American Psychological Association

Psychological Assessment

1040-3590/19/$12.00

2019, Vol. 31, No. 7, 851–860
http://dx.doi.org/10.1037/pas0000706

The ADHD Symptom Infrequency Scale (ASIS): A Novel Measure Designed to Detect Adult ADHD Simulators

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The current project outlines the development of the Attention-Deficit/Hyperactivity Disorder (ADHD) Symptom Infrequency Scale (ASIS), a stand-alone measure designed to identify individuals feigning or exaggerating symptoms to receive a diagnosis of ADHD. Over the course of 3 studies, valid data was collected from 402 participants assigned to control, simulator, ADHD diagnosed, or possible undiagnosed ADHD groups. Group assignment was based on self-reported history of ADHD diagnosis including information about the credentials of diagnosing professional and methods used. The ASIS includes an Infrequency Scale (INF) designed to detect rarely reported symptoms of ADHD and several clinical scales designed to measure genuine symptoms. The final version of the ASIS demonstrated high internal consistency for the INF ($\alpha = .96$) and the ADHD Total scales ($\alpha = .96$). Convergent validity for the ADHD Total was established through a strong correlation with Barkley Adult ADHD Rating Scale–IV ($r = .92$). Initial validation of the INF yielded high discriminability between groups ($d = 2.76$; 95% confidence interval [2.17, 3.36]). The final INF scale demonstrated strong sensitivity (.79–.86) and excellent specificity (.89). Using our study's malingering base rate of 29%, positive and negative predictive values were strong (.71–.79 and .92–.93, respectively). Additional information is provided for a range of base rates. Current results suggest that the ASIS has potential as a reliable and valid measure of ADHD that is sensitive to malingering when compared to a sample of individuals self-reporting a history of ADHD diagnosis.

Public Significance Statement
The present studies describe and validate a new self-report measure designed to detect exaggerated or feigned symptoms of ADHD in adults, known as the ADHD Symptom Infrequency Scale (ASIS). In these studies, the ASIS appeared to detect feigned symptoms better than similar measures, and could be used in ADHD evaluations to protect adults from the risks associated with false diagnosis. While the results of this study are promising, further research on the ASIS will be necessary.

Keywords: attention-deficit/hyperactivity disorder, ADHD, assessment, effort, malingering

Identifying suspect effort in adult attention-deficit/hyperactivity disorder (ADHD) evaluations continues to be an important endeavor for the field. Regardless of whether an examinee is intentionally or unintentionally feigning or exaggerating symptoms, there can be negative consequences, both from an individual and societal perspective, following failure to identify feigning or exaggeration. Although there has been a recent increase in efforts to flag suspect effort in ADHD evaluations (Harrison & Armstrong, 2016; Smith, Cox, Mowle, & Edens, 2017; Walls, Wallace, Brothers, & Berry, 2017), existing methods continue to have gaps in their coverage and limited psychometric properties. Furthermore, few measures are written expressly for this purpose (Suhr & Berry, 2017). As background for the present study, this article will review the importance of identifying suspect effort in ADHD evaluations and provide an overview of recent attempts to identify suspect effort.

Need for Accurate Assessment of ADHD

The most obvious reasons to prioritize increasing the accuracy of ADHD diagnosis are the various problems associated with medications prescribed to patients. Rare, but relatively severe side effects of ADHD medications include seizures, obsessive–compulsive behaviors, transient psychotic episodes, liver failure, lowered blood cell count, stroke, cardiac arrest and death (Graham & Coghill, 2008). It is notable that these rare events often appear to occur in the context of preexisting, sometimes previously un-

This article was published Online First February 25, 2019.

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Portions of this article were presented at the 50th annual meeting of the International Neuropsychological Society in New Orleans, Louisiana; at the National Academy of Neuropsychology 36th annual conference in Seattle, Washington; and at the 37th annual conference in Boston, Massachusetts.

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known conditions such as structural cardiac abnormalities in the cases of cardiac death (Graham & Coghill, 2008) or seizures in children with abnormal electroencephalography pretreatment (Wigal et al., 2006). Nonetheless, these side effects clearly represent an unnecessary risk of severe reaction for those inaccurately diagnosed with ADHD. In addition to these rare but relatively severe reactions, a survey by Advokat, Martino, and Guidry (2008) found that a majority of users of stimulant medications reported at least one side effect. The most common side effects were decreased appetite (74%), insomnia (71%), irritability (29%), headaches (27%), and stomachaches (23%). It is clear that the assumed accuracy of ADHD diagnosis and utility of these medications should be weighed against the likelihood of such side effects and possible effects on quality of life.

Stimulant-based ADHD medications are considered to have a high potential for abuse, given their ability to increase brain dopamine, speed of action, and "stimulant feel" (Clemow & Walker, 2014). One possible factor in stimulant misuse is the widespread belief among students that stimulants act as "neuroenhancers"—drugs believed to improve memory, cognitive focus, and attention span regardless of ADHD status. There is evidence to suggest that stimulants such as amphetamines and methylphenidate do, in fact, improve sustained, focused attention, but that they may impair several other cognitive abilities (Advokat, 2010). Specifically, commonly prescribed (and commonly abused) prescription stimulants do not improve, and may impair short-term acquisition of information, cognitive flexibility, and planning abilities (Advokat, 2010). Nonetheless, this widespread belief in neuroenhancers makes prescription stimulants attractive for illicit trade and may represent a source of secondary gain in ADHD evaluations. The Advokat et al. (2008) survey found that 43% of respondents without a diagnosis of ADHD had used stimulant medications without a prescription. This may be considered an upper-limit estimate of the prevalence of misuse on college campuses; other estimates from peer-reviewed studies range from 6.9% (McCabe, Knight, Teter, & Wechsler, 2005) to 35.5% (Low & Gendaszek, 2002). Furthermore, 84% of students with a stimulant prescription for ADHD had been asked to give their medication to a peer, and 54% had been asked to sell their medication. In other words, having a prescription for stimulant medication likely subjects individuals to opportunities for the illegal diversion of their medication to others. The severity of the risks associated with stimulant prescriptions makes it necessary to have accurate diagnoses while reducing overall false positives.

In addition to possible harm to the client following false diagnosis of ADHD, there may be a detrimental aggregate effect such that the overall societal confidence in ADHD diagnoses is reduced. This likely contributes to the belief that ADHD is "not real," an opinion reported by 22% of survey respondents (McLeod, Fettes, Jensen, Pescosolido, & Martin, 2007). More recent studies have found similar results (Lebowitz, 2016; Partridge, Lucke, & Hall, 2014). This belief may, in turn, lead to reluctance to provide resources to adults with genuine ADHD symptoms. A large number of false positives may also strain the limited resources available to individuals with ADHD, such as accommodations, technology, or space.

Current ADHD Assessment Practices

As with any evaluation in which there are opportunities for secondary gain, some adults will seek to feign ADHD symptoms during a formal evaluation. Prior studies that used symptom validity tests (SVTs) to classify patients as feigning vary in their estimated rate of feigning during ADHD evaluations, and reported percentages include 14.6% in a Canadian postsecondary sample (Harrison & Edwards, 2010) and 31% (Suhr, Hammers, Dobbins-Buckland, Zimak, & Hughes, 2008) to 47.6% (Sullivan, May, & Galbally, 2007) in samples of self-referred U.S. college students. Despite these statistics, only 3% of the psychological reports of ADHD evaluations examined by Nelson, Whipple, Lindstrom, and Foels (2014) contained evidence of SVTs having been utilized during the evaluation.

Because a *Diagnostic and Statistical Manual of Mental Disorders* (*DSM*)*-5* diagnosis of ADHD relies on relatively subjective behavioral symptoms rather than measurable cognitive or functional deficits, behavioral rating scales (especially self-report scales) are the cornerstone of adult ADHD evaluations. It should be noted that the *DSM-5* symptoms for ADHD diagnosis appear to be easy to feign because the symptoms are nonspecific and are endorsed by a large number of adults, particularly college students. For example, Lewandowski, Lovett, Codding, and Gordon (2008) found that although students diagnosed with ADHD did endorse significantly more ADHD symptoms and academic concerns than their peers, none of the 18 *DSM-5* symptoms proved to be both sensitive and specific to ADHD. Also concerning was that typical college students without an ADHD diagnosis endorsed an average of 4.5 out of the 18 symptoms. With such high endorsement of symptoms even in non-ADHD students, the positive predictive power of the *DSM* criteria was only .52, indicating that endorsement of six or more symptoms would not yield a confident diagnosis of ADHD. Changing this threshold did not improve classification rates. Because most rating scales are based on these 18 symptoms, rating scales are likely to suffer from similarly high classification error rates.

Research has consistently shown that ADHD self-report behavioral rating scales are easily falsifiable in isolation. Jachimowicz and Geiselman (2004) found that four common ADHD self-report scales tested were all significantly falsifiable, including the Wender Utah Rating Scale (WURS; Ward, Wender, & Reimherr, 1993), the Conners Adult ADHD Self-Report of Symptoms (CAARS; Conners, Erhardt, & Sparrow, 1999), the Brown Adult ADD Scale (Brown, 1996), and the ADHD Rating Scale (ARS; DuPaul, Power, Anastopoulos, & Reid, 1998). Booksh, Pella, Singh, and Gouvier (2010) found that simulators also successfully feigned ADHD on two retrospective measures: the Attention Deficit Scales for Adults (Triolo & Murphy, 1996) and the WURS. A study by Quinn (2003) may represent the most striking example of the falsifiability of ADHD self-report scales. The author found that the ADHD Behavior Checklist–Current scale (Murphy & Barkley, 1996) did not discriminate between college students asked to simulate ADHD and those diagnosed with ADHD. In fact, the mean scores for the diagnosed ADHD group did not fall in the clinical range according to *DSM* criteria, while the mean scores of those instructed to simulate ADHD did. Marshall, Hoelzle, Heyerdahl, and Nelson (2016) used clinical retrospective data to show that true ADHD groups and groups expending suspect effort or

exaggerating symptoms are nearly indistinguishable in typical ADHD assessments. Of considerable concern was their conclusion that more than 60% of individuals demonstrating suspect effort may be incorrectly diagnosed with ADHD in a typical evaluation. Furthermore, there is evidence that students intent on feigning will seek out information on symptoms, as 19% of students in the Advokat et al. (2008) study who had been prescribed stimulants for ADHD had been asked by peers how to fake ADHD symptoms, showing that students may study these symptoms to secure a diagnosis.

In summary, individuals are typically able to falsify self-report behavioral rating scales, one of the primary methods of assessing ADHD. To assess ADHD based on performance rather than self-report, some researchers have demonstrated proof-of-concept applications of neuropsychological or cognitive tests in the diagnosis of ADHD, particularly with continuous performance tests (Booksh et al., 2010; Leark, Dixon, Hoffman, & Huynh, 2002; Quinn, 2003). However, because researchers have yet to agree on a neuropsychological profile of ADHD (Wasserstein, 2005), it is unclear how neuropsychological or cognitive tests should influence differential diagnosis of ADHD. Various studies have found that adults with ADHD perform significantly worse on a myriad of functions, including response inhibition, vigilance, selective attention, divided attention, cognitive flexibility, working memory, set shifting, and verbal memory (Musso & Gouvier, 2014). While promising, these impairments do not appear as symptoms of ADHD in the *DSM* and so, at present, cognitive or neuropsychological assessments appear to be of limited clinical use and confined to individual descriptions rather than standard decision rules (Lange et al., 2014). Furthermore, like the behavioral symptoms of ADHD, the impairments measured by neuropsychological tests are not specific to ADHD (Nigg, 2005).

Flagging Noncredible Responding

In spite of the demonstrated consequences of failing to include SVTs during an ADHD evaluation, it appears that this practice has not yet generalized from research studies to typical clinical practice. Furthermore, there is little guidance available for clinicians on standards of practice when assessing adult ADHD. Few guidelines exist, and those that do fail to endorse the use of even one performance validity test or SVT (e.g., Gibbins & Weiss, 2007). Results by Sollman, Ranseen, and Berry (2010); Jasinski et al. (2011) and Williamson et al. (2014) reveal that several neuropsychological tests do have utility in identifying suspect effort in ADHD evaluations. Across these studies, using more than one failed performance validity test/SVT as a cutoff resulted in high specificity (.91 to 1.00) and moderate sensitivity (.48 to .50) to feigned ADHD. Musso and Gouvier (2014) provide a comprehensive review of the utility of various measures' ability to detect malingered ADHD in college students, including behavioral rating scales, traditional neuropsychological tests, stand-alone SVTs, and broadband personality inventories.

Broadband Personality Inventories

Three broadband personality inventories that have been used to identify noncredible responding in the context of ADHD evaluations include the Minnesota Multiphasic Personality Inventory–Second Edition (MMPI-2; Butcher, Dahlstrom, Graham, Tellegen, & Kaemmer, 1989), the MMPI-2–Restructured Form (MMPI-2-RF; Ben-Porath & Tellegen, 2008), and the Personality Assessment Inventory (PAI; Morey, 1991). Young and Gross (2011) explored the utility of MMPI-2 validity scales in detecting and classifying individuals instructed to feign ADHD. Logistic regressions revealed that the Infrequency–Psychopathology Scale (Fp; Arbisi & Ben-Porath, 1995) best detected response bias. Fp displayed the best balance of specificity (.94) and sensitivity (.59) at the raw score cutoff of 5. Similarly, Harp, Jasinski, Shandera-Ochsner, Mason, and Berry (2011) found similar classification rates when examining the revised Fp Scale (Fp-r), which appears as part of the MMPI-2-RF. A *T* score cutoff of 77 on Fp-r resulted in sensitivity of .63 to simulators and a specificity of .90. A study by Robinson and Rogers (2018) found less impressive classification rates using the MMPI-2-RF's F family of scales, with Fp-r $\geq$ 77 producing sensitivity of .23 and specificity of .92 and Fs $\geq$91 producing sensitivity of .21 and specificity of 1.00. In response to the poor performance of the existing F scales, the authors created a 10-item Dissimulation Scale (Ds-ADHD), which produced promising classification rates with sensitivity of .75 and specificity of .97. The authors note the need for cross-validation of Ds-ADHD.

Several studies have examined the utility of the PAI in detecting feigning or exaggerating symptoms in ADHD evaluations. Sullivan et al. (2007) examined the utility of PAI negative response bias indices at the cut-off levels recommended by the manual with ADHD/LD evaluations. Only two of the 28 patients examined produced *T* scores of 70 or greater on any of the negative response bias scales. Smith et al. (2017) also found that simulators did not tend to show elevations on negative response bias scales. Musso, Hill, Barker, Pella, and Gouvier (2016) found similar results, noting that simulators are able to manipulate the PAI without being flagged by traditional validity scale cut scores. The authors validated alternative cut scores on the Negative Impression Management Scale, Malingering Index, and the Rogers Discriminant Function and found that three alternative cut scores had sensitivities between .20 and .33 while maintaining high specificity. One recent study that used the PAI to assess for feigned ADHD shows promise for the use of broadband personality measures in flagging suspect effort. Aita, Sofko, Hill, Musso, and Boettcher (2018) found that using a logistic regression algorithm of PAI items conceptually related to ADHD produced a sensitivity of .86 and specificity of .97. While this algorithm needs to be cross-validated in other samples or settings, it currently represents the best combination of sensitivity and specificity to feigning of ADHD in adults. It should also be noted that while both the PAI and MMPI-2-RF show promise in detecting noncredible responding in ADHD evaluations, the considerable length and cost of broadband personality instruments leave room for other solutions.

ADHD-Specific Symptom Validity Scales

Many ADHD self-report forms have no scales to identify noncredible or biased responding (e.g., the ARS, the Brown Adult ADD Scale, the WURS, and the Barkley Adult ADHD Rating Scale [BAARS]; Barkley & Murphy, 2006). The Attention Deficit Scales for Adults and the CAARS do each contain one validity scale, but on each it is an inconsistency scale designed to detect

random or inconsistent responding, rather than feigned or exaggerated reporting. Only one commercial ADHD self-report rating scale attempts to measure infrequent responding: the Clinical Assessment of Attention Deficit-Adult Infrequency Scale (Bracken & Boatwright, 2005). Marshall et al. (2010) found a sensitivity of 58% and specificity of 89% when using a cut score of 3 or more infrequency items. Most recently, Suhr, Buelow, and Riddle (2011) created the Conners Infrequency Index as an embedded index of noncredible reporting within the CAARS. Using the Word Memory Test (Green, 2005) as the criterion for patients responding noncredibly, the Conners Infrequency Index had a sensitivity of .24 and a specificity of .90. This scale has been cross-validated, though studies have reported large variations in classification rates. Using the same cutoff, Fuermaier et al. (2016) found "unsatisfactory" classification rates with sensitivity of .52 and specificity of .65. Walls et al. (2017) found sensitivity of .34 and sensitivity of .95 while Robinson and Rogers (2018) found sensitivity of .51 and specificity of .86. Fuermaier et al. (2016) concluded that there is still a need for infrequency scales composed of items that were specifically developed to be endorsed infrequently and embedded within valid self-report scales. One promising example of this method is Harrison and Armstrong's (2016) E-CAARS, which embeds 18 items assessing symptoms infrequently endorsed in the general population within the CAARS. The authors' Exaggeration Index, which integrates scores on these 18 items with high scores on certain CAARS scales, produced sensitivity to feigning ranging from .24 to .69 and specificity ranging from .74 to .97, depending on cut score used. The present study attempts to develop and validate a new symptom validity measure with items written to detect noncredible responding in ADHD evaluations.

Method

Participants

The Institutional Review Board at Central Michigan University approved the studies included in this article. All participants were recruited online through Amazon Mechanical Turk (MTurk). Participants were recruited via MTurk's list of available studies, which provided the study name, brief description, and compensation amount. Any participants residing within the United States of America were eligible to complete the study. Interested participants were required to complete the questionnaires online for one 35-min session. Participants completing the questionnaires were compensated for their participation through MTurk in line with Institutional Review Board standards. Total data collection for each study lasted less than 1 week. Table 1 summarizes the demographic characteristics for all three studies.

For the first study, 179 participants were recruited. After screening for eligibility and removing ineligible participants (detailed below), 106 participants were retained. For the second study, 269 participants were recruited and 151 participants were retained. For the third study, 309 participants were recruited and 145 participants were retained.

For all three studies, participants were screened out of the final participant pool for a variety of reasons, including failing to complete the study (n = 155), failing to accurately recall task instructions (n = 114), self-reported ineffective performance (n = 39), inconsistent responding (n = 35), being under 18 years old (n = 2), denying consent (n = 1), or a combination of these (n = 9). Self-reported ineffective performance was operationalized as either a 1 or 2 on a 4-point scale in response to a question provided at the end of the questionnaires that asked, "How effective do you think you were at this task?" To assess consistency of responding, nine pairs of items (using items from both the *DSM-5* ADHD scale and the infrequency items) asking slightly reworded versions of the same question were included in the scale. Less than five percent of the sample from Study 1 was inconsistent on more than three pairs. Thus, participants were excluded from the study if they showed inconsistency on more than three pairs.

Table 1
Demographic Characteristics by Study

Demographic characteristic	Study 1	Study 2	Study 3
Age (years)			
Range	18–58	19–70	19–75
M (*SD*)	33 (9.8)	35 (11.5)	36 (13.0)
Gender (%)			
Female	50.0	65.6	65.5
Male	50.0	33.8	33.1
Transgender	.0	.7	1.4
Race/Ethnicity (%)			
White/Caucasian	74.5	81.5	82.1
Black/African American	9.4	5.3	2.8
Asian/Pacific Islander	8.5	5.3	4.8
Hispanic/Latinx	2.8	4.0	6.2
Multiple Ethnicity	2.8	2.6	2.1
American Indian/Alaskan Native	1.9	1.3	2.1

Procedure

A four-group comparison model (control, ADHD-diagnosed, undiagnosed but self-reported possible ADHD, and ADHD simulators) was used to examine differences in endorsement rates across the ASIS. Those in the ADHD-diagnosed group provided details about their ADHD assessment, such as when it occurred, what type of professional completed the assessment, whether it included an interview, a symptom questionnaire, and/or cognitive testing, whether a diagnosis of ADHD was received, and whether medication was prescribed as a result. Across the sample, psychiatrists were most frequently cited professional providing the diagnosis, followed by physicians and psychologists (see Table 2). Those in the undiagnosed but self-reported possible ADHD reported they suspected they had ADHD, but had not been provided a formal diagnosis.

The control, ADHD-diagnosed, and possible undiagnosed ADHD groups were instructed to answer both questionnaires honestly. The simulator group was instructed to complete the questionnaires as if trying to convince a doctor they had ADHD to receive medication. They were explicitly educated with a narrative list of examples of inattention, hyperactivity, and impulsivity obtained from the *DSM-5* ADHD criteria (American Psychiatric Association, 2013). Participants were instructed to read the instructions and the list of symptom examples before continuing to the questionnaires.

Table 2
Assessment Details of Group Diagnosed With Attention-Deficit/Hyperactivity Disorder (ADHD)

Assessment details	Study 1	Study 2	Study 3
Type of provider (% of sample)			
Physician	32.1	34.5	38.5
Psychiatrist	50.0	37.9	34.6
Psychologist	14.3	24.1	7.7
Other	3.6	3.4	19.2
Evaluation included (% of sample)			
Interview	50.0	89.7	73.1
Testing	10.7	—	—
Both interview and testing	39.3	—	—
ADHD symptom measure	—	75.9	57.7
Cognitive testing	—	48.3	38.5
Medication prescribed (% of sample)			
Yes, currently taking	32.1	41.4	33.3
Yes, but not currently taking	60.7	48.3	57.1
No	7.1	10.3	9.5

Note. Study 1 only inquired into whether testing occurred, but not the specific nature of the testing. The "other" category under type of provider includes neuropsychologists or a combination of providers.

Measures

ADHD Symptom Infrequency Scale (ASIS). The ASIS consisted of two sets of true–false items. First, there were items written to assess current ADHD symptoms. These items were designed to correspond with the 18 *DSM-5* ADHD symptoms, with specific questions regarding ADHD symptoms. As such, this scale can be used to assess if individuals are reporting five or more ADHD symptoms, consistent with *DSM-5* diagnostic criteria.

Second, there were items written to assess ADHD symptom exaggeration. These items did not assess *DSM-5* ADHD symptoms, but instead were designed to be inaccurate, yet plausible symptoms for someone to associate with stereotypes of individuals with ADHD. It was the goal of the study to identify items that would be endorsed by those exaggerating ADHD symptoms and not endorsed by those displaying accurately diagnosed ADHD.

In Study 1, participants completed 80 true–false items. Of these items, 26 were ADHD symptoms and 54 were Infrequency items. After Study 1, both clinical ADHD and infrequency items were assessed for performance based on the utility of the items to distinguish between groups. Poorly performing items were removed, replaced, or revised. In Study 2, participants completed 81 items (29 ADHD, 52 Infrequency). After Study 2, five infrequency items were removed to improve performance in discriminating between simulators and other groups. In Study 3, participants completed 74 items (29 ADHD, 47 Infrequency). Further item and scale analysis was conducted to reduce the scale length while maintaining performance. After these analyses, the resulting final scale used in Study 3 contained 52 items (19 ADHD, 33 Infrequency). This final scale was reevaluated using participants from Study 2.

Barkley Adult ADHD Rating Scale–Fourth Edition (BAARS-IV): Self-Report Form. Participants completed the 27-item self-report form of the BAARS-IV to assess current ADHD symptoms associated with *DSM-5* diagnostic criteria. Items were rated on a 4-point scale. The BAARS-IV was included to examine the convergent validity of the ASIS ADHD items.

Results

Reliability

Cronbach's alpha values for each group and scale across all three studies are summarized in Table 3.

Study 1. Estimates of reliability were examined for the ASIS scales used in Study 1. From the ASIS clinical scale (ADHD Total), Inattention and Hyperactivity/Impulsivity (Hyper/Imp) subscales were created. These scales showed Cronbach's alpha values in the excellent range (ADHD Total: $\alpha = .95$; Inattention: $\alpha = .91$; Hyper/Imp: $\alpha = .91$) in the overall sample. Within the ADHD group, the Cronbach's alpha values of the ADHD subscales were acceptable (ADHD Total: $\alpha = .79$; Inattention: $\alpha = .75$; Hyper/Imp: $\alpha = .72$). The ASIS Infrequency Scale (INF) demonstrated a Cronbach's alpha value in the excellent range ($\alpha = .92$) in the overall sample. Within the simulator group, the Cronbach's alpha value of INF was also excellent ($\alpha = 92$).

Study 2. Estimates of reliability showed overall improvement in Study 2. The clinical scales continued to show Cronbach's alpha values in the excellent range (ADHD Total: $\alpha = .97$; Inattention: $\alpha = .94$; Hyper/Imp: $\alpha = .94$) in the overall sample. Within the ADHD group, the Cronbach's alpha values of the ADHD subscales showed moderate improvement, ranging from acceptable to good (ADHD Total: $\alpha = .84$; Inattention: $\alpha = .85$; Hyper/Imp: $\alpha = .73$). INF also maintained Cronbach's alpha values in the

Table 3
Coefficient Alphas for Attention-Deficit/Hyperactivity Disorder (ADHD) Symptom Infrequency Scale (ASIS) Scales, by Groups and by Study

Study and group	ASIS ADHD total	ASIS Inattention	ASIS Hyper/Imp	ASIS INF
Study 1[a]				
Overall sample ($N = 106$)	.95	.91	.91	.92
Control ($n = 30$)	.90	.84	.89	.83
Think ADHD ($n = 17$)	.78	.66	.70	.83
ADHD ($n = 28$)	.79	.75	.72	.75
Simulator ($n = 31$)	.96	.95	.93	.92
Study 2[b]				
Overall sample ($N = 151$)	.97	.94	.94	.96
Control ($n = 42$)	.91	.90	.74	.80
Think ADHD ($n = 31$)	.89	.83	.85	.93
ADHD ($n = 29$)	.84	.85	.73	.74
Simulator ($n = 49$)	.91	.85	.81	.93
Study 3[c]				
Overall Sample ($N = 145$)	.96	.94	.92	.96
Control ($n = 48$)	.90	.89	.85	.80
Think ADHD ($n = 33$)	.90	.89	.80	.94
ADHD ($n = 26$)	.94	.93	.86	.86
Simulator ($n = 38$)	.85	.75	.78	.93

Note. Hyper/Imp = Hyperactivity/Impulsivity; INF = Infrequency; Think ADHD = individuals who think they have ADHD but have not been diagnosed. Scale length differed across studies due to refinement of scales and items over time.
[a] Scale length in Study 1: ASIS ADHD Total, 26 items; ASIS Inattention, 14 items; ASIS Hyper/Imp, 12 items; and ASIS Infrequency, 54 items. [b] Scale length in Study 2: ASIS ADHD Total, 29 items; ASIS Inattention, 15 items; ASIS Hyper/Imp, 14 items; and ASIS Infrequency, 53 items. [c] Scale length in Study 3: ASIS ADHD Total, 19 items; ASIS Inattention, 10 items; ASIS Hyper/Imp, nine items; and ASIS Infrequency, 33 items.

excellent range in the overall sample (α = .96) and within the simulator group (α =.93).

Study 3. Estimates of reliability were examined for the revised ASIS scales used in Study 3. The clinical scales maintained Cronbach's alpha values in excellent range (ADHD Total: α = .96; Inattention: α = .94; Hyper/Imp: α = .92) in the overall sample. Within the ADHD group the Cronbach's alpha values of the Clinical Scales improved to the good to excellent range despite being reduced significantly in length (ADHD Total: α = .94; Inattention: α = .93; Hyper/Imp: α = .86). INF maintained a Cronbach's alpha value in the excellent range (α = .96) in the overall sample and in the simulator group (α = .93) despite removing 20 items from the overall scale length.

Validity

Convergent validity.

Study 1. Correlations between the clinical scales of the ASIS and the BAARS-IV were examined to estimate convergent validity of the current measure with an established self-report measure of ADHD symptoms. The ADHD Total was strongly correlated with the BAARS-IV Total in the overall sample and the ADHD group ($r = .90$, $p < .001$; $r = .63$, $p < .001$, respectively). Similarly, the Inattention and Hyper/Imp Subscales of the ASIS were highly correlated with the Inattention and Hyperactivity/Impulsivity scales of the BAARS-IV among participants in the overall sample ($r = .87$, $p < .001$; $r = .87$, $p < .001$, respectively) and in the ADHD group ($r = .67$, $p < .001$; $r = .55$, $p < .01$, respectively). However, the lower than expected correlations among scales assessing the same set of symptoms in the ADHD group led to revision (addition, deletion, and altering) of the items in the ASIS clinical scales.

Study 2. The ADHD Total, Inattention, and Hyper/Imp Subscales of the ASIS remained highly correlated with the Inattention and Hyperactivity/Impulsivity scales of the BAARS-IV among participants in the overall sample ($r = .91$, $p < .001$; $r = .89$, $p < .001$; $r = .91$, $p < .001$, respectively). However, within the ADHD group the correlations between the ADHD total, ASIS Inattention, and Hyper/Imp Subscales and the BAARS-IV Inattention and Hyperactivity/Impulsivity scales decreased in magnitude from the first study ($r = .51$, $p < .01$; $r = .62$, $p < .01$; $r = .49$, $p < .01$, respectively). Again, the lower than expected correlations between scales assessing similar symptoms led to targeted improvement in Study 3.

Study 3. Within the overall sample and the ADHD group, the ADHD Total was strongly correlated with the BAARS-IV Total ($r = .92$, $p < .001$; $r = .85$, $p < .001$, respectively). Similarly, the Inattention and Hyper/Imp Subscales of the ASIS were highly correlated with the Inattention and Hyperactivity/Impulsivity scales of the BAARS-IV among participants in the overall sample ($r = .88$, $p < .001$; $r = .90$, $p < .001$, respectively) and in the ADHD group ($r = .78$, $p < .001$; $r = .84$, $p < .001$, respectively). Of particular note, when comparing the scale in Study 3 to Study 2, the correlations between the ASIS and BAARS-IV scales among ADHD participants increased in magnitude. This provided initial evidence of convergent validity of the ASIS clinical scales with an established self-report measure of ADHD symptoms.

Group endorsement. Omnibus mean comparison ANOVA tests were conducted to compare the mean values between groups on the ASIS ADHD Total, INF, and BAARS-IV scales. Table 4 summarizes the ANOVA results. Analyses demonstrated strong effect sizes across all studies and scale comparisons.

Table 5 contains the mean values for each group on the ASIS ADHD Total, INF, and BAARS-IV scales, by study. Controls endorsed significantly fewer ADHD symptoms than the true ADHD group on both the BAARS-IV and the ASIS ADHD Total scale in all three studies. Simulators endorsed significantly more items on the ASIS Infrequency scale than the control, "Think" ADHD, or true ADHD groups in all three studies.

Classification Accuracy

In each study, an optimal cut score on INF was chosen to maximize the predictive ability of the measure. The authors reviewed the sensitivity and specificity of each cut score when distinguishing those simulating ADHD from those diagnosed with ADHD, and chose the cut score with the highest overall classification accuracy that also met our minimum requirements for specificity (≥.80). Our decision to keep specificity at .80 or higher reflects our priority of minimizing the number of honest respondents diagnosed with ADHD being flagged incorrectly as feigning. Table 6 shows PPV, NPV, sensitivity, and specificity when distinguishing those simulating ADHD symptoms from controls, "Think" ADHD, or true ADHD groups with cut score based on the highest overall classification accuracy while meeting the a priori concerning specificity. The INF cut scores chosen in Studies 1, 2, and 3 resulted in consistently strong accuracy values when identifying group membership. For Study 3, the final 33-item scale and cut scores demonstrated strong sensitivity and specificity (.79 and .89, respectively) when distinguishing simulators ($n = 38$) from all other groups ($n = 107$). Cut scores from Study 3 were then reevaluated using the sample from Study 2, and showed similar sensitivity and specificity (.86 and .89, respectively) distinguishing simulators ($n = 49$) from all other groups ($n = 102$).

Positive predictive values (PPV) and negative predictive values (NPV) were calculated for Study 3 using the combined sample. Using the final 33-item scale and cut score, 71% of participants identified as simulators by the INF were truly simulating (PPV = .71)

Table 4
Omnibus Mean Comparisons for Attention-Deficit/Hyperactivity Disorder (ADHD) Symptom Infrequency Scale (ASIS) ADHD, ASIS Infrequency, and Barkley Adult ADHD Rating Scale (BAARS)-IV Scales Across All Groups, by Study

Study and scale	*df*	*F*	*p*	*d* [95% confidence interval]
Study 1				
ASIS ADHD total	3, 102	32.79	<.001	2.41 [1.75, 3.07]
ASIS Infrequency	3, 102	29.73	<.001	2.39 [1.73, 3.05]
BAARS-IV total	3, 97	29.31	<.001	2.35 [1.70, 3.01]
Study 2				
ASIS ADHD total	3, 147	120.14	<.001	3.87 [3.18, 4.57]
ASIS Infrequency	3, 147	89.09	<.001	3.39 [2.75, 4.03]
BAARS-IV total	3, 141	82.42	<.001	3.27 [2.64, 3.90]
Study 3				
ASIS ADHD total	3, 141	51.77	<.001	2.65 [2.07, 3.23]
ASIS Infrequency	3, 141	56.57	<.001	2.76 [2.17, 3.36]
BAARS-IV total	3, 135	45.36	<.001	2.49 [1.93, 3.06]

Table 5
Post Hoc Mean Comparisons for Attention-Deficit/Hyperactivity Disorder (ADHD) Symptom Infrequency Scale (ASIS) ADHD, ASIS Infrequency, and Barkley Adult ADHD Rating Scale (BAARS)-IV Scales, by Study

Group (N)	ASIS ADHD total		ASIS Infrequency		BAARS-IV total	
	M	*SD*	*M*	*SD*	*M*	*SD*
Study 1						
Control ($N = 30$)	7.70[a]	6.24	12.80[a]	6.35	28.92[a]	11.04
Think ADHD ($N = 17$)	18.94[b]	4.44	26.00[b,c]	8.22	46.35[b]	11.95
ADHD ($N = 28$)	18.04[b]	4.73	24.25[b]	6.67	48.75[b,c]	9.28
Simulators ($N = 31$)	21.81[b]	6.92	32.42[c,d]	10.70	57.93[c,d]	13.97
Study 2						
Control ($N = 42$)	6.02[a]	6.04	8.95[a]	4.87	25.78[a]	9.27
Think ADHD ($N = 31$)	22.13[b]	5.81	24.55[b]	10.71	49.87[b]	12.36
ADHD ($N = 29$)	19.48[b]	5.65	19.69[b]	5.81	44.19[b]	11.11
Simulators ($N = 49$)	26.71[c]	4.06	37.55[c]	10.31	61.49[c]	10.63
Study 3						
Control ($N = 48$)	4.79[a]	4.92	4.71[a]	4.08	27.60[a]	10.20
Think ADHD ($N = 22$)	13.27[b]	5.22	13.00[b]	9.04	47.87[b]	14.45
ADHD ($N = 26$)	11.15[b]	6.36	8.92[a,b]	6.09	42.73[b]	15.70
Simulators ($N = 38$)	17.50[c]	2.68	23.76[c]	8.03	59.14[c]	10.79

Note. Think ADHD = individuals who think they have ADHD but have not been diagnosed. The possible range of scores for each measure in Study 1: ASIS ADHD, 0–25; ASIS Infrequency, 0–54; and BAARS-IV, 0–72. In Study 2: ASIS ADHD, 0–29, and ASIS Infrequency, 0–53. In Study 3, ASIS ADHD, 0–19, and ASIS Infrequency, 0–33. Values with the same superscript letter were not significantly different from each other at $p < .05$.

and 92% of those identified as nonsimulators were truly participants in the control, "Think" ADHD, or true ADHD groups (NPV = .92). Cut scores from Study 3 were then reevaluated using the sample from Study 2 and showed similar PPV (.79) and NPV (.93) in the context of a base rate of simulating ADHD of 29% in the combined sample. Additionally, estimated positive and negative predictive values are reported for base rates of 5%, 15%, and 50% in Table 6. These base rates were included to serve as comparisons to prior studies that used SVTs to classify patients as feigning, which vary widely in their estimated rate of feigning during ADHD evaluations. Reported percentages include 14.6% in a Canadian postsecondary sample (Harrison & Edwards, 2010), 31% (Suhr et al., 2008) to 47.6% (Sullivan et al., 2007) in samples of self-referred US college students.

Discussion

The current study outlined the development and refinement of a novel measure designed to detect exaggerated or malingered symptoms of ADHD in an adult population. The measure includes both clinical scales that map onto *DSM-5* criteria to aid in accurate diagnosis and also a scale designed to elicit endorsement of symptoms rarely reported by clinical samples. Results provide preliminary support to the ASIS as a measure of exaggerated symptoms in individuals attempting to feign symptoms of ADHD as well as a clinical measure with clinical accuracy for ADHD evaluations.

Overall, the measure demonstrated strong psychometric features. After performing the initial study and two follow-up studies revising the measure, internal consistency on the final clinical

Table 6
Attention-Deficit/Hyperactivity Disorder (ADHD) Symptom Infrequency Scale (ASIS) Infrequency Scale (INF) Positive Predictive Value (PPV) and Negative Predictive Value (NPV) When Discriminating Simulators From Controls, Think ADHD, and ADHD Participants, as a Function of Base Rate of Feigning

Study	Base rate					
	5%	15%	29% (Current study)			50%
	PPV/NPV	PPV/NPV	PPV/NPV	Sensitivity	Specificity	PPV/NPV
Study 1	.19/.98	.44/.94	.66/.87	.68	.85	.82/.73
Study 2	.26/.99	.54/.98	.77/.94	.88	.87	.87/.88
Study 3	.27/.99	.56/.96	.71/.92	.79	.89	.88/.81
33-Item scale validated in Study 2 sample	.29/.99	.58/.97	.79/.93	.86	.89	.89/.86

Note. Current Sample = the proportion of simulators within the Study 1, 2, and 3 samples combined. ASIS Infrequency Scale cut scores by study: Study 1, 30; Study 2, 28; and Study 3, 17.

scales was in the excellent range for both the overall group and the sample of individuals with ADHD. Similarly, internal consistency remained excellent for the final version of INF for both the overall sample and the Simulator group, despite paring the number of questions on INF down to 33 items.

With regard to validity, the ASIS ADHD Total and the BAARS-IV Total showed excellent correlations for both the ADHD group and the total sample. In addition, the final versions of the ASIS Inattention and Hyper/Imp subscales were highly correlated with the Inattention and Hyper/Imp scales of the BAARS-IV, respectively. This shows convergent validity with an existing, well-validated clinical scale. Concerning the ability to differentiate between simulator, clinical, and control groups, the simulator group scored higher than all other groups on INF on all versions of the measure. In addition, the ADHD group scored higher than the control group on the ASIS ADHD scale on all versions of the measure. Optimal cut scores for INF were chosen to preserve specificity to minimize the likelihood of false positives for feigning.

In addition to the strong classification accuracy of the ASIS, this measure can be differentiated from most previous attempts to identify feigned ADHD in that the development of this scale included writing new items that specifically targeted stereotypes of ADHD, rather than relying on existing items. Approaches using broadband personality inventories (such as the MMPI-2, MMPI-2-RF, and PAI) are forced to rely on preexisting validity scales that may or may not map onto hypothetical symptoms associated with ADHD. Similarly, investigators have attempted to develop embedded measures of rarely endorsed items within existing ADHD self-report measures, and these approaches have typically resulted in less than adequate psychometrics (Fuermaier et al., 2016; Suhr et al., 2011). One exception to this is Harrison and Armstrong (2016). Though the authors did not write new items for the E-CAARS, their decision to embed infrequently endorsed symptoms within the CAARS led to superior classification accuracy than several other attempts.

The current study has several limitations that will be important in guiding future research. First, this study used volunteer simulators rather than clinical subjects, and so there may be differences between how volunteers versus real-world patients feign ADHD due to differences in motivation, access to information about ADHD, or other factors. Additionally, our classification of participants was based on their own report rather than concurrent diagnosis, and our participants may not have answered honestly. In addition, successful documentation of ADHD based on review of applications of accommodations for standardized has even proven problematic (Joy, Julius, Akter, & Baron, 2010). Thus, while self-reported diagnostic information regarding psychiatric diagnoses has been validated previously with individuals diagnosed with depression (Sanchez-Villegas et al., 2008), obtaining a sample population in which diagnoses are contemporaneously derived with questionnaire administration would further validate the measure. Our study also did not include clinical controls, such as participants with psychiatric symptoms unrelated to ADHD, a group found in similar studies (e.g., Harrison & Armstrong, 2016). The inclusion of such a group will likely lower the classification accuracy of the ASIS INF scale, and may require reexamination of possible cut scores. Such a study is an important next step for the ASIS.

As an additional limitation, the current samples were notably older than typical college age students, where ADHD assessment may be more relevant and frequent. Of course, assessments for adult ADHD do take place across the life span (Torgersen, Gjervan, Lensing, & Rasmussen, 2016). It may be the case that young adults are more familiar with necessary and sufficient conditions for a diagnosis of ADHD due to awareness of peers with ADHD. Thus, further validation of the measure solely in a sample of individuals of traditional college age would be a valuable addition to future psychometric analysis of the measure. Additionally, simulator participants were instructed to read instructions and a narrative list of symptom examples before completing the questionnaires, but no knowledge check was included to ensure participants understood this information. While participants who were unable to reiterate their task as simulators were removed from the final sample, it would be beneficial to include a knowledge check to ensure participants are fully engaging with the provided educational materials. With regard to psychometric analysis and reliability, the current study only examined internal consistency. Future analysis may benefit from test–retest evaluation to verify temporal stability of the measure.

There have been regular calls for credible standalone measures of feigning symptoms of ADHD (Musso & Gouvier, 2014; Suhr & Berry, 2017) and the product of this initial attempt to create such a measure demonstrates strong classification accuracy, superior or comparable to previous attempts. Future research can include further validation with additional self-report measures of ADHD as well as other measures of psychopathology to further assess convergent and discriminant validity and determine the extent to which measures of feigned ADHD can be combined to enhance clinical decision-making. Along the same lines, further validation that includes other measures of dissimulation will be valuable to compare classification accuracy rates within a single sample. Such studies may include other measures on feigned ADHD needing cross-validation such as the Ds-ADHD on the MMPI-2-RF (Robinson & Rogers, 2018) or the PAI algorithms developed by Aita et al. (2018). Finally, cross-validation will be necessary to determine classification accuracy and optimal cut scores across various settings and populations. For example, a clinical sample that includes both suspected dissimulators and a psychiatric control group is a logical next step in the continued refinement of this measure.

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Received March 27, 2018
Revision received December 1, 2018
Accepted January 4, 2019 ■