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Adolescent and Caregiver Reports of ADHD Symptoms among Inner-City Youth: Agreement, Perceived Need for Treatment, and Behavioral Correlates

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Abstract

Objective—This study investigated adolescent and caregiver reports of ADHD symptoms in a sample of clinically referred inner-city adolescents.

Method—Participants (N = 168) included youth ages 12–18 (54% male, 98% ethnic minority) and their caregivers who each completed diagnostic interviews of ADHD symptoms and assessments of perceived need for ADHD treatment and correlated behavior problems.

Results—Informants showed poor agreement on DSM-IV diagnostic categories and also dimensional scales, Inattention/Disorganization (I/D) and Hyperactivity/Impulsivity (H/I). Both caregiver and adolescent reports of I/D symptoms, but not H/I symptoms, were related to perceived need for ADHD treatment. Caregiver reports were linked to behavioral correlates typically associated with ADHD: I/D symptoms correlated with planning/organization and socioemotional deficits, and H/I symptoms correlated with externalizing and behavior regulation deficits. In contrast, adolescent reports of I/D were related to internalizing and externalizing problems, and their reports of H/I correlated with externalizing only. Few gender effects were found.

Conclusion—Study results underscore the developmental salience of I/D symptoms and have implications for ADHD diagnosis and treatment planning for adolescents.

Keywords

adolescent ADHD; informant agreement; perceived need for treatment; ADHD correlates; ADHD subtypes

Research on Attention-Deficit/Hyperactivity Disorder (ADHD) in adolescent populations has gained considerable momentum over the past decade. Studies that extend ADHD research beyond childhood into the teenage years include research on longitudinal trajectories and correlates of ADHD symptoms (e.g., Todd et al., 2008), diagnosis of ADHD and co-occurring disorders in high-risk samples (e.g., Malone et al., 2010), and treatment responsiveness to stimulant medications alone (e.g., McGough et al., 2006) or medications combined with behavioral interventions (e.g., Riggs et al., 2011). There is now consensus that ADHD is a prevalent mental health problem across the adolescent developmental span (Taylor, 2009).

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The current study focuses on assessment of ADHD in a sample of clinically referred inner-city adolescents. The growing research base on adolescent ADHD has underscored numerous challenges related to symptom assessment and clinical diagnosis for this age group. One important issue is cross-informant agreement between caregivers and teens. Among the most robust findings in clinical child research is that, across a diverse range of ages, ethnicities, and symptom profiles, different informants routinely provide discrepant ratings for emotional and behavioral problems (Comer & Kendall, 2004; De Los Reyes & Kazdin, 2004; Yeh & Weisz, 2001), including ADHD classifications (e.g., Hartung, McCarthy, Milich, & Martin, 2005; Rowland et al., 2008; Serra-Pinheiro, Mattos, & Regalla, 2008; Valo & Tannock, 2010). It has also been shown that discrepancies in symptom ratings are larger for parent-teen dyads than for parent-child dyads (Achenbach, McConaughy, & Howell, 1987), which may be related to developmental differences in type of symptom being rated, informant awareness of problematic behaviors, and cross-situational consistency in symptoms (Achenbach, 2011; Hartung et al., 2005). Many advocate the position that modest correspondence does not reflect measurement error but rather ecologically valid differences in reporter perspective that constitute a rich source of nosological and clinical data to be carefully mined (Achenbach, 2011; De Los Reyes & Kazdin, 2005). The current study follows this logic by exploring differences in the profiles of ADHD correlates reported by caregivers versus their teenagers.

Another key assessment issue is the developmental fit of ADHD subtypes for adolescent populations. The DSM-IV (Diagnostic and Statistical Manual of Mental Disorders—Fourth Edition; American Psychiatric Association, 2000) recognizes three subtypes of ADHD: *Inattentive (ADHD-I)*, characterized by symptoms related to inattention, disorganization, and distractibility; *Hyperactive/Impulsive (ADHD-HI)*, characterized by restlessness, motor and verbal excesses, and impulsivity; and *Combined (ADHD-C)*, which describes youth who meet criteria for both ADHD-I and ADHD-HI. There is substantial support for this nosology in children (see Nigg, Tannock, & Rohde, 2010) and emerging consensus for adolescents as well (e.g., Hudziak et al., 1998; Rohde et al., 2001). Nevertheless, there appear to be several developmental caveats to the ADHD subtype nosology. The DSM-IV criteria are weighted heavily toward behaviors that are more common and/or evident at younger ages (Sibley et al., 2012). For example, the motor restlessness observed in early childhood may convert to cognitive restlessness in teen and young adult years that is not well represented in DSM descriptions (Weyandt et al., 2003). And the age of onset criterion, which requires that symptoms be evident by age 7, is susceptible to retrospective reporting error and under-identifies teens with late-onset symptoms (Todd, Huang, & Henderson, 2008). Some have argued that these and related measurement shortcomings are partially responsible for the marked decline in ADHD prevalence rates during adolescence, especially with regard to hyperactivity/impulsivity symptoms (Valo & Tannock, 2010), and lead to under-identification of ADHD in adolescence (Sibley et al., 2012). Thus there is clearly need for additional research describing the psychometric and clinical properties of ADHD subtypes in adolescents.

The current study addressed these key issues in adolescent ADHD assessment in three ways. First, it calculated caregiver-adolescent agreement on ADHD symptoms using both (a) *categorical* DSM variables based on diagnostic thresholds that yield either a positive or negative diagnosis and (b) *dimensional* DSM variables based on summed symptom counts that yield normally distributed scores for Inattention/Disorganization (I/D) and Hyperactivity/Impulsivity (H/I). Several recent studies have shown that continuous variables derived from summing the number of endorsed ADHD-I and ADHD-HI symptoms demonstrate equivalent or superior construct validity (Hartung et al., 2005) and reliability and predictive validity properties (Lahey & Willcutt, 2010; Todd et al., 2008; Volk, Todorov, Hay, & Todd, 2009) compared to diagnostic scores, indicating that research on informant agreement should examine both kinds of variables.

Second, this study assessed the relation between endorsed ADHD symptoms and perceived need for ADHD treatment separately for caregiver and teen reports. Perceived need for treatment is one key element of overall treatment motivation, alongside related elements such as perceived barriers to participation, readiness to change, and attitudes about counseling and the treatment system (Heflinger & Hinshaw, 2010; McKay & Bannon, 2004; Neff & Zule, 2000; Yeh et al., 2003). Several studies have demonstrated that caregiver perceived need predicts youth participation in mental health services (e.g., Angold et al., 1998; Shin & Brown, 2009; Yeh et al., 2005), including participation in ADHD services among school-age children (Bussing et al., 2003). However, few have assessed adolescent-perceived need (Logan & King, 2001); notably, such studies have found low concordance between parents and teens on receptivity to (Bussing et al., 2011) and perceived need for (Williams, Lindsey, & Joe, 2011) ADHD services. The current study featured an index of perceived need for ADHD treatment (based on Shen, McLellan, & Merrill, 2000) that was specifically anchored to endorsement of the DSM-IV ADHD items by each informant. This permitted analysis of how strongly each informant's ADHD symptom ratings predicted his/her perceived need for ADHD services.

Third, this study examined correlates of ADHD symptoms in related domains of adolescent functioning. This afforded a developmentally rich comparison of adolescent versus caregiver constructions of the subtype dimensions as they relate to comorbid problems and behavioral correlates of ADHD. Behaviors commonly linked with adolescent ADHD include: externalizing symptoms such as oppositionality (Barkley et al., 1991; van Lier, van der Ende, Koot, & Verhulst, 2007) and antisocial behavior (Abikoff & Klein, 1992; Satterfield & Schell, 1997); internalizing symptoms such as anxiety and depression (Bauermeister et al., 2007; Hinshaw, Owens, Sami, & Fargeon, 2006; Kessler et al., 2005); and indices of executive functioning such as self-regulation and planning (Barkley, 1997; Coolidge, Thede, & Young, 2000; Holmes et al., 2010). But there remains a paucity of research on contrasts between caregiver versus teen reports of co-occurring problems in ADHD samples (Bauermeister et al., 2007) that can inform the differential meaning of each informant's symptom ratings.

There are three specific study hypotheses: (1) Caregivers and target adolescents will show low agreement on ADHD diagnostic thresholds (ADHD-I, ADHD-HI, ADHD-C) and also symptom counts (I/D and H/I scores); (2) Caregivers will report higher levels of perceived need for the adolescent's ADHD treatment than will adolescents themselves, and for both informants, amount of perceived need will be related to amount of I/D and H/I symptoms; (3) I/D and H/I ratings by both informants will be related to behavioral traits that frequently co-occur with adolescent ADHD: externalizing symptoms, internalizing symptoms, callous-unemotional traits, and executive functioning. Of particular interest will be differences between caregiver and adolescent reports in the strength of these relations; the existing literature with adolescent-only samples is not sufficient to formulate specific hypotheses. Gender effects will also be tested in all analyses. Although parents rate boys higher than girls in ADHD symptoms across youth populations (Gershon, 2002; Rescorla et al., 2007), large-sample studies limited to adolescents have generally failed to find consistent gender differences across a variety of reporting sources (e.g., Conners, Sitarenios, Parker, & Epstein, 1998; Hartung et al., 2005; Novik et al., 2006; Rohde et al., 2001; Serra-Pinheiro et al., 2008). Thus it remains important to investigate the influence of gender on caregiver and teen reports of ADHD symptoms and correlates in this age group (Monuteaux, Mick, Faraone, & Biederman, 2010).

Method

Participants

Study participants were 168 adolescents and one primary caregiver per teen. Participants included both males (54%) and females (46%) and averaged 15.1 years of age (*SD* = 1.3). Self-reported ethnicities were Hispanic (60%), African American (22%), multiracial (11%), White (2%), and other (5%). Households were headed by a single parent (58%), two parents (28%), or grandparents (14%). Among caregivers, 67% graduated high school, 60% worked full- or part-time, 50% earned less than $15,000 per year, and 19% received public assistance, 55% reported a history of child welfare involvement, 35% reported at least one household member had ever used illegal drugs regularly, and 18% reported at least one member had been involved in illegal activities. Adolescents were referred primarily from schools (76%) but also from community-based family service agencies (10%), juvenile justice or child welfare sources (8%), and other sources (5%). Per study inclusion criteria (see below), every adolescent participant was diagnosed with at least one DSM-IV disorder, using the conventional “Or” principle of counting either positive adolescent or positive parent report (see Valo & Tannock, 2010). Overall diagnosis rates were as follows: Oppositional Defiant Disorder = 84%, Conduct Disorder = 53%, ADHD-I = 52%, Major Depressive Disorder and/or Dysthymia = 40%, alcohol and/or substance abuse/dependence = 28%, ADHD-C = 28%, Posttraumatic Stress Disorder = 19%, and Generalized Anxiety Disorder = 16%. Moreover, 88% were diagnosed with more than one disorder; of these comorbid cases, 7% met criteria for ODD + CD only, with the remaining 93% showing some other comorbidity profile.

Demographic characteristics and main study variables for the full sample and separately by gender are depicted in Table 1. Boys and girls did not differ on demographic variables, with the exception of age: boys were significantly older than girls ($t(157) = 2.13$, $p < .05$). Significant gender differences were also found for three of the main study variables: Girls self-reported more internalizing behaviors ($t(124.4) = -5.00$, $p < .001$) and externalizing behaviors ($t(164) = -2.53$, $p < .05$) than boys, and caregivers reported greater planning/organizational skills in their girls compared to boys ($t(148) = 2.75$, $p < .01$).

Study Recruitment, Participation Rates, and Procedures

Study recruitment procedures were designed to identify adolescents with untreated mental health disorders and to assist interested families in initiating available treatment services. To recruit adolescents with unmet treatment needs, research staff developed a community-based referral network of high schools, family service agencies, and youth programs in inner-city areas within a large northeastern city. Staff made regular on-site visits and phone calls to referral partners to maintain communication about current and potential cases. There were five study referral criteria: (a) target adolescent was between 12 and 18 years old; (b) adolescent lived with an adult family member who acted as primary caregiver; (c) adolescent was observed or suspected by referral source to have significant behavioral problems that impaired functioning; (d) adolescent problems were deemed beyond the scope of routine services available at the referral site (e.g., guidance/counseling services in schools, case management in family agencies); and (e) adolescent was not currently enrolled in behavioral treatment. Network partners made referrals to research staff during site visits and also by phone and confidential email. Staff then contacted referred families by phone to offer a home-based family research interview to assess the reason for study referral and discuss current developmental challenges.

A total of 675 adolescents were referred by network partners at the time of this study. Of these, 225 (33%) could not be recruited by research staff because the contact information was invalid or because the family did not respond to repeated voice messages. The contacted sample differed from the uncontacted sample in age (uncontacted had a higher proportion older than 15 years: $\chi^2(1) = 7.9$, $p < .01$), and referral source (uncontacted had a higher proportion referred by schools: $\chi^2(1) = 7.6$, $p < .01$). Of the 450 cases (67% of all referrals) successfully contacted, 359 (80%) completed a home-based family eligibility screen, whereas 91 (20%) refused due to disinterest (18%) or lack of time (2%). A full description of the demographic and clinical characteristics of the screen interview sample is available elsewhere (Hogue & Dauber, in press). Of the 359 families successfully screened, 168 (47%) met criteria for at least one DSM-IV Axis I diagnosis and subsequently completed the baseline interview; this group constitutes the sample for the current study. Reasons for attrition from the baseline interview included inability to re-establish contact with the family after the screen interview (31%), disinterest in participating (11%), or failed to meet criteria for a DSM-IV diagnosis (4%). No demographic differences were found between the study sample (who completed both screen and baseline interviews) and the attrition sample (who were successfully screened but did not complete a baseline interview).

Interviews were conducted by research staff primarily in the home but also in other locations upon request. Caregivers and teens were consented and interviewed separately; caregivers consented for themselves and their adolescents, and adolescents assented for themselves. Participants were informed that a federal Certificate of Confidentiality from the National Institutes of Health was obtained to protect their confidentiality. Assessment measures consisted of structured clinical interviews and audio computer-assisted self-report measures. Caregiver assessments were administered in the preferred language: 77% English, 23% Spanish. Caregivers and teens each received $35 in vouchers for completing the eligibility screen and $40 each for completing the baseline interview. After interview completion, interested families were linked to appropriate treatment services by research staff using intensive family-based engagement strategies (McKay & Bannon, 2004). The study was conducted under approval by the governing Institutional Review Board.

Measures

ADHD Symptoms and Diagnoses—ADHD symptoms and diagnoses were assessed using the Mini International Neuropsychiatric Interview (MINI, Version 5.0; Sheehan et al., 1998). Adolescents and caregivers were interviewed separately. The MINI is a brief structured diagnostic interview that assesses DSM-IV diagnoses in adolescent and adult populations. The MINI is specifically designed to be administered by lay interviewers and has demonstrated solid interrater and test-retest reliability on two international samples of psychiatric and nonpsychiatric patients (Lecrubier et al., 1997) and also excellent convergent validity with both the SCID and the CIDI (Lecrubier et al., 1997; Sheehan et al., 1997; Sheehan et al., 1998). ADHD variables used in the current study include both dimensional symptom counts and ADHD diagnostic categories. Two *dimensional variables* were calculated: total number of symptoms endorsed (out of 9) on the Inattentive/Disorganized (I/D) subscale, and total number of symptoms endorsed (of 9) on the Hyperactive/Impulsive (H/I) subscale. The three DSM-IV ADHD *diagnostic categories* were also included: ADHD-Inattentive subtype (ADHD-I), ADHDHyperactive/ Impulsive subtype (ADHD-HI), and ADHD-Combined subtype (ADHD-C).

Perceived Need for Treatment—To assess perceived need for treatment (PNT), we adopted two items from the Addiction Severity Index supported by strong reliability and validity data (McLellan et al., 1992; Shen, et al., 2000). Whenever either an adolescent or caregiver reported at least one symptom of ADHD that caused significant impairment, the informant was asked: “During the past month, how much have you been troubled or bothered by these [ADHD] symptoms you just reported?” Participants responded “Not at all" (0), "A little" (1), or "A lot" (2). If an informant reported a score of 1 or 2, he or she was then asked: "Is treatment in this area important to you, and if so, how much?" and given the same response choices: "Not at all" (0), "A little" (1), or "A lot" (2). The final ADHD PNT score was computed by summing the troubled and bothered score and the treatment importance score (summed scores had psychometric properties that were slightly favorable compared to multiplicative scores; Hogue & Dauber, in press). ADHD PNT scores were calculated separately for adolescent and caregivers.

Externalizing and Internalizing Symptoms—The Child Behavior Checklist (CBCL; caregiver report; Achenbach, 1991a) and Youth Self-Report (YSR; Achenbach, 1991b) are parallel measures of youth behavioral and emotional problems supported by extensive evidence encompassing reliability, validity, and clinical utility (Achenbach & Rescorla, 2001). These measures have been administered to a wide range of clinical and ADHD adolescent populations (e.g., Biederman et al., 2001, Doyle, Mick, & Biederman, 2007, McConaughy & Achenbach, 1994). Each measure contains a summary scale of Externalizing (delinquent and aggressive) and Internalizing (withdrawn, anxious/depressed, somatic complaints) symptoms used in the current study; high internal consistency (α = .87–.93) was found for all four scales in the sample.

Sociopathy—Adolescent sociopathy was assessed using the 24-item, parent-report Inventory of Callous-Unemotional Traits (ICU; Essau, Sasagawa, & Frick, 2006). The ICU is a 24-item questionnaire that assesses adolescents' callous-unemotional traits. The ICU was developed using items from the Callous-Unemotional (CU) subscale of the Antisocial Process Screening Device (Frick & Hare, 2001), which is a widely used scale to assess antisocial traits in youth. The construct validity of the ICU was supported in a large community sample (n =1,443) of German adolescents (Essau et al., 2006) as well an American sample (n = 248) of juvenile offenders (Kimonis et al., 2008). In both samples, the total scale showed internal consistency (alpha = .77 and .81, respectively); expected associations with aggression, delinquency, personality traits, emotional reactivity, and psychosocial impairment; and strong validity associations with aggression, delinquency, personality traits, emotional reactivity, and psychosocial impairment. Internal consistency in the study sample was high (α = .88).

Behavior Regulation and Planning—The Behavior Rating Inventory of Executive Function (BRIEF) is a caregiver-report measure of behavioral problems that are linked to executive functioning and commonly observed in ADHD youth (Gioia, Isquith, Guy, & Kenworthy, 2000, MaCandless & O' Laughlin, 2007).Gioia et al. (2000) report good convergent and discriminant validity between the BRIEF and similar behavioral rating systems as well as test-retest reliability statistics ranging from .79 to .88 during a 2-week period; internal consistency ranging from α = .80 to .98; and interrater reliability between parent and teacher responses of r = .32. The BRIEF has been validated on ADHD outpatient samples (Mares, McLuckie, Schwartz, & Saini, 2007) and teens with mixed clinical diagnoses (Gioia Isquith, Retzlaff, & Espy, 2002). This study used two BRIEF scales, the Behavioral Regulation Index (BRI) global scale (comprised of the Inhibition, Behavioral Shift, and Emotional Control subscales) and the Plan/Organize scale. Internal consistency in our sample was α = .93 for the BRI and α = .85 for the Plan/Organize scale. Higher scores indicate poorer functioning.

Statistical Analyses

Preliminary analyses included descriptive statistics of adolescent and caregiver reports on the ADHD dimensional scales (I/D and H/I) and perceived need for treatment (PNT) scores, as well as mean comparisons of gender, age, and ethnicity differences on these variables using independent samples *t*-tests to identify possible covariates for subsequent analyses. We examined adolescent and caregiver agreement on ADHD categorical diagnoses using Kappa coefficients and on ADHD dimensional scales using Pearson's correlations. This was followed by hierarchical regressions testing the degree to which I/D and H/I scores predicted PNT scores for each informant, conducted separately for adolescent and caregiver reports, as follows: In Step 1, gender was entered as a covariate; in Step 2, the ADHD dimensional scales were entered simultaneously to examine the effect of each on PNT while controlling for the effects of the other; in Step 3, the dimensional interaction term (I/D*H/I) and gender interaction terms (I/D*Sex, H/I*Sex) were entered to explore moderator effects. Finally, we analyzed the relation between ADHD symptoms and related behavioral variables, controlling for gender effects. A series of hierarchical multiple regressions were conducted to examine the individual and interactive effects of I/D and H/I scores on the following dependent variables (DVs): externalizing symptoms, internalizing symptoms, callous-unemotional traits, school engagement, and executive functioning. Two sets of regressions were conducted, one for adolescent-reported and one for caregiver-reported ADHD scores. A separate regression was conducted for each DV: In Step 1, gender was entered as a covariate; in Step 2, the two ADHD dimensional scales were entered simultaneously to examine the effect of each on study DVs while controlling for the effects of the other; in Step 3, the interaction term (I/D*H/I) was tested to examine moderating effects for ADHD dimensional symptoms. We did not test three-way interactions involving gender effects because the study was under-powered to detect three-way interactions, and there were no a priori hypotheses to guide interpretation of significant findings.

Results

Descriptive Statistics for the ADHD Dimensional Scales (I/D and H/I) and Perceived Need for Treatment (PNT)

Descriptive statistics on the I/D and H/I dimensional scales and PNT for adolescent and caregiver reports are depicted in Table 2 for the full sample, as well as separately by gender. As seen in the table, the dimensional scales and PNT scores were normally distributed in the full sample and in the gender groups for both adolescent and caregiver reports. Gender differences were found on the I/D scale for caregiver report, with caregivers indicating more I/D symptoms in their boys than in their girls ($t(165) = 1.96$, $p = .05$). No gender differences were found for H/I symptoms, and no significant age or ethnicity differences were found for either scale. No gender, age, or ethnicity differences were found for adolescent or caregiver PNT.

Paired samples *t*-tests were conducted to examine differences in levels of I/D versus H/I symptoms reported by adolescents and caregivers in the full sample and separately by gender. Significantly more inattention symptoms than hyperactivity symptoms were reported by both adolescents and caregivers in the full sample and within each gender group: Adolescent report full sample: $t(165) = 4.5$, $p < .001$; Caregiver report full sample: $t(166) = 11.1$, $p < .001$; Adolescent report boys: $t(87) = 2.9$, $p < .01$; Caregiver report boys: $t(88) = 9.2$, $p < .001$; Adolescent report girls: $t(77) = 3.5$, $p < .01$; Caregiver report girls: $t(77) = 6.5$, $p < .001$. Paired samples *t*-tests were also conducted to compare adolescent and caregiver PNT for the 146 cases that had available scores from both informants. Caregivers reported higher PNT than adolescents in the full sample ($t\ (145) = -12.2$, $p < .001$), as well as among boys ($t\ (77) = -10.5$, $p < .001$) and girls ($t\ (67) = -6.9$, $p < .001$).

Bivariate correlations of adolescent and caregiver reports on each dimensional scale as well as scale correlations within informant were examined for the full sample and for gender, ethnicity, and age subgroups. Findings are presented for the full sample only, as correlations in the subgroups mirrored those for the full sample. Low correlations were found between adolescent and caregiver reports on both I/D ($r = .14$, *ns*) and H/I ($r = .16$, $p < .05$), indicating weak agreement between informants on ADHD symptoms and supporting the decision to conduct remaining study analyses separately by reporter. I/D and H/I scales were moderately correlated for both adolescent ($r = .37$, $p < .001$) and caregiver reports ($r = .41$, $p < .001$).

Cross-Informant Agreement on the ADHD Diagnostic Categories

Agreement between adolescent and caregiver on the ADHD diagnostic subtypes (ADHD-I, ADHD-HI, ADHD-C) is shown in Table 3. The data reveal a modest 36% rate of absolute agreement overall: For 61 of the 168 participants, teens and parents gave identical reports, including 25% of the sample (n = 42) who jointly reported no ADHD diagnosis. One-tenth of the sample (n = 16) agreed on the ADHD-I diagnosis, and only 2% (n = 3) agreed on ADHD-C. An additional 11% were in partial agreement, wherein one reporter indicated ADHD-C while the other indicated either ADHD-I or ADHD-HI. The largest example of partial agreement (n = 11; 7% of the sample) resulted from an adolescent reporting ADHD-C while his/her caregiver reported ADHD-I. Only 4 participants were diagnosed as ADHD-HI by either reporter, with no agreement among these. Finally, we identified the percentage of pair agreement for each “diagnostic decision”: No Diagnosis, ADHD-I, and ADHD-HI. For No Diagnosis, 33% of those cases with at least one registered report of no diagnosis were matched with a second report of no diagnosis. Pair agreement was 30% for ADHD-I cases and 9% of ADHD-HI cases, respectively. Cohen’s κ (see Bakeman & Gottman, 1997) was calculated as a measure of cross-informant agreement for each diagnosis that controls for chance agreement. Guidelines for interpreting values of κ are provided by Landis and Koch (1977): κ between .40 – .60 is considered moderate, .60 – .80 substantial, and > .80 excellent. For the current study, $\kappa = .05$ (SE = .07, ns) for ADHD-I, $\kappa = -.03$ (SE = .07, ns) for ADHD-C, $\kappa = -.04$ (SE = .01, ns) for ADHD-HI, and $\kappa = .04$ (SE = .07, ns) for any positive ADHD diagnosis, indicating virtually nonexistent diagnostic agreement between adolescent and caregiver beyond chance occurrence.

Relation of ADHD Dimensional Scales to Perceived Need for ADHD Treatment

Hierarchical regressions were conducted to examine the degree to which I/D and H/I symptoms predicted adolescent and caregiver PNT. Results are presented in Table 4. In order to account for the potential influence of DSM-IV diagnoses other than ADHD on the perceived need for ADHD treatment, the total number of co-occurring diagnoses was included in Step 1 as a covariate, along with gender. Step 2 included simultaneous entry of I/D and H/I dimensional scores, and Step 3 included interactions among I/D and H/I and gender. Adolescent-reported ADHD symptoms were used in the analysis predicting adolescent PNT, and caregiver-reported symptoms were used to predict caregiver PNT. Higher number of co-occurring diagnoses was associated with higher adolescent PNT ($\beta = .21$, $p < .05$) but not with caregiver PNT. Higher I/D symptoms predicted greater adolescent-reported PNT ($\beta = .33$, $p < .001$) and also caregiver-reported PNT ($\beta = .48$, $p < .001$). Additionally, there was a significant I/D by H/I interaction predicting caregiver PNT ($\beta = -.61$, $p < .05$). Probing this interaction using a mean-split strategy revealed that caregiver-reported I/D predicted caregiver PNT more strongly when the H/I score was low ($\beta = .54$, $p < .001$). When H/I was high, the predictive strength of I/D was diminished ($\beta = .22$, $p = .07$). H/I symptoms did not predict either adolescent PNT or caregiver PNT. No moderating effects of gender were found.

Relation of ADHD Dimensional Scales to Co-Occurring Problems

As described above, a series of hierarchical regressions were conducted to examine the relations between I/D and H/I scales and adolescent behavior problems, callous-unemotional traits, school engagement, and executive functioning, controlling for gender. Separate analyses were conducted for adolescent and caregiver reports and results are presented in Table 5. Adolescent-reported I/D symptoms were associated with greater adolescent-reported internalizing symptoms ($\beta = .29$, $p < .001$) and externalizing symptoms ($\beta = .24$, $p < .01$). Adolescent-reported H/I symptoms were associated with more externalizing symptoms, based on both adolescent report ($\beta = .31$, $p < .001$) and caregiver report ($\beta = .19$, $p < .05$). Finally, a significant I/D by H/I interaction was found for callous-unemotional traits ($\beta = .73$, $p < .01$). Probing this interaction revealed a trend-level effect of I/D symptoms on callous-unemotional traits only when H/I symptoms were also high ($\beta = .24$, $p < .10$). Although it did not reach statistical significance, the effect of I/D symptoms on callous-unemotional traits in the presence of low H/I symptoms was in the opposite direction ($\beta = -.16$, $p = .17$). Thus, it may be that higher I/D symptoms are associated with more sociopathy traits when H/I symptoms are also high, but with lower sociopathy traits when H/I symptoms are low.

Caregiver-reported I/D symptoms were associated with more callous-unemotional traits ($\beta = .18$, $p < .05$), as well as higher scores on the behavior regulation index ($\beta = .19$, $p < .05$) and the plan/organize scale ($\beta = .55$, $p < .001$). Caregiver-reported H/I symptoms were associated with greater externalizing symptoms (caregiver reported) ($\beta = .41$, $p < .001$), more callousunemotional traits ($\beta = .18$, $p < .05$), and higher scores on the behavior regulation index ($\beta = .43$, $p < .001$). No interactions between I/D and H/I were found for caregiver reported symptoms.

Discussion

This study is among the first to examine youth-caregiver agreement, perceived need for treatment, and co-occurring problems related to ADHD dimensional symptoms among clinically referred adolescents. There were three main study findings. First, there was markedly low agreement between caregivers and teens on ADHD diagnostic categories and dimensional scales. This replicates previous research demonstrating weak cross-reporter correspondence across a range of youth behavior problems, including ADHD (e.g., Rowland et al., 2008; Sayal & Goodman, 2009). These data confirm that parents and teens make highly discrepant judgments about adolescent ADHD symptoms as contained in the DSM-IV.

A second main finding was that I/D symptoms, but not H/I symptoms, predicted perceived need for ADHD treatment on the part of both caregivers and teens. This finding was robust even when controlling for other psychiatric diagnoses and for level of H/I symptoms. Also, among caregivers only, I/D symptoms were more strongly related to perceived treatment needs when relatively fewer H/I symptoms were identified. These results underscore the clinical salience of the I/D subtype in adolescent populations: Not only are I/D symptoms more prevalent than H/I symptoms, they appear to be strongly related to family perceptions about counseling needs. This finding takes on added significance in light of emerging data suggesting that both parent and adolescent perceptions about the need for behavioral treatment are important predictors of treatment participation (e.g., Williams et al., 2011), including treatment for ADHD specifically (Bussing et al., 2011).

The third main finding was that caregiver and adolescent reports of ADHD produced notably different profiles of behavioral correlates. Caregiver reports of I/D symptoms were related to executive functioning and socioemotional deficits—planning/organization, behavior regulation, sociopathy—that are typically associated with ADHD; in contrast, adolescent reports of I/D were related exclusively to internalizing and externalizing problems. Similarly, caregiver reports of H/I matched the fuller spectrum of behavioral excess associated with the H/I construct—externalizing and behavior regulation deficits—whereas adolescent reports of H/I were related to externalizing problems only. On the one hand these data support the validity, and thus the utility, of caregiver data for diagnosing both dimensions of adolescent ADHD (Sibley et al., 2012). On the other hand, findings raise intriguing questions about the informative value of adolescent reports. According to the teenagers themselves, their ADHD symptoms were associated with broad-based psychological symptoms but not with the self-regulation and self-organizational deficits thought to be endemic to ADHD youth (Coolidge et al., 2000; Dendy, 2006; Holmes et al., 2010). The profile of adolescent I/D correlates was particularly complex, intertwined most strongly with internalizing problems and also related to callous-unemotional traits among those teens with elevated H/I symptoms; in contrast, ADHD was not associated with internalizing problems according to caregivers. Because I/D is arguably the key dimension for diagnosis and treatment planning among adolescents, more research on the convergent and discriminant validity of adolescent-reported I/D symptoms is certainly warranted. Such research would add to our understanding of the conceptual and psychometric underpinnings of ADHD-I in adolescents, as well as provide new insights into the clinical (e.g., Dendy, 2006) and research (Carr, Henderson, & Nigg, 2010; Diamond, 2005; Milich, Balentine, & Lynam, 2001) debates as to whether ADHD-I and ADHD-C are two variants of the same disorder or altogether separate clinical syndromes.

Despite poor agreement on symptom counts and differential profiles of behavioral correlates, caregivers and teens were uniform in reporting higher levels of I/D symptoms compared to H/I symptoms, and this was equally true for boys and girls. This confirms research showing that I/D is far more prevalent than H/I among teens (e.g., Sibley et al., 2012; Todd et al., 2008), unlike younger children, who tend to exhibit relatively equivalent levels of each dimension (e.g., Valo & Tannock, 2010). Interestingly, only caregivers reported higher levels of I/D for boys than girls, and neither informant reported gender differences for H/I. Results overall support the assertion that ADHD creates significant multi-domain impairment for teenage girls as well as boys (Hinshaw et al., 2006; Monuteaux et al., 2010; Owens et al., 2009).

Study Strengths and Limitations

Several features of the study design strengthen the validity of reported findings. The assessment design included both adolescent and caregiver reports of most study variables, and the analytic plan encompassed both dimensional (i.e., symptom counts) and categorical (i.e., diagnostic subtypes) constructs for ADHD. By including both I/D and H/I scores in all dimensional analyses, we were able to calculate the unique effect of each score on predicted variables, independent of the other dimension. Analyses also controlled for gender differences in individual levels of ADHD symptoms and for gender effects on ADHD symptom-correlate relations. Space limitations precluded analysis of individual and family characteristics that may be related to caregiver-adolescent reporting discrepancies. There is keen interest in whether informant discrepancies about behavioral symptoms are related to the developmental course of symptoms over time (e.g., De Los Reyes, Goodman, Kliewer, & Reid-Quinones, 2010) and to treatment planning (e.g., Hawley & Weisz, 2003). However, such analyses require theory-driven examination of multiple facets of observed discrepancies (De Los Reyes & Kazdin, 2005), which was beyond the scope of this study.

Common source variance was an unavoidable influence on the analyses of ADHD correlates: For most (but not all) significant effects, caregiver-reported ADHD symptoms predicted caregiver-reported correlates, and likewise for adolescent report. However, the impact of common source variance was at least partly mitigated by the inclusion of both dimensional scales as simultaneous predictors in regression analyses: Each scale acted as a statistical control for the other, partialling out common variance associated with reporter identity prior to calculation of unique scale effects. Also note that there were two "crossover" effects: adolescent-reported ADHD symptoms predicted caregiver-reported externalizing problems and sociopathy. It would be possible to eliminate the common variance confound altogether by utilizing a multitrait-multimethod analytic approach that fully models reporter effects across a combined-informant data set (e.g., Greenbaum, Dedrick, Prange, & Friedman, 1994; Phillips, Lonigan, Driscoll, & Hooe, 2002). However, whereas this approach might better inform the construct validity of ADHD reports, it would negate our ability to examine the internal diagnostic logic that distinguishes adolescent from caregiver reports and to accentuate differences in reporter perspective that may have strong ecological validity and clinical implications (Achenbach, 2011; Valo & Tannock, 2010).

The study design was limited by the absence of teacher reports of ADHD symptoms. Teacher reports are not required for making a DSM-IV ADHD diagnosis—the only contextual stipulation is that impairment be reported for multiple settings—and acquiring teacher data for teens is complicated by the fact that several teachers are involved with any given student during a routine school day (Evans, Serpell, Schultz, & Pastor, 2007). Nevertheless, in their longitudinal study comparing gold-standard childhood ADHD diagnoses to diagnoses made in adolescence,Sibley et al. (2012) found that the optimal reporting source for accurate diagnosis of adolescent ADHD is parent report combined with teacher report. Finally, it is not known whether study findings are generalizable to adolescents and families who have different points of entry to care and different cultural backgrounds. It would be worthwhile to replicate and extend study analyses with other clinical and community-based adolescent ADHD populations.

Implications for Treatment Policy and Practice

Study findings underscore the need for ADHD assessment and treatment services for inner-city teens identified by school-based referral sources as having unmet behavioral health problems (Atkins et al., 2006). In the study sample both caregivers and adolescents themselves expressed serious concerns about all varieties of ADHD symptoms: poor attention span, disorganization, impulsivity, and so forth. Because ADHD often co-occurs with learning disabilities (e.g., Bental & Tirosh, 2007; McGrath et al., 2011), adolescents meeting criteria for ADHD will likely require a combination of behavioral, scholastic, and perhaps pharmacological interventions to meet expectancies for school achievement. As such, school guidance personnel and allied mental health disciplines may have to significantly upgrade training efforts in ADHD assessment, referral, and intervention procedures to properly meet this need (Jitendra, DuPaul, Someki, & Tresco, 2008; Kent et al., 2011; Leslie et al., 2008; Young & Amarasinghe, 2010).

All evidence to date points to the particular importance of assessing the Inattention/ Disorganization dimension—ADHD-I, often referred to as ADD—in adolescents. Indeed the salience of teacher-report data for diagnosing adolescent ADHD (Sibley et al., 2012) may stem in large part from the fact that I/D symptoms, which are more prevalent than H/I symptoms among teens, create relatively greater impairment in school settings than home settings. Because secondary education places a premium on student initiative and selforganization, teachers in these settings may be (much) better informed than parents about the debilitating effects of ADHD symptoms (Dendy, 2011). In lieu of obtaining reports directly from hard-to-reach teachers with limited knowledge of individual students, diagnosticians might seek access to available school records pertaining to the teen's history of disciplinary problems, special education services, or counseling services. Such documents often refer directly or indirectly to ADHD symptoms and related problems and can thereby provide cross-situational support for, or competing hypotheses to, an ADHD diagnosis.

Along these same lines, in order to encourage appropriate help-seeking among families, diagnosticians should carefully assess the evidence of I/D symptoms and formulate I/D-relevant treatment recommendations for teens undergoing ADHD evaluation. Many families may be less knowledgeable about the established benefits of medication and other interventions for the I/D dimension (see Smith, Waschbusch, Willoughby, & Evans, 2000; Wilens et al., 2006), including families who previously pursued services for childhood H/I symptoms. Targeted, family-centered support of help-seeking for ADHD symptoms in teens may be especially important among ethnic minority populations, who, for a variety of reasons, generally underutilize behavioral services (Cauce et al., 2002; Eirladi et al., 2006; Hervey-Jumper et al., 2008).

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Table 1

Demographic and Clinical Characteristics of the Sample and Gender Differences

	Full Sample	Boys	Girls
N	167	89	78
Age in Years (M/SD)*	15.1 (1.3)	15.3 (1.4)	14.8 (1.3)
Ethnicity			
Hispanic	60%	54%	65%
African American	22%	24%	19%
Other	19%	21%	15%
Family Composition			
Single Parent	58%	54%	63%
Two Parents	28%	29%	26%
Grandparents	14%	17%	11%
Caregiver Characteristics			
Graduated High School	67%	65%	69%
Worked Full-or Part-Time	60%	60%	59%
Annual Income less than $15K	50%	49%	50%
Received Public Assistance	19%	14%	24%
Household History Characteristics			
Child Welfare Involvement	55%	49%	61%
One Member Regularly Used Drugs	35%	38%	30%
One Member Involved in Illegal Activities	18%	19%	17%
Participant Referral Source			
School	76%	77%	76%
Other	24%	23%	24%
Adolescent Externalizing Symptoms			
CBCL Externalizing Score (M/SD)	19.2 (11.8)	19.6 (12.4)	18.8 (11.2)
YSR Externalizing Score (M/SD)*	14.4 (8.7)	12.8 (7.6)	16.2 (9.5)
Adolescent Internalizing Symptoms			
CBCL Internalizing Score (M/SD)	13.1 (8.5)	12.4 (7.7)	13.9 (9.3)
YSR Internalizing Score (M/SD)***	10.0 (7.9)	7.3 (5.6)	13.2 (8.9)
Adolescent Behavioral Characteristics			
ICU Total Score (M/SD)	33.0 (12.1)	32.5 (12.8)	33.5 (11.2)
BRIEF Behavior Regulation Index (M/SD)	47.9 (10.8)	48.5 (10.2)	47.1 (11.6)
BRIEF Plan/Organize Scale (M/SD)**	23.7 (5.3)	24.8 (5.2)	22.4 (5.3)

Note.

* $p < .05$,

** $p < .01$,

*** $p < .001$

CBCL = Child Behavior Checklist; YSR = Youth Self-Report; ICU = Inventory of Callous-Unemotional Traits; BRIEF = Behavior Rating Inventory of Executive Function.

Table 2

Descriptive Statistics of Adolescent and Caregiver Reports on ADHD Dimensional Scales and Perceived Need for Treatment

	Adolescent Report					Caregiver Report				
	N	M	SD	Skew (SE)	Kurtosis (SE)	N	M	SD	Skew (SE)	Kurtosis (SE)
Inattentive/Disorganized Scale										
Full Sample	167	4.3	2.4	−.25 (.19)	−.87 (.37)	167	5.6	2.6	−.64 (.19)	−.72 (.37)
Boys	89	4.0	2.4	−.09 (.26)	−.90 (.51)	89	5.9[*]	2.5	−.79 (.26)	−.45 (.51)
Girls	78	4.7	2.3	−.45 (.27)	−.66 (.54)	78	5.2[*]	2.7	−.47 (.27)	−.94 (.54)
Hyperactive/Impulsive Scale										
Full Sample	166	3.4	2.3	.32 (.19)	−.72 (.38)	167	3.1	2.6	.64 (.19)	−.59 (.37)
Boys	88	3.3	2.1	.45 (.26)	−.16 (.51)	89	3.1	2.6	.60 (.26)	−.56 (.51)
Girls	78	3.6	2.5	.18 (.27)	−1.1 (.54)	78	3.1	2.7	.69 (.27)	−.58 (.54)
Perceived Need for Treatment (PNT)										
Full Sample	158	.81	1.3	1.2 (.19)	.11 (.38)	156	2.9	1.6	−1.1 (.19)	−.49 (.39)
Boys	83	.64	1.1	1.6 (.26)	1.5 (.52)	85	2.9	1.5	−1.2 (.26)	−.05 (.52)
Girls	75	1.0	1.4	.92 (.28)	−.72 (.55)	71	2.8	1.6	−.92 (.29)	−.85 (.56)

Note.

[*] There was a significant difference between boys and girls on the Inattentive/Disorganized Scale according to caregiver report, (t (165) = 1.96, p = .05). No other significant gender, age, or ethnicity differences were found on any scale for either adolescent or caregiver reports.

Table 3

Agreement between Caregiver and Adolescent Report of ADHD Diagnoses

	Adolescent Report				
Caregiver Report	No Diagnosis	ADHD-I	ADHD-HI	ADHD-C	Total
No Diagnosis	**42 (25%)**	13 (8%)	6 (4%)	6 (4%)	67
ADHD-I	37 (22%)	**16 (10%)**	4 (2%)	*11 (7%)*	68
ADHD-HI	2 (1%)	0 (0%)	**0 (0%)**	*2 (1%)*	4
ADHD-C	19 (11%)	*6 (4%)*	*0 (0%)*	**3 (2%)**	28
Total	100	35	10	22	168

Note.

ADHD-I = ADHD-Inattentive Subtype; ADHD-HI = ADHD-Hyperactive/Impulsive Subtype; ADHD-C = ADHD-Combined Subtype. Numbers in bold type indicate absolute agreement and numbers in italicized type indicate partial agreement. Percentages in parentheses are drawn from the sample size of N = 168. Total figures for each diagnosis according to caregiver and adolescent reports are provided in the final column and row, respectively.

Table 4

Hierarchical Regressions testing the relation between ADHD Dimensional Scales and Perceived Need for ADHD Treatment

	Adolescent PNT (N = 158)				Caregiver PNT (N = 156)			
	B	**SE(B)**	**β**	**P**	**B**	**SE(B)**	**β**	**P**
Stepl:								
Gender	.21	.20	.08	Ns	−.21	.26	−.07	Ns
Number of CODs[1]	.19	.08	.21	>05	.09	.10	.07	Ns
Step 2:								
ADHD-I/D	.18	.05	.33	>.001	.31	.05	.48	>.001
ADHD-H/I	−.06	.05	−.11	Ns	.06	.04	.10	Ns
Step 3:								
ADHD-I/D*Gender	.04	.09	.13	Ns	−.07	.10	−.20	Ns
ADHD-H/I*Gender	−.03	.09	−.11	Ns	.13	.09	.37	Ns
ADHD-I/D*ADHD-H/I	−.02	.02	−.21	Ns	−.04	.02	−.61	>.05

Note.

PNT = Perceived Need for Treatment; COD = Co-Occurring Diagnosis; I/D = Inattentive/Disorganized Scale; H/I = Hyperactive/Impulsive Scale

[1] In order to account for potential influence of co-occurring diagnoses (i.e., diagnoses other than ADHD) on PNT, the total number of co-occurring diagnoses for each adolescent was included as a covariate.

For Adolescent PNT, R^2 change was .06 for Step 1 ($p > .01$), .09 for Step 2 ($p < .001$), and .01 for Step 3 (ns).

For Caregiver PNT, R^2 change was .01 for Step 1 (ns), .28 for Step 2 ($p < .001$), and .04 for Step 3 ($p = .06$).

Table 5

Hierarchical Regressions Examining Effects of ADHD Dimensional Scales on Adolescent Behavioral Characteristics

	Step 1: Gender		**Step 2: I/D and H/I Scales**				**Step 3: I/D*H/I**	
	Adolescent Report							
	B (SE)	**β**	**I/D: B (SE)**	**I/D: β**	**H/I: B (SE)**	**H/I: β**	**B (SE)**	**β**
YSR Internalizing	5.7 (1.1)	.37***	.97 (.25)	.29***	.07 (.26)	.02	−.01 (.11)	−.02
YSR Externalizing	3.2 (1.3)	.19*	.90 (.28)	.24**	1.2 (.29)	.31***	.15 (.11)	.28
CBCL Internalizing	1.6 (1.3)	.10	.31 (.30)	.09	−.40 (.32)	−.11	−.06 (.13)	−.11
CBCL Externalizing	−.72 (1.9)	−.03	−.78 (.42)	−.16	1.0 (.44)	.19*	.16 (.17)	.22
Invent. Callous-Unemotional (ICU)	.62 (2.1)	.03	−.04 (.49)	−.01	.06 (.51)	.01	.55 (.20)	.73**
Behavior Regulation Index (BRI)	−1.3 (1.9)	−.06	−.21 (.43)	−.05	−.14 (.45)	−.03	.07 (.18)	.11
Plan/Organize	−2.3 (.86)	−.22**	.25 (.20)	.11	−.10 (.21)	−.04	.13 (.08)	.40
	Caregiver Report							
	B (SE)	β	I/D: B (SE)	I/D: β	H/I: B (SE)	H/I: β	B (SE)	β
YSR Internalizing	5.8 (1.1)	.37***	−.02 (.24)	−.01	−.27 (.24)	−.09	.10 (.10)	.28
YSR Externalizing	3.3 (1.3)	.19*	.14 (.29)	.04	.08 (.28)	.03	.02 (.12)	.06
CBCL Internalizing	1.4 (1.3)	.08	.33 (.28)	.10	.08 (.28)	.03	−.03 (.12)	−.07
CBCL Externalizing	−.86 (1.8)	−.04	.01 (.36)	.00	1.8 (.36)	.41***	.07 (.15)	.12
Invent. Callous-Unemotional (ICU)	.98 (2.1)	.04	.84 (.43)	.18*	.83 (.41)	.18*	.25 (.18)	.44
Behavior Regulation Index (BRI)	−1.4 (1.9)	−.07	.75 (.33)	.19*	1.8 (.33)	.43***	.12 (.14)	.24
Plan/Organize	−2.4 (.86)	−.22**	1.1 (.15)	.55***	−.02 (.15)	−.01	.05 (.06)	.19

Note.

$^{*}p < .05$,

$^{**}p < .01$,

$^{***}p < .001$

Adolescent Report: YSR Internalizing Step 1 $R^2\Delta = .134^{***}$, Step 2 $R^2\Delta = .089^{***}$, Step 3 $R^2\Delta = .000$; YSR Externalizing Step 1 $R^2\Delta = .034^{*}$, Step 2 $R^2\Delta = .210^{***}$, Step 3 $R^2\Delta = .009$; CBCL Internalizing Step 1 $R^2\Delta = .009$, Step 2 $R^2\Delta = .012$, Step 3 $R^2\Delta = .001$; CBCL Externalizing Step 1 $R^2\Delta = .001$, Step 2 $R^2\Delta = .040^{*}$, Step 3 $R^2\Delta = .005$; ICU Step 1 $R^2\Delta = .001$, Step 2 $R^2\Delta = .000$, Step 3 $R^2\Delta = .056^{**}$; BRI Step 1 $R^2\Delta = .004$, Step 2 $R^2\Delta = .004$, Step 3 $R^2\Delta = .001$; Plan/Organize Step 1 $R^2\Delta = .047^{**}$, Step 2 $R^2\Delta = .010$, Step 3 $R^2\Delta = .017$.

Caregiver Report: YSR Internalizing Step 1 $R^2\Delta = .137^{***}$, Step 2 $R^2\Delta = .009$, Step 3 $R^2\Delta = .005$; YSR Externalizing Step 1 $R^2\Delta = .036^{*}$, Step 2 $R^2\Delta = .003$, Step 3 $R^2\Delta = .000$; CBCL Internalizing Step 1 $R^2\Delta = .007$, Step 2 $R^2\Delta = .013$, Step 3 $R^2\Delta = .000$; CBCL Externalizing Step 1 $R^2\Delta = .001$, Step 2 $R^2\Delta = .168^{***}$, Step 3 $R^2\Delta = .001$; ICU Step 1 $R^2\Delta = .002$, Step 2 $R^2\Delta = .092^{**}$, Step 3 $R^2\Delta = .013$; BRI Step 1 $R^2\Delta = .004$, Step 2 $R^2\Delta = .275^{***}$, Step 3 $R^2\Delta = .004$; Plan/Organize Step 1 $R^2\Delta = .049^{**}$, Step 2 $R^2\Delta = .292^{***}$, Step 3 $R^2\Delta = .003$.