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Attention-Deficit/Hyperactivity Disorder Symptom Profiles in Medication-Treated Adults Entering a Psychosocial Treatment Program

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Abstract

Background—Although medications are the most widely studied effective treatments for adults with attention-deficit/hyperactivity disorder (ADHD), patients treated with medications often have significant residual symptoms that may be amenable to psychosocial intervention. Few studies, however, report on the structure and severity of specific residual ADHD symptoms in adult patients who have been treated with medications. This information may be important in identifying the most important psychosocial treatment targets for medicated adults with ADHD with residual symptoms.

Objectives—Identify which symptoms of ADHD are most frequent and severe for medication-treated adults. Identify meaningful factors underlying self-report and clinician ratings in this group.

Methods—Self-reported and clinician-rated ADHD symptom data from 105 adults in the community already receiving medication treatment who were entering cognitive behavioral therapy studies were examined. First, we examined the frequency and severity of each of the 18 ADHD symptoms that were present in the sample. Second, we conducted exploratory factor analyses of self-reported and clinician-rated ADHD symptoms to best describe the structure of residual symptoms in medication-treated adults, Lastly, we examined the association of the resulting factor scores with clinician-rated global ADHD severity (Clinical Global Impressions) and functional impairment (Global Assessment of Functioning) scales to determine which factors relate to overall severity.

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In our factor analyses, *Inattention* was the third factor to be extracted for both self-reported and clinician-rated data and thus accounted for a lower percentage of the overall variance than the preceding factors. This may seem surprising given that (1.) inattention symptoms were rated as more severe and (2) an inattention factor is often the first to emerge in analyses using general population samples. Factors, however, are calculated to account for maximum variance among items and may not necessarily reflect the items that have the highest means. Given that we sampled only adults with an ADHD diagnosis, hyperactivity and impulsivity items may be more variable in this population than inattention items, In contrast, inattention items may be endorsed at higher rates—but more homogeneously so—by these adults with ADHD. Comparison of dispersion between the *DSM-IV* inattentive versus hyperactive/impulsive symptom items using the CV supports this notion. *CV* is a dimensionless metric used to compare dispersion between 2 samples with different means and is calculated by *SD/M*. For both clinician-rated and self-reported data, *DSM-IV* hyperactive/impulsive symptom items had a higher CV (0.51 and 0.56, respectively) than inattentive symptom items (0.27 for both reporters), indicating greater variability in endorsement of hyperactive/impulsive items and supporting the above.

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Results—The 2 most frequent (self-reported and clinician-rated) residual symptoms were disorganization (85%–88%) and distractibility (74%–83%). Exploratory factor analyses for both self-reported and clinician-rated data yielded a 3-factor model: (1) Hyperactivity/Restlessness, (2) Impulsivity/Poor Prospective Memory, and (3) Inattention. Using multiple regression, the Inattention factor from self-reported and clinician-rated data was most strongly, consistently, and uniquely related to clinician ratings of both illness severity and functioning.

Conclusions—In this sample, disorganization and distractibility were the most frequent and clinically significant residual symptoms; therefore, these should be important targets in psychosocial treatments for this population. Scoring symptom rating scales in medication-treated adults with ADHD using Hyperactivity. Restlessness, Impulsivity/Poor Prospective Memory, and Inattention factors may be more informative with respect to evaluating psychosocial treatment outcome than overall scale scores alone.

Keywords

hyperactivity/restlessness; impulsivity/poor prospective memory; inattention

INTRODUCTION

Attention-deficit/hyperactivity disorder (ADHD) is a chronic and impairing psychiatric disorder beginning in childhood and persisting into adulthood in a substantial proportion of cases.[1] Although stimulant and other medication treatment is efficacious in adults with ADHD, a substantial proportion of patients do not respond fully to medication monotherapy[2]; thus, combination with psychosocial treatments is often recommended. Studies of residual symptom structure and severity in adults with ADHD who are treated with medications are generally lacking and may help inform appropriate and treatment-sensitive targets for psychosocial interventions.

ADHD is a heterogeneous disorder both clinically and neurobiologically[3]. Profiles of endorsed symptoms vary from patient to patient and within a person across development. The Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (*DSM-IV*) criteria and symptom set were selected based on field trials involving individuals aged 4 to 17 years[4,5] and involve 2 separate but related symptom dimensions: Inattention and Hyperactivity/Impulsivity. On average, endorsement of hyperactive/impulsive symptoms has been shown to decline more steeply with age while inattentive symptoms remain more severe.[6]

The pattern of ADHD symptoms in adults treated with medications is less clear in the literature. Several studies in adults document the impact of stimulant medication treatment on overall symptoms of ADHD; however, studies seldom report which subsets of ADHD symptoms are still present and impairing after medication treatment. We identified only 5 published adult ADHD medication trials that reported on inattentive and hyperactive/impulsive symptoms separately.[7-11] These studies generally indicated significant reductions for both symptom subscales, but statistical comparisons were often inadequate to assess whether medications *produced* a greater reduction in one cluster of symptoms versus the other. Data available from 3 of these studies[8-10] support the idea that although inattentive

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symptoms are reduced by medication treatment, they continue to be rated as more severe than hyperactive/impulsive symptoms following efficacious medication treatment. These data suggest that in a sample of medication-treated adults with ADHD, problems with distractibility, disorganization, and sustained attention are likely to continue to be more severe and impairing than problems with restlessness or impulsivity as measured by *DSM-IV* symptoms.

Information on the factor structure of ADHD symptoms in a medication-treated adult sample is also important because knowing how symptoms cluster together in this population can allow for more sensitive measurement of treatment-related change. Existing studies that did not focus on medication-treated adults have employed factor analytic strategies to determine whether the *DSM-IV* 2-factor model of inattention and hyperactivity/impulsivity is applicable to ADHD symptoms in adults. Results from both exploratory and confirmatory factor analytic studies[1,12-14] support a 3-factor solution of inattention, hyperactivity, and impulsivity, the latter of which is characterized by verbal impulsivity. DuPaul et al[15] reported support for a 2-factor model using exploratory factor analysis, but their solution was unstable across separate samples drawn from 3 different cultures. It is also important to note that while the majority of factor analytic studies of ADHD symptoms in adults referenced previously support the 3-factor solution, cross-loadings of items that differ from the *DSM-IV* model are uncommon. Via confirmatory factor analysis, Kooij et al[13] found that a 3-factor model that allowed for item cross-loadings provided the best fit to their data. Thus, while the 3-factor inattention/hyperactivity/impulsivity solution is generally supported, studies vary in terms of which items load on which factors.

Developing psychosocial treatments for adults with ADHD requires outcome measures that will be maximally descriptive of the primary symptom profiles of this population and maximally associated with improvements in functioning. Symptom dimensions should not only be descriptive but also should be meaningfully associated with overall illness severity and functioning. Clinically, one would want to direct treatment efforts toward the factors that are most closely related to functional impairment and overall illness severity. The current study describes a sample of adults in the community already receiving medication treatment who enrolled in 1 completed[16] and 1 ongoing randomized controlled trial of a psychosocial treatment for adults with ADHD and residual symptoms. The present study sought to: (1) describe which ADHD symptoms were most frequent and most severe; (2) examine the factor structure of these residual ADHD symptoms; and (3) examine which factors were most strongly associated with clinical ratings of overall functioning and illness severity.

METHODS

Participants

Participants were men and women meeting *DSM-IV* criteria for ADHD and participating in studies of cognitive behavioral therapy for medication-treated adults with ADHD. Participants were not selected or excluded based on sex. To be included, individuals were required to be between the ages of 18 and 65 years and be prescribed and taking a stable dose of ADHD medication for at least 2 months prior to the start of the study; *stable* was

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defined as no more than a 10% change in medication dosage over those 2 months. Hence, participants had a preexisting diagnosis of ADHD from a provider outside of the study; nonetheless, we performed a diagnostic evaluation to confirm study eligibility and a separate clinician assessment of ADHD symptom severity. These assessments took place before the participant was randomized to 1 of 2 psychosocial treatment conditions. Initial diagnostic assessments were conducted by a clinician who, in most cases, became the participant's study therapist. Assessment of ADHD severity was conducted by a second clinician who remained blinded to treatment condition throughout the study. Participants also completed self-report measures prior to randomization and returned these reports to the study coordinator.

Assessment Measures and Procedures

Initial Diagnostic Assessment—To confirm the outside providers' diagnosis of ADHD and assess comorbid conditions, clinicians with extensive experience both working with adults with ADHD and administering structured interviews conducted the Structured Clinical Interview for *DSM-IV*,[17] supplemented by sections of the Kiddie Schedule for Affective Disorders and Schizophrenia, Epidemiologic version[18] to assess ADHD and other childhood disorders. In previous studies conducted in our affiliated clinic (the Pediatric Psychopharmacology Clinic at Massachusetts General Hospital), diagnostic reliability of ADHD diagnoses has been high, obtaining a K of 1.0 and a 95% CI of 0.8 to 1.0.[19] Participants also reported their currently prescribed psychotropic medications and daily dosages of these medications.

Clinician-Rated Measures—Following the diagnostic assessment, an assessment session was scheduled with a second PhD-level clinical assessor who had extensive training on the required assessments. For those participating in the completed treatment study (approximately one third of the sample), the assessor had >10 years of supervised experience using the ADHD symptom measure. The assessments of this rater were audiotaped and a subset of tapes was reviewed and discussed with another doctoral-level clinician. For those remaining in the ongoing study, the assessor received extensive training on the ADHD symptom instrument and all sessions were audiotaped for supervision purposes. Tapes were regularly reviewed by 1 of 2 doctoral-level study staff. No significant discrepancies in ratings between assessor and supervisors occurred that necessitated changes to the original ratings.

This assessment session included the ADHD Rating Scale (ADHD-RS)[20,21] which, modified for *DSM-IV,* assesses each of the 18 individual symptoms of ADHD using an identical 4-point scale (0 = not present, 1 = mild, 2 = moderate, 3 = severe; minimum total score = 0; maximum total score = 54). Total scores were examined in this study. The frequency of endorsement of individual items was also considered.

During this assessment, the clinician assigned a Clinical Global Impression (CGI)[22] score for severity to each participant. The CGI score ranged from 1 (not at all ill) to 7 (among the most extremely ill patients). The clinician also assigned a Global Assessment of Functioning (GAF) score[5] to each participant. GAF scores range from 1 to 100 and represent a person's

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overall functioning during the previous 12 months, not including functional impairment due to physical or environmental limitations.

Self-Reported Measures—Participants rated their experience of each of the 18 *DSM-IV* symptoms of ADHD using the Current Symptoms Scale (CSS).[23] Items were rated on a 4-point scale similar to the ADHD-RS but with frequency-related anchors of 0 = never or rarely, 1 = sometimes, 2 = often, or 3 = very often.

RESULTS

Participant Characteristics and Medication Treatment

Data were available for 105 participants (55 men; 50 women), although some did not have complete data either for the ADHD-RS or the CSS. Mean (SD) age was 41.96 (10.95) years. Race/ethnicity was as follows: 84.8% white; 6.7% black; 2.9% Asian; 2.9% Hispanic or Latino; and 2.9% other. Educational level was as follows: 3-8% high school or general equivalency diploma; 11.4% 2 years of post–high school education (eg, associates or technical school degree); 44.8% college education; 28.6% masters' degree; and 11.4% doctorate (including doctor of jurisprudence).

The median number of prescribed psychotropic medications reported by participants was 2 (range, 1–5) and the mode was 1. The majority of participants (88.6%) were taking some form of stimulant medication to treat their symptoms of ADHD. Of those participants taking stimulant medication, 67% reported taking a short-acting stimulant and 43% reported taking a long-acting stimulant (percentages sum to >100% because some participants were taking >1 type of stimulant). Of those not taking a stimulant, two thirds (8 participants) were taking bupropion only, 2 additional patients were taking bupropion along with another medication for ADHD (modafinil or atomoxetine), and the 2 remaining patients were taking an antidepressant (venlafaxine or sertraline) as their primary ADHD therapy.

Among participants taking stimulant medication, two thirds (66.7%) were receiving stimulant monotherapy (some of these participants reported taking other psychotropic medications such as selective serotonin reuptake inhibitors in addition to ADHD medications). Another 12.9% were prescribed a long-acting stimulant along with a short-acting stimulant, often to be used when needed. A greater percentage of patients (17.2%) were receiving bupropion in addition to a stimulant and a few patients (3.2%) were receiving atomoxetine in addition to a stimulant. Of those participants prescribed only 1 stimulant for ADHD, 62.9% were prescribed short-acting stimulants, 33.9% were prescribed long-acting stimulants, 1 participant was using the methylphenidate patch, and another was taking an unspecified stimulant medication.

Total daily dosing data were available for 91% of the participants. Of those participants taking only a short-acting stimulant, most (n = 23) were taking short-acting preparations of amphetamine(d,l) (mean [SD] dosage, 35.0 [14.7] mg) or methylphenidate(d,l) (n = 18; mean [SD] dosage, 39.0 [31.8] mg). Short-acting amphetamine(d) and short-acting methylphenidate(d) each were taken by 3 participants with a mean (SD) dosage of 21.7 (2.9) and 20.8 (25.5) mg, respectively. Of those participants taking a long-acting stimulant

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preparation, most (n = 21) were taking long-acting methylphenidate(d,l) (mean [SD] dosage, 60.7 [40.8] mg) or long-acting amphetamine(d,l) (n = 12; mean [SD] dosage, 30.8 [12.4] mg). Four participants were taking long-acting methylphenidate(d) with a mean (SD) daily dosage of 36.3 (13.8) mg.

Symptom Descriptive Statistics

Clinician Ratings—Descriptive statistics across the sample of adults with complete data for each item on the clinician's rating of *DSM-IV* ADHD via the ADHD-RS (n = 98) are shown in Table I. Descriptive labels associated with each mean score on this scale are also displayed along with the percent of participants endorsing each symptom at each severity level. The percent of participants rated as moderate or severe (score of 2 or 3) is displayed in bold, as these scores are often considered to fall above the symptomatic threshold on *DSM-IV*–based rating scales.[23] Per Table I, symptoms with a mean score in the "moderate" severity range across the sample related to problems with organization, distractibility/ sustained attention, losing items, and task persistence. In addition, the symptom denoting problems with forgetfulness was rated at the symptomatic level by >50% of participants. Excessive talking (38%) and fidgeting (30%) were the most frequently rated *DSM-IV* hyperactive/impulsive symptoms.

Self-Reports—Descriptive statistics across the sample of adults with complete data for each item on the self-report CSS (n = 97) are shown in Table II. As seen in Table II, symptoms with mean ratings of "often" across the sample related to problems with organization, distractibility/sustained attention, avoiding mental effort, losing items, task persistence, and forgetfulness For the self-reported data, fidgeting (47%) was the *DSM-IV* hyperactive/impulsive symptom most commonly endorsed at the symptomatic level, followed by blurting out answers (42%) and restlessness (41%).

Factor Analysis: Clinician Ratings

Our data set contained >5 participants per *DSM-IV* item in the ADHD-RS (18 items), thus exceeding minimum sample size criteria for a factor analysis. The correlation matrix had adequate correlations to warrant a factor analysis as supported by the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (0.612; "mediocre" amount of common variance). Bartlett's tests of sphericity indicated significant correlations in the matrix ($\chi^2 = 396.53$; $P = 0.000$). The item, "Don't listen when spoken to directly," showed very poor communalities with the other variables (0.14 at initial extraction) and failed to load significantly on a factor in any candidate variable model. Thus, the variable was dropped from consideration.

We employed a common factor analysis (SPSS Principle Axis Factoring; Statistical Package for the Social Sciences, Chicago, Illinois) with varimax rotation to extract orthogonal factors. We also examined patterns of loading using an oblique rotation strategy. Because loading patterns were nearly identical for both rotation methods and because we wished to predict a maximum amount of unique variance with each factor, we report the orthogonally rotated solutions. Table III presents the unrotated factors and percentage of variance for factors with eigenvalues ≥1.0. A scree plot of the unrotated eigenvalues[24] supported a 3-

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factor solution. The rotated 3-factor solution accounted for 31.5% of the overall variance and this solution was judged to be the most parsimonious model.

Table IV presents the factor loadings for each item on the clinician-rated ADHD-RS as well as the mean (SD) for the factor summation scores. Guidelines used to determine which items loaded on which factors were applied according to Safren et al[25] and were as follows: variables with loadings of >0.30 were considered to load on a particular factor; a variable was permitted to load on > 1 factor if its loadings exceeded 0.30 on both factors and the difference between loadings was <0.10; if the difference in loadings was >0.10, the variable was considered to load only on the factor with which it had the higher loading.

The first factor extracted from the analysis of the clinician-rated ADHD-RS data, *Hyperactivity*, consisted of 7 items—6 *DSM-IV* hyperactive/impulsive symptoms and 1 *DSM-IV* inattentive symptom (sustained attention difficulties). (Note: Factor-derived scales are denoted by italics throughout the manuscript to distinguish them from *DSM-IV* factors with similar names.) The second factor, *Impulsivity/Poor Prospective Memory*, included 6 items split evenly between *DSM-IV* inattention and hyperactivity/Impulsivity symptoms. The third and final factor extracted from the clinician-rated data, *Inattention*, included 5 symptoms from the *DSM-IV* inattentive list. The only item to load on > 1 scale was the item indexing difficulties with sustained attention, which loaded on both the *Hyperactivity* and *Inattention* factors of the ADHD-RS. Mean scores on the 3 scales correlated significantly with one another: *Impulsivity/Poor Prospective Memory* correlated significantly with *Hyperactivity* ($r = 0.24$; $P = 0.02$) and *Inattention* ($r = 0.22$; $P = 0.03$), and the correlation between *Hyperactivity* and *Inattention* was also significant ($r = 0.41$; $P < 0.001$).

Medication-treated adults with ADHD with residual symptoms in this sample received the highest mean score on the *Inattention* factor of the clinician-rated ADHD-RS, followed by the *Impulsivity/Poor Prospective Memory* and then the *Hyperactivity* factors. All of these differences between scale scores were significant at $P < 0.001$.

Factor Analysis: Self-Reports

For the self-reported CSS, the correlation matrix warranted a factor analysis as supported by the KMO measure of sampling adequacy (0.82; “meritorious” amount of common variance). Bartlett’s tests of sphericity indicated significant correlations in the matrix ($\chi^2 = 566.61$; $P = 0.000$). As in the factor analysis using the clinician’s data, the “Don’t listen when spoken to directly” item showed very poor communalities with the other variables (0.17 at extraction) and failed to load significantly on a factor in any candidate model. Thus, the variable was dropped from consideration.

Again, a common factor analysis (SPSS Principle Axis Factoring) with varimax rotation was used. Table III presents the unrotated factors and percentage of variance for factors with eigenvalues ≥1.0. A scree plot of the unrotated eigenvalues again supported a 3-factor solution. The rotated 3-factor solution accounted for 43-2% of the variance.

Table V presents the factor loadings for each item on the self-reported CSS as well as the mean (SD) for the factor summation scores, Variables were considered to load on factors as

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described previously. The first factor extracted from the analysis of self-report data, *Impulsivity/Poor Prospective Memory*, consisted of 9 items—5 *DSM-IV* hyperactive/impulsive symptoms and 4 *DSM-IV* inattentive symptoms. The second factor, *Hyperactivity*, included 7 items with 6 *DSM-IV* hyperactive/impulsive symptoms and 1 *DSM-IV* inattentive symptom (easily distracted). The third and final factor extracted from the self-reported data, *Inattention*, included 6 symptoms from the *DSM-IV* inattentive list. Four items loaded on >1 factor: "Difficulty doing activities quietly" and "Difficulty waiting" loaded on both *Impulsivity/Poor Prospective Memory* and *Hyperactivity*, "Forgetful" loaded on both *Impulsivity/Poor Prospective Memory* and *Inattention*; and "Easily distracted" loaded on all 3 scales of the self-reported CSS. Mean scores on the 3 scales correlated significantly with one another: *Impulsivity/Poor Prospective Memory* correlated significantly with *Hyperactivity* ($r = 0.73$; $P < 0.001$) and *Inattention* ($r = 0.56$; $P < 0.001$), and the correlation between *Hyperactivity* and *Inattention* was also significant ($r = 0.50$; $P < 0.001$).

Medication-treated adults with ADHD with residual symptoms in this sample received the highest mean score on the *Inattention* factor of the self-reported CSS, followed by the *Impulsivity/Poor Prospective Memory* and then the *Hyperactivity* factors. All of these differences between scale scores were significant at $P < 0.001$.

Prediction of Global Clinician Ratings

As seen in Table VI, correlations among target variables were adequate to warrant regression analyses and in the hypothesized directions. Four multiple regression models were tested: clinician-rated symptom factor scores predicting CGI and GAF followed by self-reported symptom factor scores predicting CGI and GAF. Predictors were entered simultaneously into the model and evaluated using significance testing and semipartial r^2, which represents the percentage of unique variance in the dependent variable accounted for by a predictor, taking into account the other variables in the model.

Clinician-rated data (n = 98)—All 3 clinician-rated factor-derived subscales significantly contributed to the prediction of CGI score (Table VII). The model accounted for 60% of the variance in CGI scores with comparable contributions of each subscale as evidenced by the magnitude of β weights and semipartial r^2. In contrast, clinician-rated *Impulsivity/Poor Prospective Memory* did not significantly contribute to the prediction of GAF. The overall model predicted 18% of the variance in this dependent variable (Table VII). *Inattention* was a statistically significant predictor, accounting for 6% of unique variance, while *Hyperactivity* reached marginal significance as a predictor, contributing another 3% of unique variance.

Self-reported data (n = 97)—For self-reported ADHD symptom factor scores, the overall model accounted for 39% of the variance in CGI. Again, *Inattention* made a significant contribution to the model and accounted for 12% of unique variance in CGI. *Impulsivity/Poor Prospective Memory* reached marginal significance, contributing an additional 3% of unique variance. *Hyperactivity* did not significantly predict clinician-rated CGI scores (Table VIII). For GAF, only *Inattention* was a significant predictor with 9% of unique variance predicted. The overall model accounted for 13% of the variance in GAF.

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DISCUSSION

In the current study of medication-treated adults with ADHD, self-reported and clinician-rated data found that symptoms related to problems with sustained attention, distractibility, disorganization, poor task persistence, and, to a certain extent, misplacing items and forgetting were the most frequent and severe symptoms. Despite being on stable medication treatment, 85% to 88% (self-reported and clinician-rated data) of adults in our sample endorsed significant ongoing disorganization and 74% to 83% endorsed significant distractibility. These results are remarkably similar to those obtained in another large sample (N = 146) of clinic-referred adults with ADHD.[1] In contrast, in a smaller sample (N = 32) of clinic-referred adults, Riccio et al[26] found problems with attention to detail to be the most commonly reported symptom—a result not obtained in our sample. The most commonly reported symptoms across studies, however, overwhelmingly belong to the *DSM-IV* inattention symptom list, consistent with findings of a decline in *DSM-IV* hyperactivity/impulsivity across development.[6] Fidgetiness, subjective restlessness, and verbal impulsivity were the most frequently reported *DSM-IV* hyperactive/impulsive symptoms.

Similar to studies that did not specifically select adults on the basis of medication treatment, we found that a 3-factor solution best characterized residual ADHD symptoms for self-reported and clinician-rated data in our sample of patients stabilized on medications. While the patterns of loading across these 2 sources of data differed, the overall factor structure was similar to previous studies—namely, a 3-factor structure consisting of items clustering within domains of hyperactivity, inattention, and impulsivity.[1] Interestingly, however, in our sample, items tapping forgetfulness and poor prospective memory were as likely and, in some cases, more likely to load on the impulsivity dimension than on the inattention dimension. This may be a result either of some unique property of our sample or, given that we used exploratory factor analysis, a less stable factor solution. It is important to note that in addition to not specifically selecting adults who were stabilized on medications, prior cited factor analytic studies did not always screen participants based on meeting clinical diagnosis thresholds. Perhaps within the group of adults meeting criteria for ADHD, higher levels of forgetfulness and losing items is associated with more impulsive behavior (ie, lower likelihood that the patient will “stop and think” when engaged in an activity). These factor-analysis results yielded interesting dimensions and will be useful in measuring treatment-related outcomes in this sample.

Of the 3 factors, *Inattention* was most consistently related to global ratings of functioning across self-reported and clinician-rated data. This was the only factor to significantly predict global functioning across raters—that is, self-reported inattentive symptoms significantly predicted clinician-rated overall functioning. Notably, this factor is not identical to the *DSM-IV* inattention symptom list—it only consists of 5 of the 9 items in the case of clinician ratings: sustained attention problems, problems following directions/finishing work, distractibility, disorganization, and *avoiding sustained mental effort*; the self-reported *Inattention* scale includes an additional *item, forgetfulness.* These items are also the most severe in our sample (Tables I and II), highlighting the fact that the most frequent/severe items are also the most impairing. These data suggest that the intervention being studied in our research program—as well as other psychosocial interventions focused on self-

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management skills to improve organization and planning[27]—may be directly addressing the dimension of ADHD most strongly associated with functional outcomes. Thus, self-reported and clinician-rated *Inattention* data may be a particularly appropriate way to measure treatment outcomes in these types of studies. Notably, all 3 symptom dimensions derived by clinician report were significantly correlated with CGI, suggesting that the CGI score possesses criterion validity in capturing the 3 most important symptom facets in our sample identified by factor analysis.

It should be noted, however, that correlations between symptoms and impairment (GAF) were moderate in size, which is consistent with observations across samples of children and adults.[28] This suggests that for both children and adults, assessment of functional impairment apart from symptoms alone is important to diagnosis and, likely, treatment. Additionally, although self-reports and clinician ratings of symptoms captured similar patterns of symptom seventy in this sample, the relationship of symptom clusters to illness severity (CGI) and global functioning (GAF) differed. Both self-report and clinician ratings implicated similar symptoms—those tapping distractibility and disorganization—as being most severe (see Tables I and II). However, factors derived from the clinician ratings were more strongly predictive of both CGI and GAF, It is likely that shared method variance was a factor in this result in that CGI and GAF were both rated by the clinician. However, it is interesting to note that all 3 symptom dimensions contributed to the prediction of CGI for the clinician but that only *Inattention* significantly predicted self-report ratings. This suggests that clinician ratings of symptoms may better reflect all 3 important facets of ADHD in adults. Patients may be less readily aware of their hyperactive symptoms because they do not cause as much personal distress.

While the adults in this study do not represent all adults with ADHD treated with medications, they do represent a clinically important subgroup of patients who may show some response to medication but who do not experience remission of symptoms and impairment. The issue of treatment response versus remission has received significant attention in the depression literature and has recently been highlighted with respect to ADHD in children. Steele et al[29] point out that because response to medication in randomized controlled trials is often defined as a 25% to 30% reduction in symptoms or a CGI score of “much improved” or “very much improved,” patients with high levels of baseline symptoms may respond to treatment but still have residual symptoms. Thus, even medication responders may require additional treatment to achieve maximum symptom reduction and improvements in functioning. Clinically, pharmacologic and psychosocial efforts should be directed at improving treatment effects even in patients classified as medication responders.

In addition, studies of both types of treatment should include more fine-grained analyses of which symptoms and behaviors improve with treatment and which continue to remain problematic—2 separate but related issues. For example, Biederman et al[30] recently reported that stimulant medication treatment in young adults was associated with improved performance for some neuropsychological functions but not others. Medication studies could more frequently report on the separate subscales of the symptom measures they employ in

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addition to total scale scores, which would provide relevant data without increasing research burden.

The limitations of the current study should be noted. First, we caution readers against overgeneralization of the results of our factor analysis to other samples of adults, especially given the unique characteristics of this sample, the sample size, and the use of exploratory rather than confirmatory methods. These findings will require replication in other samples of medication-treated adults with ADHD.

Second, our sample is more highly educated and less ethnically diverse than samples of adults with ADHD identified through longitudinal and population-based studies; it is more similar to clinic-referred samples. This likely reflects the requirement that participants in our study already be diagnosed with ADHD and receiving medication treatment. Caution is emphasized in generalizing results outside of adults receiving medication treatment, as the goal of the current study was to examine patients on medications with residual symptoms.

Third, the results of our study with respect to symptoms are confined to the 18 *DSM-IV* symptom items that were developed in research with children. This may account for the observation that the total amount of variance accounted for by our factor solutions is smaller than in exploratory factor analyses of parent and teacher ratings of child symptoms (43.2%–70.3%[31-34]) but more comparable with other adult studies (34.8%–60.9%[1,12,15]). If *DSM-IV* symptom items are a less precise reflection of ADHD in adults, a greater number of additional factors may be required to account for diminishing portions of variance. This highlights the need for adult-specific models of ADHD symptomatology based on factor analytic studies of adult-appropriate items.[35]

Fourth, this study included self-reported and clinician ratings of symptoms and therefore was unable to assess symptom profiles of adults as rated by other observers in the patient's life; these ratings are an important source of clinical data that deserves further study. Finally, as this study did not include data collection from either a healthy control group or a clinical control group, we are unable to compare symptoms endorsed by medication-treated adults with ADHD and these groups. Future studies should continue to address the specificity of patterns of symptoms and impairment to adults with ADHD.

CONCLUSIONS

These results provide information important to the design of clinical interventions and trials for adults with ADHD and extends findings from general samples of adults with ADHD to those already receiving medication treatment. Factor-derived methods of scoring rating scales may yield more informative treatment outcome data than total scores alone. Symptoms of Inattention remain the most severe and the most consistently related to impairment—thus, adjunctive psychosocial treatments should target these symptoms.

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TABLE I

DESCRIPTIVE STATISTICS (RANK-ORDERED BY MEAN [M]) FOR EACH ITEM ON THE CLINICIAN-RATED ATTENTION-DEFICIT/HYPERACTIVITY DISORDER RATING SCALE FOR 98 STUDY PARTICIPANTS

			Endorsement, %				
Item Content	**M (SD)**	**Label**	**None**	**Mild**	**Moderate**	**Severe**	**Moderate + Severe**
Disorganized	2.33 (0.77)	Moderate	3	9	40	48	88
Distracted	1.98 (0.80)	Moderate	3	24	46	28	74
Poor sustained attention	1.90 (0.95)	Moderate	11	16	44	29	73
Fail to follow/finish	1.81 (0.93)	Moderate	11	20	45	24	69
Lose things	1.74 (1.05)	Moderate	18	15	40	27	67
Avoid mental effort	1.72 (1.05)	Moderate	18	17	38	27	65
Forgetful	1.47 (0.92)	Mild	18	28	43	11	54
Talk excessively	1.14 (0.92)	Mild	30	33	32	6	38
Don’t listen	1.13 (0.89)	Mild	27	41	26	7	32
Careless mistakes	1.09 (0.91)	Mild	34	27	37	3	40
Fidget	1.06 (0.76)	Mild	25	46	29	1	30
Interrupt or intrude	1.02 (0.80)	Mild	28	46	24	3	27
Difficulty waiting	0.96 (0.95)	Mild	41	29	25	6	31
Blurt out answers	0.93 (0.76)	Mild	32	45	22	1	23
Restless	0.90 (0.86)	Mild	39	36	22	3	25
On the go/motor	0.77 (0.87)	Mild	48	32	16	4	20
Leave seat	0.74 (0.88)	Mild	52	24	22	2	24
Don’t play quietly	0.44 (0.73)	None	69	18	11	1	12

Percent of endorsement for each symptom may not total 100% due to rounding.

* Represents percent of participants rated as “2” or “3” for each symptom.

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TABLE II

DESCRIPTIVE STATISTICS FOR EACH ITEM (RANK-ORDERED BY MEAN [M]) ON THE SELF-REPORTED CURRENT SYMPTOMS SCALE FOR 97 PARTICIPANTS

			Endorsement, %				
Item Content	**M (SD)**	**Label**	**Never or Rarely**	**Sometimes**	**Often**	**Very Often**	**Often + Very Often***
Disorganized	2.36 (0.80)	Often	2	14	31	54	85
Distracted	2.10 (0.73)	Often	2	16	53	30	83
Avoid mental effort	1.80 (0.87)	Often	4	37	33	26	59
Lose things	1.75 (0.96)	Often	8	36	28	28	56
Fail to follow/finish	1.71 (1.16)	Often	6	45	27	21	48
Forgetful	1.69 (0.83)	Often	5	39	37	19	56
Poor sustained attention	1.64 (1.13)	Often	8	41	37	14	51
Careless mistakes	1.46 (0.80)	Sometimes	8	49	32	11	43
Fidget	1.43 (1.01)	Sometimes	21	33	29	18	47
Restless	1.41 (0.91)	Sometimes	14	44	27	14	41
Blurt out answers	1.28 (0.98)	Sometimes	26	32	31	11	42
Talk excessively	1.25 (1.04)	Sometimes	27	40	17	18	35
Interrupt or intrude	1.24 (0.91)	Sometimes	22	43	25	10	35
Difficulty waiting	1.15 (1.02)	Sometimes	31	37	18	14	32
On the go/motor	1.10 (1.03)	Sometimes	34	35	18	13	31
Don’t listen	0.99 (0.74)	Sometimes	24	58	14	4	18
Don’t play quietly	0.85 (0.85)	Sometimes	38	45	10	6	16
Leave seat	0.52 (0.69)	Sometimes	59	32	8	1	9

Percent of endorsement for each symptom may not total 100% due to rounding.

* Represents percent of participants rated as “2” or “3” for each symptom.

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TABLE III

UNROTATED FACTORS WITH EIGEN-VALUES ≥1.0 FOR INITIAL SOLUTION AND PERCENTAGE OF VARIANCE

Factor	Eigenvalue	% of Variance	Cumulative % of Variance
Clinician-Rated Attention-Deficit/Hyperactivity Disorder Rating Scale			
1	3.43	20.1	20.1
2	2.16	12.7	32.8
3	1.70	10.0	42.8
4	1.27	7.5	50.3
5	1.23	7.2	57.5
6	1.11	6.6	64.1
7	1.00	5.9	70.0
Self-Reported Current Symptoms Scale			
1	5.41	31.8	31.8
2	1.86	10.9	42.7
3	1.65	9.7	52.4
4	1.16	6.8	59.2
5	1.07	6.3	65.6

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TABLE IV

ROTATED FACTOR LOADINGS FOR COMMON FACTOR ANALYSIS OF THE CLINICIAN-RATED ATTENTION-DEFICIT/HYPERACTIVITY DISORDER RATING SCALE IN STUDY PARTICIPANTS

Item Content	Factor 1	Factor 2	Factor 3
Factor 1: *Hyperactivity* (Mean [M] = 0.97; SD = 0.53; α = 0.73)			
Leave seat	0.652	−0.007	0.100
Fidget	0.543	0.094	−0.076
Play quietly	0.515	0.159	0.039
Difficulty waiting	0.329	0.198	0.249
On the go/driven by motor	0.564	0.166	0.160
Hyperactive/restless	0.700	−0.166	−0.004
Sustained attention	0.336	0.229	0.430
Factor 2: *Impulsivity/Poor Prospective Memory* (M = 1.23; SD = 0.55; α = 0.66)			
Talk excessively	0.141	0.460	−0.032
Interrupt or intrude	0.060	0.687	−0.108
Blurt out answers	−0.006	0.679	0.117
Lose things	0.109	0.336	0.206
Attention to detail/ careless mistakes	0.112	0.459	0.107
Forgetful	−0.017	0.324	0.093
Factor 3: *Inattention* (M = 1.95; SD = 0.56; α = 0.50)			
Sustained attention	0.336	0.229	0.430
Trouble following directions/fail to finish work	0.051	0.238	0.475
Distracted	0.247	0.176	0.324
Disorganized	−0.162	0.059	0.651
Avoid mental effort	0.082	−0.167	0.430

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TABLE V

ROTATED FACTOR LOADINGS FOR COMMON FACTOR ANALYSIS OF THE SELF-REPORTED CURRENT SYMPTOMS SCALE IN STUDY PARTICIPANTS

Item Content	Factor 1	Factor 2	Factor 3
Factor 1: *Impulsivity/Poor Prospective Memory* (Mean [M] = 1.42; SD = 0.59; α = 0.83)			
Talk excessively	0.616	0.249	−0.036
Blurt out answers	0.817	0.171	0.033
Interrupt or intrude	0.775	0.134	0.024
Play quietly	0.473	0.434	0.225
Attention to detail/careless mistakes	0.404	0.182	0.268
Lose things	0.370	0.091	0.100
Distracted	0.384	0.311	0.308
Difficulty waiting	0.449	0.448	0.127
Forgetful	0.453	0.052	0.372
Factor 2: *Hyperactivity* (M = 1.22; SD = 0.63; α = 0.82)			
Fidget	0.189	0.597	0.149
Stay seated	0.313	0.601	0.100
Hyperactive/restless	0.105	0.822	0.144
Play quietly	0.473	0.434	0.225
On the go/driven by motor	0.129	0.633	0.047
Distracted	0.384	0.311	0.308
Difficulty waiting	0.449	0.448	0.127
Factor 3: *Inattention* (M = 1.86; SD = 0.54; α =0.69)			
Sustained attention	−0.017	0.337	0.721
Don’t follow instructions/fail to finish work	0.273	0.115	0.510
Distracted	0.384	0.311	0.308
Disorganized	0.104	−0.034	0.564
Avoid mental effort	−0.009	0.103	0.511
Forgetful	0.453	0.052	0.372

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TABLE VI

CORRELATIONS (*r*) BETWEEN ADHD SYMPTOM FACTOR-DERIVED SCALES AND FUNCTIONAL IMPAIRMENT MEASURES

	Clinical Global Impression	Global Assessment of Functioning
Clinician-Rated ADHD Rating Scale		
Inattention	0.59*	−0.37*
Hyperactivity	0.56*	−0.32*
Impulsivity/Poor Prospective Memory	0.54*	−0.21*
Self-Reported Current Symptoms Scale		
Inattention	0.58*	−0.37*
Hyperactivity	0.42*	−0.18
Impulsivity/Poor Prospective Memory	0.51*	−0.21*

ADHD = attention-deficit/hyperactivity disorder.

* $P < 0.05$.

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TABLE VII

PREDICTION OF GLOBAL CLINICIAN RATINGS USING CLINICIAN-RATED FACTOR-DERIVED SYMPTOM SCORES (ATTENTION-DEFICIT/ HYPERACTIVITY DISORDER RATING SCALE)

	β	*t*	Semipartial r^2	*P*
Dependent Variable: Clinical Global Impression (model $R^2 = 0.60$)				
Inattention	0.38	5.23	0.12	<0.001
Impulsivity/Poor Prospective Memory	0.38	5.59	0.13	<0.001
Hyperactivity	0.32	4.42	0.08	<0.001
Dependent Variable: Global Assessment of Functioning (model $R^2 = 0.18$)				
Inattention	−0.27	−2.57	0.06	0.01
Impulsivity/Poor Prospective Memory	−0.11	−1.14	0.01	NS
Hyperactivity	−0.19	−1.82	0.03	0.07

Semipartial r^2 = percentage of variance uniquely explained by that predictor, accounting for the other predictors.

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TABLE VIII

PREDICTION OF GLOBAL CLINICIAN RATINGS USING SELF-REPORTED FACTOR-DERIVED SYMPTOM SCORES (CURRENT SYMPTOMS SCALE)

	β	*t*	Semipartial r^2	*P*
Dependent Variable: Clinical Global Impression (model $R^2 = 0.39$)				
Inattention	0.43	4.19	0.12	<0.001
Impulsivity/Poor Prospective Memory	0.25	1.92	0.03	0.06
Hyperactivity	0.03	0.23	0.00	NS
Dependent Variable: Global Assessment of Functioning (model $R^2 = 0.13$)				
Inattention	−0.36	−3.01	0.09	0.003
Impulsivity/Poor Prospective Memory	−0.02	−0.12	0.00	NS
Hyperactivity	0.01	−0.10	0.00	NS

Semipartial r^2 = percentage of variance uniquely explained by that predictor, accounting for the other predictors.