10.7)	34.63	.01	0.38
Counselor ratings[b]					
IOWA Conners Inattention/Overactivity rating	4.4 (2.3)	3.0 (1.4)	131.22	.01	0.61
IOWA Conners Oppositional/Defiant rating	3.3 (2.8)	1.7 (1.3)	91.57	.01	0.57
Classroom measures[c]					
Percentage following classroom rules	75.2 (31.4)	95.2 (23.7)	93.00	.01	0.64
Percentage disruptive behavior	8.9 (20.7)	4.9 (22.4)	5.93	.03	0.19
Percentage on-task behavior	82.6 (23.8)	92.9 (22.7)	45.05	.01	0.43
Percentage seatwork completion	67.5 (25.0)	84.8 (25.6)	118.26	.01	0.69
Percentage seatwork accuracy	87.0 (16.3)	92.0 (21.4)	16.05	.01	0.31
Teacher ratings[b]					
IOWA Conners Inattention/Overactivity rating	3.5 (2.9)	1.8 (1.7)	107.01	.01	0.59
IOWA Conners Oppositional/Defiant rating	1.9 (2.7)	0.5 (1.1)	52.92	.01	0.52
Daily report card percentage of days positive					
Classroom behavior[d]	70.0 (30.4)	92.8 (14.2)	121.77	.01	0.75
Classroom work[e]	48.3 (25.3)	69.8 (22.1)	155.97	.01	0.85
Getting along with peers[f]	52.1 (32.1)	83.3 (20.8)	87.23	.01	0.97
Getting along with counselors[g]	52.4 (32.2)	82.4 (20.6)	118.41	.01	0.93

Note. ES = effect size: (placebo *M* − drug *M*)/placebo *SD*. Transformed data were used to compute ES. ANOVA = analysis of variance.
[a] *df*s = 1, 135. [b] Loney and Milich (1982); Pelham et al. (1989). *df*s = 1, 133. [c] *df*s = 1, 134 (1 participant was eliminated from the analysis because of differing classroom content). [d] *df*s = 1, 123 (12 participants were eliminated because they did not have classroom behavior targets). [e] *df*s = 1, 134 (1 boy did not have a target in this domain). [f] *df*s = 1, 72 (63 boys did not have a target in this domain). [g] *df*s = 1, 105 (30 boys did not have a target in this domain).

than when they received medication. Effect sizes were in the small-to-moderate range; 0.12 for ability, 0.28 for fairness, and 0.34 for effort.

Simple effects tests of the Expectancy × Outcome interaction showed that the effect of expectancy was significant for both negative outcome, $F(5, 120) = 8.21$, $p < .01$, and positive outcome, $F(5, 120) = 9.79$, $p < .01$. Examination of the means in Table 4 shows that on positive days, boys were slightly more likely to say the task was easy (ES = 0.10) and less likely to say the pill helped them (ES = 0.46) when they were told the pill was fake than when they were told it was real. On negative days, boys were more likely to say the pill did *not* help them (ES = 0.38) and less likely to blame their ability (ES = 0.08) when they were told the pill was fake.

As illustrated in Table 4, regardless of drug or expectancy, boys gave weaker success endorsements to the pill than to any other category. The boys did not make any strong attributions for failure—their attributions to the external dimensions of task difficulty and the pill were only moderately endorsed, whereas failure attributions for internal factors were strongly denied.

Individual Differences

To determine whether the participants varied in their response to medication and their expectancies regarding medication, we conducted a series of analyses with several grouping factors. Only effects where individual-difference factors interacted with medication or expectancy, or affected attributions to the pill, are presented here.

Age and codiagnosis. First, age and codiagnosis of ODD or CD were examined for all measures to determine the effects of those factors. A median split was performed on the boys' ages (*Mdn* = 9.42). Regarding *behavioral* measures, the only interaction involving age or diagnosis was a Drug × Diagnosis interaction on one domain of the DRC, counselors: $F(2, 129) = 7.28$, $p < .01$. This interaction showed that, as would be expected, boys with comorbid ODD/CD had worse placebo rates of getting along with adults. Drug produced significant improvement in all three groups: for placebo, *M*s (*SD*s) = 60 (36), 55 (30), and 43 (34) for ADHD, ADHD/ODD, and ADHD/CD, respectively; for MPH, *M*s (*SD*s) = 79 (19), 83 (22), and 85 (20). Age did not produce any

Table 3
Odds Ratios for Medication Effects on Behavioral Outcome on Daily Report Card in Experiment 1

Domain	Common odds ratio (df = 135)	95% confidence interval	$p<$	Homogeneity test $\chi^2(135, N = 136)$	p
Classroom behavior	4.58	3.36–5.46	.01	87.95	.9994
Classroom work	2.41	1.97–2.73	.01	110.73	.9376
Getting along with peers	4.32	3.22–5.50	.01	81.78	.9999
Getting along with counselors	4.00	2.95–4.58	.01	133.26	.5263

Note. The odds ratio indicates the likelihood that the child would receive a positive mark on the daily report card if he or she received medication versus a placebo.

interactions, and neither factor interacted with drug or expectancy on the attributional measures.

Baseline measures. In three separate analyses, the attribution measures were then examined as a function of (a) the boys' baseline attributional styles as measured by the CASQ, (b) SPPC global self-worth, and (c) CDI scores. Median splits were used to group the children on these measures (*Mdn*s = 4 for CASQ, 3.42 for SPPC, and 7 for CDI). None of the three factors interacted with drug or expectancy, and none affected boys' attributions to the pill.

Pill attribution grouping. Pelham, Murphy, et al. (1992) grouped participants according to their relative attributions to the pill for success. We sought to replicate those findings in the current sample. To group the participants, we used rank-order data that were collected at the same time as the ratings data. We computed the percentage of times that each boy ranked the pill as the most important reason for success and grouped the participants according to the most extreme quartiles. Of the 136 boys, 25% ranked the pill as the number one reason for success more than 20% of the time; these boys formed the high pill attribution for success (HPA) group. Forty-six percent of the boys never chose the pill as the most important reason for success; these boys formed the low pill attribution for success (LPA) group.

First, the HPA–LPA grouping factor was used to examine whether children who attribute success to an external factor also attributed failure to internal factors. A Drug × Expectancy × Pill Attribution (HPA, LPA) MANOVA was thus performed on the children's ratings for negative outcomes. The results showed a significant multivariate main effect of pill attribution, $F(5, 177) = 3.64$, $p < .01$. This effect was significant only for the pill dimension, $F(1, 121) = 14.68$, $p < .01$; HPA boys blamed the pill for failure less ($M = 7.0$, $SD = 2.6$) than LPA boys ($M = 5.2$, $SD = 2.8$). Pill attributions did not affect any of the other explanations (Fs < 2.5), indicating that boys who made pill attributions for success were *not* more likely to make internal attributions for failure than boys who did not make pill attributions for success. Next, counselor-recorded behavioral measures and classroom measures were analyzed as a function of pill attributions for success in Expectancy × Pill Attribution MANOVAs. Only placebo days were included in this analysis, because our interest was in how attributions might affect children's *unmedicated* behavior. Pill

Table 4
Means (and Standard Deviations) for Attribution Ratings in Experiment 1

Variable	Task difficulty	Effort	Ability	Pill	Fairness
			Positive outcome		
Overall	3.1 (2.1)[a]	1.8 (1.2)[a]	2.2 (1.3)[a]	4.6 (3.0)[a]	2.8 (1.9)[a]
Drug					
Placebo	3.1 (2.1)	1.9 (1.2)	2.3 (1.4)	4.6 (3.0)	2.8 (1.9)
MPH	3.1 (2.1)	1.8 (1.1)	2.2 (1.2)	4.6 (3.0)	2.8 (1.9)
Expectancy					
Fake	3.0 (2.0)[c]	1.8 (1.2)	2.2 (1.2)	5.3 (3.1)[c]	2.8 (1.9)
Real	3.2 (2.1)	1.8 (1.1)	2.2 (1.3)	4.0 (2.8)	2.8 (1.9)
			Negative outcome		
Overall	5.4 (2.6)[a]	7.6 (2.4)[a]	7.2 (2.5)[a]	5.7 (2.9)[a]	6.7 (2.7)[a]
Drug					
Placebo	5.3 (2.5)	7.2 (2.3)[b]	7.1 (2.4)[b]	5.6 (2.7)	6.3 (2.5)[b]
MPH	5.4 (2.8)	8.0 (2.4)	7.4 (2.5)	5.8 (3.0)	7.0 (2.7)
Expectancy					
Fake	5.4 (2.7)	7.7 (2.4)	7.3 (2.5)[c]	5.1 (2.9)[c]	6.7 (2.7)
Real	5.3 (2.6)	7.5 (2.4)	7.1 (2.5)	6.2 (2.7)	6.7 (2.6)

Note. Scores could range from 1 (*really true*) to 10 (*not true at all*). Scores were averaged across daily report card domains and days within each condition. MPH = methylphenidate.
[a] Significant ($p < .01$) main effect of outcome. [b] Significant ($p < .05$) simple effect of drug. [c] Significant ($p < .05$) simple effect of expectancy.

attributions had no effects on the children's behavior and did not interact with expectancy (Fs < 2.0). These a priori analyses thus failed to replicate our previous post hoc results.

Clinical Recommendations

At the end of the STP medication assessments, a team of medical, research, and clinical staff members discussed each boy's data and response to medication on the dependent measures that were most clinically salient for the boy. The team made recommendations for post-STP treatment on the basis of those meetings. The team recommended continuing medication for 87 boys (64%) and recommended that the remaining 49 (36%) continue to receive behavioral treatment with the addition of medication only if the behavioral treatment provided in school and home was insufficient. None of the boys were judged to have severe adverse side effects of medication such that medication was not recommended.

Discussion

Results showed that a low dose of MPH (0.3 mg/kg/dose) improved boys' behavior in a summer treatment program and made them far more likely to meet daily behavioral goals compared with placebo. Expectancy regarding medication influenced boys' predictions for daily success but had no effects on the boys' behavior. Boys made much stronger internal attributions than external attributions for success, and they strongly denied internal causes as explanations for failure. In general, the effects of and attributions for medication did not differ according to individual difference factors.

MPH significantly improved children's behavior on almost all of the measures taken in recreational and classroom settings, as well as on children's individualized target behaviors contained in the daily report card, replicating our previous studies in the STP setting (e.g., Pelham et al., 1985, 1990, 1993; Pelham, Aronoff, et al., 1999; Pelham, Gnagy, et al., 1999). Others have reported similar findings in other settings (Hinshaw, Heller, & McHale, 1992; Rapport, Stoner, DuPaul, Birmingham, & Tucker, 1985). The odds ratios reported in Table 3 show that the boys were two to four times more likely to reach their individualized daily goals on their DRCs—the target behaviors that were most clinically important for each child—when medicated than when they received placebo. These results support previous arguments that combined treatments are more efficacious for children with ADHD than are behavioral treatments alone, as the placebo condition in this study corresponds to behavioral treatment alone (Pelham et al., 1993).

In contrast to medication, expectancy did not affect the boys' behavior on any of the large number of measures of functioning. In our balanced-placebo reports involving persistence on social and cognitive laboratory tasks (Pelham, Hoza, et al., 1997, 2000; Pelham et al., 2001), we found a similar lack of expectancy effects on children's persistence in the face of failure; the current results extend these findings to a nonlaboratory setting.

With regard to participants' attributions, the results of the current investigation parallel those of the Pelham, Murphy, et al. (1992) study in the STP context, as well as our controlled laboratory investigations (Pelham, Hoza, et al., 1997, 2000; Pelham et al., 2001). Overwhelmingly, participants attributed their success to their own efforts and ability (mean scores of 1.8 and 2.2 on a 10-point scale) versus external factors (mean scores for pill, for example, of 4.6 on the 10-point scale). They strongly denied that they were responsible for their failures (ratings of 7.2 and 7.6) and did not strongly state that any explanation was responsible for their failure. Thus, the children exhibited an overall positive illusory attributional pattern (Alloy & Abramson, 1988; Snyder & Higgins, 1988; Taylor & Brown, 1988).

We found virtually no differences among the children with regard to age, diagnosis, baseline attributional style, self-esteem, or attributions to the pill. Using the HPA–LPA pill-attribution grouping in a priori analyses did not replicate the post hoc findings of Pelham, Murphy, et al. (1992). One factor that may have influenced the 1992 study findings is that task difficulty was not included as an attributional category; it is possible that the previous subgroup of boys attributed failure to internal causes because of a lack of alternative external attributions. Further, the sample size in that study was only 17 for the HPA–LPA grouping, versus the 123 in the current HPA–LPA analysis. Our failure to replicate our previous post hoc HPA–LPA effect, as well as the absence of findings related to pill attributions on the measures of cognition and affect given *at baseline*, highlight the need for replication of post hoc results, particularly with regard to individual differences.

Experiment 2

The efficacy of medication and behavior therapy for children with ADHD has been well established in assessments conducted in controlled environments (e.g., STP, as described in Experiment 1). However, no studies to date have examined the generalizability of the results to children's regular classrooms. In addition, no study has examined expectancy effects outside of an STP in which an intensive behavioral intervention is in effect. It is possible that our results showing a lack of dysfunctional attributions are a function of conducting the studies in a therapeutic context that is designed explicitly to encourage effort and maximize success while minimizing failure (Pelham, Murphy, et al., 1992). To examine these issues, we conducted a follow-up assessment on the children described in Experiment 1 in their regular school settings during the school year that followed their participation in the STP. Because most classrooms are much less structured than the STP, we hypothesized that the children's response to medication would be at least as positive, and perhaps more positive, in their classrooms as it was in the acute trial in the STP. We predicted that children's attributions were not unduly influenced by the background behavioral treatments in the STP and would remain stable.

Method

Participants

Participants were 110 of the 136 boys described in Experiment 1 (see Table 1 for participant characteristics). Parents of 15 boys did not agree to their son's participation in the follow-up assessment because they did not want to withhold their child's medication on placebo days of the assessment; 3 other parents declined for other reasons. Another 3 schools declined to participate in the follow-up study, and 1 boy declined to participate. Finally, 4 boys began the follow-up assessment but their parents stopped the assessment prematurely because the boys were doing poorly in school when they were not medicated. For feasibility and cost

reasons, half of the boys completed the assessment during the fall and half during the spring of the year following their STP participation. The sample of 110 did not differ significantly from the 136 boys in Experiment 1 (Table 1).

Procedure

Beyond the medication procedures and the daily report card procedures described below, no modifications were made to the children's regular environments. Eighty-seven (79%) of the boys were in regular education settings, 5 were in full-time special education classrooms, and 17 were placed in regular education classrooms with part-time (pull out) services for special education. One boy attended an approved private school that provided intensive day treatment.

Medication procedure. For 30 days during the school year, participants received the same type of medication assessment described in Experiment 1. Children received the same dose that was used in Experiment 1 with the exception of one boy whose weight changed between the summer and the school-year follow-up; his 0.3 mg/kg dose was recalculated. Parents administered morning medication, and school personnel administered midday doses. After administering the morning pill, each boy's parent told him whether he had received a real or fake pill and asked him to recall the kind of pill he received. Parents were provided with schedules that informed them what to tell their child each day. Parents were aware that this information was false half of the time but were unaware of the actual medication conditions each day. Study staff members asked the boys to recall their pill conditions before administering afternoon questionnaires by telephone. In contrast to Experiment 1, children were not reminded of their pill condition after their midday dose in order to keep school personnel uninformed of the nature of the expectancy manipulation.

Classroom measures. Children's behavior and academic performance were tracked using a DRC, the format of which was identical to that used in Experiment 1. A clinical study staff member met with each child's teacher to establish target behaviors for the DRC. Target behaviors and criteria for success were individualized based on the child's primary problems at school as determined by his teacher. Clinicians made weekly school visits to collect data, discussed report card criteria with teachers, and made necessary modifications to DRC criteria to maintain a consistent level of challenge for each child (K. D. O'Leary, Pelham, Rosenbaum, & Price, 1976; S. G. O'Leary & Pelham, 1978; Pelham, Schnedler, Bologna, & Contreras, 1980).

Teachers, who were blind to medication condition, recorded positive or negative outcomes on the DRC each day. In addition, teachers completed daily the IOWA Conners Teacher Rating Scale and completed items assessing (a) how well the child behaved in class, (b) how well the child did his schoolwork, (c) how well the child got along with peers, and (d) how well the child got along with and listened to the teacher (i.e., the same as the four DRC domains). At the end of each school day, research assistants conducted brief telephone interviews with each child's teacher, during which the teacher provided the results of the DRC and ratings.

Questionnaire procedures. After each boy arrived home from school, two research assistants contacted him by telephone. One asked the child to recall the kind of pill he had received that morning and reminded him of the condition if he had forgotten. The boys remembered the expectancy condition an average of 83% of the time (range = 46%–100%). A second research assistant then administered the same attribution questionnaire used in Experiment 1. The research assistant who administered the questionnaire was not informed of the child's medication or expectancy condition for the day. The administration procedures were identical to those completed in Experiment 1, with the exception that questions regarding all four domains of the DRC were asked at the end of the school day. Participants were provided with a copy of the rating scale to keep at home and to use while answering the questions. Dependent measures were the boys' average scores in each Drug × Expectancy × Outcome condition, as in Experiment 1.

Results

Behavioral Measures

Teacher ratings. Teacher ratings on the IOWA Conners were analyzed in a 2 (drug) × 2 (expectancy) MANOVA (see Table 5). Drug showed a significant multivariate main effect, $F(2, 106) = 107.28$, $p < .01$. There was no effect for expectancy or for the interaction of expectancy and drug (Fs < 0.5). A second 2 (drug) × 2 (expectancy) MANOVA on the global functioning ratings showed a significant multivariate main effect of drug, $F(4,$

Table 5
Means (and Standard Deviations) and ANOVA Results for Drug Effect on Behavioral Measures in Experiment 2

Measure	Placebo	Drug	F	$p<$	ES
IOWA Conners Inattention–Overactivity Subscale[a]	5.5 (3.5)	2.2 (2.0)	196.35	.01	0.94
IOWA Conners Oppositional–Defiant Subscale[a]	2.4 (3.4)	0.8 (1.8)	51.39	.01	0.47
Classroom behavior[b]	2.6 (1.6)	1.1 (1.0)	162.75	.01	0.94
Classroom performance[b]	2.5 (1.6)	1.3 (1.0)	138.87	.01	0.75
Getting along with peers[b]	2.2 (1.6)	1.2 (1.0)	96.84	.01	0.63
Getting along with the teacher[b]	2.4 (1.6)	1.0 (1.0)	132.69	.01	0.88
Daily report card percentage of days positive					
Classroom behavior[c]	41.1 (31.3)	76.8 (24.9)	160.67	.01	1.14
Classroom work[d]	46.8 (32.3)	74.7 (26.6)	161.57	.01	0.86
Getting along with peers[e]	54.0 (33.8)	83.9 (22.0)	81.22	.01	0.88
Getting along with teachers[f]	43.9 (34.6)	76.7 (26.1)	97.51	.01	0.95

Note. ES = effect size: (placebo M − drug M)/placebo SD; ANOVA = analysis of variance.
[a] Loney and Milich (1982); Pelham et al. (1989). dfs = 1, 107 (2 teachers did not complete daily ratings). [b] Ratings were made on a scale of 0 (*very well*) to 6 (*very poorly*). dfs = 1, 96. [c] dfs = 1, 99 (10 cases were excluded because they did not have target behaviors). [d] dfs = 1, 108 (1 case was excluded). [e] dfs = 1, 72 (41 cases were excluded). [f] dfs = 1, 75 (34 cases were excluded).

Table 6
Mantel–Haenszel Procedure Results for Medication Effects on Behavioral Outcome on Daily Report Card in Experiment 2

Domain	Common odds ratio (df = 109)	95% confidence interval	p	Homogeneity test χ^2(109, N = 110)	p
Classroom behavior	5.13	3.93–6.03	.01	141.11	.0244
Classroom work	4.08	3.21–4.77	.01	99.55	.7528
Getting along with peers	4.83	3.21–5.46	.01	82.98	.9999
Getting along with teachers	4.75	3.30–5.41	.01	217.94	.9908

Note. The odds ratio indicates the likelihood that the child would receive a positive mark on the daily report card if he or she received medication versus a placebo.

89) = 46.55, $p < .01$ (Table 5). There was no effect of expectancy and no interaction (Fs < 0.5).

Daily report cards. As in Experiment 1, percentages of days on which the boys received positive marks in each domain were first analyzed in a series of four Drug × Expectancy ANOVAs. Results showed significant drug effects for all four domains (see Table 5). Expectancy did not interact with drug. The only DRC domain on which expectancy had an effect was the peers domain, $F(1, 80) = 5.45$, $p = .02$. Boys earned slightly higher percentages of yes marks in the peers domain when they were told they received a real pill (M = 72%, SD = 32) than when they were told they received a fake pill (M = 68%, SD = 33), although the ES, 0.08, was very small. In addition, common odds ratios were calculated. The results again show that the boys were far more likely to have positive outcomes when they were medicated than when they received placebo (see Table 6). There were no effects of expectancy (odds ratios < 1.22).

Attribution Measures

As in Experiment 1, a 2 (drug) × 2 (expectancy) × 2 (outcome) MANOVA was performed on the children's attribution ratings, averaged across domains and across days (see Table 7).[6] A significant multivariate effect of outcome was found, $F(5, 75) = 80.52$, $p < .01$. As in Experiment 1, the boys made stronger attributions for success than for failure, with an ES of 1.16 for the task, 4.01 for effort, 4.0 for ability, 1.76 for fair treatment, and 0.42 for the pill. Neither drug nor expectancy produced significant multivariate main effects.

There was a significant multivariate Outcome × Drug interaction, $F(5, 75) = 2.72$, $p = .03$. Simple effects follow-up tests of the effect of drug showed an effect only for positive outcome. Table 7 shows that boys endorsed their effort more strongly for success when medicated than when they received placebo, with a small ES (0.13). A multivariate Outcome × Expectancy interaction also was produced, $F(5, 75) = 2.93$, $p = .02$. In simple effects follow-up tests, expectancy was significant only for positive outcome; boys said the pill helped them slightly more when they were told it was real than when they were told it was fake, with a small ES (0.19).

Clinical Recommendations

The clinical team meetings described in Experiment 1 were repeated following the school-based assessments conducted in Experiment 2 to make recommendations for continued treatment with medication. Twelve of the boys for whom medication was recommended only if behavioral treatment was insufficient after the STP (29%) were deemed to be positive responders to medication after the school-based medication assessment, and medication was recommended for their continued treatment. Conversely, for 5 of the boys for whom medication was recommended at the end of the summer (7%), the school-based assessment showed that the boys behaved sufficiently well with their daily report card in the regular classroom setting that medication was not necessary.

Discussion

The medication results were closely comparable to those conducted in the structured setting of the STP, and the few differences reflected larger effects of medication in the less-structured school setting. The absence of expectancy effects in Experiment 1 was replicated, as were the attributional findings.

On the behavioral measures, the positive effects of MPH were clearly evident in the participants' natural environment. Across domains, the results of the odds ratios and effect sizes show that the drug effects were slightly stronger in the school setting compared with the STP (see Tables 2, 3, 5, and 6). Children behaved more appropriately on placebo days in the STP than in their classrooms and therefore had less room for improvement with medication (see Tables 2 and 5). We interpret these differences as being due to the behavioral treatment program in the STP classroom, which is structured and staffed similarly to a special education classroom. The effect of the behavioral intervention in the STP—improved levels of functioning on placebo days—may lessen the incremental benefit of medication in that setting, a finding similar to the medication effect that Carlson et al. (1992) reported in a behavior-modification/no-behavior-modification crossover in the STP classroom. Indeed, we have shown that children who attend the STP steadily unmedicated for the entire summer show very few differences from children who attend the program steadily medicated during the summer (Pelham, Gnagy, et al., 2000), with a large percentage of ADHD children being normalized on classroom functioning in the STP without medication.

Of special interest is that as in Experiment 1, medication effects were clearly reflected in the children's success in reaching their

[6] Thirty-three cases were eliminated from this analysis because the boys did not have both positive and negative outcomes in each of the Drug × Expectancy cells.

Table 7
Means (and Standard Deviations) for Attribution Ratings in Experiment 2

Variable	Task difficulty	Effort	Ability	Pill	Fairness
			Positive outcome		
Overall	3.1 (2.3)[a]	1.9 (1.5)[a]	2.1 (1.4)[a]	4.8 (3.3)[a]	2.8 (2.1)[a]
Drug					
Placebo	3.1 (2.4)	2.0 (1.6)[b]	2.0 (1.5)	4.8 (3.3)	2.9 (2.2)
MPH	3.0 (2.2)	1.8 (1.4)	2.1 (1.4)	4.8 (3.3)	2.8 (2.1)
Expectancy					
Fake	3.1 (2.3)	1.9 (1.5)	2.1 (1.5)	5.3 (3.3)[c]	2.8 (2.1)
Real	3.1 (2.4)	1.9 (1.6)	2.0 (1.3)	4.2 (3.2)	2.8 (2.1)
			Negative outcome		
Overall	6.0 (2.9)	8.0 (2.5)	7.7 (2.5)	6.2 (3.1)	6.5 (2.9)
Drug					
Placebo	5.9 (2.8)	7.9 (2.4)	7.6 (2.4)	6.1 (2.9)	6.4 (2.8)
MPH	6.1 (3.1)	8.1 (2.6)	7.8 (2.7)	6.3 (3.3)	6.7 (3.1)
Expectancy					
Fake	6.1 (2.8)	8.1 (2.5)	7.7 (2.4)	5.9 (3.2)	6.5 (2.9)
Real	5.9 (3.1)	7.9 (2.6)	7.6 (2.6)	6.5 (3.0)	6.5 (3.0)

Note. Scores could range from 1 (*really true*) to 10 (*not true at all*). Scores were averaged across daily report card domains and days within each condition. MPH = methylphenidate.
[a] Significant ($p < .01$) main effect of outcome. [b] Significant ($p < .05$) simple effect of drug. [c] Significant ($p < .05$) simple effect of expectancy.

individualized target behaviors on their DRCs—an increase of four to five times in likelihood of success on medication days versus placebo days. We have long argued that relative to rating scales, objective measures of child behavior provide more ecologically valid evidence both for studying medication in children and for making clinical decisions regarding medication for children and adolescents (e.g., Evans et al., 2001; Pelham, Aronoff, et al., 1999; Pelham, Gnagy, et al., 1999; Pelham & Hoza, 1987; Pelham & Smith, 2000; Smith et al., 1998). However, it is often very difficult, if not impossible, to collect objective behavioral measures in regular classroom settings, with the result that clinicians and researchers typically rely on teacher ratings. However, teacher ratings are not uniquely tailored, include many items that do not apply to the individual child being evaluated, and are difficult to interpret. For example, is a change on the IOWA Conners I/O factor from a score of 5 to a score of 2, as in Table 5, a meaningful change or of sufficient magnitude to warrant recommending medication for a child? Others have called for clinical instruments that provide more meaningful measures of change than simple rating scales (Sechrest, McKnight, & McKnight, 1996). In contrast to ratings, DRCs with individualized target behaviors in each child's most salient domains of impairment are easily interpretable. Because the target behaviors and goals are operationally defined and discrete, the DRC provides an excellent proximal measure of objective data in the classroom.

The participants' attributional patterns were virtually identical to those gathered in the STP, showing a general pattern of self-serving bias. Our previous results regarding attributions may have been influenced by the fact that we assessed them in an intensive behavioral program in which the treatment program develops, maintains, and reinforces success. The fact that the patterns are identical in the children's regular classroom settings argues against this point.

General Discussion

These two studies add to the existing evidence that stimulant medication is an effective acute treatment for children with ADHD in a variety of domains of impairment—parent and peer interactions, classroom behavior, and class work—in both summer program and regular classroom settings. Furthermore, we found that children with ADHD do not exhibit the kinds of debilitating attributions regarding success when medicated that some have postulated. The balanced-placebo manipulation shows that it is the medication, not children's perceptions of the medication, that influences their behavior. Finally, individual-difference assessments did not reveal any subgroup of children who make pill attributions that appear to affect their behavior when they are unmedicated.

We have replicated the absence of expectancy effects in four different settings: the STP, the regular classroom, a social persistence laboratory task (Pelham et al., 2001) and a cognitive persistence task (Pelham, Hoza, et al., 1997, 2000), and using a balanced-placebo design. We have investigated naturally occurring as well as manipulated success and failure. We are therefore confident that medication expectancies play no role in ADHD children's behavior, classroom, or laboratory-task performance. In a few instances, expectancy had effects on children's beliefs about their DRC performance. For example, boys predicted that they would do better if they were told they had received a real pill, although they generally predicted success and the magnitude of the effect was small. Similarly, expectancy interacted with outcome to produce effects on attributions such that both in the STP and in the regular classroom setting, participants were more likely to blame the pill for failure when they were told the pill was fake and to credit a "real" pill more than a "fake" pill for success. Some might interpret these findings as suggesting that the boys viewed the pill

as responsible for their successes and failures, thereby undermining perceived self efficacy. However, our data taken as a whole suggest a different picture. For the most part, effort and ability comparisons showed no difference as a function of the pill or expectancy in our assessments of attributions for children's own real-life successes and failures across settings, especially for success. Furthermore, expectancy did not affect the children's actual behavior in any domain or setting; that is, they did not behave more appropriately when they were told they received a real pill but received placebo, and they did not perform worse when they were told they received a fake pill but were medicated. The expectancy findings should not be surprising given that the children are all aware that the medication is designed to help them, indeed, it would be concerning if a child thought that a fake pill would help him or her more than a real pill. Along with our failure to find expectancy effects on predictions of success in laboratory persistence tasks (Pelham, Hoza, et al., 1997; Pelham et al., 2001), our findings indicate that children have generally positive expectations about medication effects but that these expectancies do not occur in all situations and do not translate into behavior changes (the concern that has been raised).

It was surprising that there were so few effects of the analyses of individual differences on cognitive styles or behavior. A recent article again raised the possibility that subsets of ADHD children have dysfunctional medication attributions (Treuting & Hinshaw, 2001). However, Treuting and Hinshaw used hypothetical vignettes of ADHD boys who were allegedly medicated or not. In the present study, which used attributions for children's own naturally occurring successes and failures, there were no effects related to baseline attributional style. Indeed, as with expectancies, we have reported the attributional pattern found in this investigation in the same four settings cited above using different manipulations, different ways of defining and assuring outcomes, and different assessment procedures; our results have consistently failed to reveal that medication induces changes in attributional patterns in ADHD children.

The results of the balanced-placebo design provide unique information about placebo effects in ADHD children and raise important questions about the way studies of stimulant effects are conducted. Whalen and Henker (1997) have called for more studies of placebo effects, and this design provides the best examination of placebo effects to date in the literature. The expectancy data show that it is not necessary to control for pill expectancy in ADHD children in future studies with methods and measures similar to this one. When objective measures or children's self-report are used to measure stimulant effects in children with ADHD, a placebo condition appears to be unnecessary. Crossover studies with "no-pill" days (e.g., Pelham, Murphy, et al., 1992) or open trials may be sufficient. Of course, when adult ratings or other subjective adult evaluations are used as outcome measures, raters will still need to be kept blind to conditions. We have previously demonstrated that children in this age range do not detect the presence of 0.3 mg/kg or 0.6 mg/kg of MPH relative to placebo (Pelham, 1990). A recent review of studies that used placebos and no treatment similarly concluded that placebo effects were generally nonexistent or very weak, especially when objective measures are used (Hrobjartsson & Gotzsche, 2001).

Our findings differ from studies of other psychotropic drugs with adults (e.g., Fisher & Greenberg, 1993; Greenberg, Bornstein, Greenberg, & Fisher, 1992), which have found that the highest possible degree of blindness should be used to obtain unbiased results. Why are our results, showing no placebo effect or expectancy effects, different? One possible answer may relate to the degree to which the participants could detect the presence of medication. Fisher and Greenberg (1993) mention that side effects are often a major cause of "unblinding." We used a relatively low dosage of MPH, at which very few children experienced substantial side effects. Alternatively, the discrepancy between our findings and well-established placebo effects in the extant literature may have to do with the separate components of the placebo effect. It is widely assumed that placebo effects are entirely a function of expectancy. Placebo effects actually include expectancy as well as all variables in addition to medication that are associated with the passage of time in between-group studies. One of the primary of these variables is improvement over time that results from factors other than drug condition. In rapidly alternating crossover designs such as the ones used in the current study, such variables are equally distributed across drug and placebo conditions and are thus not part of a placebo effect. We have shown that with respect to stimulants and ADHD, children's expectancies are not likely a component of a placebo effect.

Our series of investigations has made it clear that children with ADHD as a group display a strong self-serving attributional style and that neither medication nor expectancy produces short-term changes in this style. Elementary aged ADHD children have not developed maladaptive attributions regarding medication. Within our findings, however, several issues stand out. First, in this study, the boys did not strongly endorse any of the possible dimensions for their failure to meet daily behavioral goals. Denial that internal factors such as effort and ability are responsible for failure is part of the self-serving bias that can characterize children's attributions. In two studies (Hoza, Pelham, Waschbusch, Kipp, & Owens, 2001; Hoza, Waschbusch, Pelham, Molina, & Milich, 2000) it was found that unmedicated ADHD boys deny lack of effort as a reason for failure more often than do control boys, suggesting that the self-serving bias, at least in regard to effort, may be more extreme in ADHD boys. The children did not endorse unfair staff treatment for failure, presumably due to the fact that staff members were generally positive in their interactions with the children and provided specific behavioral feedback when they assigned negative marks. Although the external factors of pill and task difficulty were rated as relatively better explanations for failure, these ratings were only in the middle range of the scale, never toward the "very true" end of the scale. This pattern raises an interesting issue: to what do ADHD children attribute negative outcomes? In other studies we have added luck and their diagnosis (i.e., "I didn't earn a positive DRC because I have ADHD") to the list of attributions, and neither of these was any more likely to be endorsed than those attributions included herein. Further research is needed on this point and its meaning and importance.

A second issue to be examined is that the results of the attributions to the pill show that children with ADHD are reluctant to say that the pill is responsible either for their success or for their failure in their daily goals. This finding would appear to be in contrast to what some critics have postulated regarding ADHD children's coming to depend on the medication for success. The long-term ramifications of ADHD children's medication attributions may be just the opposite of what has been presumed—despite the fact that

medication clearly produces improvement in multiple domains and settings, these children's positive illusory style causes them to take the credit for treatment-induced success. As children get older, they may thus decide to stop taking medication because they think they do not need treatment. Indeed, follow-up data have shown that the large majority of adolescents and young adults who have taken medication for ADHD (including those in this investigation) stop taking it during their teenage years (Meichenbaum, Gnagy, Flammer, Molina, & Pelham, 2001). Given that their impairment remains severe in adolescence and young adulthood, failure to continue taking medication may lead to negative outcomes. Furthermore, if their beliefs that medication does not influence their behavior extend to drugs of abuse, such beliefs may lead to experimentation and heavy use (Molina & Pelham, 1999). At the same time as these concerns are apparent, it has long been argued that a positive illusory bias is adaptive across a range of settings and populations in adulthood (Taylor & Brown, 1988). However, to our knowledge no studies have evaluated the relationship between the positive illusory bias in childhood and adult outcomes using a deviant sample, and further investigation is clearly warranted.

On the other hand, one could speculate that maladaptive attributions about medication might emerge over the long run as a result of factors that we have not evaluated. For example, little research has been directed at what parents and teachers tell ADHD children about medication effects (Flannagan & Pillow, 2000). If adults believe that medication produces maladaptive attributions in ADHD children, they may impart that information to the children with whom they interact. The role of parent beliefs in influencing the development of children's motivation has been well documented (Eccles, Wigfield, & Schiefele, 1998), but it has yet to be studied whether parents' beliefs about medication are a mediator of their ADHD children's beliefs and, in the long term, of the development of maladaptive cognitive schema.

Parents, teachers, and health professionals should be cautioned not to inadvertently contribute to the emergence of negative cognitive styles by emphasizing to children the role of medication in the children's daily successes and failures. Instead, adults should shape, reinforce, and emphasize the role of children's effort for their successes, ensure that they have the skills necessary to attain goals, and structure tasks and activities to ensure that children are capable of being successful if they exert effort (Eccles et al., 1998). To ensure that the self-enhancing bias does not become delusional in the direction of denial of responsibility for failure, adults should also work to teach ADHD children to take some degree of responsibility when they do not succeed in these tasks (Hoza, Pelham, Dobbs, & Owens, 2001). Teaching children the necessary skills, structuring task situations appropriately, and imparting motivation to succeed are all goals and products of behavioral and educational interventions for ADHD children and emphasize the essential role that behavioral treatments play in ADHD (K. D. O'Leary, 1980; Pelham, Wheeler, & Chronis, 1998). As the results of Experiment 1 illustrate, adjunctive stimulant medication improves even further children's success in the context of a behavioral intervention, as many studies of combined treatment have shown (Pelham & Waschbusch, 1999). Because medication leads to success and because ADHD children make self-enhancing attributions when they are successful, medication would appear to have a positive rather than a negative acute emanative effect on ADHD children's social cognitions related to their daily life functioning. For children who respond positively to medication, perhaps adults should also work to develop realistic medication attributions in children that strike a balance between a belief that they are completely dependent on the medication, on the one hand, and complete denial of medication effects, on the other hand. There are a variety of factors that parents need to consider in deciding whether to use stimulant medication in the long-term treatment of their ADHD child, but the putative development of maladaptive success attributions related to stimulant medication use does not appear to be one of these factors.

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