MATERNAL ADHD SYMPTOMS AND MATERNAL RATINGS OF CHILD ADHD SYMPTOMS: ARE MORE INATTENTIVE MOTHERS LESS ACCURATE?

by

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Abstract

Maternal reports are crucial in the diagnosis of Attention-Deficit/Hyperactivity Disorder (ADHD) in children. While some past research has found that the presence of psychopathologies such as depression bias maternal reports of child ADHD symptoms, few studies have explored the effects of maternal ADHD symptoms on maternal ratings of child ADHD behavior. The current study examined whether maternal ADHD symptoms of inattention (IA) and hyperactivity/impulsivity (HI) are related to rating accuracy in a community sample of 97 mothers (*M* age = 39.7 years) of 5-12-year-old boys. Mothers completed measures of their own and their child's functioning as well as of their family demographics; mothers and other informants also provided ratings of the mothers' ADHD symptoms. Mothers watched videotapes of children with ADHD and then rated each child's symptoms of ADHD. Analyses of associations between maternal ADHD symptoms and maternal rating accuracy (i.e. commission errors and omission errors) controlled for maternal and family characteristics that typically co-occur with maternal ADHD symptoms. Contrary to predictions, results revealed few significant associations overall, with neither maternal IA nor maternal HI symptoms being associated with either maternal rating commission or omission rating errors or with bias in rating videotaped child behavior, once covariates were controlled. Analysis of covariates further revealed that, while lower family SES and mothers' own sons' level of oppositional/conduct problems were each associated with mothers' over-reporting ADHD symptoms in the videotaped children, few other significant associations between covariates and maternal ratings emerged for this sample. Overall, results may be interpreted as supporting past research in finding no associations between maternal ADHD symptoms and maternal rating accuracy or bias. Alternatively, characteristics of the current sample, especially the exclusion of mothers with

clinical levels of ADHD symptoms in themselves or their sons, may have prevented significant relationships from emerging.

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To Heather, my wife

Maternal ADHD Symptoms and Maternal Ratings of Child ADHD Symptoms: Are More Inattentive Mothers Less Accurate?

Maternal cognition is an important but often overlooked factor in the diagnosis of child behavior problems. Impaired cognition associated with some maternal psychopathologies could cause pervasive errors in mothers' reports of child behavior, potentially leading to child misdiagnosis, in some cases. Researchers have found some evidence to support this hypothesis in relation to the effects of maternal depression, stress, and anxiety on maternal reports of child symptoms of Attention-Deficit/Hyperactivity Disorder (ADHD). However, the effects of maternal ADHD symptoms on maternal ratings of child ADHD behavior have been relatively unexplored. This paper will discuss accuracy of maternal ratings of child behavior, ADHD symptom expression in adults, past research on the effects of maternal ADHD on maternal rating accuracy and potential new avenues of investigation suggested by recent findings in the adult ADHD cognitive literature, as well as the effects of other maternal psychopathologies on maternal reports of child ADHD behavior. The primary aim of this study is to investigate associations between maternal symptoms of ADHD and both accuracy and bias of maternal reports of child ADHD symptoms among a community sample of mothers of pre-adolescent sons.

The Importance of Maternal Rating Accuracy

Adult informant reports are critical in the assessment of child behavioral and emotional problems, with maternal reports being a primary source of behavioral data for clinicians and researchers alike (Pelham, Fabiano, & Massetti, 2005). Accuracy of maternal ratings on rating scales of child behavior is critical to overall diagnostic accuracy for several reasons. While clinicians and researchers vary in the diagnostic algorithms that they use to combine information

across informants, all rely on maternal report in some way (for example, see Chhabildas, Pennington, & Willcutt, 2001; Faraone, Biederman, & Monuteaux, 2002; Neuman et al., 1999). In addition, adult raters are likely to be exposed to differing samples of child behavior due to the different roles that they play in children's lives (Achenbach, Krukowski, Dumenci, & Ivanova, 2005). As such, mothers often are exposed to child behavior in domains that other adult raters do not see (e.g., behavior with siblings). Therefore, maternal ratings of child behavior are vital for gathering the information needed to assess the full spectrum of a child's behavior. Maternal rating inaccuracy, thus, can significantly threaten overall diagnostic accuracy, leading to either over-diagnosis in some instances and under-diagnosis in others.

Potential Sources of Error in Maternal Ratings of Child Behavior

While the accuracy of maternal ratings of child behavior is likely affected by contextual, situational, and child-centered factors (for example, see Hartman, Rhee, Willcutt, & Pennington, 2007; Mikami, Chi, & Hinshaw, 2004; Simonoff, Pickles, Hervas, Silverberg, Rutter, & Eaves, 1998), it also is likely affected by characteristics of the mother. Research has suggested that a potential source of inaccuracy in maternal ratings of child symptoms is maternal psychopathology (e.g., Chi & Hinshaw, 2002; Chilcoat & Breslau, 1997; Youngstrom, Izard, & Ackerman 1999). Most of the literature investigating the effects of maternal psychopathology on maternal ratings of child behavior has examined whether or not specific maternal symptoms such as depression, anxiety, or stress, cause systematic errors— or biases— leading to over-reporting of child behavior problems, due to either cognitive distortions, heightened sensitivity to child behavior problems, or decreased tolerance for child misbehavior (Baumann, Pelham, Lang, Jacob, & Blumenthal, 2004; Chilcoat & Breslau, 1997).

Typically, maternal over-reporting of child behavior problems is indexed by a discrepancy in the association between maternal psychopathology and maternal reports of child behavior, as compared to the association between maternal psychopathology and other informants' reports of the same child's behavior. Chi and Hinshaw (2002), for example, made use of other raters (e.g., teacher and child self-ratings) as the criteria against which they compared maternal ratings, and found that maternal depressive symptoms accounted for significant variance in mother-teacher rating discrepancies. Some degree of controversy exists, however, as to how to interpret elevated maternal ratings of child behavior, relative to ratings made by teachers, fathers, or child self-reports. While some researchers have concluded that these rater discrepancies are evidence of cognitive bias associated with maternal psychopathology, others argue that instead, this is only evidence that children act differently in the presence of different raters (see Barry, Dunlap, Cotten, Lochman, & Wells, 2005; Chilcoat & Breslau, 1997; Richters, 1992). When each mother rates her own child's behavior using conventional child behavior rating scales, there is no way for researchers to easily test these hypotheses against one another, since no person other than the mother and child witnesses the full range of the child's behavior in the mother's presence. Hence, a boy with high maternal ratings of hyperactivity symptoms— but low teacher ratings of the same symptoms— might truly be more hyperactive at home with his mother than he is at school with his teacher. Conversely, the boy's mother might have an exaggerated sense of her son's level of hyperactive symptoms. The distinction between actual variation in child behavior across situational contexts, on the one hand, and distorted maternal ratings of child behavior, on the other, is vital to researchers interested in the accuracy of maternal ratings, as well as to professionals whose

diagnoses rely on maternal ratings of child behavior. Therefore, disentangling these phenomena is imperative.

Possibly the most practical, efficient, and valid means to accomplish this in a research setting would be to standardize the child behaviors that mothers rate, so that any systematic differences in maternal ratings are due to specific cognitive factors in mothers instead of differences in child behavior across situations. Researchers have typically used either child confederates (e.g., Baumann et al., 2004; Lang, Pelham, Atkeson, & Murphy, 1997), written vignettes describing child behavior (e.g., Krech & Johnston, 1992), or videotaped child behaviors (e.g., Youngstrom et al., 1999) in order to show mothers standardized child behaviors. Although containing their own set of disadvantages, videotaped child behaviors may have the advantage of exposing mothers to naturalistic samples of child behavior, which correspond to the real-world behaviors that mothers must rate when completing a rating scale of child behavior. Use of standardized child behaviors permits examination of cognitive biases in mothers when making child behavior ratings, while controlling for child behavior variance across situations. I will therefore use standardized videotaped child behaviors in order to assess the accuracy of maternal ratings.

Attention-Deficit/Hyperactivity Disorder (ADHD) in Children and Adults

Perhaps the most prevalent set of child behavioral problems that mothers are asked to report in their children are those behaviors that comprise ADHD. ADHD is one of the most common behavioral disorders of childhood, affecting 3-7% of North American children (American Psychiatric Association, 2000), and is characterized by developmentally inappropriate levels of inattention, hyperactivity and impulsivity. Factor analytic studies have repeatedly found that two distinct clusters of symptoms, each with its own set of correlates and impairment,

underlie ADHD: inattention and hyperactivity-impulsivity (Milich, Balentine, & Lynam, 2001; Nigg, Stavro, Ettenhofer, Hambrick, Miller, & Henderson, 2005). The inattention (IA) cluster includes symptoms such as "is often easily distracted by extraneous stimuli," "often has difficulty sustaining attention in play and activities" and "often has difficulty organizing tasks and activities." Combining symptoms of both hyperactivity and impulsivity, the hyperactive-impulsive (HI) cluster includes items such as "often fidgets with hands or feet or squirms in seat," "often has difficulty playing or engaging in leisure activities quietly" and "often blurts out answers before questions have been completed." ADHD has been found to be highly heritable, with 57% of children of parents with ADHD estimated to have ADHD themselves, and with 16-37% of parents of children with ADHD estimated to also meet diagnostic criteria for ADHD (Barkley, 2006; Biederman, Mick & Faraone, 2000; Faraone et al., 2000, Faraone, Monuteaux, Biederman, Cohan, & Mick, 2003; Kuntsi & Stevenson, 2000). Current estimates of the persistence of ADHD into adulthood from childhood range from 4%-80% (Faraone et al., 2000; Hervey et al., 2006; Wilens, Biederman, & Spencer, 2002). Researchers have found that adults with ADHD suffer impairment across a broad range of domains, including employment, friendships, marriage, driving, legal problems, academic achievement, psychiatric functioning, and physical health (Adler et al., 2008; Barkley, Fischer, Smallish, & Fletcher, 2002; Minde et al, 2003; Weiss, Hechtman, & Weiss, 2000; Wilens et al., 2002). Therefore, not only is adult ADHD more prevalent than previous estimates of 4-8% (see Mannuzza, Klein, Bessler, Malloy, & LaPadula, 1998), it also causes cross-domain impairment for individuals in their various roles as adults.

Associations Between Maternal ADHD Symptoms and Maternal Ratings of Child ADHD

Four reasons would recommend examining associations between maternal ADHD symptoms and maternal ratings of child ADHD symptoms. First, ADHD tends to be heritable, as mentioned above. Therefore, there is an increased likelihood that the mother of a child who is being assessed for ADHD may, herself, suffer from ADHD symptoms. Second, some evidence has been found for maternal bias in reporting child ADHD symptoms (e.g., contrast effects in rating dizygotic twins; see Hartman et al., 2007; Simonoff et al., 1998). Third, other maternal psychopathologies, such as depression and anxiety, have been associated with possible maternal over-reporting of child ADHD symptoms (e.g., Chi & Hinshaw, 2002; Chilcoat & Breslau, 1997); however, little research has investigated associations between mothers' ADHD symptoms and their reporting of child ADHD symptoms. And finally, with research findings indicating inaccurate self-ratings in adults with ADHD (e.g., Barkley et al., 2002; Knouse, Bagwell, Barkley, & Murphy, 2005), one might wonder how accurate mothers with elevated ADHD symptoms might be in their ratings of their own children's ADHD symptoms. To my knowledge, however, only two studies have examined the question of whether maternal ADHD symptoms influence maternal ratings of child ADHD symptoms.

In a large sample of mothers with and without ADHD whose children all had ADHD, Faraone et al. (2003) assessed differences in maternal ratings of child ADHD behavior according to maternal ADHD diagnostic status. In order to also account for possible parent-child ADHD heritability effects, they compared maternal ratings in three groups: 1) maternal ADHD present, paternal ADHD absent; 2) paternal ADHD present, maternal ADHD absent; or 3) both maternal and paternal ADHD absent. They reasoned that if there was a rating bias in mothers with ADHD, then these mothers would endorse DSM-III-R ADHD symptoms more frequently in

their children than would mothers without ADHD (regardless of fathers' ADHD status). Finding few significant group differences in maternal ratings of individual child ADHD symptoms (the only significant difference found was for a DSM-III-R symptom that was not retained in the DSM-IV definition of ADHD), Faraone et al. (2003) concluded that there was no evidence for a maternal ADHD reporting bias.

In an earlier study of ADHD families, Faraone, Biederman, Chen, Milberger, Warburton, and Tsuang (1995) attempted to examine the possibility of maternal reporting bias in a sample that included 16 mothers with ADHD and 116 mothers without ADHD of children with ADHD as well as 120 mothers without ADHD of control children without ADHD. Faraone et al. (1995) proposed to index maternal reporting bias in three ways: a) comparing the total number of DSM-III-R child ADHD symptoms endorsed by mothers with ADHD of children with ADHD as compared to mothers without ADHD of children with ADHD, with the premise that if mothers with ADHD were biased to over-report child ADHD symptoms, then they would endorse significantly more ADHD symptoms in their children than would mothers without ADHD; b) in ADHD families of children with ADHD, predicting maternal ADHD status from their children's scores on measures of common correlates of ADHD (higher incidence of depression, anxiety, conduct disorder, and school failure; poorer intellectual functioning), with the premise that if mothers with ADHD were spuriously over-reporting ADHD symptoms in their children, then their children would significantly differ on these correlates from children with ADHD of mothers without ADHD; and c) comparing those siblings with ADHD of children with ADHD whose mothers have ADHD to siblings of control children with mothers without ADHD on the same aforementioned common correlates of ADHD, with the assumption that if mothers with ADHD were not over-reporting child ADHD symptoms, then there should be significant group

differences between their children and those of mothers without ADHD. Similar to Faraone et al. (2003), Faraone et al. (1995) did not find significant group differences in the number of child ADHD symptoms reported between mothers with and without ADHD in families of children with ADHD. Faraone et al. (1995) also found that maternal ADHD status was not predicted by any of the typical external correlates of ADHD in their ADHD child sample. They did find significant group differences, however, between mothers with ADHD of children with ADHD and mothers without ADHD of control children without ADHD in their reports of psychiatric comorbidity and school failure (but not of intellectual functioning) among the children's siblings. Taking these results together, Faraone et al. (1995) therefore concluded that there was no evidence for maternal reporting bias in mothers with ADHD when reporting their child's ADHD symptoms.

In both of the above studies, however, Faraone et al. (1995, 2003) examined maternal reports of child behavior using semi-structured interviews instead of child behavior rating scales, which are more commonly used in clinical settings (Pelham et al., 2005). Even more importantly, Faraone et al. (1995, 2003) assumed that if underlying cognitive deficits affected maternal ratings, they would bias them systematically in one direction. This would be consistent with the literature that has found an over-reporting bias of child externalizing symptoms in mothers with depression, anxiety, or stress.

Findings from the cognitive literature pertaining to ADHD, however, might potentially suggest a more variable and less consistent pattern of rating errors in mothers with ADHD, which assessment of systematic biases, alone, might not detect (see Castellanos, Sonuga-Barke, Scheres, Di Martino, Hyde, & Walters, 2005). Some child behaviors may be *wrongly endorsed* by these mothers (commission errors), yet other child behaviors may be incorrectly *missed*

(omission errors). Thus, looking for only a unidirectional systematic bias in mothers' ratings might not yield significant group differences in spite of substantial differences in accuracy between the two groups. Therefore, analysis of both commission and omission errors in maternal ratings of child behavior in mothers with and without ADHD symptoms might yield significant associations when analysis of a unidirectional bias would not.

Thus, in spite of the null findings obtained by Faraone et al. (1995, 2003), a number of conceptual and methodological questions remain for those interested in examining associations between maternal symptoms of ADHD and maternal reports of child ADHD symptoms. First, their results might be less applicable when examining maternal reports of child behavior on child behavior rating scales, which are more commonly used than are semi-structured interviews outside of research settings. Second, one may wonder whether their experimental design enabled them to capture core cognitive deficits of adult ADHD (i.e., both commission and omission errors), as they would apply to completion of child behavior rating scales by mothers with ADHD.

Findings from the Adult ADHD Cognitive Literature and Their Relation to Maternal Ratings of Child ADHD Symptoms

A growing body of literature has found that adults with clinically elevated ADHD symptoms are less accurate and make more errors on cognitive tasks that tap executive function (EF; such as working memory, response inhibition, sustained attention, set-shifting, planning, response organization) and vigilance than do adults with normal-range ADHD symptom levels. For example, Fischer, Barkley, Smallish, and Fletcher (2005) found that adults with ADHD were less accurate and made more commission and omission errors on tasks tapping response inhibition and vigilance. In a recent meta-analysis of the neuropsychological correlates of

ADHD in adults, Hervey, Epstein, and Curry (2004) reported deficits in adults with ADHD in working memory (WM), response inhibition, vigilance, planning, memory performance (encoding, retrieval, and memory-enhancement strategies), and organization of verbal information. Researchers have also found significantly higher levels of intra-individual variability (IRV)— which is often indexed as variability in reaction times on EF and vigilance tasks— in adults with ADHD (e.g., Hervey et al., 2004, 2006; Kuntsi, Oosterlaan, & Stevenson, 2001; Rucklidge & Tannock, 2002).

These impaired cognitive domains might affect ratings of child behavior in mothers with ADHD symptoms in a number of ways. First of all, the ability to detect child behaviors is crucial in order for a mother to be able to report them on a rating scale. Impaired vigilance and IRV would compromise a mother's sustained attention capacity and hence her ability to accurately rate the full range of child behaviors to which she is exposed. Secondly, rating child behavior requires mothers to recall, organize and choose the most salient information about child behavior that they have accumulated—often while confronted with high cognitive loads associated with the day-to-day demands of parenting. Each of these skills is impaired in adults with ADHD (see, for example, Halperin, Trampush, Miller, Marks, & Newcorn, 2008). Deficits in these areas are particularly pronounced in children and adolescents with ADHD when confronted with high cognitive loads (e.g., Cadesky, Mota, & Schachar, 2000; Lorch et al., 2004), although research has not yet been undertaken to explore these effects in adults. Additionally, poor WM and IRV would impair a mother's ability to accurately carry out these operations in order to summarize child behaviors with a single numeric rating (Castellanos et al., 2005; McInnes, Humphries, Hogg-Johnson, & Tannock, 2003). According to findings of the relationship of IRV to ADHD (e.g., Castellanos et al., 2005), one would expect a preponderance

of careless errors, as well. Thus, a mother with impaired and inconsistent vigilance, incomplete encoding of observed behavioral events, poor inhibition of distracting and extraneous information, and poor memory organization would be expected to both incorrectly recall and miss child behaviors, leading to increased rates of both commission and omission errors in their reporting of child ADHD behaviors. Taken together, findings from the cognitive literature would seem to indicate that mothers with elevated ADHD symptoms would make both commission and omission errors as a result of their weaknesses in executive functioning, vigilance, listening comprehension, and ability to make inferences.

The Relationship of IA and HI Symptom Clusters to Functioning in Adults

In addition to recent findings of cognitive impairment in adults with ADHD, researchers have found emerging evidence for differential patterns of continuing symptomatology, neuropsychological functioning, and functional impairment associated with the IA and HI symptom clusters in adults with ADHD. Research has converged to show that as children with persistent ADHD advance into adulthood, their HI symptoms decrease while their IA and disorganization symptoms remain prominent (Adler et al., 2008; Biederman et al., 2000; Hinshaw, Owens, Sami, & Fargeon, 2006; Nigg et al., 2005; Wilens, 2007). In addition, growing evidence has begun to link EF impairment and vigilance deficits in adults with the IA symptom cluster of ADHD, specifically, as opposed to the HI cluster. For example, Nigg et al. (2005) found significant associations between adult symptoms of IA and elevated IRV as well as deficits in WM, response inhibition, set-shifting, planning, and response speed (which they indexed as a measure of vigilance or state regulation). These associations remained robust to statistical control of adult symptoms of HI. However, Nigg et al. (2005) did not find similarly

robust associations between adult HI symptoms and these cognitive deficits once adult IA symptoms were controlled.

In the parenting domain, Murray and Johnston (2006) found that mothers with clinically elevated IA symptoms, only, evidenced poorer parenting practices than did mothers who had both clinically elevated IA and HI symptoms. Further, Stavro, Ettenhofer, and Nigg (2007) recently found that in adults, symptoms of IA and disorganization were far more closely associated with adaptive functioning than were symptoms of HI. While they found that EF impairment was associated specifically with IA symptoms (even with HI symptoms statistically controlled), they also found that HI symptoms were associated with EF impairment (with IA symptoms controlled) and that IA and HI symptoms were highly correlated with one another.

Despite occasional inconsistent findings, the cognitive literature, as a whole, would suggest that maternal symptoms of IA are associated with the pattern of inaccurate and variable responding that has long been considered to characterize ADHD, in general. Higher levels of IA symptoms in mothers (as compared to lower levels of maternal IA symptoms) would thus predict less accurate maternal ratings of child behavior (i.e., more errors of both commission and omission). This prediction should survive statistical control for maternal HI symptoms. The cognitive literature would also predict that HI symptoms would be significantly associated with inaccurate ratings; however, with statistical control of maternal IA symptoms and other common comorbid maternal psychopathology, this association would disappear.

Overall, these results and predictions argue for separate examination of the IA and HI symptom clusters in mothers. Faraone et al. (1995, 2003) had mothers report on their own ADHD symptoms based on the DSM-III-R conceptualization of ADHD (APA, 1987), which used slightly different items than the current DSM-IV (APA, 2000) and did not differentiate

among ADHD symptom clusters (i.e., IA and HI). As discussed above, separate examination of IA and HI symptom clusters enables more sensitive analysis of associations between adult ADHD symptoms and both cognitive functioning and functional impairment. Therefore, I will examine the relationship between maternal symptoms of IA and accuracy of maternal ratings of child ADHD symptoms, as well as the relationship between maternal symptoms of HI and accuracy of maternal ratings of child ADHD symptoms.

I predict the following pattern of results: a) maternal IA symptoms will be positively correlated with and predictive of the number of omission and commission errors in mothers' behavior ratings of videotaped children; b) maternal HI symptoms will be positively correlated with and predictive of the number of omission and commission errors in mothers' behavior ratings of videotaped children; c) significant associations between maternal IA symptoms and behavior ratings of videotaped children will survive statistical control for HI symptoms, but significant associations between maternal HI symptoms and behavior ratings of videotaped children will not survive statistical control for IA symptoms.

Comorbid Maternal Psychopathology and Its Effects on Maternal Ratings of Child Behavior

Comorbidity is common in adults with ADHD. Researchers in the adult ADHD literature have found significant associations between adult ADHD symptoms and symptoms of depression, dysthymia, and anxiety (e.g., Biederman et al., 1993; Biederman, Faraone, Spencer, & Wilens, 1994; Faraone et al., 2000; Harvey, Danforth, McKee, Ulaszek, & Friedman, 2003; Kera, Marks, Berwid, Santra, & Halperin, 2004; Steer, Kumar, & Beck, 2003). Estimates of comorbid Major Depressive Disorder and dysthymia in adult ADHD samples have ranged from 15-44% (Chronis, Gamble, Roberts, & Pelham, 2006; Fischer et al., 2005; James, Lai, & Dahl, 2004; McGough , Smalley, McCracken Yang, Lynn, & Loo, 2005). Past research has estimated

rates of co-occurring ADHD and anxiety disorders as high as 19-51% (McGough et al., 2005; Wilens, 2007). Thus, there is ample evidence that both maternal depressive and anxiety disorders frequently co-occur with maternal ADHD symptoms.

Since comorbid psychopathologies are relatively common in mothers with elevated symptoms of ADHD, examination of the potential effects of these comorbidities on maternal reports of child ADHD symptoms is warranted. Numerous research findings have provided support for associations between maternal depression, maternal stress, or maternal anxiety on the one hand, and maternal biases in ratings of child ADHD symptoms, on the other hand. When examining the effects of maternal depressive symptoms on maternal ratings of child ADHD symptoms, specifically, several investigators have concluded that depressive cognitive distortions result in depressed mothers over-reporting their children's ADHD symptoms (see Boyle & Pickles, 1997a; Chi & Hinshaw, 2002; Fergusson, Lynskey, & Horwood, 1993; Youngstrom et al., 1999; Youngstrom, Loeber, & Stouthamer-Loeber, 2000). However, others have found no significant evidence for maternal depressive distortions in reports of child behavior problems (e.g., Boyle & Pickles, 1997b; Mick, Santangelo, Wypij, & Biederman, 2000; Richters, 1992). Baumann et al. (2004), for example, found no significant differences between depressed and non-depressed mothers' child behavior ratings of IA and HI when using trained child confederates in order to control for the child behavior presented. Thus, while evidence for associations between maternal depression and maternal rating bias has been somewhat mixed, there is enough evidence for depressed mothers over-reporting child ADHD behaviors to necessitate at least accounting for maternal depressive symptoms when investigating associations between maternal ADHD symptoms and maternal ratings of child ADHD behaviors.

A number of investigators have found evidence of maternal over-reporting of child externalizing behavior— including child ADHD symptoms— in mothers under stress. Youngstrom et al. (2000), examining discrepancies among mothers', teachers' and children's self-reports, found associations between elevated levels of maternal-reported child ADHD symptoms and both maternal depression and maternal stress. Barry et al. (2005) found significant associations between maternal ratings of child ADHD and externalizing behavior and maternal parenting stress; however they did not find significant associations between teacher ratings of child ADHD and externalizing behavior and maternal symptoms of stress. Krech and Johnston (1992) investigated the effects of minor everyday stressors on maternal perceptions of child externalizing behavior, using short, written scenarios describing child behavior. Krech and Johnston (1992) found that maternal depression and stress (both everyday hassles and major life events) each were associated independently with more negative maternal ratings of child behavior. Intriguingly, van der Oord, Prins, Oosterlaan, and Emmelkamp (2006) examined the relationships among mother and teacher disagreement in ratings of IA, HI and Oppositional Defiant Disorder symptoms on the one hand, and maternal depression and maternal parenting stress (as measured by the Parenting Stress Index) on the other. They found that parenting stress accounted for 12% of IA symptom disagreement and 14% of HI symptom disagreement between mothers and teachers in their ratings of child behavior, but that maternal depressive symptoms did not account for any of the model's unique variance when parenting stress was controlled. Thus, maternal stress would appear to correlate with maternal over-reporting of child externalizing behaviors.

Although limited to a few studies, some evidence has been found to support the hypothesis that mothers with high levels of anxiety symptoms over-report child behavior

problems. Chilcoat and Breslau (1997) found evidence supporting a link between comorbid maternal depression and anxiety, as well as maternal anxiety alone, and maternal over-reporting of child externalizing symptoms, as assessed by discrepancies between maternal and teacher ratings. A number of investigators have also found evidence of an association between maternal anxiety and elevated maternal reporting of child anxiety symptoms (e.g., Chilcoat & Breslau, 1997; Frick, Silverthorn & Evans, 1994). However, little investigation has explored the relationship between maternal anxiety and maternal ratings of child ADHD symptoms, specifically. Barry et al. (2005), though, reported a significant association between level of maternal anxiety and maternal ratings of child ADHD symptoms without finding the same relationship between maternal anxiety and teacher ratings of child ADHD symptoms, suggesting that mothers with high levels of anxiety over-report their children's levels of ADHD symptoms.

Taken together, these results indicate that maternal depression, stress, and anxiety frequently co-occur with maternal IA and HI symptoms. In addition, they indicate at least a possibility that maternal depression, maternal anxiety, and maternal stress might systematically bias mothers to over-report child ADHD symptoms. It is, therefore, crucial for researchers to co-vary maternal depression, anxiety and stress when assessing associations between maternal symptoms of IA and HI and maternal ratings of child ADHD symptoms. Thus, I will measure and statistically control for these three common comorbidities in mothers with elevated IA and HI symptoms when I analyze associations between maternal symptoms of IA and HI and maternal ratings of child ADHD symptoms.

SES and Its Effects on Maternal Ratings of Child ADHD Behaviors

Socioeconomic status (SES) has been associated with a wide range of negative family and child outcomes. Lower SES has been associated with crowded living conditions, high

mobility, persistent family illness and other poor health outcomes, and higher life stress in parents and families, as well as with poor nutrition, poor health outcomes, less access to cognitively stimulating materials, and higher incidence of psychiatric disorders in children (Bradley & Corwyn, 2002; Lasky-Su et al., 2007; Pinderhughes, Dodge, Bates, Pettit, & Zelli, 2000; Webster-Stratton & Hammond, 1998). Amongst the child psychiatric disorders with which low SES has been associated are child ADHD and other child externalizing disorders, with past research finding these disorders more common in lower-SES children (Barry et al., 2005; Campbell, Breaux, Ewing, & Szumowski, 1986; Counts, Nigg, Stawicki, Rappley, & Von Eye, 2005; Frigerio, Cattaneo, Catalado, Schiatti, Molteni, & Battaglia, 2004; Gingerich, Turnock, Litfin, & Rosén, 1998; Lasky-Su et al., 2007; Pineda et al., 1999). Adults with ADHD, on a conceptual level, would be expected to have lower SES due to their functional impairment in the domains that comprise the SES construct: occupational and academic functioning (see, for example, Adler et al., 2008; Barkley et al., 2002; Wilens et al., 2002).

Past research has provided some evidence for possible effects of family SES on maternal rating accuracy. In particular, parents with lower SES have been thought to have deficits in some areas of functioning similar to those of mothers with ADHD, most notably— as it relates to parent ratings— in monitoring of child behavior (Bradley & Corwyn, 2002). Thus, it is possible that lower family SES might be associated with lower maternal rating accuracy in the same manner that maternal ADHD symptoms would be through impaired encoding processes for recall of child behaviors (see Lorch et al., 2004).

An even greater preponderance of evidence and conceptual considerations would suggest a systematic over-reporting bias in mothers in lower SES families, due to the negative effects on maternal cognitive processes that are associated with lower SES and the increased number of

family stressors that accompany it. Youngstrom et al. (2000), for example, found that family SES had a significant association with caregiver-rated child externalizing symptoms, but not with teacher-rated child externalizing symptoms, suggesting a possible over-reporting bias in caregivers. Pinderhughes et al. (2000) found mediated relations between SES and harsh discipline practices, such that lower SES parents suffered from higher stress and that this, in turn, was associated with more intense cognitive-emotional processes and more negative child perceptions. In a 3-year prospective study, Campbell et al. (1986) found that both lower family SES at study outset and concurrent family stress/disruption (e.g., marital discord, separation or divorce, unemployment, chronic illness) predicted elevated maternal ratings of child ADHD symptoms both at study outset and 3 years later. Campbell et al. (1986) explained at least some portion of the variance of their results as being indicative of the following process: lower family SES and concurrent family stress/disruption cause lower maternal tolerance for overactive or impulsive child behavior, which, in turn, then leads to more negative maternal attitudes that cause higher maternal ratings of child ADHD symptoms. In sum, mothers in lower SES families have more negative cognitive processes than do other mothers when describing their own children's behavior and while little research has directly addressed maternal cognitive biases, there is some indication in past research that mothers with lower SES might over-report child ADHD and externalizing symptoms.

Therefore, taken together, past research not only indicates an association between both child and adult ADHD and lower SES but also the possibility that family SES may independently affect maternal cognition and affect, which in turn, might cause systematic maternal over-reporting bias or maternal rating inaccuracy. As a result, I decided to include

family SES as a covariate in my analyses of relations between maternal ADHD symptoms and maternal ratings of child behavior.

Potential Influences of Child ADHD Symptoms and Child Oppositional/Conduct Problems on Maternal Ratings of Child ADHD Behaviors

Several considerations would also recommend covariation of the levels of ADHD and oppositional/conduct problems in the mother's own child. On a conceptual level, mothers will have different levels of familiarity with and sensitivity to child ADHD symptoms based, in large part, on their own children's level of ADHD symptoms. A mother who has a son with elevated ADHD symptoms will likely be more sensitive to these symptoms and potentially better able to recognize these symptoms than a mother whose son has fewer ADHD symptoms. Conversely, a mother whose son has less ADHD symptoms might find that, in contrast, the videotaped children she is viewing have far greater levels of ADHD symptoms. Thus, one way or another, mothers' own sons' level of ADHD symptoms would seem to require statistical control. On a practical level, ADHD is frequently comorbid with other child externalizing behaviors, particularly child oppositional/conduct problems, which past researchers have found to occur in 30-60% of ADHD cases (see, for example, Johnston & Jassy, 2007; Pineda et al., 1999). The presence of child oppositional/conduct problems has been found to affect maternal cognition and appraisals of child behavior. Potier and Day (2007) found that mothers of children with conduct problems had more negative interpersonal schemas about their children and liked their children's expected behavior less than mothers of children without conduct problems. Researchers have also found that mothers of children with oppositional/conduct problems were more negative when interpreting child behavior, using both videotaped child behavior and hypothetical written vignettes (Nix, Pinderhughes, Dodge, Bates, Pettit, & McFadyen-Ketchum, 1999; Sanders &

Dadds, 1992; Snarr, Strassberg, & Slep, 2003; Strassberg, 1995). For example, Strassberg (1995) found that mothers of oppositional boys made more negative inferences of videotaped child behaviors (particularly when the behaviors were ambiguous) when directed to imagine themselves and their sons in the same situation than did mothers of non-oppositional boys. These negative cognitive processes might well apply when rating videotaped child behaviors with at least some ADHD and oppositional/conduct problem behaviors contained therein, since ADHD and oppositional/conduct problems so frequently co-occur outside of the laboratory setting. Taken together, past research indicates that child ADHD and child oppositional/conduct problems behaviors frequently co-occur and are frequently associated with negatively biased maternal cognitive and affective appraisals. Therefore, I decided to control for symptom levels of both ADHD and oppositional/conduct problems in mothers' own sons.

Measurement Issues in the Diagnosis of Adult IA and HI Symptoms

Three findings in the literature recommend dimensional instead of categorical assessment of maternal symptoms of IA and HI. First, past research has firmly established that adults vary dimensionally in the number of symptoms they have that comprise a given syndrome, including ADHD (for further discussion, see Widiger & Clark, 2000; Widiger & Samuel, 2005). Second, research focusing specifically on adults with ADHD has found significant ADHD-related impairment in individuals who have some symptoms of IA and HI but not enough to fully warrant a clinical ADHD diagnosis (Faraone et al., 2000). Third, Faraone et al. (2006) and other researchers (e.g., Barkley et al., 2002) have argued that diagnostic criteria for ADHD were developed for children and are not developmentally appropriate for adults. As a result, a study that compares mothers with and without ADHD using categorical diagnoses may confound, within the group of mothers without ADHD, mothers both with and without significantly

impairing symptoms of IA and HI. I therefore plan to measure adult IA and HI symptoms dimensionally instead of categorically.

A number of findings suggest that researchers should utilize both self-ratings and independent observer ratings when assessing maternal ADHD symptoms. Barkley et al. (2002), for example, found that according to self-reports, only 5% of children with ADHD continued to suffer from significant IA and HI symptoms as adults. However, when Barkley et al. (2002) used parent reports of these young adults' behavior, this persistence rate rose to 46% (and to 66% when using both parent reports and more developmentally appropriate diagnostic criteria). Other researchers have largely replicated these estimates (e.g., Faraone et al., 2000; Wilens et al., 2002). Barkley et al. (2002) also found that parent reports of young adult ADHD symptoms better correlated with indicators of young adults' functional impairment (e.g., occupational, academic, legal, social) than did young adults' self-reports. While an argument might be made for use of only informant ratings of adult ADHD symptoms, self-reports of IA and HI continue to be the foci of diagnostic strategies in the assessment of adult symptoms of ADHD in clinical practice (Faraone et al., 2000) and research by Achenbach et al. (2005) suggested that diagnosis of adult psychological functioning is optimal when both self-ratings and informant ratings are used. In sum, these findings suggest that precise, clinically relevant measurement of the association between maternal symptoms of IA and HI and accuracy of maternal reports of child behavior requires both self-ratings and independent observer ratings of maternal IA and HI symptoms. As a result, I decided to obtain both self-ratings and independent observer ratings of maternal symptoms of IA and HI.

The Current Study

Using videotaped child behaviors, I designed a study to assess associations (both through bivariate correlations and hierarchical multiple regression analyses) between maternal IA and HI symptoms (using both self-ratings and informant ratings) and maternal accuracy in rating child ADHD behaviors in a community sample of mothers. Measuring IA and HI symptoms separately, I planned to mutually control maternal IA and HI symptoms for one another. Additionally, I also planned to control for maternal symptoms of depression, anxiety, and stress, as well as for family SES and child hyperactive/inattentive symptoms and oppositional/conduct problems. Finally, in order to explore whether the null maternal rating bias results of Faraone et al. (1995, 2003) would be replicated in a community sample with ADHD symptoms measured dimensionally and rated by multiple informants (i.e., self-ratings and informant ratings), I decided to run the same sets of analyses as above, but using as dependent variables measures of maternal rating bias (i.e., number of child IA symptoms endorsed and number of child HI symptoms endorsed).

Method

Participants

I recruited mothers of 5-12 year-old boys in the Greater Vancouver/Lower Mainland metropolitan area from a variety of sources, including notices posted in community centers, community bulletin boards, health clinics, as well as on listservs and the Internet. Mothers were recruited from a variety of sources in order to obtain a diverse sample that would provide a wide range of maternal psychological functioning, child functioning, socioeconomic status, and family cultural background. Mothers were excluded from participation in the study if they were non-native English speakers with less than 3 years of English-speaking experience, if they had been

diagnosed with psychosis, if they had a current diagnosis of ADHD, or if their 5-12 year-old sons had been diagnosed with ADHD, pervasive developmental disorder, mental retardation, or an autistic spectrum disorder. One hundred and fifty-seven telephone calls from mothers were screened by study personnel, using the above exclusion criteria. One hundred and twenty-three mothers (78%) met study inclusion criteria and were scheduled for an appointment to participate in the study. Subsequently, 18 mothers (15%) dropped out of the study due to reasons that included time unavailability, repeated failure to keep appointments, or difficulty in arranging transportation for the mother or laboratory personnel (in the case of home visits). One hundred and five mothers initially participated in the study in our laboratory or at their homes and received questionnaires for themselves and a close other informant to fill out either on-site or to be mailed back to our laboratory.[1] Five mothers (4%) participated initially and filled out self-rating measures, but their informants failed to complete and return the questionnaires given to them. Thus, I received fully completed questionnaires from 100 mothers and their designated informants.

In addition, I excluded one mother's data (1%) from analysis because five or more of 18 total items were missing from 75% of her videotaped child behavior rating scales, thereby making them impossible to definitively interpret, according to the scale's authors (DuPaul, Power, Anastopoulos, Reid, McGoey, & Ikeda, 1997). Another two mothers (2%) and their informants completed and returned all questionnaires; however, their Four-Factor Indexes of Social Status were not interpretable because they omitted crucial information for determining socioeconomic status when they returned these forms (for details on interpretation of Four-Factor Index of Social Status scores, see Hollingshead, 1975). Therefore, my final sample was

comprised of 97 mothers. Table 1 describes the characteristics of the sample that I used for this study.

Stimulus Materials

Eight boys aged 7 to 10 years old who had been diagnosed with ADHD were recruited to perform various semi-scripted behaviors and were videotaped in their home environments as part of an ongoing study of the effects of an instructional protocol for use with parental rating of child ADHD symptoms. Each videotaped child behavior lasted between 3 to 27 seconds and belonged to one of the following behavior clusters: Inattentive (IA), Hyperactive-Impulsive (HI), Oppositional Defiant (OD), Internalizing (Int), or normal (Nor). Based on an initial review of the behaviors by our research staff, several behaviors in each cluster from each child were selected for further piloting. Since the empirical questions of this study are confined to maternal ratings of child ADHD and non-problem behaviors, I will discuss only the child IA, HI, and Nor behaviors used as stimuli.

Piloting was undertaken in order to select those behaviors for each child from each behavior category that were most clearly identified as the intended behavior. Ninety-three undergraduate and two graduate students in Psychology at the University of British Columbia (UBC), naïve to the experimental hypotheses, were each shown DVDs with 31 to 34 short behavior clips from four children, counterbalanced across all participants such that each of the eight children was viewed by 42 to 53 students. After each behavior clip was shown, the raters were asked to classify the child behavior using a list of symptoms which included the complete DSM-IV symptoms for ADHD (both the IA and HI symptom clusters). In addition, raters were given a 'none of the above' response option. I selected 10 to 17 IA, HI, and Nor behaviors for each child based on the following criteria: 1) 60% or more of raters endorsed the behavior as

identical or belonging to the same symptom cluster as those selected by our research staff and 2) no other behavior or behavior cluster received 21% or more of rater endorsements (except Nor behaviors, which were allowed to receive up to 29% of rater endorsements). It was necessary to extend the inclusion criteria to symptoms belonging to the same symptom cluster as the intended behavior because of the substantial degree of symptom overlap that exists within the DSM criteria. For example, the DSM-IV defines as two distinct IA symptoms: "often has difficulty sustaining attention in tasks or play activities," and "often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as school or homework)" (APA, 2000). A child observed leaving his seat to play with his pet cat soon after sitting down to do his homework could easily be classified as exhibiting either or both of the above IA symptoms.

For each videotaped child, I chose 4 to 7 ADHD and 6 to 10 Nor behavior clips that met the above criteria (with the exception of one Nor behavior, which had only 57% of raters' endorsements, but retaining this behavior enabled me to preserve the Nor to ADHD behavior proportions, as explained below). Using the behaviors selected for each child, our laboratory then created four DVDs for each of the eight children (for a total of 32 DVDs) containing 6 to 10 behaviors displayed in the following proportions: a) 2 ADHD: 1 Nor; b) 2 ADHD: 1 OD; c) 2 ADHD: 1 Int; d) all Nor behaviors. For each child, the quantity and content of ADHD behaviors depicted were identical across all DVDs (except the Nor behavior DVDs). Additionally, for each child, the number of behaviors depicted on the DVD with 100% Nor behaviors was equivalent to 150% of the number of ADHD behaviors depicted by that child on each of his other DVDs. A total of 45 ADHD and 65 Nor behaviors were selected across all children.

Measures

Ratings of Videotaped Child Behaviors

ADHD-RS-IV— Home Version (Dupaul et al., 1997; Dupaul, Power, Anastopoulos, & Reid, 1998). The ADHD-RS-IV consists of 18 items drawn directly from the DSM-IV (DuPaul et al., 1998). It has shown good psychometric properties, in terms of reliability, and has been extensively validated (see DuPaul et al., 1997, 1998; Johnston & Mah, 2007). The ADHD-RS-IV assesses child IA and HI symptoms on a 4-point scale. For maternal ratings of videotaped children's behaviors, because there was limited opportunity for mothers to observe each child's behavior, the frequency metric used on the ADHD-RS-IV would not have been meaningful. That is, mothers would have had no way of accurately rating if children perform a behavior "sometimes" or "a lot," for example. Therefore, I used anchors that depicted the degree of the behavior observed as follows: 0 (not at all), 1 (just a little), 2 (pretty much) and 3 (very much). Since diagnostic algorithms used in past research (e.g., Chhabildas et al., 2001; Maedgen & Carlson, 2000) counted a symptom as 'present' if it is rated as a '2' or '3,' I used the same criteria to conclude whether or not a mother rated an IA or HI symptom as 'present' in the videotaped child.

I created two scores for each mother from her ratings of the videotaped children: *total commission errors and total omission errors.* Conceptually, a commission error was an IA or HI behavior that was not shown in the DVD but which was endorsed by the mother, while an omission error was an IA or HI symptom that was shown in the DVD but not endorsed by the mother. However, as mentioned in the previous section, overlap in ratings of ADHD symptoms was expected due to the overlapping nature of the symptoms within each ADHD symptom

cluster. Therefore, my operationalization of commission errors and omission errors had to account for this overlap.

In order to avoid confounding maternal rating errors with child ADHD symptom overlap, I used a conservative standard for labeling a maternal response as an error. I considered as an acceptable 'correct' response for an intended IA symptom, any IA symptom that had been endorsed by 6% or more of pilot raters for the portrayed behavior. Similarly, I considered as an acceptable 'correct' response for an intended HI symptom, any HI symptom that had been endorsed by 6% or more of pilot raters for the portrayed behavior. Thus, if 10% of pilot raters endorsed the IA symptom "often has difficulty sustaining attention in tasks or play activities" for the intended IA behavior, "often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as school or homework)," then maternal endorsement of either of those symptoms was considered an acceptable 'correct' rating of the intended child IA behavior.

A *commission error* was defined as either: a) any maternal symptom endorsement of an IA symptom that had not received 6% or more of pilot rater endorsements for any of the IA behaviors depicted on a given DVD, or b) any maternal symptom endorsement of an HI symptom that had not received 6% or more of pilot rater endorsements for any of the HI behaviors depicted on a given DVD. An *omission error* was defined as a failure to endorse all acceptable 'correct' responses for a particular IA or HI behavior depicted on a given DVD. Thus, for a given DVD, if three HI symptoms received 6% or more of pilot rater endorsements for an intended HI behavior, an omission error was recorded *only* if a mother failed to endorse all three of these HI symptoms. Further, if the same combination of possible behaviors (i.e., behaviors considered as acceptably 'correct,' according to the 6% standard above) was depicted on a video more than once, mothers were only considered to have committed a single omission

error if they failed to endorse all acceptable 'correct' responses. The reason for this decision was that, by filling out an ADHD-RS-IV after viewing each video, mothers were rating the aggregate of child behaviors depicted on the video, instead of each behavior depicted, individually. Thus, for example, if on a given DVD, "often fidgets with hands or feet or squirms in seat," "often has difficulty playing or engaging in leisure activities quietly," and "often talks excessively" were all acceptable 'correct' ratings for one intended HI behavior, while the first two symptoms were acceptable 'correct' ratings for a second intended HI behavior, then a mother's failure to endorse all three was only considered to be a single omission error.

Depending on which particular child DVDs they viewed, mothers could make a maximum of 57 to 74 commission errors and 18 to 21 omission errors across all eight children viewed. Because of these range discrepancies, I created separate Error Proportion Scores for commission errors *(Commission EPS)* and omission errors *(Omission EPS)* for each mother. The Commission EPS was calculated for each mother as follows: the proportion of commission errors made to the total potential commission errors possible for the set of DVDs viewed. The Omission EPS was calculated for each mother as follows: the proportion of omission errors made to the total potential omission errors possible for the set of DVDs viewed.

In addition, I created two scores from maternal ratings of videotaped children to indicate systematic maternal over-reporting or under-rating bias: *total IA symptoms endorsed* and *total HI symptoms endorsed.* The total IA symptoms endorsed score was the sum of all videotaped child IA symptoms endorsed as "present" by each mother across all eight videotaped children. The total HI symptoms endorsed score was the sum of all videotaped child HI symptoms endorsed as "present" by each mother across all eight videotaped children.

Measures of Maternal IA and HI Symptoms

Conners Adult ADHD Rating Scale (CAARS; Conners, Erhardt, & Sparrow, 1999). The CAARS Self-Report, Short Form is a 26-item self-report for adults assessing ADHD symptoms over the past 6 months. The CAARS Observer, Short Form is a 26-item informant report of adult ADHD symptoms intended for use by the individuals' significant others (e.g., spouses, parents, siblings, friends). Both forms have four subscales assessing the following symptoms: Inattention/Memory Problems, Hyperactivity/Restlessness, Impulsivity/Emotional Lability, and Problems with Self-Concept. The CAARS Self-Report, Short Form's 4-factor structure was replicated by Cleland, Magura, Foote, Rosenblum, and Kosanke (2006). The CAARS has been found to have excellent internal consistency for both observer and self-reports, with Cronbach alphas ranging from .80-.81 for self-report and .81-.85 for observer report on the Inattention/Memory, Hyperactivity/Restlessness, and Impulsivity/Emotional Lability scales (Conners et al., 1999). Also for those scales, observer forms of the CAARS obtained test-retest reliabilities ranging from .85-.91 (Conners et al., 1999). While little research has established test-retest reliability for the CAARS Self-Report Short Form, Erhardt, Epstein, Conners, Parker, and Sitarenios (1999) found test-retest reliabilities for the CAARS Self-Report Long Version's four subscales ranging from .79-.91 in females across diverse age groups. Using the DSM-IV's two-factor structure of IA and HI for conceptualizing symptoms of ADHD, I used the mean of mothers' scores on the Inattention/Memory Problems scale to index IA symptoms, and the mean of mothers' combined scores across the Hyperactivity/Restlessness and Impulsivity/Emotional Lability scales (referred to hereafter as Hyperactivity/Impulsivity) in order to index HI symptoms. Similar to what Conners et al. (1999) reported, internal consistencies (Cronbach's α) for the Inattention/Memory Problems Scale in this sample were good (.83 for self-ratings and .86

for informant ratings). For the combined Hyperactivity/Impulsivity scale, internal consistencies in this sample were lower than those obtained by Conners et al. (1999), ranging from moderate to good (.69 for self-ratings and .87 for informant ratings).

Current Symptoms Scale (CSS; Barkley & Murphy, 2006). The CSS Self-Report Form and the CSS Other Report Form are 18-item scales measuring IA and HI symptoms in adults over the preceding 6 months. The CSS is based on the DSM-IV diagnostic criteria for ADHD but slightly changes the wording on some items in order to be more developmentally appropriate for adults. CSS forms were completed by mothers and significant others for the purposes of assessing maternal IA and HI symptoms. The CSS has excellent psychometric properties, with Cronbach alphas ranging from .84-.91 and inter-rater reliabilities ranging from r= .55-.57 between informant and self-ratings (Barkley & Murphy, 2006). Mean scores for each mother were analyzed separately for IA symptoms and HI symptoms. In the current sample, internal consistencies (Cronbach's α) were somewhat lower than those obtained by Barkley and Murphy (2006), but still ranged from acceptable to good. Specifically, internal consistencies were .81 for self-rated IA symptoms, .73 for self-rated HI symptoms, .87 for informant-rated IA symptoms, and .85 for informant-rated HI symptoms.

Measures of Comorbid Maternal Psychopathology

Brief Symptom Inventory (BSI; Derogatis, 1993). The BSI is a shortened version of the 90-item Symptom Checklist (SCL-90; Derogatis, 1973), which assesses various domains of psychological functioning in adults. I chose to use the BSI Anxiety and BSI Depression subscales, which each contain six items. The BSI has good psychometric properties with Cronbach alphas for its Anxiety and Depression subscales of .81 and .85 respectively (Derogatis, 1993). Test-retest reliabilities for the Anxiety and Depression and subscales were .79 and .84

respectively, and moderate to good convergent validity was found with the MMPI Wiggins Depression and Poor Morale Content Scales (Derogatis, 1993). I analyzed the mean scores for each of the Anxiety and Depression scales. Similar to Derogatis' findings, in the current sample, internal consistencies (Cronbach's α) were also good (.82 for Anxiety and .86 for Depression).

Parenting Stress Index, Short Form (PSI; Abidin, 1995). This commonly used measure of maternal stress contains 36 items assessing parenting stress caused by dysfunctional parental behaviors and child behavioral characteristics. Adequate psychometrics have been demonstrated for this measure, with an overall Cronbach alpha of .87, an overall test-retest reliability of .85, and a concurrent validity ranging from .92-.94 with the long form of the PSI (Abidin, 1995; Copeland & Harbaugh, 2005). I used the Parental Distress (PD) scale of the PSI Short Form, which has a total of 12 items. Haskett, Ahern, Ward, and Allaire (2006) confirmed the factor validity of the PD scale and found that the PD scale's test-retest reliability was .75 after a 1-year interval. Additionally, they found that concurrent validity of the PD scale was .54 when compared with the SCL-90 Global Severity Index. In the current sample, internal consistency was good (Cronbach's α= .88).

Hollingshead Four Factor Index of Social Status (SES; Hollingshead, 1975). The Hollingshead Four Factor Index of Social Status is one of the most widely used measures of socioeconomic status (SES). The Hollingshead Four Factor Index raw score is comprised of two components: education and occupation. Finer-grained distinctions and more relative weight are placed upon the occupational component. In two-income households, SES raw scores are averaged in order to derive a single household SES raw score. In single-income households, only the wage-earner's occupational status and education are taken into account when calculating household SES raw score. Raw scores can range from 20 to 66, with higher raw scores

indicative of higher SES. Cirino, Chin, Sevcik, Wolf, Lovett, and Morris (2002) found an inter-rater reliability of r=.91 for the Hollingshead Four-Factor Index, in addition to concurrent validity coefficients ranging from r= .81 to .86 with other well-known measures of SES. I used the raw SES score for each mother's household, based on mother's and/or father's income and occupation.

Strength and Difficulties Questionnaire (SDQ; Goodman, 1997). The SDQ is a brief behavioral screening questionnaire for 3-16 year-old children which is already one of the most widely used research instruments in Europe for assessment of child behavior problems and which is being used with increasing frequency in North America. The SDQ has five scales, each containing five items, for a total of 25 items. Responses to each item can range from 0 (Not True) to 2 (Certainly True). The Hyperactivity/Inattention scale and the Conduct Problems scale were used, respectively, to assess ADHD symptoms and externalizing symptoms (i.e., oppositional behavior and conduct problems) in mothers' own sons. The SDQ's psychometric properties in parent ratings of child behavior have been well documented, with a number of studies confirming its five-factor structure (Goodman, 2001; Smedje, Broman, Hetta, & von Knorring, 1999). Goodman (2001) found a satisfactory Cronbach alpha for Hyperactivity/Inattention with a coefficient of .77, and a moderate Cronbach alpha coefficient of .63 for Conduct problems, although other researchers have found Cronbach alphas ranging from .73 to .84 for Hyperactivity/Impulsivity and from .54 to .66 for Conduct Problems (e.g., Hawes & Dadds, 2004; Koskelainen, Sourander, & Kaljonen, 2000; Smedje et al., 1999). Test-retest reliabilities for Hyperactivity/Inattention and Conduct Problems have ranged, respectively, between .72 to .77 and between .64 to .65 (Goodman, 2001; Hawes & Dadds, 2004). The Hyperactivity/Inattention scale had a concurrent validity coefficient ranging from r=.67 to .78

with the Attention Problems subscale of the Child Behavior Checklist (CBCL; Achenbach, 1991), while Conduct Problems correlated between .60 and .72 with the CBCL Externalizing Problems subscale (Koskelainen et al., 2000; van Widenfelt, Goedhart, Treffers, & Goodman, 2003). The current sample, in line with previous research, had internal consistencies (Cronbach's α) of .77 and .59 for Hyperactivity/Inattention and Conduct Problems, respectively.

Procedure

I applied for and received Ethics Board approval from UBC's Behavioral Ethics Review Board prior to collecting data. Mothers were recruited as part of a larger study examining the effects of an instructional protocol on maternal ratings of child ADHD behaviors. Mothers interested in participating in the study initially called the UBC Parenting Lab and were screened over the phone to assess whether they met study criteria. Mothers came to the Parenting Laboratory at UBC in Vancouver or UBC Parenting Lab personnel visited mothers' homes in order for mothers to participate in the study.[1] Mothers were assigned to two instructional conditions: Instructional or Non-instructional. Mothers in both instructional conditions read and signed consent forms. Mothers in the Instructional condition then watched a 15-minute PowerPoint presentation instructing them as to how to rate child ADHD behaviors; mothers in the Non-instructional condition, on the other hand, were given a brief set of oral instructions for rating child ADHD behaviors.

As described previously, mothers were subsequently shown DVDs of eight children, each containing 6 to 10 behaviors. The combination of child behaviors presented on each DVD, as well as the order of children presented, were randomized across mothers. Thus, mothers viewed each combination of IA, HI, OD, Int and Nor child behaviors depicted by two different children,

randomized across all mothers such that each of the four behavior combinations for each of the eight videotaped children was viewed by an approximately equal number of mothers.

After viewing each DVD, mothers filled out an ADHD-RS-IV for the child they had just viewed. Following the eight child DVDs, mothers then filled out a battery of questionnaires in counter-balanced order: the CAARS, CSS, BSI, PSI, SDQ, and a General Family Information form containing basic demographic information for the mother and her family (including mothers' and fathers' levels of education and family income, which formed the basis for determining family SES). As recommended by Barkley et al. (2002), I arranged to obtain ratings of maternal symptoms of IA and HI from an independent rater who knew the mother well, in order to ensure that maternal IA and HI symptoms were not under-reported (see, also, Faraone et al., 2000). I obtained the name and contact information of a significant other— defined as a spouse, romantic partner, close friend, sibling, parent or other family member— whom either I or the mother initially contacted to fill out observer forms of the CAARS and CSS. Informants completed and returned these forms either in person, by mail, or by email, subsequent to the mother's participation in the study. UBC Parenting Lab personnel contacted informants to follow up if they had not returned their completed questionnaires within 2 weeks. When possible, I attempted to use cohabitating spouses or romantic partners as informants. In cases where that was not possible, I encouraged mothers to have a close friend act as an informant and then, if that was not feasible, to approach a sibling or parent to act as the independent rater. Of the 97 informants who participated, 62 of them (64%) were cohabitating spouses or romantic partners, 24 of them (25%) were close friends, 7 of them (7%) were siblings, 2 of them (2%) were parents, 1 of them (1%) was an in-law, and 1 of them (1%) was an adult daughter.

Together, 69% of informants were male and 31% were female. Mothers were paid $35 for their participation in the study.

Missing Data

Missing data did not profoundly affect my results, since missing data was uncommon in my sample and mean scores could be used even with missing items. Nonetheless, I followed guidelines set out by the authors of the various scales used when deciding whether or not to exclude a particular measure from analysis for each mother. Across all measures in my sample, there were only two instances of my having to exclude any measure or scale from analysis: one ADHD-RS-IV (out of eight total) was not analyzed in 2 of the 97 mothers in the sample. The reasons for each instance are as follows: a) one mother recognized the family depicted on the video and was therefore not shown the entire video; b) one mother omitted five ADHD-RS-IV items for one of the videotaped children, rendering meaningful interpretation difficult for that particular ADHD-RS-IV form, according to the missing data guidelines found in DuPaul et al. (1998). Overall, for all maternal ratings of videotaped child behaviors on the ADHD-RS-IV, only 67 out of 23,668 (0.21%) total items received no response across all 97 mothers. For measures of maternal rating accuracy, which used EPS as their metric and were based on mothers' ADHD-RS-IV responses, items with no response were merely subtracted from the total number of possible commission or omission errors that mothers could make for that particular video. For measures of maternal rating bias (using number of IA and HI symptoms endorsed on the ADHD-RS-IV), I treated each instance of missing data as a failure to rate a symptom 'present,' thereby making it similar to items rated as 'absent.' As for missing data for other measures, percentages of missing items were 0.34% for CAARS self-ratings and 0.62% for CAARS informant ratings. For the CSS, only 0.80% of self-rating items and 0.28% of informant

rating items had no response across the aggregate of 97 mothers and their informants. For covariates, missing data amounted to 0.34% for the BSI, 0.10% for the PSI, and 0.34% for the SDQ. There was no missing data for SES. Thus, no measure or subscale in my sample was missing even 1% of its data.

Data Reduction

With the goal of obtaining the most reliable measure of maternal symptoms of IA and HI, and consistent with previous research (e.g., Chen & Johnston, 2007), I ran a series of bivariate correlations to determine whether to combine data on mothers' IA and HI symptoms across multiple measures (in this case, the CAARS and the CSS) and multiple raters. First, I analyzed bivariate correlations between maternal self-rating measures of IA symptoms (the CAARS Inattention/Memory Problems and CSS IA subscales) as well as bivariate correlations between maternal self-rating measures of HI symptoms (the CAARS Impulsivity/Hyperactivity and CSS HI). I then did the same for informant ratings of maternal IA and HI, respectively. Since I found significant correlations with large effect sizes for each of the above analyses (see Table 2), I collapsed my measures of maternal IA and HI symptoms into the following four composites: self-rated IA symptoms, self-rated HI symptoms, informant-rated IA symptoms, and informant-rated HI symptoms. To see if the four composites could be subsequently collapsed into two, I performed bivariate correlations between self-rated IA and informant-rated IA symptoms as well as between self-rated HI and informant-rated HI symptoms. Although these correlations were significant, the effect sizes were only moderate (see Table 2). Therefore, I decided to separately analyze self-ratings and informant ratings of maternal IA and HI symptoms, thus utilizing two composite measures each for maternal IA symptoms and maternal HI symptoms.

In order to check for unexpected effects of location of maternal participation (i.e., in the lab or at home) affecting maternal ratings, I performed a series of *t*-tests comparing means on measures of maternal rating accuracy and bias. No significant differences emerged between mothers who participated in the UBC Parenting Lab and mothers who participated at home in Commission EPS, $t(95) = .43$, $p = .671$, Omission EPS, $t(95) = .00$, $p > .99$, the number of child IA symptoms endorsed, $t(95) = .15$, $p = .88$, or the number of child HI symptoms endorsed, $t(95) = .38$, $p = .70$. Therefore, I did not analyze separately mothers participating in the UBC Parenting Lab and mothers participating in their home settings.

In order to check for effects of instructional condition (i.e., *Instructional condition* or *Non-instructional condition*) on maternal ratings, I performed a series of *t*-tests comparing means on measures of maternal rating accuracy and bias. No significant differences emerged between mothers in the Instructional condition and mothers in the Non-instructional condition for Commission EPS, $t(95) = 1.02$, $p = .31$, Omission EPS, $t(95) = -1.70$, $p = .08$, number of child IA symptoms endorsed, $t(95) = .82$, $p = .42$, or number of child HI symptoms endorsed, $t(95) = 1.41$, $p = .16$. Since I did not obtain significant differences between instructional conditions on any of the four measures of maternal rating accuracy and bias, I combined mothers across the two instructional conditions in my analyses.

Data Analysis

I conducted a series of bivariate correlations and hierarchical multiple regressions. My dependent variables were the Commission EPS and Omission EPS (measures of maternal rating accuracy), as well as the number of child IA symptoms endorsed as present and the number of child HI symptoms endorsed as present (measures of maternal rating bias), for maternal ratings of videotaped child behaviors; my predictors were the self-rated maternal IA symptom composite

and the self-rated maternal HI symptom composite, or the informant-rated IA symptom composite and the informant-rated HI symptom composite; and my covariates were maternal anxiety, maternal depression, maternal parenting stress, family SES, mothers' sons' hyperactive/impulsive symptoms, and mothers' sons' oppositional/conduct problems. Although my hypotheses focused on measures of maternal rating accuracy, I decided to perform exploratory analyses of the relationships between measures of maternal IA and HI symptoms and measures of maternal bias both at the bivariate level and in hierarchical multiple regressions for two reasons: a) since so little previous research has been undertaken to examine relationships between maternal symptoms of IA and HI and maternal ratings of child ADHD behavior, I intended to examine whether my results would confirm those of Faraone et al. (1995, 2003) when examining systematic maternal rating bias; the current study, however, would expand upon past research by including both self-ratings and informant ratings of maternal IA and HI symptoms, as well as by using standardized child behaviors (i.e., videotaped behaviors) for mothers to rate; b) in order to evaluate whether examining maternal rating accuracy was a more useful construct for examining maternal ratings of child ADHD behavior than the construct of maternal bias, I decided to include both approaches to maternal ratings in my analyses in order to examine these two patterns of maternal rating distortion.

To analyze simple relationships among my variables, I used bivariate correlations between: a) maternal IA and HI symptoms, b) measures of maternal psychological and family functioning (covariates), and c) my dependent variables. To test whether maternal IA and HI predict either maternal rating accuracy or maternal rating bias, I ran a series of hierarchical multiple regressions in which: 1) composite maternal IA and HI scores (analyzed separately for self-ratings and informant ratings) were used to predict Commission EPS; 2) maternal IA and HI

scores (analyzed separately for self-ratings and informant ratings) were used to predict Omission EPS; 3) composite maternal IA and HI scores (analyzed separately for self-ratings and informant ratings) were used to predict total videotaped child IA symptoms endorsed; 4) composite maternal IA and HI scores (analyzed separately for self-ratings and informant ratings) were used to predict total videotaped child HI symptoms endorsed.

I chose hierarchical multiple regression analyses for the purposes of examining whether maternal symptoms of IA and HI predicted unique variance in my dependent variables above and beyond common maternal, child and family characteristics (as indexed by BSI Anxiety, BSI Depression, PSI Parental Distress, SES, SDQ Hyperactivity/Inattention, and SDQ Conduct Problems scores) that are typically associated with maternal IA and HI symptoms and measures of maternal rating accuracy and bias.

Results

Type I Error

In testing these hypotheses, I chose to use the nominal level of α =.05 as my approach to Type I error. In addition to being consistent with past literature (e.g., Barry et al., 2005; Youngstrom et al., 1999), I chose this level on the basis of a number of considerations. With analysis of bivariate correlations among four predictors, six covariates and four outcomes, there existed a real possibility of at least one Type I error, even more so were I to set an α level that was too lenient. At the same time, however, little past research has been conducted on the relation of self-rated maternal IA and HI symptoms to maternal child behavior rating bias, and no past research has separately analyzed maternal rating accuracy nor informant-rated maternal symptoms of IA and HI. Moreover, the past research that has examined maternal bias in ratings of child ADHD behavior has not detected significant relations. Thus, null findings in this study

might confirm past null findings; however, they might also be indicative of Type II error if I set α at a level that was too stringent. That risk was heightened by the nature of my sample, which was less variable than most community samples, since it excluded mothers with clinical levels of ADHD symptoms in either themselves or their sons. An additional consideration was the practical ramifications of making a Type II error: if indeed this study found even small effects for maternal inaccuracy in rating child ADHD behaviors, then this would still be important information for clinicians to take into account when relying on maternal reports of children. As a result of all of the above considerations, I chose a nominal α=.05 as a middle ground and reported trends for findings with α=.05-.10. With a sample size of 97, I had enough power to detect effects of small-medium size with α=.05.

Descriptive Statistics

Table 3 describes the characteristics of the variables that I used for this study, in terms of means, standard deviations, and ranges. The sample's mean family SES raw score was within the range that Hollingshead (1975) characterized as *middle class* to *upper middle class.* Mothers in the sample scored within one standard deviation of normative means on all measures of self-reported depression, anxiety, parental stress, and ADHD symptoms as well as on informant-rated symptoms of IA and HI (Abidin, 1995; Barkley & Murphy, 2006; Conners et al., 1999; Derogatis, 1993; Erhardt et al., 1999). More precisely, mothers' mean scores on self-rated IA, Hyperactive, and Impulsive symptoms for the CAARS placed them at the 63rd, 39th, and 63rd percentiles, respectively. When considering the same CAARS scales, but based on informant ratings, mothers were at the 58th percentile for IA, the 48th percentile for Hyperactivity, and the 56th percentile for Impulsivity. For BSI Anxiety and Depression, mothers' mean scores corresponded to T-scores of 58 and 59, respectively. Similarly, mothers also rated their sons as

having levels of hyperactive-inattentive symptoms and oppositional/conduct problems within one standard deviation of normative American and Australians male sample means (Goodman, 2001; Hawes & Dadds, 2004). More specifically, for maternal ratings of their own sons' symptoms, mean Hyperactivity/Inattention was at the 58th percentile while mean Conduct Problems was at the 61st percentile.

Distributions of several of my predictors and covariates had substantial positive skew. These variables included: the self-rated maternal IA composite, the self-rated maternal HI composite, the informant-rated maternal IA composite, BSI Anxiety, BSI Depression, SDQ Hyperactivity-Inattention, and SDQ Conduct Problems. This likely reflects the nature of my sample, which excluded mothers who had been diagnosed with adult ADHD or whose sons had been diagnosed with ADHD. Since higher levels of anxiety, depression, and parental stress often co-occur with higher levels of adult IA and HI, and since elevated child oppositional/conduct problems often co-occur with elevated child hyperactive-inattentive symptoms, it is logical that in addition to the measures of maternal IA and HI symptoms and child hyperactive-inattentive symptoms, that other measures of maternal and child functioning would also be positively skewed. Using natural log transformations, I transformed the positively skewed variables and ran the same series of bivariate correlations and hierarchical multiple regressions as those presented below with untransformed variables and found a highly similar pattern of results with minimal differences in significance of relationships or size of effects. Even with transformation of variables, however, the assumption of homoscedasticity was violated. Thus, with few substantial differences between results using untransformed variables and results using transformed variables, and with the assumption of homoscedasticity being

violated in both sets of analyses, I elected to use untransformed variables in order to facilitate interpretation of results.

Bivariate Relationships of Maternal IA Symptoms and HI Symptoms With Measures of Maternal Rating Accuracy and Maternal Rating Bias

In order to examine relationships between symptoms of maternal IA and HI and measures of maternal rating accuracy and bias, I conducted bivariate correlations.

Table 4 displays the bivariate correlations between maternal symptoms of IA and HI and: a) measures of maternal rating errors (Commission EPS and Omission EPS); and b) measures of maternal rating bias (the total number of child IA symptoms endorsed and number of child HI symptoms endorsed). Contrary to my predictions, the bivariate correlations between symptoms of maternal IA and HI and maternal commission and omission rating errors were small and generally nonsignificant. For maternal rating omission errors, however, I did find a significant negative correlation with informant-rated maternal IA and a nonsignificant trend for a negative correlation with informant-rated maternal HI. Thus, I obtained results that did not support my hypotheses when analyzing bivariate correlations between maternal IA and HI symptoms and measures of maternal rating accuracy (errors). Indeed, the only significant bivariate associations found were with informant ratings of maternal IA and HI and these were related to rating errors in the direction opposite to that I predicted. In exploratory analyses, while the bivariate correlations were positive between maternal IA and HI symptoms and the two measures of maternal rating bias, the relations were generally small and the only significant association was between informant-rated maternal HI and maternal child behavior ratings of HI. Thus, results of bivariate correlations between maternal IA and HI and maternal child rating bias mostly indicated that an overall bias in maternal ratings was not related to maternal ADHD symptoms.

In summary, I found few significant bivariate correlations between maternal IA and HI symptoms and measures of maternal rating accuracy (errors) and maternal rating bias. The few significant correlations I did find were with informant ratings, but even these were small in size and often were opposite to predictions.

Bivariate Relationships of Covariates with Maternal IA and HI Symptoms, Measures of Maternal Rating Accuracy, and Measures of Maternal Rating Bias

As previously discussed, some researchers have found associations between maternal ratings and maternal depression, anxiety, and parenting stress (e.g., Chi & Hinshaw, 2002; Chilcoat & Breslau, 1997; van der Oord et al., 2006). In addition, researchers have also found associations between symptoms of adult ADHD (i.e., IA and HI symptoms) and symptoms of anxiety, depression, and parenting stress (e.g., Biederman et al., 1993; Kera et al., 2004; van der Oord et al., 2006). I therefore decided to examine whether maternal anxiety, depression, and parenting stress should be included as covariates in my regression analyses of the effects of maternal symptoms of IA and HI on measures of maternal child rating accuracy and maternal child rating bias. In addition, family socioeconomic status is associated with ADHD, adult psychopathology, and their correlates and outcomes (e.g., Lasky-Su et al., 2006; Monuteaux, Wilens, & Biederman, 2007; Rieppi et al., 2002). Therefore, I examined family SES, using the raw score from the Hollingshead (with higher scores corresponding to higher SES) as a possible covariate. Finally, in order to be able to tease apart maternal rating effects related to maternal IA and HI symptoms, themselves, from maternal rating effects that might relate to having a child with higher or lower levels of hyperactive-inattentive symptoms and oppositional/conduct problems, I examined the need to control for ADHD symptoms and oppositional/conduct problems in mothers' own sons. Therefore, potential covariates included measures of maternal

anxiety, depression, and parenting stress, family SES, and child hyperactivity-inattention and oppositional/conduct problems. I conducted bivariate correlations to examine whether these covariates were associated with maternal IA and HI symptoms, as well as with maternal rating accuracy and maternal rating bias.

As shown in Table 5, there were significant medium-size relationships between self-rated maternal IA and HI, and each of maternal anxiety, depression, and parenting stress; I found significant but smaller effects for bivariate correlations between self-rated maternal IA and HI, and each of family SES (i.e., as family social status decreases, both maternal IA and HI increase), child hyperactivity-inattention and child oppositional/conduct problems. Informant-rated maternal IA was significantly, although not strongly, associated with both maternal anxiety and depression, while its correlation with parenting stress was a nonsignificant trend. Informant-rated maternal IA was not significantly associated with any of the other covariates. Informant-rated HI was not significantly associated with any of the covariates and its bivariate correlation with maternal anxiety resulted in a nonsignificant trend. Thus, all of the covariates I examined were associated with at least two of predictors of interest (self-ratings of maternal IA and HI), at the bivariate level, while significant or marginally significant relations were obtained between informant-rated IA and each of maternal anxiety, maternal depression and parenting stress.

Table 5 also displays the results of bivariate correlations between covariates and measures of maternal child rating accuracy and bias. Family SES was significantly and inversely correlated with commission errors, correlated positively and significantly with omission errors, as well as correlating significantly and inversely with both maternal bias measures. Thus, as SES decreased, maternal endorsement of child IA and HI symptoms and maternal commission errors increased but omission errors decreased. Parenting stress either significantly or

marginally significantly correlated with all four maternal rating measures, such that increased parenting stress was associated with increased commission errors, decreased omission errors, and increased number of child IA and HI symptoms endorsed. At the bivariate level, neither maternal anxiety nor the mothers' own children's hyperactive-inattentive symptoms correlated significantly with any of the maternal rating accuracy or bias measures. Midway between these, maternal depression was significantly and inversely correlated with omission errors at the bivariate level; mothers' own children's oppositional/conduct problems were significantly and inversely correlated with maternal omission errors and marginally significantly associated with total child IA symptoms endorsed on the videotapes.

Taken together, setting aside conceptual considerations, maternal anxiety, maternal depression, maternal parenting stress, family SES, and mother's own children's oppositional/conduct problems were significantly or marginally correlated with at least four of the eight variables measuring maternal ADHD symptoms and maternal rating accuracy and bias. As a result, I decided to include these five covariates in regression analyses.

While the mother's own child's hyperactivity-inattention only correlated, at the bivariate level, with self-rated maternal symptoms of IA and HI, its weak bivariate correlations with two of the four maternal rating bias and accuracy measures were in opposite directions from the other covariates and predictors. Making a conservative decision not to overlook potential suppressor effects that might be present, as well as taking into account previously mentioned conceptual considerations, I decided to also include child hyperactivity-inattention as a covariate in the regression.

Overview of Hierarchical Multiple Regressions Predicting Maternal Rating Accuracy and Maternal Rating Bias from Maternal IA and HI Symptoms and Covariates

In order to examine whether symptoms of maternal IA and symptoms of maternal HI would predict maternal rating inaccuracy or maternal rating bias above and beyond prediction that could be accounted for by covariates, I ran a series of hierarchical multiple regressions. I ran separate analyses first using self-ratings of maternal IA and HI to predict outcomes on both maternal rating accuracy measures after controlling for all six covariates, before subsequently using informant ratings to do the same. I then used self-ratings of maternal IA and HI to predict outcomes on both maternal rating bias measures after controlling for all six covariates, before, likewise, subsequently using informant ratings to do the same. Therefore, I ran a total of eight hierarchical multiple regressions.

Hierarchical Multiple Regressions Predicting Maternal Rating Accuracy from Self-Rated Maternal IA and HI Symptoms and Covariates

Table 6 displays the results of the hierarchical multiple regression predicting maternal child behavior rating commission errors from self-rated maternal IA and HI symptoms and covariates. While the model at Step 2 was significant, R^2 =.18, F (8,88)= 2 .41, p=.021, maternal IA and HI did not improve prediction, either separately or collectively, above and beyond the variance accounted for by covariates. In the full model, significant unique contribution to the variance was found for SES and for mothers' own sons' level of hyperactive-inattentive symptoms, such that lower levels of these covariates predicted higher levels of maternal child rating commission errors.

Table 7 displays the results of the hierarchical multiple regression predicting maternal child behavior rating omission errors from self-rated maternal IA and HI symptoms and

covariates. Although the regression model was significant at Step 1, the full model was only marginally significant at Step 2, R^2 =.16, F(8,88)=2.03, p=.052. Not only did self-rated maternal IA and HI symptoms not add significant incremental variance above and beyond that provided by covariates, no individual betas in the full model reached statistical significance.

Therefore, for both measures of maternal rating accuracy, as predicted by self-rated maternal IA and HI symptoms and covariates, the following results were most salient: 1) contrary to my hypotheses, neither maternal IA nor maternal HI predicted significantly more maternal child rating commission or omission errors either collectively or individually; 2) only lower levels of mothers' own sons' hyperactivity-inattention and lower family SES predicted more maternal commission errors.

Hierarchical Multiple Regressions Predicting Maternal Rating Accuracy from Informant-Rated Maternal IA and HI Symptoms and Covariates

Table 8 displays the results of the hierarchical multiple regression predicting maternal child behavior rating commission errors from informant-rated maternal IA and HI symptoms and covariates. While the full model at Step 2 was significant, R^2 =.21, F (8,88)= 2.98, p=.005, maternal IA and HI did not improve prediction, either separately or collectively, above and beyond the variance accounted for by covariates. In the full model, significant unique contribution to the variance was found for maternal anxiety, SES and for mothers' own sons' level of hyperactive-inattentive symptoms, such that lower levels of these covariates predicted higher levels of maternal child rating commission errors.

Table 9 displays the results of the hierarchical multiple regression for predicting maternal omission errors from informant-rated maternal IA and HI symptoms and covariates. Unlike the regression analysis using self-ratings of IA and HI symptoms to predict omission errors, the

regression model was significant at Step 2 when using informant ratings as predictors, R^2 =.23, F (8,88)= 3.21, p=.019. In addition, informant-rated maternal IA and HI symptoms added significant incremental variance above and beyond that provided by covariates. Individual betas for the full model revealed that, contrary to my prediction, informant-rated maternal IA negatively predicted levels of omission errors. Additionally, I found that family SES positively predicted number of omission errors (i.e., higher SES was associated with increased maternal videotaped child rating omission errors) and mothers' own sons' level of oppositional/conduct problems negatively predicted maternal omission errors. Therefore, for measures of maternal rating accuracy, as predicted by informant-rated maternal IA and HI symptoms and covariates, the following results were most salient: 1) contrary to my hypotheses, neither maternal IA nor maternal HI significantly predicted more maternal child rating commission errors and, in fact, maternal IA negatively predicted omission errors; 2) family SES and the mother's own son's hyperactivity-inattention negatively predicted levels of maternal child rating commission errors; 3) besides maternal IA, mothers' own sons' levels of oppositional/conduct problems also negatively predicted maternal child rating omission errors; however, family SES positively predicted maternal rating omission errors (i.e., higher income levels predicted more omission errors). Thus, I found that lower levels of SES are associated with more commission errors and less omission errors.

Hierarchical Multiple Regressions Predicting Maternal Rating Bias from Self-Rated Maternal IA and HI Symptoms and Covariates

Table 10 displays the hierarchical multiple regression predicting maternal ratings of videotaped child IA symptoms from self-rated maternal IA and HI symptoms and covariates. While the full model at Step 2 was significant, R^2 = .20, F (8,88)= 2.81, p=.008, maternal IA

and HI did not improve prediction, either separately or collectively, above and beyond the variance accounted for by covariates. In the full model, significant unique contribution to the variance was found for SES (i.e., lower SES predicted more child IA symptoms endorsed by the mother) and for mothers' own sons' oppositional/conduct problems.

Table 11 displays the results of the hierarchical multiple regression predicting maternal ratings of videotaped child HI symptoms from self-rated maternal IA and HI symptoms and covariates. Similar to the previous analysis, the regression model was significant at Step 2, R^2 =.16, F (8,88)= 2.17, p=.038, although self-rated maternal IA and HI symptoms did not add significant incremental variance above and beyond that provided by covariates. In terms of individual betas in the full model, only lower familial SES and lower hyperactivity-inattention in the mothers' own sons significantly predicted more videotaped child HI symptoms endorsed by mothers.

Therefore, for both measures of maternal rating bias as predicted from self-rated maternal IA and HI symptoms and covariates, the following results were most salient: 1) neither maternal IA nor maternal HI predicted significantly more or less child ADHD symptoms endorsed by mothers; 2) family SES negatively predicted systematically higher maternal ratings of videotaped child ADHD symptoms in both analyses; 3) mothers' own sons' oppositional/conduct problems predicted higher endorsement of videotaped child IA behaviors; 4) mothers' own sons' hyperactivity-inattention significantly and negatively predicted higher ratings of videotaped child HI behaviors; 5) I failed to find prediction of systematic negative maternal child rating bias by maternal depression, anxiety, or parenting stress, as past research might have indicated (e.g., Chi & Hinshaw, 2002; Chilcoat & Breslau, 1997; van der Oord et al., 2006).

Hierarchical Multiple Regressions for Prediction of Maternal Rating Bias from Informant-Rated Maternal IA and HI Symptoms and Covariates

Table 12 displays the results of the hierarchical multiple regression for prediction of maternal ratings of videotaped child IA symptoms from informant-rated maternal IA and HI symptoms and covariates. While the full model at Step 2 was significant, R^2 =.23, F (8,88)= 3 .35, p=.002, maternal IA and HI did not improve prediction, either separately or collectively, above and beyond the variance accounted for by covariates. In the full model, significant unique and negative contribution to the variance was found for SES, maternal anxiety, and mothers' own sons' hyperactivity-inattention. Significant unique and positive contribution to the variance was found for mothers' own sons' oppositional/conduct problems.

Table 13 displays the results of the hierarchical multiple regression for predicting maternal ratings of videotaped child HI symptoms from informant-rated maternal IA and HI symptoms and covariates. Unlike previous analyses, the regression model was significant at Step 2, R^2 =.22, F (8,88)= 3 .05, p=.004, and in addition, informant-rated maternal IA and HI symptoms added significant incremental variance above and beyond that provided by covariates. In terms of individual betas in the full model, however, maternal ratings of videotaped child HI symptoms were not significantly predicted by informant-rated maternal IA and were only marginally significantly predicted by informant-rated maternal HI. Maternal anxiety, family SES, and mothers' own sons' level of hyperactive-inattentive symptoms each negatively predicted the number of videotaped child HI symptoms endorsed by mothers.

Therefore, for both measures of maternal rating bias as predicted from informant-rated maternal IA and HI symptoms and covariates, the following results were most salient: 1) individual betas for maternal IA and maternal HI did not predict significantly more or less child

ADHD symptoms endorsed by mothers; however, for ratings of child HI behaviors, maternal IA and HI symptoms collectively provided incremental variance over and above that provided by covariates alone (although the IA and HI symptoms did not provide significant incremental variance at the individual level); 2) in analyzing individual betas in both models, I found that lower family SES predicted higher maternal ratings of videotaped child ADHD symptoms in both analyses, which, when combined with results for maternal rating accuracy analyses, indicates child behavior over-reporting bias in mothers with lower SES levels; 3) maternal anxiety and mothers' own sons' hyperactivity-inattention predicted lower maternal ratings of videotaped child ADHD symptoms in both analyses (i.e., maternal under-reporting bias) when predictors and other covariates were controlled; 4) mothers' own sons' oppositional/conduct problems predicted higher endorsement of videotaped child IA behaviors; 5) systematic negative maternal child rating bias was not predicted by either maternal depression, anxiety, or parenting stress.

Discussion

Associations Between Maternal IA and HI Symptoms and Maternal Rating Accuracy

The current study investigated whether maternal symptoms of IA and HI were associated with accuracy of maternal ratings of child ADHD behaviors in a community sample of mothers without ADHD of 5-12 year-old boys without ADHD. Both self-ratings and informant ratings of maternal IA and HI symptoms, as well as relevant covariates, were used in bivariate correlations and in hierarchical multiple regression analyses predicting commission and omission errors in maternal ratings.

Contrary to my hypotheses, neither maternal symptoms of IA nor maternal symptoms of HI were associated with maternal rating inaccuracy in any analysis. This pattern of results is not

suggestive of impairment in mothers' ability to rate child behavior due to either cognitive factors (e.g., poor vigilance, poor WM, poor sustained attention, response variability) or related functional impairments (e.g., poor monitoring, encoding, or ability to filter out extraneous environmental stimuli) associated with the levels of ADHD symptoms seen in this sample of mothers.

A number of possible interpretations might explain this pattern of results. First, consistent with the conclusions drawn by Faraone et al. (1995, 2003), it might be concluded that maternal ratings of child ADHD behaviors are not significantly marred by the presence of maternal ADHD symptoms. In fact, the findings suggest the possibility that in some cases, mothers with higher informant-rated levels of IA symptoms are more accurate in their ratings of child ADHD behavior than mothers with fewer informant-rated IA symptoms. However, although most associations were weak and fell short of significance, the general pattern of associations between maternal symptoms of IA and HI (particularly based on informant ratings) and measures of maternal rating accuracy indicated that higher levels of maternal ADHD symptoms were associated with more commission errors and fewer omission errors, suggesting the possibility of an association with over-reporting bias. I will return to this possibility later in the discussion.

A second possible interpretation of results relates to the sample used for this study. Using only mothers without ADHD of children without ADHD, the current sample was restricted in its range of variability of child and maternal IA and HI symptoms, as compared to the variability found in the overall North American population of mothers of 5-12 year-old boys. This lack of variability in child and maternal ADHD symptoms might have prevented more robust associations between maternal IA and HI symptoms and maternal rating accuracy

from emerging in this sample. A different pattern of results might also be obtained in clinical samples (i.e., mothers of children with clinical levels of ADHD symptoms or mothers with higher levels of their own ADHD symptoms), as compared to the community sample used in the current study. The presence of clinical levels of either maternal or child ADHD symptoms might be a necessary threshold for maternal rating accuracy (as measured by maternal rating errors of commission and omission) to be significantly impacted. Indeed, other researchers have found significant associations between other types of maternal psychopathology (e.g., depression, anxiety, maternal stress) and maternal ratings of child ADHD symptoms in clinical samples of children with ADHD (e.g., Chi & Hinshaw, 2002; Chilcoat & Breslau, 1997; van der Oord et al., 2006). However, it should be recalled that Faraone et al. (1995, 2003) obtained their null results for maternal rating bias in clinical samples with mothers with ADHD and children with ADHD.

The current study might have failed to systematically evoke a high enough cognitive load on mothers for rating accuracy effects related to IA and HI symptomatology to be detected and this may offer a third interpretation of the null findings. As much as possible, mothers were tested in areas with minimal distractions, both in laboratory and home settings. Since past literature has found that children and adolescents with ADHD make more mistakes in encoding and recall in situations with multiple distractors present, but do not necessarily make more mistakes in less cognitively demanding situations (e.g., Lorch et al., 2004), it is possible that the same would apply to adults. Thus, not only would a more distracting environment have been more ecologically valid, it might also have provoked significant effects for maternal rating inaccuracy.

Finally, the lack of significant results in this sample might also be a product of an overly conservative view of what constituted a rating error. By considering a symptom endorsement as acceptably 'correct' if it agreed with 6% or more of pilot rater endorsements, I might have minimized the sensitivity of the current procedures to detect maternal rating inaccuracy, thereby attenuating the strength of all associations. Use of simpler and more objective child behaviors (as opposed to more naturalistic behaviors), as well as having mothers rate each child behavior individually (instead of rating the aggregate of behaviors for each child), might have improved the study's internal validity, although it would have come at the expense of external validity. More objective child behaviors might also have reduced the extent of rater disagreement across adult raters of child behavior, such that the need for pilot raters would have been minimized.

Associations Between Maternal IA and HI Symptoms and Maternal Rating Bias

To investigate a possible maternal over-reporting bias in the current sample, I analyzed associations between either self-rated or informant-rated maternal symptoms of IA and HI and the overall number of child IA and HI symptoms endorsed by mothers. Like the maternal accuracy analyses, I mutually controlled maternal IA and HI symptoms and used the same covariates (family SES, symptoms of maternal depression, anxiety, and parenting stress, and mothers' sons' hyperactive-inattentive symptoms and oppositional/conduct problems) in regressions predicting maternal rating bias from self-ratings and informant ratings of maternal IA and HI symptoms.

Results mostly indicated the absence of maternal rating bias, although weak over-reporting bias effects were suggested by correlations using informant ratings of maternal IA and HI symptoms. However, the lone significant bivariate correlation was reduced to a nonsignificant trend once covariates and the other ADHD symptom cluster were controlled in the

regression analyses. A number of explanations might underlie this pattern of results for maternal rating bias.

First, it is possible that there are no significant associations between maternal IA and HI symptoms and maternal rating bias, supporting the finding of Faraone et al. (1995, 2003). Thus, it is possible that differences between ratings of child behavior by mothers and other raters found in past research (e.g., Chi & Hinshaw, 2002; van der Oord et al., 2006) are more reflective of differences in child behavior across situations (e.g., see Richters, 1992).

Second, as in the discussion of findings for maternal rating accuracy, results of maternal bias analyses also might be due to a lack of variability in ADHD symptoms in the sample resulting from the exclusion of mothers with clinical levels of IA or HI symptoms in their sons or themselves. Relatedly, associations might have been significant if instead of using a community sample, I had used a sample of mothers with clinical levels of ADHD in their sons or themselves.

A third possible explanation for the lack of significant bias effects related to maternal symptoms of IA and HI is that the current study did not systematically activate mothers' schemas for their own sons. Snarr et al. (2003) found that mothers of oppositional boys had more negative reactions to child behavior in hypothetical vignettes when imagining their own children performing the behavior, but not when imagining another child doing so. Similarly, other researchers (e.g., Sanders & Dadds, 1992; Strassberg, 1995) found that mothers of children with clinical levels of oppositional, aggressive, and conduct-disordered behavior displayed negative cognitive processes when either watching videotapes or reading vignettes while imagining their own child performing the behaviors presented. It is thus possible that mothers observing videotaped children with whom they were not previously acquainted might show less bias than they would with ratings of their own children.

Contrasts Between Self-Ratings and Informant Ratings of Maternal IA and HI Symptoms in Analyses of Maternal Rating Accuracy and Bias

Another consideration in interpreting the overall pattern of associations between maternal ADHD symptoms and maternal ratings is the apparent differences between self-ratings and informant ratings of maternal IA and HI symptoms. Relationships among covariates and predictors were indicative of substantial collinearity among self-rated maternal symptoms of IA, HI, anxiety, depression, and parenting stress. Past research has similarly found robust associations among self-rated adult symptoms of anxiety, depression, parenting stress, IA, and HI (e.g., Barry et al., 2005; Kera et al., 2004; McGough et al., 2005; Norberg, Diefenbach, & Tolin, 2008; van der Oord et al., 2006). Nonetheless, the strength of the relationships among these variables in the current study might be partially attributed to rater variance, since self-rated maternal IA and HI were strongly correlated with other self-rated symptoms (i.e., anxiety, depression, and parenting stress), but informant-rated maternal IA and HI were not.

In contrast, the current pattern of results might also indicate that self-ratings of maternal IA and HI are different constructs from informant-rated maternal IA and HI symptoms. The paucity of significant associations between self-rated maternal symptoms of IA and HI and maternal rating accuracy or bias, combined with the medium-large effect sizes of correlations among self-rated IA, HI, anxiety, depression, and parenting stress, might lead the researcher to speculate as to whether self-rated maternal IA and HI symptoms are more closely related to maternal affect or other subjective factors. On the other hand, since informant-rated maternal symptoms of IA and HI were mostly not correlated with maternal anxiety, depression, and parenting stress, yet were significantly associated with some measures of maternal rating accuracy and bias, one might speculate as to whether or not informant ratings of maternal IA and

HI symptoms are more related to functional impairment or other objective factors than are maternal self-ratings of IA and HI symptoms. Further investigation, however, would need to be undertaken to investigate this possibility.

Associations Between Family SES and Parenting Stress and Maternal Rating Accuracy and Bias

Turning to findings for the covariates in this study, significant associations between SES and measures of maternal rating accuracy and bias indicated a clear over-reporting bias in mothers with lower SES, even when other covariates and maternal ADHD symptoms were controlled in hierarchical multiple regressions.[2] This pattern of associations would support past research findings reporting a link between low family SES and the presence of more negative maternal cognitive and affective processes which, in turn, were related with higher maternal ratings of child ADHD and externalizing symptoms (see Campbell et al., 1986; Pinderhughes et al., 2000). To my knowledge, however, the current study is the first to document a systematic maternal over-reporting bias in lower SES mothers when rating child ADHD behaviors. Furthermore, it should be noted that past studies (e.g., Campbell et al., 1986; Pinderhughes et al., 2000) also reported that stress mediated these effects (i.e., low family SES causes increased family stress, which then elicited more negative maternal cognitive and affective processes and subsequent elevated child ADHD behavior ratings). It is thus interesting to note that while there were significant or marginal associations at the bivariate level indicated an over-reporting bias in mothers with higher levels of parenting stress, these associations were no longer significant once SES, other covariates, and maternal ADHD symptoms were controlled in hierarchical multiple regressions. This finding might be pertinent to the child ADHD behavior over-reporting bias that van der Oord et al. (2006) reported in mothers with higher levels of parenting stress, since van der Oord et al. did not control for family SES. Thus, with family SES but not maternal

parenting stress surviving statistical control for other variables, the current study would seem to support the assertions of some researchers (e.g., Lasky-Su et al., 2007, Webster-Stratton & Hammond, 1998) that among family and maternal stressors, low family SES is of particular importance, stemming from the aggregation of risk factors that accompany it, such as crowded living conditions, unemployment, high life stress, and health problems. Conceptually, parenting stress should overlap with some— but not all— aspects of the high life stress that mothers experience as a result of lower family SES. However, parenting stress likely would not sufficiently encompass other potential psychological effects of low SES-related life stress for mothers, such as the psychological effects of increased family disruption and instability, marginalization and discrimination, and decreased access to social and parenting resources. Alternatively, another way to conceptualize the current study's results would be that mothers with higher family SES have less life stress, due to greater family stability (e.g., less chronic unemployment, less economic-related family mobility) and increased access to supplemental resources (e.g., tutoring, childcare assistance, less crowded living conditions), and these enhanced conditions serve to reduce mothers' negative cognitions or biases regarding child behavior. Thus, taken together, results of the current study related to SES and parenting stress indicate that lower SES (and its accompanying maternal stress) predicts over-reporting bias in mothers when rating child ADHD symptoms.

Associations Between Other Covariates and Maternal Rating Accuracy and Bias

Four other notable results emerged from analyses of associations among other covariates, predictors, and maternal ratings.

First, contrary to previous findings (e.g., Chi & Hinshaw, 2002; Chilcoat & Breslau, 1997; Youngstrom et al., 1999), maternal anxiety and maternal depression, overall, were not

associated with a maternal over-reporting bias, particularly when other covariates and predictors were controlled. One possible explanation for these results would be the current study's use of a sample of mothers without clinical levels of IA and HI symptoms in themselves or their sons. Since anxiety, depression, and ADHD are often comorbid in adults (e.g., McGough et al., 2005) and since lifetime prevalence of depressive and anxiety disorders has been found to be almost twice as high in mothers of children with ADHD as it is in mothers of children without ADHD (Chronis, Lahey, Pelham, Kipp, Baumann, & Lee, 2003), the current study's sample of mothers likely has a restricted range of anxiety and depressive symptoms in comparison to the general population. Another possible explanation of these results would be that the current study supports other past research that found no association between maternal depression or maternal anxiety and maternal over-reporting bias (e.g., see Frick et al., 1994; Mick et al., 2000; Richters, 1992).

Second, for the most part, the level of oppositional/conduct problems in the mothers' sons was predictive of a systematic over-reporting bias (especially entered with informant ratings of maternal IA and HI symptoms as indicators in hierarchical multiple regression analyses). This finding is similar to past research indicating that mothers of children with oppositional/conduct problems are more negative than mothers of control children in their interpretations of child behavior (e.g., Snarr et al., 2003; Strassberg, 1995).

Third, in addition to indicating strong collinearity among maternal anxiety, depression, and parenting stress, results of the current study also indicated a large degree of collinearity between levels of hyperactive-inattentive symptoms and oppositional/conduct problems in the mothers' own sons, thus suggesting possible rater variance in mothers' ratings of their sons' behavior.

Fourth and related to the high collinearity in mothers' ratings of their own symptoms and their sons' behavior, possible suppressor effects were found for maternal anxiety and child hyperactive-inattentive symptoms, contrary to predictions. Specifically, despite their near-zero bivariate correlations with maternal rating accuracy and bias measures, as well as their positive correlations with predictors and other covariates, maternal anxiety symptoms and mothers' sons' hyperactive-inattentive symptoms unexpectedly predicted systematic maternal *under-reporting* bias once predictors and other covariates were controlled in hierarchical multiple regression analyses. This finding might be due to the very fact that there are large inter-correlations among maternal anxiety, depression, and parenting stress, as well as between child hyperactive-inattentive symptoms and child oppositional/conduct problems. When these highly collinear variables are placed into multiple regression equations together, unexpected but chance effects may arise due to mutual control of substantially overlapping variables; however, it should also be acknowledged that true suppressor effects might be occurring. For example, the variance that maternal anxiety shares with depression and parenting stress might well correspond to characteristics of all three conditions that lead to maternal over-reporting of child ADHD symptoms (e.g., maternal cognitive bias); however, the remaining variance accounted for by maternal anxiety might be associated with those aspects of maternal anxiety that would correspond to under-reporting of child ADHD symptoms (e.g., cautious, inhibited responding).

Clinical Implications

Clinicians applying the current study to their work might consider a number of issues, while keeping study limitations in mind. First, the current study suggests that mothers without ADHD of children without ADHD do not make less accurate ratings of child behavior due to inherent deficits related to a higher level of IA or HI symptoms. Second, based on the stronger

associations between informant-rated (as opposed to self-rated) maternal IA and HI symptoms and maternal ratings, the current study raises the possibility that mothers' self-reports of IA and HI symptoms are most related to overall maternal mood (e.g., anxiety, depression, and parenting stress), whereas informants' reports of mothers' ADHD symptoms are more related to mothers' functioning and impairment. Therefore, clinicians might endeavor to gather both self-rating and informant rating data for assessing the presence of IA and HI symptoms in a given individual. Third, current findings indicate family SES might act as a stressor that causes mothers to over-report child ADHD symptoms. However, as indicated by past research (e.g., Webster-Stratton & Hammond, 1998), low family SES is typically accompanied by an aggregation of related risk factors, which also lead to real differences in child behavior. There also is a real possibility that children from lower SES families might have *both* more behavior problems and more negatively biased maternal raters of their behavior (e.g., see Campbell et al., 1986). Therefore, clinicians might wish to solicit child behavior ratings from multiple raters in order to tease apart these issues.

Limitations

A number of limitations temper the conclusions that may be drawn from the current study. First, by excluding mothers with clinical levels of ADHD symptoms in their children or themselves, the current study likely compromised the variability of maternal ADHD and maternal anxiety, depression, and parenting stress symptoms in its sample. It is also unknown whether results would be substantially different in a clinical sample of mothers of boys with ADHD or a clinical sample of mothers with ADHD. Second, the current study did not systematically activate mothers' schemas for their own sons, which might have affected the study's ability to elicit maternal cognitive processes that might be associated with a maternal

over-reporting bias for child IA or HI symptoms. Third, the current study did not control for mothers' perceptions of the maternal behavior observed on the DVDs. Many of the child behaviors observed were presented in the context of ongoing mother-son interactions. It is possible that mothers in the current study believed that at least some of the observed child ADHD and oppositional behaviors were a function of the videotaped mothers instead of the videotaped children. As a result, when rating the videotaped children, mothers might have minimized the level of ADHD symptoms they rated in children whose mothers they believed were causing the child ADHD behaviors. Finally, in only using parenting stress to index maternal stress, the current study might not have been optimally precise in its measurement of maternal stressors. As a result, interpretation of the over-reporting bias found in mothers with lower SES should be cautious until a fuller range of maternal stressors may be examined.

Future Directions

The current study might be expanded in a number of ways. As already noted, one primary way the current study might be extended is to repeat it in a community sample that does not exclude mothers with ADHD or mothers of children with ADHD and/or in a clinical sample of mothers of children with ADHD.

Another direction in which future research might be expanded would be to draw upon signal detection theory in order to more sensitively examine maternal rating accuracy. Signal detection theory enables researchers to examine both individual participants' ability to discriminate a target signal (e.g., child IA or HI behaviors) from noise (e.g., other child behaviors to which mothers are exposed, such as other IA, HI, OD, Int, and Nor behaviors) as well as individual participants' response bias (e.g., the likelihood that an individual mother reports detection of child IA and HI behaviors). Researchers could use a sensitivity index (e.g.,

d') to index maternal rating accuracy, with higher levels of *d'* indicating more accurate maternal ratings; researchers could also use a bias index (e.g., *C*) to measure maternal rating bias, with higher levels of *C* indicating a more conservative rating bias and lower levels of *C* indicating a more liberal rating bias (Neath & Surprenant, 2003). For example, a study using a signal detection theory paradigm might be designed such that mothers must respond to each individual child target or distractor behavior immediately after its presentation, by deciding whether the behavior is IA, HI, or non-ADHD. By aggregating mothers' responses, it would be possible to discern each mother's sensitivity to target behaviors, as well as her overall bias in making positive or negative responses. As a result, analyses of sensitivity and bias might be performed comparing mothers with higher levels of IA or HI symptoms to mothers with lower levels of IA or HI symptoms. Additionally, varying parameters, such as the speed/accuracy trade-off in decision making or the ambiguity of target behaviors and distractors (i.e., in terms of similarity between targets and distractors), might be used to examine the possibility of differential influence of these parameters on responding within mothers with higher or lower degrees of IA or HI symptoms. For example, use of more ambiguous child behaviors (i.e., behaviors with approximately 50% pilot rater agreement) might improve the ability to detect significant bias differences in mothers with differing levels of ADHD symptoms, although detection of differences in maternal sensitivity might be rendered more difficult under those conditions. Similarly, more distinct differences between target and distractor behaviors might improve the study's ability to detect differences in sensitivity between mothers with higher levels of IA or HI symptoms, as compared to mothers with lower levels of IA or HI symptoms; however, the improved ability to detect these differences in sensitivity might come at the cost of lower external validity. Thus, overall, signal detection designs might have sufficient sensitivity to

detect potential patterns of results similar to those found in the cognitive literature on ADHD (e.g., lower *d′* in mothers with higher levels of IA), particularly in situations of higher cognitive load (see Lorch et al., 2004).

Future research systematically activating (e.g., priming) mothers' schemas of their own sons might also produce more ecologically valid cognitive processes in mothers that would better relate to their rating accuracy when reporting on their sons' ADHD symptoms outside of the laboratory. For example, mothers might be given an open-ended task to describe their sons in two paragraphs prior to watching videotaped child behaviors. This sort of priming task would seem to be preferable to having mothers imagine their own child performing the behavior viewed, in order to control for different contextual meanings that the same child behavior might engender in different mother-child dyads.

In addition, future investigations might examine the effects of, or control for, maternal attributions for the causes of observed child behavior. In other words, future inquiry might investigate whether mothers offer situational— as opposed to internal/global/stable (i.e. characterological)— attributions of observed child behavior, in order to see if this type of maternal attribution might mediate or moderate maternal rating accuracy or bias effects (for discussion of the role of maternal attributions in reporting child behavior, see Johnston & Ohan, 2005).

Additionally, future research might include measures of maternal cognitive functioning in order to investigate whether the subgroup of 35-55% of mothers with ADHD who have EF impairments found in past research (e.g., Coghill, Nigg, Rothenbegrer, Sonuga-Barke, & Tannock, 2005; Nigg, Blaskey, Stawicki, & Sachek, 2004) might be less accurate in their ratings of child ADHD symptoms than other mothers.

And finally, future researchers may wish to investigate different effects of low family SES, parenting stress, and other components of maternal stress on the accuracy and bias of maternal ratings of child ADHD behaviors. One possible source of other candidate maternal stressors would be Rutter's index of six psychosocial risk factors for child mental disorders (see, for example, Biederman, Faraone, & Monuteaux, 2002; Rutter, Yule, Quinton, Rowlands, Yule, & Berger, 1975). Besides low family SES, these include family conflict or marital discord, paternal criminality or antisocial behavior, maternal psychopathology, large family size, and foster care placement. Future research might examine those factors that Biederman et al. (2002) found were associated with significantly elevated rates of maternal reports of child ADHD symptoms: lower family SES, higher levels of family conflict, higher levels of paternal antisocial behavior, and higher levels of maternal psychopathology. Future research might also examine other maternal stressors that past researchers have indicated might be associated with elevated maternal report of child ADHD symptoms and externalizing behavior problems, such as daily parenting hassles and chronic physical health problems (Krech & Johnston, 1992; Webster-Stratton & Hammond, 1998). Moreover, future researchers might wish to also model various relationships between family SES and other maternal stressors in their effects on maternal over-reporting bias, including potential mediation and moderation effects. It is possible that low family SES leads to other family stressors, such as severe marital discord, as well as increased maternal psychopathology, paternal criminality, and family physical health problems, which, in turn, lead to maternal over-reporting bias when rating child ADHD symptoms. It is also possible, however, that in families with the same aforementioned psychosocial stressors, maternal over-reporting bias only occurs in the presence of low family SES. Future investigations might address this set of issues with more precision. This would enable

researchers, in the future, to more precisely delineate which factors might impact maternal rating accuracy and bias. As a result, our ability to accurately assess and help families with child behavior difficulties will be improved in the future.

Summary of Implications

Thus, in a study investigating whether maternal symptoms of IA and HI were associated with accuracy and bias of maternal ratings of child ADHD behaviors, while controlling for common covariates in a community sample of mothers without ADHD of 5-12 year-old boys without ADHD, four implications are most salient. First, neither maternal IA nor HI was associated with higher levels of maternal rating inaccuracy or bias. While there may be a lack of associations between maternal IA and HI symptoms and maternal ratings, other possible explanations include sample range restriction and methodological concerns. Second, lower family SES was associated with a maternal over-reporting bias even with maternal IA and HI symptoms and covariates controlled, while measures of maternal psychopathology and parenting stress were not, suggesting that even in middle-class samples, family SES has a crucial association with maternal ratings. Third, results of the current study were suggestive of a differential pattern of associations between self-ratings and informant ratings of maternal IA and HI symptoms: self-rated maternal IA and HI symptoms are possibly more related to overall maternal affect, while informant-rated maternal IA and HI symptoms correspond more to mothers' functional impairment. And fourth, the current study did not find an over-reporting bias in mothers with higher levels of depression or anxiety (once covariates were controlled) indicating either sample range restriction or support for past research that found no significant over-reporting bias in mothers with elevated levels of depression or anxiety (e.g., Frick et al., 1994; Richters, 1992).

Table 1

Maternal, Child, and Family Characteristics (N=97)

Variable	M	SD	Range
Child age (in months)	105.32	26.06	60.00 - 154.00
Maternal age (in years)	39.73	5.79	27.00 - 57.00
How much does Mom identify as a Canadian (1= not at all, 10= very much)	7.86	2.74	1.00 – 10.00
Location of participation	Percent		
Lab	63		
Home	37		
Instructional condition[a]			
Instructional	52		
Non-instructional	48		

Variable	Percent
Son's grade	
Preschool	5
Kindergarten	11
Grade 1	11
Grade 2	9
Grade 3	21
Grade 4	12
Grade 5	17
Grade 6	5
Grade 7	7
Not enrolled in school	1

Variable	Percent
Number of other children in family	
0	22
1	55
2	20
3	3
4	1
Son's ordinal position in family birth order	
Only child	22
Twins, no other siblings	2
Oldest	41
Twins, oldest children in family	1
2nd	26
3rd	6
4th	2

Variable	Percent
Mother's report of son's disorders	
Anxiety disorder	1
Learning disability	2
Speech delay	1
Other	3
Mother's relationship to son	
Biological	100
Adopted	0
Mother's employment	
Employed	71
Not employed	29

Variable	Percent
Mother's highest educational level attained	
Partial high school	3
High school graduate	5
Partial college/university or special training	28
Standard college or university graduate	39
Graduate or professional training	25
Mother's familiarity with ADHD prior to study participation	
Not at all familiar	7
Somewhat familiar	68
Quite familiar	21
Completely familiar	4
Mother's marital status	
Married/Common-law	71
Single/Divorced/Widowed/Separated	29

Variable	Percent
Mother's cultural background	
Euro-Canadian	53
Asian-Canadian/Pacific Islander-Canadian	34
Other (e.g., First Nations, mixed heritage)	13
Family income	
$5,000-$19,999	9
$20,000-$34,999	12
$35,000-$49,999	18
$50,000-$74,999	23
$75,000-$99,999	17
$100,000-$149,999	15
$150,000-$199,999	5
$200,000 and higher	1

Note. M=mean; SD= standard deviation;

[a]= mothers were randomly assigned to receive different types of instructions for rating child ADHD behaviors.

Table 2

Correlations Between Maternal ADHD Subscales

Maternal Subscales	Pearson r
Self-ratings	
CAARS and CSS IA	.72***
CAARS and CSS HI	.70***
Informant ratings	
CAARS and CSS IA	.78***
CAARS and CSS HI	.77***
CAARS-CSS composites	
Self and Informant IA	.47***
Self and Informant HI	.34**

Note. CAARS= Conners Adult ADHD Rating Scale, Short Form; CSS= Current Symptoms Scale; Self= maternal self-reported ADHD symptoms; Informant= maternal ADHD symptoms as rated by close other informants; IA=Inattentive; HI=Hyperactive/Impulsive.

*$p<.05$; **$p<.01$; ***$p<.001$.

Table 3

Mean Levels of Maternal, Child, and Family Characteristics, and Mothers' Scores on Measures of Maternal Rating Accuracy and Measures of Maternal Rating Bias (N=97)

Variable	M	SD	Range
Characteristics of the mother's own child & family characteristics			
SDQ Hyperactivity/Inattention	0.56	0.47	0.00 - 1.80
SDQ Conduct Problems	0.28	0.31	0.00 - 1.20
Family SES (raw score)	48.30	11.98	20.00 – 66.00
Maternal characteristics			
Maternal age (in years)	39.73	5.79	27.00 - 57.00
BSI Anxiety	0.64	0.66	0.00 – 2.83
BSI Depression	0.57	0.68	0.00 - 2.83
PSI Parental Distress	2.23	0.73	1.00 - 3.92
CAARS Self IA	0.75	0.62	0.00 – 2.80
CAARS Self Hyperactivity	0.65	0.46	0.00 – 4.00
CAARS Self Impulsivity	0.72	0.46	0.00 – 4.00

Variable	M	SD	Range
CAARS Self HI	0.69	0.37	0.00 – 1.80
CSS Self IA	0.47	0.41	0.00 – 2.11
CSS Self HI	0.40	0.35	0.00 – 1.63
CAARS Informant IA	0.77	0.65	0.00 – 2.60
CAARS Informant Hyperactivity	0.73	0.58	0.00 – 2.40
CAARS Informant Impulsivity	0.81	0.65	0.00 – 2.80
CAARS Informant HI	0.77	0.55	0.00 – 2.40
CSS Informant IA	0.46	0.46	0.00 – 2.11
CSS Informant HI	0.51	0.49	0.00 – 1.78
CAARS-CSS Self IA Composite [a]	0.00	1.00	-1.17 – 3.66
CAARS-CSS Self HI Composite [a]	0.00	1.00	-1.50 – 2.73
CAARS-CSS Informant IA Composite [a]	0.00	1.00	-1.10 – 3.06
CAARS-CSS Informant HI Composite [a]	0.00	1.00	-1.23 – 2.31

Variable	M	SD	Range
	Maternal ratings of videotaped children		
Total Child IA Symptoms Endorsed	24.52	13.45	0.00 - 54.00
Total Child HI Symptoms Endorsed	21.98	12.79	0.00 - 59.00
Total Commission EPS	0.18	0.14	0.00 - 0.65
Total Omission EPS	0.36	0.26	0.00 - 1.00

Note. M=mean; SD= standard deviation; SDQ= Strengths and Difficulties Questionnaire (Goodman, 1997); SES= Hollingshead 4-Factor Index of Social Status raw score; BSI= Brief Symptom Inventory (Derogatis, 1993); PSI= Parenting Stress Index, Short Form scale (Abidin, 1995); CAARS= Conners Adult ADHD Rating Scale, Short Form (Conners, Erhardt, & Sparrow, 1999); CSS= Current Symptoms Scale (Barkley & Murphy, 1998); IA= Inattention; HI= Hyperactivity/Impulsivity; Self= maternal self-reported ADHD symptoms; Informant= maternal ADHD symptoms as rated by close other informants; CAARS HI= Composite of CAARS Hyperactivity and CAARS Impulsivity Scales; Commission EPS= Commission Error Proportion Score; Omission EPS= Omission Error Proportion Score.

[a]= z-scores.

Table 4

Bivariate Correlations of Maternal IA and HI With Measures of Maternal Rating Accuracy and With Measures of Maternal Rating Bias

Maternal Composite	C EPS	O EPS	Total Child IA	Total Child HI
CAARS-CSS Self IA Composite[a]	.08	-.13	.10	.11
CAARS-CSS Self HI Composite[a]	.03	-.15	.04	.12
CAARS-CSS Informant IA Composite[a]	.12	-.28**	.15	.16
CAARS-CSS Informant HI Composite[a]	.17	-.19+	.14	.21*

Note. IA= Inattention; HI= Hyperactivity/Impulsivity; C EPS= Maternal Commission Error Proportion Score; O EPS= Maternal Omission Error Proportion Score; Total Child IA= Total number of videotaped child IA symptoms endorsed; Total Child HI= Total number of videotaped child HI symptoms endorsed; CAARS= Conners Adult ADHD Rating Scale, Short Form; CSS= Current Symptoms Scale; Self= maternal self-reported ADHD symptoms; Informant= maternal ADHD symptoms as rated by close other informants.

[a]= z-scores.

+p< .10.; *p<.05; **p<.01.

Table 5

Bivariate Correlations of Covariates with IA and HI Composites and Measures of Maternal Rating Accuracy And Maternal Rating Bias

Covariate	IA Self	HI Self	IA Informant	HI Informant	C EPS	O EPS	Total Child IA	Total Child HI
BSI Anxiety	.55***	.50***	.24*	.19+	.00	-.10	.00	.02
BSI Depression	.59***	.44***	.28**	.12	.15	-.25*	.16	.17
PSI Parental Distress	.49***	.40***	.20+	.17	.19+	-.23*	.21*	.17+
SES	-.27**	-.25*	-.01	.06	-.26**	.24*	-.29**	-.27**
SDQ Hyperactivity/Inattention	.25*	.29**	.12	.05	-.03	-.07	.02	-.04
SDQ Conduct Problems	.23*	.33**	.01	.05	.15	-.20*	.19+	.13

Note. IA= Inattention; HI= Hyperactivity/Impulsivity; Self= maternal self-reported ADHD symptoms; Informant= maternal ADHD symptoms as rated by close other informants; C EPS= Maternal Commission Error Proportion Score; O EPS= Maternal Omission Error Proportion Score; Total Child IA= Total number of videotaped child IA symptoms endorsed; Total Child HI= Total number of videotaped child HI symptoms endorsed; BSI= Brief Symptom Inventory; PSI= Parenting Stress Index; SES= Hollingshead 4-Factor Index of Social Status raw score; SDQ= Strengths and Difficulties Questionnaire.

[a]= z-scores.

+p<.10.; *p<.05; **p<.01, ***p<.001.

Table 6

Hierarchical Multiple Regressions Testing if Self-Rated Maternal Inattention and Hyperactivity-Impulsivity Improve Prediction of Maternal Commission Errors for Rating Videotaped Child ADHD Symptoms Beyond Maternal Distress and Maternal Demographic Characteristics (N=97)

Variable	*B*	*SE B*	β	*p*
Step 1				
BSI Anxiety	-0.06	0.03	-.29	.065
BSI Depression	0.03	0.04	.14	.423
PSI Parental Distress	0.05	0.03	.25	.066
Hollingshead SES raw score	0.00	0.00	-.26	.013
SDQ Hyperactivity/Inattention	-0.08	0.04	-.26	.029
SDQ Conduct Problems	0.09	0.05	.20	.074

Variable	*B*	*SE B*	β	*p*
Step 2				
BSI Anxiety	-0.06	0.03	-.26	.116
BSI Depression	0.03	0.04	.14	.438
PSI Parental Distress	0.05	0.03	.26	.064
Hollingshead SES raw score	0.00	0.00	-.27	.012
SDQ Hyperactivity/Inattention	-0.08	0.04	-.26	.034
SDQ Conduct Problems	0.10	0.05	.22	.065
CAARS-CSS Self HI Composite	-0.01	0.02	-.07	.598
CAARS-CSS Self IA Composite	0.00	0.02	.00	.994

Note. R^2 = .18, F (6,90)= 3.22, p=.007 for Step 1; ΔR^2 = .00, ΔF (2,88)= .16, p=.85 for Step 2.

Table 7

Hierarchical Multiple Regressions Testing if Self-Rated Maternal Inattention and Hyperactivity-Impulsivity Improve Prediction of Maternal Omission Errors for Rating Videotaped Child ADHD Symptoms Beyond Maternal Distress and Familial Characteristics (N=97

Variable	*B*	*SE B*	β	*p*
Step 1				
BSI Anxiety	0.09	0.06	.22	.160
BSI Depression	-0.10	0.07	-.26	.142
PSI Parental Distress	-0.05	0.05	-.15	.282
Hollingshead SES raw score	0.00	0.00	.18	.089
SDQ Hyperactivity/Inattention	0.09	0.07	.15	.200
SDQ Conduct Problems	-0.18	0.10	-.21	.064

Variable	*B*	*SE B*	β	*p*
Step 2				
BSI Anxiety	0.09	0.07	.22	.184
BSI Depression	-0.10	0.07	-.28	.128
PSI Parental Distress	-0.05	0.05	-.15	.276
Hollingshead SES raw score	0.00	0.00	.18	.095
SDQ Hyperactivity/Inattention	0.09	0.07	.15	.205
SDQ Conduct Problems	-0.18	0.10	-.21	.078
CAARS-CSS Self HI Composite	-0.01	0.04	-.04	.736
CAARS-CSS Self IA Composite	0.02	0.04	.07	.624

Note. R^2 = .15, F (6,90)= 2.71, p=.018 for Step 1; ΔR^2 = .00, ΔF (2,88)= .14, p=.87 for Step 2.

Table 8

Hierarchical Multiple Regressions Testing if Informant-Rated Maternal Inattention and Hyperactivity-Impulsivity Improve Prediction of Maternal Commission Errors for Rating Videotaped Child ADHD Symptoms Beyond Maternal Distress and Familial Characteristics (N=97)

Variable	*B*	*SE B*	β	*p*
Step 1				
BSI Anxiety	-0.06	0.03	-.29	.065
BSI Depression	0.03	0.04	.14	.423
PSI Parental Distress	0.05	0.03	.25	.066
Hollingshead SES raw score	0.00	0.00	-.26	.013
SDQ Hyperactivity/Inattention	-0.08	0.04	-.26	.029
SDQ Conduct Problems	0.09	0.05	.20	.074

Variable	*B*	*SE B*	β	*p*
Step 2				
BSI Anxiety	-0.07	0.03	-.32	.038
BSI Depression	0.03	0.04	.14	.429
PSI Parental Distress	0.04	0.03	.23	.089
Hollingshead SES raw score	0.00	0.00	-.29	.007
SDQ Hyperactivity/Inattention	-0.08	0.04	-.27	.025
SDQ Conduct Problems	0.09	0.05	.20	.070
CAARS-CSS Informant HI Composite	0.02	0.02	.16	.138
CAARS-CSS Informant IA Composite	0.01	0.02	.06	.596

Note. R^2 = .18, F (6,90)= 3.22, p=.007 for Step 1; ΔR^2 = .04, ΔF (2,88)= 2.04, p=.14 for Step 2.

Table 9

Hierarchical Multiple Regressions Testing if Informant-Rated Maternal Inattention and Hyperactivity-Impulsivity Improve Prediction of Maternal Omission Errors for Rating Videotaped Child ADHD Symptoms Beyond Maternal Distress and Familial Characteristics (N=97

Variable	*B*	*SE B*	β	*p*
Step 1				
BSI Anxiety	0.09	0.06	.22	.160
BSI Depression	-0.10	0.07	-.26	.142
PSI Parental Distress	-0.05	0.05	-.15	.282
Hollingshead SES raw score	0.00	0.00	.18	.089
SDQ Hyperactivity/Inattention	0.09	0.07	.15	.200
SDQ Conduct Problems	-0.18	0.10	-.21	.064

Variable	*B*	*SE B*	β	*p*
Step 2				
BSI Anxiety	0.10	0.06	.25	.104
BSI Depression	-0.08	0.07	-.21	.234
PSI Parental Distress	-0.05	0.05	-.14	.303
Hollingshead SES raw score	0.01	0.00	.21	.040
SDQ Hyperactivity/Inattention	0.10	0.06	.18	.123
SDQ Conduct Problems	-0.19	0.09	-.23	.040
CAARS-CSS Informant HI Composite	-0.03	0.03	-.10	.362
CAARS-CSS Informant IA Composite	-0.06	0.03	-.22	.047

Note. R^2 = .15, F (6,90)= 2.71, p=.018 for Step 1; ΔR^2 = .07, ΔF (2,88)= 4.13, p=.019 for Step 2.

Table 10

Hierarchical Multiple Regressions Testing if Self-Rated Maternal Inattention and Hyperactivity-Impulsivity Improve Prediction of Maternal Rating Bias for Videotaped Child IA Beyond Maternal Distress and Familial Characteristics (N=97)

Variable	*B*	*SE B*	β	*p*
Step 1				
BSI Anxiety	-5.84	3.09	-.29	.062
BSI Depression	2.50	3.41	.13	.465
PSI Parental Distress	4.74	2.44	.26^{+}	.056
Hollingshead SES raw score	-0.32	0.12	-.29	.006
SDQ Hyperactivity/Inattention	-6.64	3.32	-.23	.049
SDQ Conduct Problems	10.10	4.79	.23	.038

Variable	*B*	*SE B*	β	*p*
Step 2				
BSI Anxiety	-5.11	3.28	-.25	.123
BSI Depression	2.39	3.50	.12	.497
PSI Parental Distress	4.84	2.48	.26	.054
Hollingshead SES raw score	-0.33	0.12	-.30	.006
SDQ Hyperactivity/Inattention	-6.49	3.36	-.23	.056
SDQ Conduct Problems	10.98	4.97	.25	.030
CAARS-CSS Self HI Composite	-1.44	1.85	-.10	.441
CAARS-CSS Self IA Composite	0.25	1.92	.02	.896

Note. R^2 = .20, F (6,90)= 3.70, p=.003 for Step 1; ΔR^2 = .01, ΔF (2,88)= .31 p=.73 for Step 2.

Table 11

Hierarchical Multiple Regressions Testing if Self-Rated Maternal Inattention and Hyperactivity-Impulsivity Improve Prediction of Maternal Rating Bias for Videotaped Child HI Symptoms Beyond Maternal Distress and Familial Characteristics (N=97)

Variable	*B*	*SE B*	β	*p*
Step 1				
BSI Anxiety	-5.17	3.01	-.27	.089
BSI Depression	3.53	3.32	.19	.290
PSI Parental Distress	3.30	2.38	.19	.169
Hollingshead SES raw score	-0.27	0.11	-.26	.016
SDQ Hyperactivity/Inattention	-6.93	3.23	-.25	.035
SDQ Conduct Problems	7.81	4.66	.19	.097

Variable	*B*	*SE B*	β	*p*
Step 2				
BSI Anxiety	-5.67	3.20	-.29	.080
BSI Depression	3.63	3.41	.19	.290
PSI Parental Distress	3.23	2.41	.19	.185
Hollingshead SES raw score	-0.27	0.11	-.25	.022
SDQ Hyperactivity/Inattention	-7.03	3.27	-.26	.034
SDQ Conduct Problems	7.20	4.84	.17	.141
CAARS-CSS Self HI Composite	1.03	1.80	.07	.570
CAARS-CSS Self IA Composite	-0.23	1.87	-.02	.901

Note. R^2 = .16, F (6,90)= 2.89, p=.013 for Step 1; ΔR^2 = .00, ; ΔF (2,88)= .17, p=.85 for Step 2.

Table 12

Hierarchical Multiple Regressions Testing if Informant-Rated Maternal Inattention and Hyperactivity-Impulsivity Improve Prediction of Maternal Rating Bias for Videotaped Child IA Symptoms Beyond Maternal Distress and Familial Characteristics (N=97)

Variable	*B*	*SE B*	β	*p*
Step 1				
BSI Anxiety	-5.84	3.09	-.29	.062
BSI Depression	2.50	3.41	.13	.465
PSI Parental Distress	4.74	2.44	.26	.056
Hollingshead SES raw score	-0.32	0.12	-.29	.006
SDQ Hyperactivity/Inattention	-6.64	3.32	-.23	.049
SDQ Conduct Problems	10.10	4.79	.23	.038

Variable	*B*	*SE B*	β	*p*
Step 2				
BSI Anxiety	-6.41	3.09	-.31	.041
BSI Depression	2.08	3.45	.11	.548
PSI Parental Distress	4.49	2.43	.25	.068
Hollingshead SES raw score	-0.35	0.11	-.31	.003
SDQ Hyperactivity/Inattention	-7.04	3.31	-.24	.036
SDQ Conduct Problems	10.43	4.76	.24	.031
CAARS-CSS Informant HI Composite	1.61	1.54	.11	.297
CAARS-CSS Informant IA Composite	1.68	1.57	.12	.289

Note. R^2 = .20, F (6,90)= 3.70, p=.003 for Step 1; ΔR^2 = .04, ΔF (2,88)= 2.04, p=.13 for Step 2.

Table 13

Hierarchical Multiple Regressions Testing if Informant-Rated Maternal Inattention and Hyperactivity-Impulsivity Improve Prediction of Maternal Rating Bias for Videotaped Child HI Symptoms Beyond Maternal Distress and Familial Characteristics (N=97)

Variable	*B*	*SE B*	β	*p*
Step 1				
BSI Anxiety	-5.17	3.01	-.27	.089
BSI Depression	3.53	3.32	.19	.290
PSI Parental Distress	3.30	2.38	.19	.169
Hollingshead SES raw score	-0.27	0.11	-.26	.016
SDQ Hyperactivity/Inattention	-6.93	3.23	-.25	.035
SDQ Conduct Problems	7.81	4.66	.19	.097

Variable	*B*	*SE B*	β	*p*
Step 2				
BSI Anxiety	-6.02	2.97	-.31	.046
BSI Depression	3.46	3.31	.18	.300
PSI Parental Distress	2.87	2.34	.17	.222
Hollingshead SES raw score	-0.30	0.11	-.28	.007
SDQ Hyperactivity/Inattention	-7.19	3.18	-.26	.026
SDQ Conduct Problems	7.95	4.58	.19	.086
CAARS-CSS Informant HI Composite	2.64	1.48	.20	.077
CAARS-CSS Informant IA Composite	1.15	1.51	.09	.449

Note. R^2 = .16, F (6,90)= 2.89, p=.013 for Step 1; ΔR^2 = .06, ΔF (2,88)= 3.14, p=.048 for Step 2.

Footnotes

[1]Note: one mother participated at her sister's home.

[2]It should be noted that when family SES was broken down into its family income and parental education components, analyses revealed that neither component, individually, was superior to the Hollingshead 4-Factor Index of Social Status in predicting maternal child behavior rating outcomes.

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Appendices

Appendix A

Behavioural Research Ethics Board Study Approval for Initial Study Proposal

The University of British Columbia
Office of Research Services
Behavioural Research Ethics Board
Suite 102, 6190 Agronomy Road, Vancouver, B.C. V6T 1Z3

CERTIFICATE OF APPROVAL - MINIMAL RISK

PRINCIPAL INVESTIGATOR:	INSTITUTION / DEPARTMENT:	UBC BREB NUMBER:
Charlotte Johnston	UBC/Arts/Psychology, Department of	H07-00727

INSTITUTION(S) WHERE RESEARCH WILL BE CARRIED OUT:

Institution	Site
UBC	Point Grey Site

Other locations where the research will be conducted:
N/A

CO-INVESTIGATOR(S):

Candice Murray
Margaret Weiss
Lorelei Faulkner

SPONSORING AGENCIES:

Canadian Institutes of Health Research (CIHR)

PROJECT TITLE:
Improving the accuracy of parents' reports of child Attention-Deficit/Hyperactivity Disorder

CERTIFICATE EXPIRY DATE: April 25, 2008

DOCUMENTS INCLUDED IN THIS APPROVAL:	DATE APPROVED:	
	April 25, 2007	
Document Name	**Version**	**Date**
Consent Forms:		
Consent Form	N/A	March 27, 2007
Advertisements:		
Advertising Flyer	N/A	March 27, 2007
Advertising Poster	N/A	March 27, 2007
Questionnaire, Questionnaire Cover Letter, Tests:		
Feedback on Instructional Material	N/A	March 27, 2007
Instructional Material	N/A	March 27, 2007
CAARS	N/A	March 27, 2007
BSI	N/A	March 27, 2007
Prompts to Help Mothers Describe ADHD	N/A	March 27, 2007
ADHD IV	N/A	March 27, 2007
SDQ	N/A	March 27, 2007
GFI	N/A	March 27, 2007

The application for ethical review and the document(s) listed above have been reviewed and the procedures were found to be acceptable on ethical grounds for research involving human subjects.

Approval is issued on behalf of the Behavioural Research Ethics Board and signed electronically by one of the following:

Dr. Peter Suedfeld, Chair
Dr. Jim Rupert, Associate Chair
Dr. Arminee Kazanjian, Associate Chair
Dr. M. Judith Lynam, Associate Chair
Dr. Laurie Ford, Associate Chair

Appendix B

Behavioural Research Ethics Board Approval for Study Amendments

The University of British Columbia
Office of Research Services
Behavioural Research Ethics Board
Suite 102, 6190 Agronomy Road, Vancouver, B.C. V6T 1Z3

CERTIFICATE OF APPROVAL - FULL BOARD AMENDMENT

PRINCIPAL INVESTIGATOR:	DEPARTMENT:	UBC BREB NUMBER:
Charlotte Johnston	UBC/Arts/Psychology, Department of	H07-00727

INSTITUTION(S) WHERE RESEARCH WILL BE CARRIED OUT:

Institution	Site
UBC	Vancouver (excludes UBC Hospital)

Other locations where the research will be conducted:
N/A

CO-INVESTIGATOR(S):

Candice Murray
Lorelei P. Faulkner
Margaret Weiss

SPONSORING AGENCIES:

Canadian Institutes of Health Research (CIHR)

PROJECT TITLE:
Improving the accuracy of parents' reports of child Attention-Deficit/Hyperactivity Disorder

Expiry Date - Approval of an amendment does not change the expiry date on the current UBC BREB approval of this study. An application for renewal is required on or before: April 25, 2008

REB MEETING DATE:
November 22, 2007

AMENDMENT(S):

AMENDMENT APPROVAL DATE:
January 4, 2008

Document Name	Version	Date
Consent Forms:		
Informant consent form	3	December 18, 2007
Mother consent form	4	December 18, 2007
Advertisements:		
Newspaper Advertisement	N/A	December 6, 2007
Advertising Poster	2	December 6, 2007
Questionnaire, Questionnaire Cover Letter, Tests:		
CSS Self	N/A	October 30, 2007
CAARS Other	N/A	October 30, 2007
PSI	N/A	October 30, 2007
CSS Other	N/A	October 30, 2007
BSI Depresion/Hostility and Anxiety	2	October 30, 2007
GFI	2	December 6, 2007
Other Documents:		
Crisis Counselling Resources	N/A	December 6, 2007

The amendment(s) and the document(s) listed above have been reviewed and the procedures were found to be acceptable on ethical grounds for research involving human subjects.

Approval is issued on behalf of the Behavioural Research Ethics Board and signed electronically by one of the following:

Dr. M. Judith Lynam, Chair
Dr. Jim Rupert, Associate Chair
Dr. Laurie Ford, Associate Chair