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The Effects of Instructions on Mothers' Ratings of Attention-Deficit/Hyperactivity Disorder Symptoms in Referred Children

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Abstract Tested whether instructions for how to rate child attention-deficit/hyperactivity disorder (ADHD) symptoms would improve the agreement between mothers' ratings of symptoms in their children and ratings provided by teachers and objective observers. Sixty-eight mothers of 5 to 12 year old children (53 boys and 15 girls) referred for ADHD assessment were randomly assigned to receive or not receive the instructions. Mothers and teachers rated the children on the SNAP-IV Rating Scale and objective observers rated the children's behavior during structured tasks. Relations between mother and teacher, and mother and observer ratings were generally stronger for mothers in the Instruction group compared to mothers in the No Instruction group, in some cases significantly stronger. The instructional materials also improved mothers' knowledge of how to rate ADHD symptoms and reduced some associations between mothers' ratings and family socioeconomic status. These instructions have the potential to improve clinical assessments of child ADHD symptoms.

Keywords Attention-deficit/hyperactivity disorder · ADHD · Parent ratings · Assessment

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Childhood ADHD has a prevalence of 3 to 7 % among elementary-school aged children (American Psychiatric Association (APA) 2000) and children with ADHD experience considerable concurrent and long-term impairment (Barkley 2006). As with many childhood disorders, parents' reports play a crucial role in assessing child ADHD symptoms. Clinicians rely heavily on parent ratings on various checklists that tap symptoms of ADHD (Pelham et al. 2005). However, these checklists offer parents minimal direction for how to complete ratings or interpret items. Thus, parents' interpretations of the checklist items may be quite different from the meaning intended by scale developers. Such differences in interpretation would reduce the extent to which parent ratings of child symptoms covary with information gathered from other informants, such as teacher, or via other methods, such as clinic observations. This study examines whether instructions describing ADHD and how to rate its symptoms can increase the correlations between mothers' assessments of child ADHD symptoms and the assessments offered by teachers and objective observers.

Parents bring unique and invaluable information to the assessment of child ADHD, and their central place in the assessment of ADHD is appropriate and necessary. Parents have primary responsibility for their child's care and, typically, have more in depth and longer standing knowledge of their child and his/her behavior than anyone else. As such, their input forms a fundamental component of an evaluation of the child's difficulties. In addition, teachers' evaluations of the child's symptoms are important as they reflect the child's behavior within a more structured classroom situation and in comparison to same age and gender classmates. Similarly, although not commonly available in clinical settings, structured observations of the child also provide an objective evaluation of ADHD symptoms. However, it is well-known that ADHD ratings offered by teachers, clinicians, or objective observers often are not highly correlated with parent ratings (Collett et al. 2003; Wolraich et al. 2004). Several studies have

suggested that, for ADHD rating scales, variance due to who the rater is (i.e., rater effects) can be as large as variance due to the children being rated (Burns et al. 2003; Gadow et al. 2004; Gomez et al. 2003). Thus, when assessing childhood ADHD, clinicians and researchers are challenged by the extent to which parents' reports are essential, but often not significantly related to other assessment information.

The poor covariation between parents' reports of child ADHD and information gathered via other means may be attributed to several influences. Different raters have experience with children in different contexts, and low correlations between raters may indicate that child behavior varies across different settings (e.g., home versus school). However, even when the context is held constant (e.g., home), covariation between mothers' and fathers' ratings of child ADHD can remain modest (e.g., intraclass correlation coefficients of approximately 0.40; Langberg et al. 2010). Even when the rater and context are both held constant, variation in ratings of ADHD symptoms still exists. Solanto and Alvir (2009) examined ratings made by the same reporter completing the same items on two ADHD scales administered within a single questionnaire package and reported relatively low levels of intra-rater reliability for items. These findings lead us to the possibility that, in addition to rater and context differences, characteristics inherent in the rating scales may be contributing to the poor covariation across informants.

Several scales exist, including the SNAP-IV (Swanson 1992), for rating children's behavior according to the symptoms of ADHD as found in the Diagnostic and Statistical Manual – IV (APA 2000). Items on these measures include only brief descriptions of the symptoms (e.g., "often has difficulty organizing tasks or activities"), with only general instructions to rate how well the items describe the child. No further guidance for item or scale anchor interpretation is offered nor is the time frame for the ratings always specified. Consistent with others who have written about strategies for increasing the content validity of questionnaire measures (Haynes et al. 1995; Shipp et al. 2010), we argue that because these rating scales provide limited guidance for ratings and include many items that are relatively ambiguous, there is substantial opportunity for differential interpretation across raters (or even within a single rater over time). To the extent that parents' interpretations of the content or procedures for the ratings of items are different from the intended interpretations or from interpretations of other raters, the content validity of the measure will be compromised (e.g., Burns et al. 2003; Shipp et al. 2010). For example, parents may view the item "often does not seem to listen when spoken to directly" as referring to noncompliant behaviors, may fail to endorse the item "often fails to pay attention," because the child spends many hours playing videogames, or may not endorse the item "often has difficulty awaiting turn" because they alter situations such that the child seldom has to wait.

One way to address this issue would be to create new measures in a manner that focuses on enhancing content validity and decreasing unreliable variability in responding. For example, the Child and Adolescent Disruptive Behavior Inventory (Burns et al. 2001; Shipp et al. 2010) was developed with particular attention to issues such as including items that are specific to the situations in which the rater sees the child, providing explicit instructions with regard to the time interval to be rated, and providing detailed rating anchors. Interesting, studies evaluating this measure have indicated more substantial overlap in mother and father ratings (e.g., intraclass correlation coefficients in the range of 0.70 to 0.91; Burns et al. 2013) than the levels reported in studies with other measures of ADHD symptoms.

Another solution to problems such as unclear item content and instructions within ADHD rating scales is to develop separate instructions that can be used with existing scales to improve the content validity of these measures. In a previous study (Johnston et al. 2011), we developed and evaluated instructional materials designed to assist parents in interpreting the symptoms on ADHD rating scales. The instructions advise parents to rate their child's symptoms compared to other children of the same age and sex, to not rate behaviors that occur in limited situations, such as only when the child is tired, and to rate the child's behavior as it would be without adult intervention or help. Examples are provided for each symptom. Examples also are provided of behaviors that should not be rated as ADHD symptoms (e.g., behaviors due to learning problems or oppositional behavior). The instructions are appropriate for the behavior of elementary-school age children and require at least a grade 8 reading level. A full description of the development of the instructions is provided in our previous report and the materials are provided in an online supplement to this paper. As an initial test of the instructions, mothers of 5 to 12 year old boys in the community were randomly assigned to receive the instructions or to receive a brief, standard definition of ADHD. All mothers then watched recorded presentations of children (not their sons) displaying a range of behaviors, including ADHD symptoms, and rated the children on an ADHD rating scale. Mothers also provided open-ended responses assessing their knowledge of ADHD. Results indicated that mothers who received the instructions were more similar to objective observers in their ratings of the children in the presentations, and were more accurate in their knowledge/descriptions of ADHD. For some measures, the instructions interacted with family income, with significant effects only for mothers with lower family incomes.

Given that the instructions were successful in improving the ratings of ADHD symptoms made by community mothers, we sought to extend this work by examining how effective the instructions would be for mothers rating their own children in the context of a clinical assessment of ADHD. In this context, we do not have standardized presentations of child ADHD behaviors and instead we examined the covariation between

mothers' ratings and ratings provided by the typical other informants of child behavior used in clinical practice, teachers, as well as the ratings provided by objective observers of the child's behavior. We recognize that teachers and observers also may misinterpret ADHD rating scale items, and such person-unique interpretations present random variation within each assessment source. Importantly, we are not suggesting that parents' reports are necessarily biased or less accurate than the reports provided by other sources. However, this study is limited to assessing the effects of the instructions on parents' ratings and we predicted that the instructional materials would reduce random error and bias in the mothers' reports, such that mothers who received the instructional materials would provide ratings of their child's behavior that were more strongly associated with the ratings of the child provided by teachers and objective coders than the ratings provided by mothers who did not receive the instructional materials. We also predicted that the instructions would improve the accuracy of mothers' knowledge/descriptions of ADHD.

A second aspect of this study tested whether the instructions would lessen potential influences that social circumstances might have on mothers' ratings, perhaps by reducing ambiguities in the interpretation of items that may be particularly problematic for parents with less education. As noted above, the Johnston et al. (2011) study found that the instructions were most beneficial for mothers with relatively greater social disadvantage, and this is consistent with other research linking socioeconomic status to knowledge of child ADHD and access to mental health information (e.g., Bussing et al. 2007; Larson et al. 2011). Therefore, it is important to test whether the effects of instructions are moderated by family socioeconomic status within a clinic-referred sample. We predicted that the instructions would reduce the extent to which mothers' ratings of child ADHD covary with family socioeconomic status and that socioceconomic status moderates the effects of the instructions on mothers' knowledge/descriptions of ADHD.

In summary, we predicted that instructions regarding how to complete ratings of ADHD symptoms would improve the correlations between mothers' ratings of child ADHD symptoms and the ratings provided by teachers and objective observers. We also predicted that the instructions would increase mothers' accurate knowledge/descriptions of ADHD. Finally, we predicted that the instructions would reduce the magnitude of the associations between mothers' ratings of child ADHD and family socioeconomic status.

Methods

Participants

Sixty-eight mothers of 5 to 12 year old children were recruited from families referred to an ADHD clinic for assessment. As we consider the instructional materials most appropriate for parents who are in the initial stages of their child's ADHD assessment, eligibility was restricted to families attending their first, second, or third clinic session. Information on participant recruitment, allocation, and the number of participants analyzed is presented in Fig. 1. Following consent, an online randomizer was used to assign mothers to the Instruction ($n=35$) or No Instruction ($n=33$) group. There were no significant differences in the proportion of children in each group who were male (Instruction $n=27$; No Instruction $n=26$), χ^2 (1, 68)=0.03, $p=0.87$, or receiving medication (Instruction $n=16$; No Instruction $n=20$), χ^2 (1, 67)=1.24, $p=0.27$. Other demographic and descriptive characteristics of the two groups of mothers are shown in Table 1. There were no significant differences across the groups in ethnicity, child age, mother age, family socioeconomic status, or the mothers' self-reported familiarity with ADHD prior to study participation.

Procedures

This research was approved by our university's ethical review board and mothers' consent and children's assent were obtained prior to participation. Mothers were invited to participate during a visit to an ADHD clinic at a Children's Hospital which services both primary and tertiary care referrals. Teachers' ratings of the child's behavior were obtained from the child's clinic assessment. Mothers in the Instruction group read the instruction pamphlet and watched the computer presentation, and then rated their child's ADHD symptoms. Mothers who were assigned to the No Instruction condition were given a card with a general definition of ADHD. The card was illustrated with pictures and cartoons and indicated that ADHD is defined by age-inappropriate difficulties with attention, and/or with hyperactivity/impulsivity that lead to difficulties in children's lives. After reading the card, mothers proceeded to rate their child's ADHD symptoms. In both groups, after mothers had completed ratings of their child, they answered open-ended questions assessing knowledge/descriptions of ADHD. Finally, mothers in the Instruction group evaluated the instructional materials. All mothers received $35 for participation and the children received t-shirts.

Instructional Materials The instructions provide simple definitions and descriptions of ADHD symptoms and non-ADHD behaviors, along with guidelines instructing parents to rate the child's behavior as it would be without treatment or parental intervention, to compare the child to other children of the same age and sex, and to only rate behaviors that are consistent across situations (e.g., not restricted to only specific situations) and not due to other factors

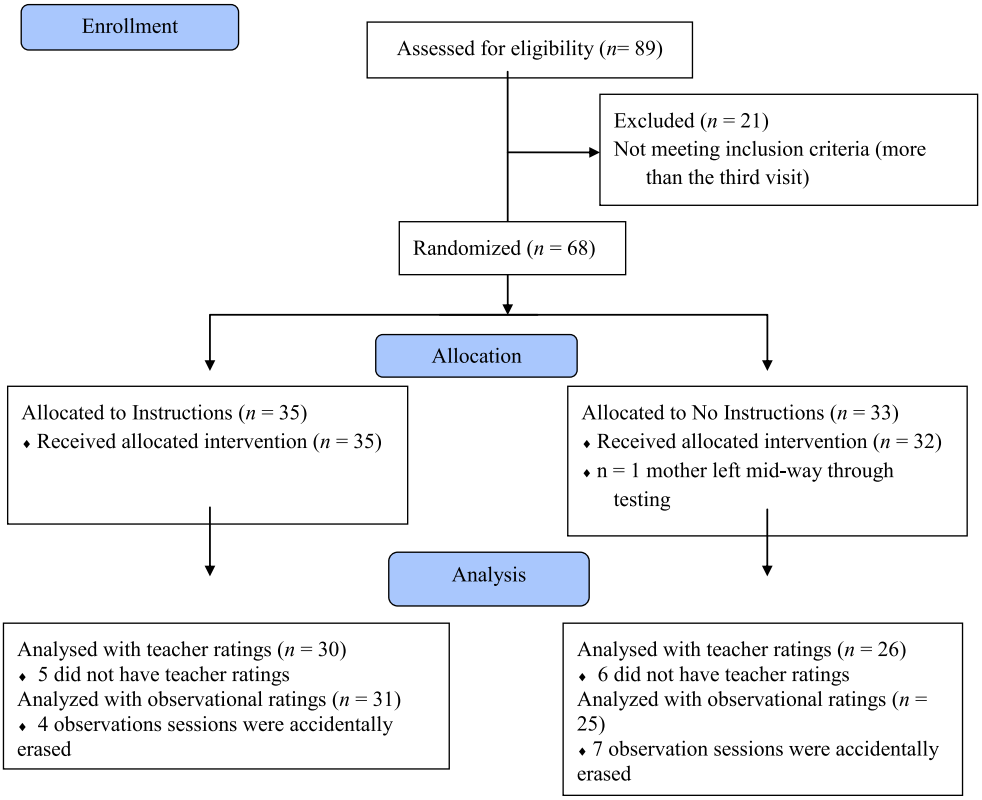

Fig. 1 Flow Diagram of Participant Recruitment, Allocation, and Analyses. Note: Comparing families who had observation data to those who did not due to the accidental erasure of recordings and comparing families who had teacher ratings and those who did not on demographic or clinical variables indicated no significant differences

(e.g., tiredness, oppositionality). Instructions were presented to mothers in a written pamphlet and an accompanying computer "slide show" presentation with a voice-over narration (see supplemental materials).

Measures

Mothers' Ratings of Child ADHD Symptoms Mothers rated their child's ADHD symptoms on the 18 ADHD items of the Swanson, Nolan, and Pelham–IV Questionnaire (SNAP-IV; Swanson 1992; http://www.ADHD.net). This measure is widely used, in both research and clinical contexts, and assesses ADHD symptoms as listed in the DSM-IV on a 4-point rating scale from 0=*not at all* to 3=*very much*. No time interval is specified for the ratings. The SNAP-IV has two subscales, assessing inattentive and hyperactive/impulsive symptoms. In addition to evidence of sensitivity to treatment effects and diagnostic utility (e.g., Bussing et al. 2008; MTA Group 1999), previous studies using the SNAP-IV have reported satisfactory internal consistency (e.g., Bussing et al. 2008; Stevens et al. 1998). Parent-teacher correlations have been reported as 0.49 for the inattentive and 0.43 for the hyperactive/impulsive subscales (Bussing et al. 2008). In this sample, Cronbach's alpha for mothers' ratings of child inattentive symptoms was 0.91 and for hyperactive/impulsive symptoms it was 0.92.

Teacher and Observer Ratings of ADHD Symptoms Teachers provided ratings for each child, also on the SNAP-IV. As with parents, satisfactory psychometrics have been reported for teacher ratings on this scale (Bussing et al. 2008). In the present sample, Cronbach's alpha for teachers' ratings of child inattentive symptoms was 0.92 and for hyperactive/impulsive symptoms it was 0.93. Some children did not have teacher ratings because they were home schooled or not currently in school (See Fig. 1). There was no significant difference in the average number of days between the mothers' and teachers' ratings for children in the Instruction group versus the No Instruction group (Instruction group, M= 47.87 (SD=60.23) and No Instruction, M=47.92 (SD= 44.19), t (55)=0.01, p=0.99).

The second measure of child ADHD was an observation of child behavior during a 10 min interaction with a research assistant. During this interaction, the research assistant instructed the child to complete a standard series of tasks designed to elicit inattentive and hyperactive/impulsive behaviors. Tasks included activities such as waiting for a bell to ring before taking a prize; sorting objects alternately by colour and shape; and writing out a sentence several times. The child's behavior during these tasks was video-recorded and subsequently coded by a team of three coders. Coders were trained using a modified version of the Attention Deficit/Hyperactivity Problems scale of the Direct Observation Form (McConaughy and Achenbach 2009). This observational

Table 1 Descriptive information

Variable	Instruction	No instruction	χ^2-tests
Mothers' ethnicity - frequency (percentage)			
European/N. American	23 (66 %)	19 (58 %)	χ^2 (2,60)=3.85, p=0.16
Asian	7 (20 %)	3 (9 %)	
Other	2 (6 %)	6 (18 %)	
Missing	3 (9 %)	5 (15 %)	
	M (SD)	M (SD)	*t-tests*
Child age in months	107.89 (20.06)	104.48 (20.52)	t (66)=0.69, p=0.42
Mother age in years	38.50 (6.48)	40.38 (7.29)	t (64)=1.11, p=0.27
Familiarity with ADHD[a]	2.74 (0.95)	2.52 (0.80)	t (66)=1.07, p=0.29
Family socioecomic status[b]	2.46 (1.10)	2.26 (1.06)	t (53)=0.70, p=0.49
Child ADHD symptoms[c]			
Mother			
Inattention	1.79 (0.65)	1.83 (0.63)	t (66)=0.27, p=0.79
Hyper-impulsivity	1.48 (0.79)	1.59 (0.71)	t (66)=0.62, p=0.54
Teacher			
Inattention	1.84 (0.81)	1.86 (0.72)	t (54)=0.08, p=0.93
Hyper-impulsivity	1.33 (0.93)	1.23 (0.74)	t (54)=0.42, p=0.68
Observer[d]			
Inattention	1.12 (0.37)	1.21 (0.33)	t (55)=0.96, p=0.34
Hyper-impulsivity	1.11 (0.47)	1.17 (0.49)	t (55)=0.52, p=0.60

[a] Mothers' familiarity with ADHD prior to the study, rated on a 1 to 4 scale

[b] Family socioeconomic status on a scale of 1 (high) to 5 (low)

[c] Mother and teacher average ratings on the SNAP-IV on a 0 to 3 scale

[d] Observer average ratings on the attention deficit/hyperactivity problems scale of the direct observation form on a 0 to 3 scale

form has demonstrated reliability and stability, discriminates clinic-referred and control children, and has incremental validity beyond rating scales in predicting ADHD diagnoses (McConaughy and Achenbach 2009; McConaughy et al. 2010). ADHD symptoms were rated on a 4-point scale (0=*not at all*; 3=*very much*) that incorporated information about frequency and intensity. Observers were randomly assigned to code children's videos, and approximately one-half of the videos were independently coded by two coders. Coders were blind to the group assignment of the child's mother. Ratings within one-point were counted as agreements. Scores were averaged across ratings of inattentive symptoms to form the inattentive observational score, and were similarly averaged across ratings of hyperactive/impulsive symptoms for the hyperactive/impulsive observational score. The intraclass correlation coefficient between the coders for inattentive symptoms was 0.75, and for hyperactive/impulsive symptoms it was 0.77.

Knowledge/Description of ADHD This was assessed by asking mothers to: 1) describe ADHD; 2) give examples of ADHD behaviors; and 3) give advice regarding how to rate a child's ADHD. Mothers' responses were coded by three coders who were different from those involved in observing child behavior and who were blind to the group assignment of the mother. Using the same coding as in our previous study (Johnston et al. 2011), the frequencies of three types of statements in mothers' responses were assessed: 1) Correct Terms/Guidelines used to describe ADHD symptoms and how to rate the symptoms (e.g., use of term attention deficit, reference to needing to rate child according to other children of the same age), 2) General Descriptions of ADHD (e.g., mention of distractibility, child being "on the go"), and 3) Inaccurate Statements regarding the nature or etiology of ADHD (e.g., statements that ADHD behaviors can be explained by bad parenting or is a current fad). Two of the three coders were randomly assigned to each mother's statement and intraclass correlation coefficients indicated good inter-coder reliability for Correct Terms/Guidelines, ICC=0.91 and General Descriptions, ICC=0.97. The ICC for Inaccurate Statements was lower, ICC=0.56, probably reflecting the low frequency of this category of statements.

Family Socioeconomic Status Family socioeconomic status was measured based on mother and father education and occupation using the Hollingshead Four-Factor Index of Social Status (Hollingshead 1975), with lower scores indicating higher status.

Evaluation of the Instructional Materials At the completion of participation, mothers in the Instruction group rated both the written pamphlet and the slide/audio presentation on 7-point scales (1=*not at all* and 7=*completely*) assessing whether the materials were easy to understand, engaging or interesting, and would be helpful or informative to parents of children with ADHD.

Analysis Plan

Variable distributions were checked for outliers and normality. The amount of data missing for the primary measures is outlined in Fig. 1. Approximately 13 % of families failed to provide information necessary to calculate family socioeconomic status. *T*-test comparisons were used to check whether randomization resulted in group differences on family, mother, and child characteristics. Within each group, Pearson correlations are calculated between the mothers' ratings of the child and the ratings provided by observers and teachers. The effects of the instructions are determined by directional comparisons of the correlations in the two groups and *t*-test and χ^2 comparisons of mothers' open-ended responses assessing Knowledge/descriptions of ADHD. The effects of the instructions on the relations between mothers' ratings of the child and family socioeconomic status are examined by comparing correlations between these variables in each group. Interactions between instructions and family socioeconomic status on mothers' Knowledge/descriptions of ADHD were explored in analyses of variance and logistic regression. Finally, mothers' evaluations of the instructional materials were examined descriptively.

Results

Variable Distributions

No outliers beyond 3 SD of the mean were found for any of the rating scales or observations of child behavior used in analyses. These variables all had skew and kurtosis values below 1 except for the frequencies of responses in the categories assessing mothers' Knowledge/descriptions of ADHD. Scores for the Correct Terms/Guidelines and General Descriptions were square root transformed prior to analysis, which resulted in skew and kurtosis values ≤1. However, the low frequency of the Inaccurate Statements category prevented successful transformation and normalization of this variable. Instead, we dichotomized the variable to reflect a presence or absence of such statements. To preserve the interpretability of all Knowledge/description scores, raw scores are presented in Table 3.

Comparison Between Groups

To establish the comparability of the groups, differences in child and maternal characteristics, and the mother, teacher, and observer ratings of the children's ADHD symptoms were tested between groups. Means, standard deviations, and range for the ratings are shown in Table 1. There are slight differences in sample sizes across the measures due to missing data. There were no significant differences between the groups on any of the measures.

Effects of the Instructions on Relations Between Mother, Teacher, and Observer Ratings

Pearson correlations between mothers' and teachers' SNAP-IV ratings, and between mothers' SNAP-IV and observers' ratings of the child for the two groups are shown in Table 2. The correlations between mothers and other reporters were more often significant in the Instruction Group. In addition, consistent with our hypothesis, directional Z-test comparisons indicated that correlations between mothers and observers for ratings of the child's hyperactive-impulsive symptoms were significantly stronger in the Instruction group compared to the No Instruction group. In sum, the instructions significantly increased the covariation between mothers' ratings of hyperactive/impulsive behaviors and the ratings provided by objective observers, with a trend for the correlation between mother and teacher ratings of hyperactive-impulsive behavior also to be stronger in the Instruction group[1].

Effects of the Instructions on Mothers' Knowledge/Descriptions of ADHD

Tests comparing mothers' responses to open-ended questions regarding how to define, describe, and rate ADHD are presented in Table 3. Consistent with our hypotheses, mothers in the Instruction group reported significantly more Correct Terms/Guidelines than mothers in the No Instruction group. The two groups did not differ in the two other coding categories. In sum, the instructions improved mothers' knowledge of the definition of ADHD and how to rate ADHD symptoms.

Effects of the Instructions on Relations Between Mother Ratings of Child ADHD and Family Socioeconomic Status

Correlations between mothers' ratings of child ADHD symptoms and family socioeconomic status are presented in Table 4. Among mothers who had not received the instructions, family socioeconomic status was significantly correlated with ratings of child inattentive symptoms, although not with ratings of hyperactive/impulsive symptoms. Interestingly, this correlation indicated that mothers with better socioeconomic status (lower scores) rated children as having more ADHD symptoms. Despite this and consistent with an effect of instructions

[1] By way of information, in the Instructional group, the discriminant correlation between mothers' ratings of Inattention and teachers' ratings of Hyperactivity/Impulsivity was 0.29 and between mothers' ratings of Hyperactivity/Impulsivity and teachers' ratings of Inattention was 0.20.

Table 2 Pearson correlations between mother ratings of child ADHD symptoms and teacher ratings and observer ratings

	Mother-teacher	Mother-observer
Instruction group		
ADHD-IV inattention	0.44*	0.03
ADHD-IV hyperactive/impulsive	0.49**[a]	0.46**[b]
No instruction group		
ADHD-IV inattention	0.29	−0.04
ADHD-IV hyperactive/impulsive	0.17[a]	−0.03[b]

*$p<0.05$; ** $p<0.01$; *** $p<0.001$

[a] Correlations in the Instruction and No Instruction groups differ at $p<0.10$

[b] Correlations in the Instruction and No Instruction groups differ at $p<0.05$

Table 4 Correlations between mother ratings of child behavior and family socioeconomic status

	Family socioeconomic status[1]
Instruction group	
ADHD-IV inattention	0.08[a]
ADHD-IV hyperactive/impulsive	0.15
No instruction group	
ADHD-IV inattention	−0.43*[a]
ADHD-IV hyperactive/impulsive	−0.07

[1] Measured using the Hollingshead Four-Factor Index of Social Status. Higher scores indicate lower social class

*$p<0.05$; [a] Correlations in the Instruction and No Instruction groups differ at $p<0.05$

reducing potential bias due to socioeconomic status, a directional Z-test indicated that the correlation between inattention ratings and family socioeconomic status was significantly weaker in the Instruction group.

For mothers' Knowledge/descriptions of ADHD, analyses of variance were conducted to examine whether family socioeconomic status (dichotomized into the two highest classes – scores 1 and 2 vs. the three lower classes – scores 3, 4, and 5) interacted with the instructions in influencing mothers' open-ended responses. For Correct Terms/Guidelines, the interaction effect was marginally significant, F (1, 49)=3.63, $p=0.06$. Post hoc tests indicated that Instructions improved the use of Correct Terms/Guidelines for all mothers. That is, for both higher SES and lower SES mothers, mothers who received instructions used significantly more Correct Terms/Guidelines relative to mothers who did not receive the instructions, (ps 0.04 and <0.001, respectively). In addition, the effect of SES on the use of Correct Terms/Guidelines was significant among mothers who did not receive instructions, but this SES effect was eliminated among mothers who received instructions. That is, in the No Instruction group, mothers of higher SES using more Correct Terms/Guidelines than mothers of lower SES ($p=0.004$), whereas in the Instruction group, higher and lower SES mothers showed the same level of use of Correct Terms/Guidelines. Thus, at a trend level, the instructions had their greatest effect on mothers in the lower socioeconomic classes. For the General Descriptions and Inaccurate Statements categories, there were no significant interactions of instruction group and socioeconomic status.

Table 3 Mothers' open-ended descriptions of ADHD

	Instruction Mean (SD)	No instruction Mean (SD)	
Correct terms	2.31 (2.23)	0.50 (0.69)	t (58)=3.97, $p<0.001$, $d=1.05$
General descriptions	4.94 (3.23)	5.00 (3.29)	NS
Inaccurate Stmts	0.13 (0.34)	0.11 (0.57)	NS

Raw score values are presented in the table to facilitate interpretation. For Correct Terms and General Descriptions, statistical comparisons were conducted with square root transformed scores, and for Inaccurate Statements, the comparison was conducted using Chi-Square analysis of a dichotomized present/absent score

Mothers' Evaluations of the Instructions

Mothers in the Instruction group completed ratings evaluating both the written and audio/visual presentations. On a scale ranging from a low of 1 to a high of 7, both materials were rated as highly understandable (written=6.39 (SD=0.60), audio/visual=6.33 (SD=1.08)). They also were evaluated as engaging (written=5.55 (SD=1.33), audio/visual=5.21 (SD=1.50)) and helpful (written=5.76 (SD=1.48), audio/visual=5.82 (SD=1.021)).

Discussion

In mothers of children referred for the assessment of ADHD, brief instructions regarding how to interpret and rate the items presented on ADHD rating scales proved effective in increasing the agreement between mothers' ratings of their children and ratings provided by other raters, at least for hyperactive-impulsive symptoms. The instructions also significantly increased mothers' ability to use correct terms in describing ADHD and their knowledge of guidelines to follow in completing rating scales, perhaps particularly for mothers in lower social class groups. The instructions also reduced the association between family socioeconomic status and mothers' ratings of the child. In sum, the use of brief instructions appears to be a promising avenue for improving the cross-informant

reliability and potentially the content validity of parents' reports of child ADHD behavior on existing ADHD rating scales. As such, the instructions stand as a supplement to important work being done to develop and evaluate alternate rating scales that are more content valid (e.g., Burns et al. 2008, 2009; Shipp et al. 2010).

The findings of this study are an encouraging extension to our previous work in a community sample of mothers (Johnston et al. 2011). Instructions were effective in increasing the convergent validity of mothers' reports of ADHD symptoms in their own children, who are being assessed and treated for ADHD, supporting the clinical utility of these materials. Although we limited participation to families early in the assessment process at this particular clinic, many of the children had previously been assessed by community practitioners and the mothers would not be characterized as entirely naïve regarding ADHD (average ratings between 2 and 3 on a 1 to 4 scale where 4=completely familiar with ADHD). The demonstrated effects of the instructions within this sample of mothers who were already relatively knowledgeable and informed are impressive, and it seems probable that the instructions would prove even more useful for parents with less previous experience with ADHD.

Looking at the specific findings in greater depth, we found that mothers who read the written instructions and listened to/viewed the audio-visual presentation showed more covariation with observers and teachers in their ratings of their child's hyperactive-impulsive symptoms (p values at the 0.05 and 0.10 levels). In addition, the mother and teacher correlation for child inattention symptoms was significant in the Instruction group and not in the No Instruction group, although the difference between the correlations was not significant. Mothers' ratings of child inattention symptoms were not significantly related to observers' ratings in either group. Thus, it appears that the instructions are most useful in improving mothers' reports of hyperactive-impulsive symptoms. In our previous test of the instructions in community mothers, changes due to instructions were noted in ratings of both inattentive and hyperactive-impulsive symptoms (Johnston et al. 2011), although the differences in samples and methodologies make direct comparison of the findings difficult. Both in our sample and in previous studies, parent-teacher correlations for hyperactive-impulsive symptoms have been lower than those for inattention (van der Oord et al. 2006), although this is not the case on measures designed to enhance content validity (e.g., Burns et al. 2008, 2009). In our sample, the mother-rater inattention correlation was very close to the average parent-teacher and parent-observer correlations of 0.27 reported in the meta-analysis by Achenbach et al. (1987). Given that hyperactive-impulsive symptoms are more likely than inattentive symptoms to co-occur with disruptive behaviors (Gaub and Carlson 1997; Wahlstedt et al. 2009), the benefit of the instructions may be in clarifying the distinctions on scales such as the SNAP-IV between hyperactive-impulsive symptoms and co-occurring oppositional or conduct problem behaviors. There may be a need to expand the instructional materials to further clarify distinctions between inattentive symptoms and the problems that frequently co-occur with these symptoms, such as academic or internalizing problems. Given that the correlations for ratings of inattention symptoms were particularly low between mothers and observers, it also is possible that our observational procedures were insufficient to elicit or record the types a range of child inattentive symptoms. For example, the short duration and structured nature of the observational situation may have precluded the children displaying problems with sustained attention or organization. Clearly, further research is needed to clarify the reasons behind the lack of impact of the instructions on ratings of inattentive symptoms.

In our previous study with community mothers (Johnston et al. 2011), the effects of the instructions were moderated by family income and only mothers with relatively lower incomes benefitted from the instructions in terms of their ratings of child behavior. In our previous study, we used standardized child stimuli and examine interactions of family income and instructions in ratings of the same children by all mothers. In this study, each mother is rating her own child, and we are thus limited to examining whether the degree of association between mothers' ratings or knowledge of ADHD and family socioeconomic status varies across the Instruction and No Instruction groups. We found that the instructions significantly reduced the association of socioeconomic status and mothers' ratings of child inattention, and that, at a trend level, the instructions were more effective in improving the use of correct ADHD terms and rating guidelines among mothers of lower socioeconomic status. Both of these results support the utility of the instructions in reducing the potentially biasing influence of socioeconomic status on mothers' ratings. Interestingly however, and perhaps contrary to what might be expected, without instructions the association between socioeconomic status and ratings was such that more advantaged mothers rated their children as more symptomatic than less advantaged mothers. We speculate that the instructions may assist mothers of lower socioeconomic status in detecting and labeling ADHD symptoms (e.g., now seeing interrupting as an impulsive behavior rather than as willful disobedience), while the instructions may help mothers of higher status to refrain from over-identifying behaviors as ADHD (e.g., now seeing occasional inattention to tasks as nonproblematic). When looking at mothers' general descriptions or inaccurate statements about ADHD, socioeconomic status had no moderating effect, replicating the lack of moderation on these measures in our 2011 study. In sum, these results invite further study, and interpretation is bounded by the fact that, despite their clinic-referred nature, the current sample remains characterized by a relatively high average level of family socioeconomic status.

The instructions had a significant main effect on mothers' use of Correct Terms/Guidelines to describe ADHD. This main effect confirms that mothers acquired the information conveyed in the instructions. The difference replicates our previous study with community mothers (Johnston et al. 2011) and is consistent with the instructions improving ratings by increasing the mothers' ability to distinguish ADHD from non-ADHD symptoms and to rate the child's behavior within the context of situational influences and normative comparisons. The failure to find differences in mothers' general descriptions of ADHD or their production of inaccurate statements may reflect either a lack of effect of the instructions, the low base rate or low reliability of coding the inaccurate statements, or other characteristics of this relatively informed sample of mothers. In our previous study, we also failed to find an effect for inaccurate statements, and this replication of low base rates for such statements confirms that, at least within the samples tested, there is not a glaring lack of knowledge regarding ADHD. Whether such effects would occur in more socially disadvantaged or less medically-literate samples remains an open question. Further testing with larger and more diverse samples is needed to explore potential mother, child or family characteristics that may moderate the effects of the instructions.

There are limitations to this study that point to areas for further investigation and the need for replications. Most importantly, the modest group sizes limited power to detect smaller instruction effects or more modest interactions of the instructions with socioeconomic status. The small sample also prevented testing possible moderation of the effects of the instructions due to variables such as child age or gender. Replication will be important to confirm the value of the instructions, and a systematic approach to such replications would test the generalizability of the findings to samples including fathers or testing of potential differences in the effects of instructions for boys versus girls or for children of different ages. Testing adaptations of the instructions for use with teachers, or with other child disorders are obvious directions for future studies. Similarly, extending testing of the instructional materials to samples that include a greater diversity of family ethnicities will be important, particularly given existing evidence of racial/ethnic differences in perceptions of ADHD behaviors (Bussing et al. 2008; Hillemeier et al. 2007) We also note that the research assistants who interacted with the children in the observational situations were not blind to mothers' group assignment, although they were not present when mothers' completed their ratings of the children and the observers who coded the child's behavior were blind to group assignment. Of course, controlling for possible biases resulting from factors extraneous to the instructional materials remains important in future studies. It also is the case that we compared the instructional materials to a condition in which mothers received only a very basic description of ADHD and we did not assess the credibility of this minimal placebo. Including alternate groups who receive variations of the instructional materials would provide information regarding the specificity of the instructions and their components. Finally, the instructional materials were designed to increase the overall content validity of parents' ratings of ADHD symptoms, but they do not focus on helping parents distinguish between the two dimensions of ADHD symptoms. It would be useful to expand the instructions in this manner, and to test their ability to enhance not only the convergent validity, but also the discriminant validity of ratings.

In summary, both our previous study and the present findings demonstrate the considerable potential of using instructions to improve the value of parents' ratings. The instructions require approximately 10 min and are entirely self-administered, making them ideal for use in a waiting room context. Using this simple tool to help parents better understand the meaning of ADHD rating scales could yield meaningful improvements in assessment and prediction of treatment response in children with ADHD. Used in a research context, the value of the instructions would lie in improving our phenotypic description of ADHD, promoting greater ability to differentiate the disorder from others, and to clarify its unique correlates. Clinically, instructions may be of particular value to clinicians working in settings where teacher reports are not available, and where the sole reliance on parent report of child behavior makes their validity of utmost importance (Lavigne et al. 2012; Tripp et al. 2006). More generally, it is argued that diagnosis in ADHD has been hampered by the reliance on parent and teacher report measures which assume a common, shared understanding of items. Given this situation, we would hope that clinical use of our instructions along with parent report scales would minimize both over and under diagnosis of ADHD.

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References

Achenbach, T. M., McConaughy, S. H., & Howell, C. T. (1987). Child/adolescent behavioral and emotional problems: implications of cross-informant correlations for situational specificity. *Psychological Bulletin, 101*, 213–232.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author. Text Revision.

Barkley, R. A. (2006). *Attention-deficit hyperactivity disorder: A handbook for diagnosis and treatment* (3rd ed.). New York: Guilford Press.

Burns, G. L., Taylor, T., & Rusby, J. (2001). Child and adolescent disruptive behavior inventory – version 2.3. Unpublished manuscript.

Burns, G. L., Gomez, R., Walsh, J. A., & De Moura, M. A. (2003). Understanding source effects in ADHD rating scales: reply to DuPaul (2003). *Psychological Assessment, 15*, 118–119.

Burns, G. L., de Moura, M. A., Walsh, J. A., Desmul, C., Silpakit, C., & Sommers-Flanagan, J. (2008). Invariance and convergent and discriminant validity between mothers' and fathers' ratings of oppositional defiant disorder toward adults, ADHD-HI, ADHD-IN, and academic competence factors within Brazilian, Thai, and American children. *Psychological Assessment, 20*, 121–130.

Burns, G. L., Desmul, C., Walsh, J. A., Silpakit, C., & Ussahawanitchakit, P. (2009). A multitrait (ADHD–IN, ADHD–HI, ODD toward adults, academic and social competence) by multisource (mothers and fathers) evaluation of the invariance and convergent/discriminant validity of the child and adolescent disruptive behavior inventory with Thai adolescents. *Psychological Assessment, 21*, 635–641.

Burns, G. L., Walsh, J. A., Servera, M., Lorenzo-Seva, U., Cardo, E., & Rodríguez-Fornells, A. (2013). Construct validity of ADHD/ODD rating scales: recommendations for the evaluation of forthcoming DSM-V ADHD/ODD scales. *Journal of Abnormal Child Psychology, 41*, 15–26.

Bussing, R., Gary, F. A., Mills, T. L., & Wilson Garvan, C. (2007). Cultural variations in parental health beliefs, knowledge, and information sources related to attention-deficit/hyperactivity disorder. *Journal of Family Issues, 28*, 291–318.

Bussing, R., Fernandez, M., Harwood, M., Hou, W., Garvan, C. W., Eyberg, S. M., et al. (2008). Parent and teacher SNAP-IV ratings of attention deficit hyperactivity disorder symptoms: psychometric properties and normative ratings from a school district sample. *Assessment, 15*, 317–328.

Collett, B. R., Ohan, J. L., & Myers, K. M. (2003). Ten-year review of rating scales. VI: scales assessing externalizing behaviors. *Journal of the American Academy of Child and Adolescent Psychiatry, 42*, 1143–1170.

Gadow, K. D., Drabick, D. A. G., Loney, J., Sprafkin, J., Salisbury, H., Azizian, A., et al. (2004). Comparison of ADHD symptom subtypes as source-specific syndromes. *Journal of Child Psychology and Psychiatry, 45*, 1135–1149.

Gaub, M., & Carlson, C. L. (1997). Gender differences in ADHD: a meta-analysis and critical review. *Journal of the American Academy of Child and Adolescent Psychiatry, 36*, 1036–1045.

Gomez, R., Burns, G. L., Walsh, J. A., & De Moura, M. A. (2003). Multitrait-multisource confirmatory factor analytic approach to the construct validity of ADHD rating scales. *Psychological Assessment, 15*, 3–16.

Haynes, S. N., Richard, D. C. S., & Kubany, E. S. (1995). Content validity in psychological assessment: a functional approach to concepts and methods. *Psychological Assessment, 7*, 238–247.

Hillemeier, M. M., Foster, E. M., Heinrichs, B., & Heier, B. (2007). Racial differences in parental reports of attention-deficit/hyperactivity disorder behaviors. *Journal of Developmental and Behavioral Pediatrics, 28*, 353–361.

Hollingshead, A. (1975). *Four factor index of social status*. New Haven: Yale University Press.

Johnston, C., Weiss, M., Murray, C., & Miller, N. (2011). The effects of instructions on mothers' ratings of child attention-deficit/hyperactivity disorder symptoms. *Journal of Abnormal Child Psychology, 39*, 1099–1110.

Langberg, J. M., Epstein, J. N., Simon, J. O., Loren, R. E. A., Arnold, L. E., Hechtman, L., et al. (2010). Parent agreement on ratings of children's attention deficit/hyperactivity disorder and broadband externalizing behaviors. *Journal of Emotional and Behavioral Disorders, 18*, 41–50.

Larson, K., Russ, S. A., Kahn, R. S., & Halfon, N. (2011). Patterns of comorbidity, functioning, and service use for US children with ADHD, 2007. *Pediatrics, 127*, 462–470.

Lavigne, J.V., Dulcan, M.K., Lebailly, S.A., & Binns, H.J. (2012). Can parent reports serve as a proxy for teacher ratings in medication management of attention-deficit/hyperactivity disorder? *Journal of Developmental and Behavioral Pediatrics, 33*, 336–342.

McConaughy, S. H., & Achenbach, T. M. (2009). *Guide for the ASEBA direct observation form*. Burlington: University of Vermont, Research Center for Children, Youth, & Families.

McConaughy, S. H., Harder, V. S., Antshel, K. M., Gordon, M., Eiraldi, R., & Dumenci, L. (2010). Incremental validity of test session and classroom observations in a multimethod assessment of attention deficit/hyperactivity disorder. *Journal of Clinical Child and Adolescent Psychology, 39*, 650–666.

MTA Group. (1999). A 14-month randomized clinical trial of treatment strategies for attention-deficit/hyperactivity disorder. *Archives of General Psychiatry, 56*, 1073–1086.

Pelham, W. E., Jr., Fabiano, G. A., & Massetti, G. M. (2005). Evidence-based assessment of attention-deficit/hyperactivity disorder in children and adolescents. *Journal of Clinical Child and Adolescent Psychology, 34*, 449–476.

Shipp, F., Burns, G. L., & Desmul, C. (2010). Construct validity of ADHD-IN, ADHD-HI, ODD toward adults, academic and social competence dimensions with teacher ratings of Thai adolescents: additional validity for the child and adolescent disruptive behavior inventory. *Journal of Psychopathology and Behavioral Assessment, 32*, 557–564.

Solanto, M. V., & Alvir, J. (2009). Reliability of DSM-IV symptom ratings of ADHD: implications for DSM-V. *Journal of Attention Disorders, 13*, 107–116.

Stevens, J., Quittner, A. L., & Abikoff, H. (1998). Factors influencing elementary school teachers' ratings of ADHD and ODD behaviors. *Journal of Clinical Child Psychology, 27*, 406–414.

Swanson, J. M. (1992). *School-based assessments and interventions for ADD students*. Irvine: KC Publishing.

Tripp, G., Schaughency, E. A., & Clarke, B. (2006). Parent and teacher rating scales in the evaluation of attention-deficit hyperactivity disorder: contribution to diagnosis and differential diagnosis in clinically referred children. *Developmental and Behavioral Pediatrics, 27*, 209–218.

van der Oord, S., Prins, P. J. M., Oosterlaan, J., & Emmelkamp, P. M. G. (2006). The association between parenting stress, depressed mood and informant agreement in ADHD and ODD. *Behaviour Research and Therapy, 44*, 1585–1595.

Wahlstedt, C., Thorell, L. B., & Bohlin, G. (2009). Heterogeneity in ADHD: neuropsychological pathways, comorbidity and symptom domains. *Journal of Abnormal Child Psychology, 37*, 551–564.

Wolraich, M. L., Lambert, E. W., Bickman, L., Simmons, T., Doffing, M. A., & Worley, K. A. (2004). Assessing the impact of parent and teacher agreement on diagnosing attention-deficit hyperactivity disorder. *Journal of Developmental and Behavioral Pediatrics, 25*, 41–47.