

## ORIGINAL PAPER

# Establishing US norms for the Adult ADHD Self-Report Scale (ASRS-v1.1) and characterising symptom burden among adults with self-reported ADHD

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## Summary

**Aims:** To estimate Adult ADHD Self-Report Scale (ASRS-v1.1) Symptom Checklist normative total scores among the US adult general population and to evaluate overall attention-deficit hyperactivity disorder (ADHD) symptom burden among US adults with ADHD.

**Methods:** Prior 2012 and 2013 US National Health and Wellness Survey respondents were re-contacted. Demographics, comorbidities, and ASRS-v1.1 data were collected. ASRS-v1.1 scores were compared by sex, age, ADHD diagnosis, and ADHD medication use. Group differences were evaluated using chi-square tests and independent samples *t*-tests for categorical and continuous variables, respectively.

**Results:** Of 22 397 respondents, 465 self-reported being diagnosed with ADHD by a physician; of these, 174 self-reported using ADHD medication. The mean ASRS-v1.1 total score was 2.0 (SD = 3.2); scores differed by age and sex (all,  $P < 0.001$ ). ADHD (vs no ADHD) was associated with depression (58.1% vs 18.0%), anxiety (53.1% vs 16.0%), and sleep difficulties (37.0% vs 14.0%) (all,  $P < 0.001$ ). ADHD medication use (vs no use) was associated with depression (68.4% vs 51.9%), anxiety (67.2% vs 44.7%), panic disorder (25.9% vs 17.2%), and insomnia (27.6% vs 19.6%) (all,  $P < 0.05$ ). ADHD (vs no ADHD) respondents scored higher on all 18 ASRS-v1.1 items (all,  $P < 0.05$ ). Medication users (vs non-users) scored higher on six items (all,  $P < 0.05$ ).

**Discussion:** Adult ADHD may be undertreated or sub-optimally treated, despite a high symptom burden. Normative data will allow comparisons with individuals' scores to support the assessment of ADHD symptom burden among adults.

**Conclusion:** Findings highlight the importance of assessing ADHD symptom burden, especially among adults presenting with comorbidities.

## 1 | INTRODUCTION

Attention-deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder that, although typically diagnosed during childhood, frequently persists into adulthood.<sup>1</sup> The prevalence of ADHD has

been estimated to be 4.4% among the US adults.<sup>2</sup> According to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), a diagnosis of adult ADHD requires at least five symptoms of inattention (eg, easily distracted) and/or at least five hyperactivity/impulsivity symptoms (eg, talks excessively) to be present for a

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minimum of 6 months.<sup>3</sup> Additionally, for a diagnosis of ADHD, some significant symptoms must have onset prior to age 12; they must be currently manifested in two or more settings and reduce the individual's functioning in social relationships, at work, or in other life domains. Additionally, alternative explanations for these symptoms, such as the presence of anxiety or mood disorders, should be excluded.

Recognizing the symptom burden of adult ADHD is important because of the negative impact it has on individuals' health and quality of life, even for those who experience few symptoms.<sup>4</sup> Furthermore, adults with a self-reported ADHD diagnosis (vs controls) reported greater impairment in social functioning, interpersonal relationships, and self-organization, among other domains, in prior retrospective observational research.<sup>5</sup> Adult ADHD has also been associated with several psychiatric (eg, substance abuse disorders, anxiety disorders) and somatic (eg, obesity, asthma) comorbidities.<sup>6,7</sup> Additionally, because of difficulties with time management, organization, and following through on tasks, adults with ADHD often report impairments in work productivity,<sup>8</sup> which suggests ADHD also has economic implications.

A better understanding of the symptoms that impair functioning in home, work, school, and social settings throughout the day is necessary for accurate evaluation and diagnosis of ADHD in adults. Yet, adults with ADHD symptoms frequently go undiagnosed, as they may be treated for a comorbid psychiatric condition instead of their underlying ADHD.<sup>9</sup> Only a quarter of adults with ADHD who had been treated for mental health or substance abuse disorders in the past year had also been treated for their ADHD; overall, just over one-in-10 adults with ADHD were treated for this condition in the prior 12 months.<sup>2</sup> More recent evidence suggests that adults with ADHD may be undertreated, particularly in primary care settings.<sup>10</sup> Thus, the suboptimal diagnosis and treatment of adult ADHD warrant greater attention.

Validated screening tools help clinicians determine which patients need further evaluation for ADHD. Accordingly, the Adult ADHD Self-Report Scale version 1.1 (ASRS-v1.1) Screener was validated to identify individuals at-risk for adult ADHD according to the DSM, Fourth Edition (DSM-4) criteria.<sup>11</sup> The ASRS-v1.1 Screener consists of six items that ask respondents to report the frequency of ADHD symptoms over the past 6 months. While the ASRS-v1.1 Screener has been well-established in clinical practice, it is not commonly used in primary care; however, research has shown it can be easily administered in a primary care setting.<sup>12</sup> A new version of the ASRS has recently been developed, based upon the DSM-5 criteria for ADHD.<sup>13</sup> Both versions of the ASRS Screener allow for the identification of ADHD patients in the general population with high sensitivity and specificity.<sup>11,13</sup>

The ASRS-v1.1 Screener is a subset of the items from the ASRS-v1.1 Symptom Checklist, which includes nine inattention and nine impulsivity/hyperactivity symptom items that are consistent with DSM-4 ADHD criteria.<sup>11</sup> However, unlike the ASRS-v1.1 Screener, the ASRS-v1.1 Symptom Checklist is not used for screening purposes. Instead, the ASRS-v1.1 Symptom Checklist is available as an inventory of ADHD inattention and impulsivity/hyperactivity symptoms, and it is a valuable tool to help healthcare providers assess adult ADHD symptom burden and establish a patient's ADHD symptom profile.

### What's known

- Attention-deficit hyperactivity disorder (ADHD) has a negative impact on adults' health, quality of life, work productivity, and social interactions. However, adult ADHD is often under-diagnosed and undertreated in a primary care setting. Validated screening tools, such as the Adult ADHD Self-Report Scale version 1.1 (ASRS-v1.1) Screener, can be used by clinicians to determine which adults may need further evaluation and possible treatment for ADHD.

### What's new

- The mean ASRS-v1.1 Symptom Checklist total score was 2.0 for the US adult general population, and normative scores were higher among younger and female adults. Adults who self-reported an ADHD diagnosis had a greater burden from ADHD symptoms and comorbidities than those who self-reported no ADHD. This burden was also greater among adults who self-reported using ADHD medication, relative to those who reported not using medication to treat their ADHD.

One issue that limits the ability to study the burden of ADHD symptoms using the ASRS-v1.1 Symptom Checklist is that, although normative data are available for referred populations,<sup>14</sup> such norms have not been examined, to date, in a general population for this measure. Furthermore, because evidence suggests ADHD prevalence and symptom severity may differ based upon demographic distinctions, such as sex or age,<sup>15,16</sup> it is important to develop demographic group norms. Thus, a key aim of the current study was to estimate United States (US) adult population norms for the ASRS-v1.1 Symptom Checklist, both overall and by sex and age. Stated alternatively, this study sought to determine mean total scores on the ASRS-v1.1 Symptom Checklist among adults in the US general population (ie, adults with ADHD and those without ADHD, in the aggregate). The establishment of these norms will permit clinicians to compare a patient's score on the ASRS-v1.1 Symptom Checklist with the appropriate normative reference group, which can help determine if symptom burden is high. Another goal of this study was to quantify the symptom burden of ADHD among a large, representative sample of US adults. Our goal was to enhance our understanding of the symptom profile and overall burden of ADHD symptoms in the US adult general population.

## 2 | METHODS

### 2.1 | Participants and procedures

Individuals who had completed the 2012 or 2013 US National Health and Wellness Survey (NHWS) were re-contacted for participation

in the current study. The NHWS is an annual, self-administered, Internet-based questionnaire examining a nationwide sample of adults. Participant recruitment occurred through an online opt-in panel, and the study survey was completed through a secure website in exchange for points to be used for consumer goods (eg, gift cards). See Figure 1 for the flow of participants in this study.

To be included in the main study sample, potential respondents had to be age 18 or older and provide their informed consent electronically to participate. The study procedures were reviewed and approved by the Sterling Institutional Review Board (Atlanta, Georgia, US). The ADHD subsample was comprised of those respondents from the main sample who self-reported experiencing ADHD or Attention Deficit Disorder (ADD) in the past 12 months and, in a follow-up item, self-reported that their ADHD or ADD had been diagnosed by a physician.

## 2.2 | Measures

### 2.2.1 | Demographics

Participants reported their age, sex, race, height, and weight (used to calculate body mass index [BMI] in  $\text{kg}/\text{m}^2$ ), and whether they were of Hispanic origin; comorbidity burden was measured via the Charlson comorbidity index (CCI). The CCI weights the self-reported presence of several different health conditions (eg diabetes, congestive heart failure, etc.) and then sums the result.<sup>17</sup> Higher CCI scores represent a greater comorbidity burden.

### 2.2.2 | Comorbidities

Participants reported on their medical conditions that had been diagnosed by a healthcare provider (eg, depression, anxiety, etc.). Participants also completed questionnaires to screen for major

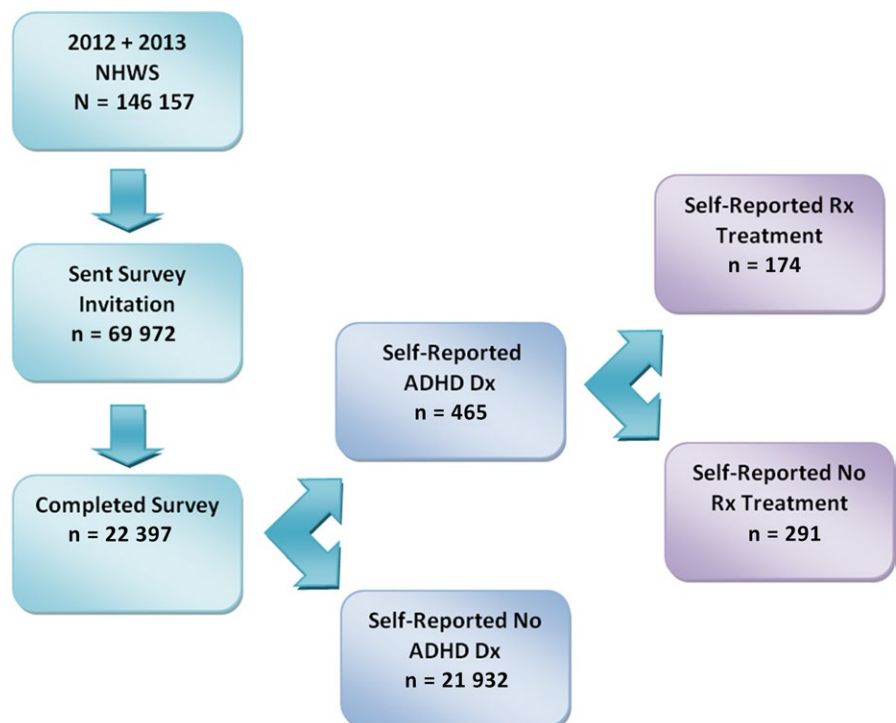
depressive disorder (MDD; the Patient Health Questionnaire [PHQ-9]) and bipolar disorder (the Mood Disorder Questionnaire [MDQ]).<sup>18,19</sup>

For the PHQ-9, respondents rated the extent to which they experienced each of nine depression symptoms (eg, little interest or pleasure in doing things, feeling tired or having little energy, etc.) in the prior 2 weeks on a scale ranging from 0 (not at all) to 3 (nearly every day). Higher scores signify greater depression symptom severity and can be categorized as follows: 5-9 (mild), 10-14 (moderate), 15-19 (moderately severe), and  $\geq 20$  (severe). Scores  $\geq 10$  indicate a positive screen for MDD.<sup>18</sup>

The MDQ consists of 13 items (eg, you felt much more self-confident than usual, you had much more energy than usual, etc.) rated yes/no that reflect symptoms or behaviours characteristic of bipolar disorder.<sup>19</sup> The MDQ also includes two follow-up items asking if symptom clustering occurred (rated: yes/no) and the degree of functional impairment (rated: no problem, minor problem, moderate problem, or serious problem). These items are only completed by those who responded affirmatively to any of the 13 initial items. Endorsing  $\geq 7$  of the 13 items, affirming the symptoms occurred during the same episode, and reporting moderate to severe impairment indicate a positive screen for bipolar disorder.

### 2.2.3 | ADHD symptoms

The ASRS-v1.1 Symptom Checklist is an 18-item measure used to determine symptom profile and assess symptom burden in adult ADHD.<sup>11</sup> The first six items (ie, Part A), constitute the ASRS-v1.1 Screener, which has been previously validated for identifying adults at-risk for ADHD.<sup>20</sup> Part B contains 12 other items that further assess the frequency of ADHD symptoms. The 18 items that comprise the entire ASRS-v1.1 Symptom Checklist represent the 18 symptoms of inattention and impulsivity/hyperactivity that characterize ADHD, according



**FIGURE 1** Flow of study participants. ADHD: Attention-deficit hyperactivity disorder; Dx: Diagnosis; NHWS: National Health and Wellness Survey; Rx: Prescription medication

to the DSM-4 (nine items apiece for each symptom subtype). The ASRS-v1.1 Symptom Checklist asks adults to rate the frequency of ADHD symptoms experienced over the past 6 months using the following rating scale: 0 = never, 1 = rarely, 2 = sometimes, 3 = often, and 4 = very often. Ratings of sometimes, often, or very often on items 1-3, 9, 12, 16, and 18 are assigned one point (ratings of never or rarely are assigned zero points). For the remaining 11 items, ratings of often or very often are assigned one point (ratings of never, rarely, or sometimes are assigned zero points). If a clinician wants to determine a patient's symptom profile, she/he can calculate scores by summing the number of points within each symptom subtype, such that subtype scores can range from 0 to 9. If an adult patient has a score of  $\geq 6$  on the nine inattention items and/or on the nine impulsivity/hyperactivity items, he or she is considered symptomatic. However, a goal of this study was to determine overall ADHD symptom burden, rather than assessing symptom subtypes. Thus, total scores on the ASRS-v1.1 Checklist were computed by summing the number of points across all 18 items, such that total scores could range from 0 to 18. The ASRS-v1.1 Symptom Checklist has been validated in community-based and referred individuals, with high internal consistency estimates found, regardless of whether it was self-reported by the patient or administered by a clinician (Cronbach's  $\alpha = 0.88-0.89$ ).<sup>21</sup> However, little data are available on its utility in very large surveys of adults with and without ADHD.

### 2.3 | Statistical analyses

Descriptive statistics included means and standard deviations (SDs) for continuous variables, with frequencies and percentages for categorical variables. Bivariate analyses included examining differences by sex and age in mean total ASRS-v1.1 Symptom Checklist scores using independent-samples t-tests and one-way analysis of variance (ANOVA) tests with post-hoc paired comparisons, respectively. Because of the small percentages of racial and ethnic minority respondents in the study sample, total ASRS-v1.1 Symptom Checklist scores by race and Hispanic origin are reported, but no statistical tests were performed to examine mean differences based on these characteristics. Differences in demographics and comorbidities by self-reported treatment status were examined using chi-square tests; independent-samples t-tests were used to evaluate differences in ADHD symptoms (ie, ASRS-v1.1 Symptom Checklist items) by self-reported treatment status. For bivariate analyses,  $P$ -values  $< 0.05$ , two-tailed, were considered statistically significant.

## 3 | RESULTS

### 3.1 | Descriptive statistics: Total sample characteristics

Altogether, 22 397 US adults participated in this study (Figure 1). Of these, 465 self-reported a physician diagnosis of ADHD. Among those self-reporting an ADHD diagnosis, 174 reported currently using a prescription treatment for their ADHD.

For the total sample, the mean age of participants was 51.1 (SD = 15.8) years (Table 1). Most respondents were female (54.4%)

**TABLE 1** Overall sample demographics

Variable	Total (n = 22 397)	
	%	n
% Male	45.6	10 215
Race		
Black	8.9	1983
Other	8.5	1899
White	82.7	18 515
% Hispanic	5.9	1317
Age (Mean, SD)	51.13	15.83
Age category		
18-29	10.8	2423
30-39	16.3	3659
40-49	20.8	4654
50-64	26.0	5823
65+	26.1	5838
BMI (Mean, SD)	28.27	6.91
BMI category (kg/m <sup>2</sup> )		
<18.50 (Underweight)	1.2	272
18.50-24.99 (Normal)	32.3	7244
25-29.99 (Overweight)	31.7	7105
30-34.99 (Obese Class I)	17.2	3847
35+ (Obese Class II and III)	14.0	3144
Decline	3.5	785
CCI (Mean, SD)	0.44	1.02
CCI category		
0	74.7	16 732
1	15.3	3422
2	6.0	1336
3+	4.0	907

BMI: Body mass index; CCI: Charlson comorbidity index; SD: Standard deviation.

and White (82.7%); overall, 5.9% self-identified as being of Hispanic origin. Most respondents were overweight or obese (BMI  $\geq 25$  kg/m<sup>2</sup>; 62.9%). The mean CCI score was 0.4 (SD = 1.0).

### 3.2 | Bivariate results: Demographics and comorbidities

Those with a self-reported ADHD diagnosis were more likely to be male (51.0% vs 45.5%,  $P = 0.02$ ) and younger ( $M = 42.0$  vs  $M = 51.3$ ,  $P < 0.001$ ) and to have higher BMI ( $M = 29.6$  vs  $M = 28.3$ ,  $P < 0.001$ ) and CCI scores ( $M = 0.6$  vs  $M = 0.4$ ,  $P = 0.01$ ) than respondents who did not self-report an ADHD diagnosis (Table 2). Those who self-reported currently using a prescription medication for ADHD had lower BMI ( $M = 28.6$  vs  $M = 30.1$ ,  $P = 0.04$ ) than those who reported not being pharmacologically treated for their ADHD (Table 2). Respondents did not differ on any other demographic characteristics by self-reported ADHD treatment status.

**TABLE 2** Group differences in demographics and clinical characteristics

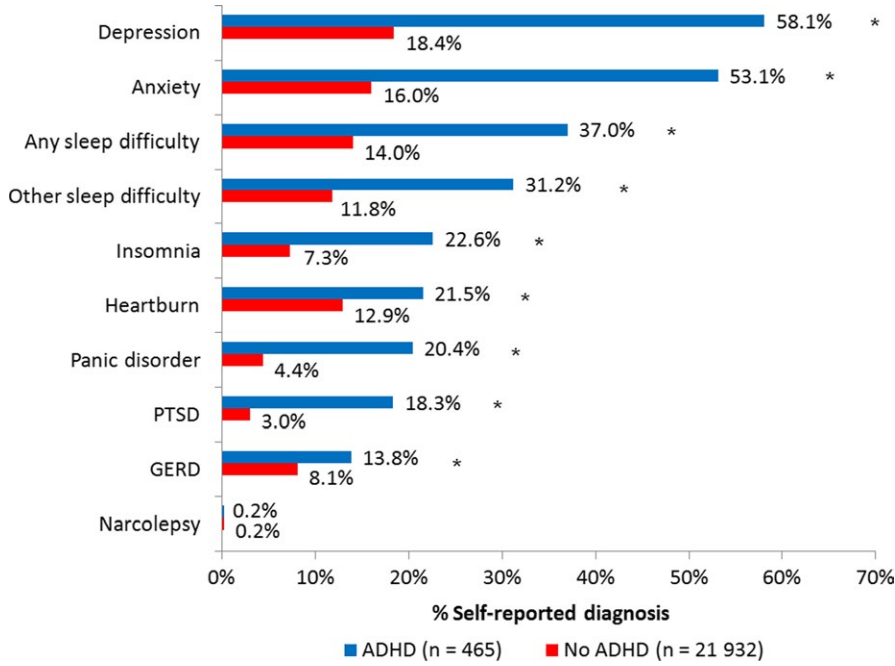
Variable	ADHD-A (n = 465)	No ADHD-B (n = 21 932)	Treated-C (n = 174)	Not treated-D (n = 291)	P-value A vs B	P-value C vs D
	n (%)	n (%)	n (%)	n (%)		
Sex					0.019	0.480
Male	237 (51.0%)	9978 (45.5%)	85 (48.9%)	152 (52.2%)		
Female	228 (49.0%)	11 954 (54.5%)	89 (51.1%)	139 (47.8%)		
Race					0.203	0.174
Black	31 (6.7%)	1952 (8.9%)	8 (4.6%)	23 (7.9%)		
Other	44 (9.5%)	1855 (8.5%)	13 (7.5%)	31 (10.7%)		
White	390 (83.9%)	18 125 (82.6%)	153 (87.9%)	237 (81.4%)		
Hispanic	33 (7.1%)	1284 (5.9%)	12 (6.9%)	21 (7.2%)	0.120	0.867
Age: Mean (SD)	41.95 (13.91)	51.33 (15.81)	41.17 (13.40)	42.42 (14.20)	<0.001	0.349
Age					<0.001	0.831
18-29	100 (21.5%)	2323 (10.6%)	41 (23.6%)	59 (20.3%)		
30-39	130 (28.0%)	3529 (16.1%)	46 (26.4%)	84 (28.9%)		
40-49	110 (23.7%)	4544 (20.7%)	43 (24.7%)	67 (23.0%)		
50-64	87 (18.7%)	5736 (26.2%)	32 (18.4%)	55 (18.9%)		
65+	38 (8.2%)	5800 (26.4%)	12 (6.9%)	26 (8.9%)		
BMI: Mean (SD)	29.55 (7.76)	28.25 (6.89)	28.60 (7.13)	30.12 (8.07)	<0.001	0.042
BMI					0.003	0.532
<17.99 (Underweight)	5 (1.1%)	267 (1.2%)	2 (1.1%)	3 (1.0%)		
18-24.99 (Normal range)	125 (26.9%)	7,119 (32.5%)	51 (29.3%)	74 (25.4%)		
25-29.99 (Overweight)	148 (31.8%)	6957 (31.7%)	61 (35.1%)	87 (29.9%)		
30-34.99 (Obese Class I)	92 (19.8%)	3755 (17.1%)	31 (17.8%)	61 (21.0%)		
35+ (Obese Class II + Class III)	87 (18.7%)	3057 (13.9%)	27 (15.5%)	60 (20.6%)		
Decline	8 (1.7%)	777 (3.5%)	2 (1.1%)	6 (2.1%)		
CCI: Mean (SD)	0.62 (1.43)	0.44 (1.01)	0.60 (1.24)	0.63 (1.54)	0.008	0.873
CCI					0.041	0.627
0	327 (70.3%)	16 405 (74.8%)	122 (70.1%)	205 (70.4%)		
1	81 (17.4%)	3341 (15.2%)	27 (15.5%)	54 (18.6%)		
2	28 (6.0%)	1308 (6.0%)	13 (7.5%)	15 (5.2%)		
3+	29 (6.2%)	878 (4.0%)	12 (6.9%)	17 (5.8%)		

For statistically significant results, *P*-values are shown in italics.

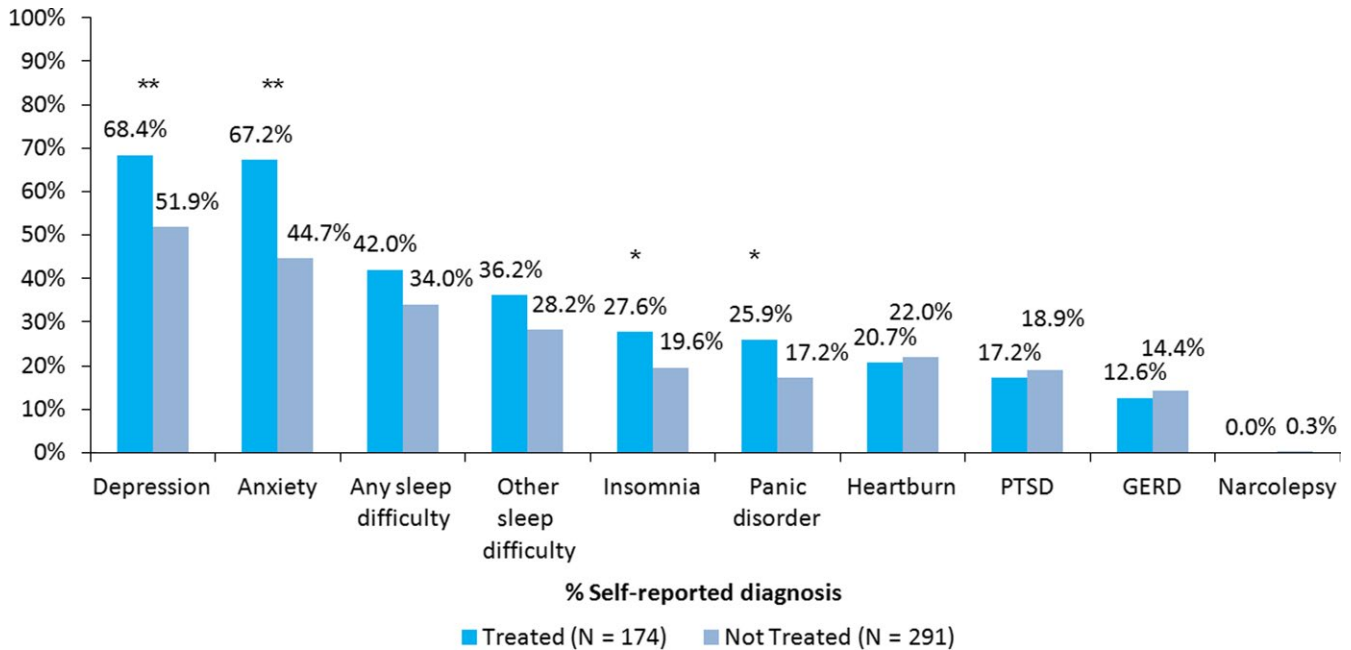
ADHD: Attention deficit hyperactivity disorder; BMI: Body mass index; CCI: Charlson comorbidity index; SD: Standard deviation.

Compared with those who did not self-report an ADHD diagnosis, respondents who self-reported ADHD were more likely to report a diagnosis of depression, anxiety, sleep difficulties (any difficulty, other difficulty, and insomnia), heartburn, panic disorder, post-traumatic stress disorder (PTSD), and gastroesophageal disease (GERD) (for each,  $P < 0.001$ ) (Figure 2). Participants who self-reported an ADHD diagnosis were also more likely to screen positive for bipolar disorder (0.2% vs 0.0%,  $P = 0.02$ ) on the MDQ and for MDD (15.5% vs 5.6%,  $P < 0.001$ ) on the PHQ-9 than those who did not self-report a diagnosis.

Respondents who self-reported ADHD and were being currently treated for ADHD with a prescription medication were more likely to report diagnoses of depression (68.4% vs 51.9%,  $P < 0.001$ ), anxiety (67.2% vs 44.7%,  $P < 0.001$ ), insomnia (27.6% vs 19.6%,  $P < 0.05$ ), or panic disorder (25.9% vs 17.2%,  $P = 0.03$ ) than respondents who self-reported not being currently treated for their ADHD with a prescription medication (Figure 3). Medicated adults with ADHD were also more likely than those not using medication to screen positive for MDD (23.0% vs 11.0%,  $P = 0.001$ ) on the PHQ-9. The groups



**FIGURE 2** Differences in comorbidities: ADHD vs No ADHD. GERD: Gastroesophageal reflux disease; PTSD: Post-traumatic stress disorder. \* $P < 0.001$



**FIGURE 3** Differences in comorbidities: Treated vs Not treated. GERD: Gastroesophageal reflux disease; PTSD: Post-traumatic stress disorder. \* $P < 0.05$ ; \*\* $P < 0.001$

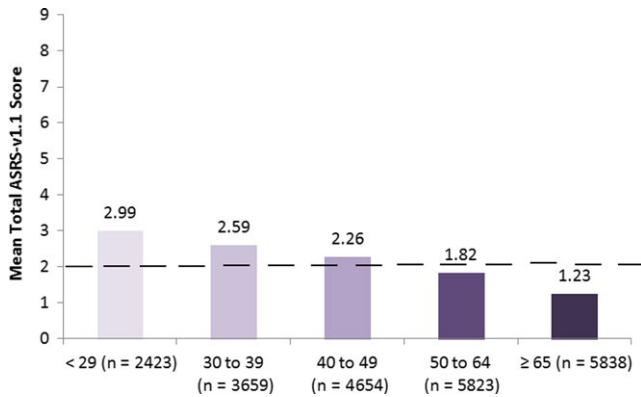
did not differ in positive screens for bipolar disorder on the MDQ (treated: 0.3% vs untreated: 0.0%,  $P = 0.44$ ).

### 3.3 | Predictors of ADHD symptoms on the ASRS-v1.1 symptom checklist

Mean ASRS-v1.1 Symptom Checklist scores varied significantly across age categories ( $P < 0.001$ ), and all post-hoc paired

comparisons were significant; for each,  $P < 0.001$  (Figure 4). Mean scores were highest for respondents aged 18-29 ( $M = 3.0$ ,  $SD = 4.1$ ) and lowest among those aged  $\geq 65$  ( $M = 1.2$ ,  $SD = 2.1$ ). Females ( $M = 2.1$ ,  $SD = 3.2$ ) had significantly higher mean total ASRS-v1.1 Symptom Checklist scores than males ( $M = 1.9$ ,  $SD = 3.3$ ;  $P < 0.001$ ). However, the size of this difference was small (Cohen's  $d = 0.06$ ).

Respondents who self-identified as being of Hispanic origin reported a mean total ASRS-v1.1 Symptom Checklist score of 2.8



**FIGURE 4** Mean ASRS-v1.1 Symptom Checklist total score by age. All post-hoc paired comparisons were significant; for each,  $P < 0.001$ . ASRS-v1.1 Symptom Checklist total scores can range from 0 to 18; however, the y-axis has been truncated to allow for easier visual comparisons of the mean bars. The horizontal, dotted line represents the mean total normative score of 2.0 on the ASRS-v1.1 Symptom Checklist for the US general population. ASRS-v1.1: Adult ADHD Self-Report Scale version 1.1 Symptom Checklist

(SD = 4.2). Those who were not of Hispanic origin had a mean total ASRS-v1.1 Symptom Checklist score of 2.0 (SD = 3.2). Regarding race, mean total ASRS-v1.1 Symptom Checklist scores were 2.5 (SD = 3.8), 2.2 (SD = 3.7), and 2.0 (SD = 3.1) for “Other” race, Black, and White respondents, respectively.

Respondents with a self-reported diagnosis of ADHD had significantly higher mean responses on all 18 items of the ASRS-v1.1 Symptom Checklist than those without a self-reported diagnosis; for each,  $P < 0.001$  (Table 3). Those who self-reported current treatment with a prescription medication for ADHD had significantly higher mean responses than non-medicated respondents. These higher scores were significant for six ASRS-v1.1 Symptom Checklist items: trouble wrapping up details (M = 2.8 vs M = 1.8,  $P = 0.01$ ), difficulty getting things in order (M = 2.9 vs M = 1.7,  $P = 0.01$ ), avoid or delay getting started (M = 3.2 vs M = 2.0,  $P = 0.02$ ), feel overly active/compelled to do things (M = 2.7 vs M = 1.7,  $P = 0.01$ ), leave your seat in meetings (M = 2.3 vs M = 1.4,  $P < 0.05$ ), and have difficulty unwinding and relaxing (M = 3.0 vs M = 1.8,  $P = 0.01$ ).

## 4 | DISCUSSION

In summary, the current study estimated the total score on the ASRS-v1.1 Symptom Checklist to be 2.0 for the US adult general population. Additionally, this study found different normative scores according to sex and age. ASRS-v1.1 Symptom Checklist total scores were higher among younger and female respondents. Those with self-reported ADHD and those who reported using a prescription medication to treat their ADHD had a higher ADHD symptom burden and were more likely to have psychiatric and somatic comorbidities than respondents who did not self-report ADHD and those who did not pharmacologically treat their ADHD, respectively.

Collectively, these normative data characterize the ADHD symptom burden in the US general adult population. The total ASRS-v1.1 Symptom Checklist score estimated in this study suggests that the overall level of ADHD symptoms in the US general adult population (most of whom do not have ADHD) is quite low. Results were consistent with prior research that showed higher ADHD symptom severity among younger and female adults.<sup>15,16</sup> The normative data generated for the ASRS-v1.1 Symptom Checklist in this study can be used to assess the deviance of individual scores in clinical settings. By placing scores in the appropriate demographic context, the results of this study help guide clinicians in understanding a patient’s symptom profile and symptom burden, based on his/her ASRS-v1.1 Symptom Checklist score.

As noted in the prior literature, ADHD is more prevalent among men,<sup>22</sup> which could account for why male participants in the current study were more likely than female participants to report an ADHD diagnosis. Paradoxically, female participants had significantly higher ASRS-v1.1 Symptom Checklist mean total scores than male participants. This finding may be explained by previous research indicating that women perceive greater impairment from their ADHD symptoms, even when no sex differences exist in objective levels of impairment.<sup>22</sup> This suggests that men may be more likely to experience ADHD symptoms, but symptoms may be particularly burdensome for women.

To reduce the clinical morbidity attributed to depression, the US Preventative Services Task Force recommends screening the adult population in primary care; the appropriate systems and support services must also be in place for patients to receive a diagnosis, treatment, and follow-up.<sup>23</sup> In a systematic literature review, this approach improved response to depression treatment and remission.<sup>24</sup> Similarly, routinely screening adults for ADHD in primary care should help identify those in need of further evaluation and possible treatment. Indeed, a prospective, multi-centre study found the ASRS-v1.1 Screener could be very quickly administered and easily used in a primary care context for this purpose.<sup>12</sup>

The new DSM-5 ASRS Screener, which has been validated for identifying individuals at risk for DSM-5 adult ADHD,<sup>13</sup> is also a suitable option to screen adults for ADHD in a primary care setting. The ASRS Symptom Checklist remains unchanged, as the core symptoms of adult ADHD in the DSM-4 and DSM-5 are the same. However, executive function deficits, which are assessed (two items) in the new six-item ASRS Screener, are not included among the adult ADHD symptoms in the DSM-5.

The finding that a self-reported ADHD diagnosis was associated with a greater likelihood of also reporting diagnosed comorbidities are consistent with much prior research.<sup>7</sup> While a prior systematic review indicated that obesity, asthma, and sleep difficulties were strongly linked to adult ADHD,<sup>6</sup> the current study provided evidence that gastrointestinal conditions (GERD, heartburn) were also related to adult ADHD. Thus, findings indicate an additional burden from somatic comorbidities that had not previously been identified.

Individuals who self-reported a diagnosis of ADHD scored significantly higher on the ASRS-v1.1 Symptom Checklist than those without a self-reported diagnosis. This finding suggests there is a high symptom burden among those with a self-reported ADHD diagnosis, relative to

**TABLE 3** Group differences in ADHD symptoms

	ADHD-A (n = 465)	No ADHD-B (n = 21 932)	Treated-C (n = 174)	Not treated-D (n = 291)	P-value	P-value
ASRSv1.1 items	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	A vs B	C vs D
<i>Trouble wrapping up details</i>	2.65 (1.26)	1.75 (0.87)	2.84 (1.21)	1.76 (0.88)	<0.001	0.008
<i>Difficulty getting things in order</i>	2.72 (1.29)	1.72 (0.88)	2.93 (1.26)	1.73 (0.90)	<0.001	0.007
<i>Problems remembering appointments</i>	2.68 (1.24)	1.77 (0.90)	2.80 (1.22)	1.78 (0.91)	<0.001	0.088
<i>Avoid or delay getting started</i>	2.97 (1.31)	2.00 (1.01)	3.16 (1.29)	2.01 (1.02)	<0.001	0.016
<i>Fidget or squirm</i>	3.14 (1.39)	1.97 (1.13)	3.16 (1.32)	1.98 (1.14)	<0.001	0.760
<i>Feel overly active/compelled to do things</i>	2.55 (1.24)	1.67 (0.93)	2.74 (1.24)	1.68 (0.94)	<0.001	0.008
Make careless mistakes	2.55 (1.16)	1.79 (0.83)	2.69 (1.18)	1.80 (0.84)	<0.001	0.053
Difficulty keeping attention	3.16 (1.30)	1.98 (0.99)	3.27 (1.28)	1.99 (1.00)	<0.001	0.147
Difficulty concentrating	2.91 (1.22)	1.79 (0.93)	3.03 (1.15)	1.81 (0.94)	<0.001	0.082
Misplace or have difficulty finding things	2.85 (1.24)	2.07 (0.96)	2.93 (1.20)	2.08 (0.97)	<0.001	0.248
Distracted by activity or noise around you	3.17 (1.29)	2.04 (1.00)	3.19 (1.24)	2.06 (1.02)	<0.001	0.842
Leave your seat in meetings	2.15 (1.24)	1.38 (0.73)	2.30 (1.18)	1.39 (0.74)	<0.001	0.046
Feel restless or fidgety	2.94 (1.24)	1.84 (0.95)	2.97 (1.22)	1.86 (0.96)	<0.001	0.693
Have difficulty unwinding and relaxing	2.79 (1.30)	1.81 (0.99)	2.99 (1.26)	1.82 (1.00)	<0.001	0.012
Find yourself talking too much	2.66 (1.30)	1.75 (0.94)	2.78 (1.28)	1.76 (0.95)	<0.001	0.127
Find yourself finishing the sentences of the people	2.62 (1.30)	1.78 (0.94)	2.71 (1.24)	1.79 (0.95)	<0.001	0.285
Difficulty waiting your turn	2.43 (1.23)	1.61 (0.86)	2.54 (1.17)	1.62 (0.87)	<0.001	0.143
Interrupt others when they are busy	2.51 (1.18)	1.76 (0.82)	2.60 (1.22)	1.77 (0.83)	<0.001	0.213

Each item was rated using response options ranging from 0 = never to 4 = very often. The six items comprising the ASRS-v1.1 Screener are shown in italicised text. For statistically significant results, P-values are shown in italics.

ASRS-v1.1: Adult ADHD Self-Report Scale version 1.1 Symptom Checklist; SD: Standard deviation.

respondents reporting no ADHD. In the current study, 62.6% of respondents who self-reported an ADHD diagnosis were not currently using a prescription medication to treat their condition, which confirms prior research reporting that ADHD is undertreated in diagnosed adults.<sup>10</sup> The higher mean ASRS-v1.1 Symptom Checklist item scores of those who self-reported using (vs not using) a prescription medication in the present study suggests that, in our sample, greater ADHD severity was associated with treatment and that ADHD treatment was not optimal.

#### 4.1 | Limitations

Diagnoses and treatment of ADHD were self-reported by respondents within our survey and could not be clinically verified. Therefore,

results could have been subject to recall error or other forms of response bias. It is important to note that conclusions cannot be drawn about the mean total ASRS-v1.1 Symptom Checklist scores of race or ethnic groups, given the study sample was not fully representative with respect to these characteristics. The small percentages of Black and Hispanic respondents in the study sample also precluded statistical testing of mean total ASRS-v1.1 Symptom Checklist scores by race or ethnicity, respectively. Additionally, given the nature of the data, causality cannot be inferred from the findings. P-values were not adjusted for multiple comparisons, which may have elevated Type 1 error rates; as a result, some group differences reported in this study may have been because of chance. It is also possible that unmeasured variables may account for the differences observed.



Future research should assess these differences after adjusting for potential confounds to verify whether this is the case.

## 5 | CONCLUSIONS

Findings indicate that ASRS-v1.1 Symptom Checklist total scores vary by sex and age. Hence, clinicians should take such demographic distinctions into account when assessing adults for ADHD, as this will help avoid the under- or over-diagnosis of the disorder. Almost two-thirds of those who self-reported an ADHD diagnosis were not pharmacologically treated, despite experiencing a high symptom burden. These results suggest ADHD is undertreated among US adults, thereby highlighting the importance of assessing symptom burden to aid the proper diagnosis and optimal management of ADHD.

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## DISCLOSURES

Dr. Adler has contracted research through NYU School of Medicine with Enzymotec, Sunovion Pharmaceuticals, and Shire Pharmaceuticals, he has served as a consultant and/or on advisory boards for Sunovion Pharmaceuticals, Enzymotec, Shire Pharmaceuticals, Otsuka Pharmaceuticals, Alcobra Pharmaceuticals, Bracket, National Football League, and Major League Baseball, and he has received royalty payments (as inventor) from NYU for the license of adult ADHD scales and training materials since 2004. In the past year, Dr. Faraone received income, potential income, travel expenses, continuing education support, and/or research support from Otsuka, Lundbeck, KenPharm, Rhodes, Arbor, Ironshore, Shire, Akili Interactive Labs, CogCubed, Alcobra, VAYA, Sunovion, Genomind, and NeuroLifeSciences. With his institution, he has US patent US20130217707 A1 for the use of sodium-hydrogen exchange inhibitors in the treatment of ADHD. Dr. Faraone also acknowledges the support of the KG Jebsen Centre for Research on Neuropsychiatric Disorders, University of Bergen, Bergen, Norway, the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 602805, the European Union's Horizon 2020 research and innovation programme under grant agreements No. 667302 and 728018, and NIMH grants 5R01MH101519 and U01 MH109536-01. Mr. Sarocco, Dr. Atkins, and Ms. Khachatryan are employees and stockholders of Shire, LLC.

## AUTHOR CONTRIBUTIONS

All the authors contributed to the concept and design of the study, interpretation of the data, critical revision of the manuscript, and approval of the manuscript.

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