Journal of Pediatric Psychology, 47(6), 2022, 652–661
https://doi.org/10.1093/jpepsy/jsab132
Advance Access Publication Date: 5 January 2022
Original Research Article

National Norms for the Vanderbilt ADHD Diagnostic Parent Rating Scale in Children

Nathan P. Anderson [1], BA, Jamie A. Feldman,[2] BA, David J. Kolko,[1] PhD, Paul A. Pilkonis,[1] PhD, and Oliver Lindhiem [1], PhD

[1]Department of Psychiatry, University of Pittsburgh, USA, and [2]University of Pittsburgh Medical Center, USA

All correspondence concerning this article should be addressed to Nathan P. Anderson, BA, University of Pittsburgh School of Medicine, 3550 Terrace St, Pittsburgh, PA 15213, USA. E-mail: npa6@pitt.edu

Received 22 August 2021; revisions received 1 December 2021; accepted 4 December 2021

Abstract

Objective To provide national norms and percentiles for both research and clinical scoring modalities of the Vanderbilt Attention Deficit/Hyperactivity Disorder (ADHD) Diagnostic Parent Rating Scale (VADPRS) for a representative sample of children ages 5–12 in the United States. **Method** The five clinical subscales of the VADPRS were completed by 1,570 caregivers of children ages 5–12 in the United States, with children representative of the national population on key demographic variables including race, sex, ethnicity, family income, and family educational level. Descriptive statistics and measures of internal consistency of both dimensional and symptom count scoring were provided for each of the five clinical subscales of the inventory, as well as percentiles and group comparisons for select dimensional scoring subscales based on age and child sex. **Results** Measures of internal consistency for each subscale using both scoring modalities of the VADPRS ranged from high to acceptable. There were statistically significant differences among the different subscales for both age (ADHD hyperactivity, anxiety/depression) and sex [both presentations of ADHD, oppositional defiant disorder (ODD)] for the total sample. These differences, however, were modest in magnitude and unlikely to be clinically meaningful. **Conclusions** This study enhances the research and clinical utility of the VADPRS by providing national norms and percentiles for each of its subscales. Differences between age and sex across the sample were statistically significant for two of the subscales (Hyperactivity and Anxiety/Depression) with additional subscales significant for sex alone (Inattentive and ODD), but these differences were not substantial enough to indicate a need for separate cut-offs for screening purposes.

Key words: attention; hyperactivity; ADHD; evidence-based practice; measure validation; school-age children.

Introduction

Attention Deficit/Hyperactivity Disorder (ADHD) is a common neurodevelopmental disorder in children, with 9.4% of children ages 2–17 diagnosed with ADHD in the United States in 2016 (Danielson et al., 2018). Children with ADHD have commonly recognized impairments in school performance, with additional risk for poor social development, impaired relationships through adulthood, and higher rates of substance use and injury (Barkley, 2014). ADHD is also associated with comorbidities including other neurodevelopmental disorders, oppositional defiant disorder (ODD), conduct disorder (CD), anxiety, and depression (Thapar & Cooper, 2016). Children untreated or undertreated for the disorder have adverse consequences in the above domains that could be mitigated by appropriate treatment (Shaw et al., 2012). However, overdiagnosis and treatment for ADHD can also be detrimental to healthcare resource allocation and child development. There is evidence

for combined behavioral and pharmacologic treatment as an efficacious strategy for children with ADHD (Felt et al., 2014). However, overdiagnosis needlessly utilizes scarce clinician and therapist appointments at cost to the system and the detriment of other patients in need of such services. Additionally, pharmacologic treatment for ADHD often consists of stimulant medications which can have a significant associated financial burden on the family in addition to potential for adverse consequences of medication including decreased appetite, irritability, insomnia, or potentially reversible decreased growth velocity (Chang et al., 2020; Charach, 2020). Therefore, it is imperative that providers be able to adequately identify children with ADHD in the clinical setting to initiate the requisite therapy while not overdiagnosing those who do not have ADHD.

Improved screening and diagnostic tools for the clinical setting that are efficient and easy to use are needed to aid in the proper identification of children with ADHD. Of particular utility are rating scales and diagnostic tools that align with the diagnostic criteria for the condition as outlined in the Diagnostic and Statistical Manual of Mental Disorders (DSM). These criteria include a list of behaviors for both the inattentive and the hyperactive/impulsive presentations of ADHD. A patient must demonstrate six of nine criteria in at least two settings (such as home and school) leading to decreased functioning to qualify for the diagnosis (American Psychiatric Association, 2013).

The Vanderbilt Attention Deficit/Hyperactive Disorder Parent Rating Scale (VADPRS) is an ADHD rating scale developed to provide efficient and useful diagnostic assistance. The 55-item VADPRS consists of 18 DSM-IV ADHD symptom items as well as subscales that screen for 8 ODD behaviors, 14 CD behaviors, and 7 anxiety or depression behaviors, all on a 4-point scale of frequency (0 = *never*, 3 = *very often*). An additional functioning subscale consists of eight items which examine academic performance and relationships on a 5-point scale (1 = *above average performance*, 5= *problematic performance*) to help establish that a child meets diagnostic criteria for ADHD (Wolraich et al., 2003). While the VADPRS was developed for the DSM-IV criteria, it is worth noting that the VADPRS is still consistent with the current version (DSM-5) for ADHD, ODD, and CD diagnoses, as criteria for diagnosis of these disorders in children did not change between versions. The VADPRS can be used to assess the presence of diagnostic behaviors, comorbidities, and level of impairment in one setting (the home). This information can then be reconciled with collateral information from the Vanderbilt Attention Deficit/Hyperactive Disorder Teacher Rating Scale (VADTRS) or another source in order to assist in the diagnosis of ADHD (Wolraich et al., 2003).

The VADPRS was initially validated in a clinical population of 243 children (mean age = 7.41 years) with high internal onsistency ($\alpha > .90$) for each of the presentations of ADHD, as well as the externalizing (ODD/CD) subscale and the internalizing (anxiety/depression) subscale (Wolraich et al., 2003). These subscales were identified using factor analysis, demonstrating a strong four-factor structure of the scale. The VADPRS was compared to the Computerized Diagnostic Interview Schedule for Children (C-DISC-IV) with a concurrent validity of $r = .79$ for the total ADHD score in one study (Wolraich et al., 2003) with $r = .73$ for inattentive ADHD and $r = .83$ for hyperactive/impulsive ADHD in a subsequent study (Wolraich et al., 2004). Cut-off scores for each of the subscales were established as ≥ 6 for the ADHD subscales, ≥ 4 for ODD, ≥ 3 for CD, and ≥ 3 for ANX/DEP (Wolraich et al., 2003).

The psychometric properties of the VADPRS were subsequently assessed in a community sample of 587 children ages 5–15 (Bard et al., 2013). The VADPRS again demonstrated good internal consistency for each of the subscales ($\alpha > .90$) and an acceptable four-factor structure by confirmatory actor analysis. The concurrent criterion validity against the C-DISC-IV was found to be acceptable ($r = .66$–$.69$) for the ADHD and ODD/CD subscales, but was low ($r = .35$) for the Anxiety/Depression subscale.

Further evaluation of the subscales of the VADPRS have led to recommendations for use of alternative cut-off scores (Becker et al., 2012). While the primary recommendations of the American Academy of Pediatrics/National Institute for Children's Health Quality (AAP/NICHQ) center on a symptom count score for the primary ADHD scales and the comorbidity subscales in addition to the performance of functioning subscale (NICHQ, 2002), it was found that a total sum score for the subscales provides improved "clinical utility" for referrals for children at risk of comorbidities accompanying their ADHD diagnosis. These alternative recommended cut-offs included rule-out values of total scores <10 for ODD, <4 for CD, <4 for ANX/DEP, though the authors note that a small sample size of children with CD and depression were present, making these recommendations preliminary only (Becker et al., 2012).

The present study seeks to provide norms for the VADPRS that are currently absent in the literature. To our knowledge, this is the first study examining the psychometric properties of the VADPRS in a U.S. nationally representative sample of children ages 5–12. Given the wide use of the VADPRS (Leslie, 2004), it is valuable to have more data on the scoring of and norms for this measure in a large, representative

sample. We aim to provide the norms for the standard symptom count scoring utilized in the majority of clinical settings, as well as normative for a total raw score. The latter normative data can benefit research by allowing for direct comparison to prior outcome studies and providing a dimensional profile across behaviors rather than only providing the binary norms of symptom count scoring.

Methods

Participants

The sample used in this study was initially recruited as part of a larger parent study examining various parent-reported scales in the domains of parenting, child behavior, and parent and child psychopathology. This parent study has examined validity and reliability of parenting measures, established norms and cut-offs for measures of parenting and child behavior, and developed brief versions of measures of parenting for clinical utility (Lindhiem et al., 2019). The final sample included 1,570 parents/guardians of children aged 5–12 from all 50 states and the District of Columbia. The ages of the children were evenly distributed across the 5–12 age range, with the sex of 53.2% of children identified as male. Of the children in the sample, 18.2% were identified by their parent/guardian as Hispanic, Latino, or of Spanish Origin, with parental racial demographics representative of the country. In addition, 36.9% of parents had obtained a bachelor's degree or higher education and annual household incomes were distributed evenly among the $0–30,000, $30,000–60,000, $60,000–90,000, and $90,000+ categories with a median income in the $50,000–59,999 bin. Psychiatric diagnoses, medical conditions, and medication use of participants were not collected. Reporting race and ethnicity in this study was for the purpose of ensuring a nationally representative sample of participants in line with the 2016 American Community Survey (ACS) data. Parents were able to select as many race and ethnicity categories as they felt were appropriate. Key demographic variables are summarized in Table I, which provides comparison data of current population demographics (U.S. Census Bureau, 2019).

Measures

Vanderbilt Assessment Scale-Parent Report (VADPRS)

The VADPRS is a 55-item parent-report assessment for ADHD (18 items), ODD (8 items), CD (14 items), and anxiety/depression (7 items). It also includes an eight-item school performance and social functioning subscale. Symptom items are rated using a 4-point Likert scale (*never* to *very often*) and the performance items are rated on a 5-point Likert scale from *problematic* to *above average*. The VADPRS score is calculated for each subscale as both a binary symptom count and as a total sum score of parent ratings. There are established clinical cut-offs for deriving a diagnosis that integrated both symptom severity scores and the performance subscale score (Wolraich et al., 2003).

Procedure

The project was approved by the Institutional Review Board at the University of Pittsburgh.

We contracted with the research agency YouGov to administer the VADPRS along with additional measures to a national sample of parents/guardians of children aged 5–12 years that was representative of the U.S. population on key demographic variables. YouGov is a large survey company that uses a panel of over 1.2 million U.S. residents who have been recruited through web advertising, permission-based e-mail campaigns, partner contacts, random digit dialing, and mail (based on voter registration). Demographic information from many panelists was obtained in previous studies, allowing for selection to represent the national population. The representative sample for this study was created by matching parents/guardians on variables of age, gender, and race to a sampling frame constructed by stratified sampling from the 2016 ACS 1-year sample. The matched cases were weighted to the sampling frame using propensity scores (Lindhiem et al., 2019).

Links to the survey including the VADPRS and other measures were emailed to YouGov panelists who have opted in to receive relevant surveys. Email survey links are appropriate for such a study, as internet samples are reasonably representative of the population (Hays et al., 2015). The response rate to the emailed survey link was 52.8%. Of those who initiated the survey, 46.2% met eligibility criteria as a parent/guardian of a child ages 5–12. Participants were compensated $25 for completing the full set of questions.

Analysis

Analysis of variance was performed for subjects in the study based on both age and sex, in addition to descriptive statistics for the whole sample with the dimensional scores. Age was treated as a binned variable with bins being 5–6 years old, 7–8 years old, 9–10 years old, and 11–12 years old. Percentiles were calculated for the sample as a whole, as well as by age. Percentile calculations were conducted using a partial-inclusive definition of percentile, in which the percentile reflects the percentage of scores below a given score and one half of the equivalent scores (Crawford et al., 2009). Percentile norms were able to be responsibly calculated, as by conservative calculation, our

Table I. *Participant Demographic Characteristics*

	Total sample ($N = 1,570$)	2016 ACS estimates[a]
Child age	$M = 8.6$; $SD = 2.3$	
5–6 years	24.7%	
7–8 years	21.1%	
9–10 years	27.4%	
11–12 years	26.8%	
Child sex		
Female	46.8%	50.8%
Male	53.2%	49.2%
Child race		
White	70.4%	72.6%
Black or African American	11.9%	12.7%
Asian	2.5%	5.4%
American Indian or Alaska Native	0.9%	0.8%
Native Hawaiian or Pacific Islander	0.8%	0.2%
Some other race	5.5%	5.1%
Multiple races selected	8.7%	3.2%
Child ethnicity		
Hispanic, Latino, or Spanish Origin	18.6%	17.8%
Not Hispanic, Latino, or Spanish Origin	81.4%	82.2%
Parent/guardian education		
High school graduate or higher	96.5%	87.5%
Bachelor's degree or higher	36.9%	31.3%
Median Household Income[b]	$50,000–60,000	$57,617

[a]Data from 2016 American Community Survey (ACS) 1-year estimates of U.S. adult population.
[b]Family income was collected by $10,000 bins to $100,000.

smallest group ($n = 707$ for 5- to 8-year-old children) was larger than the minimum sample size ($n = 385$) for alpha 0.05 and acceptable error of 0.05 (Bartlett et al., 2001). Percentiles were directly converted to *T*-scores.

Additionally, internal consistency (Cronbach's alpha) was calculated for total scores for each subscale. For symptom scoring, descriptive statistics for the whole sample were performed for each subscale, as well as measures of internal consistency [Kudar-Richardson 20 (KR-20)]. If a parent omitted any item of a subscale, the subscale score was not calculated. For any individual subscale, the number of incomplete surveys was 4 or less. Only 10 parents did not answer every question. All statistical analysis was performed using SPSS v28.0 (IBM) software.

Results

Preliminary Analyses

The VADPRS was completed by 1,570 parents/guardians and scores were calculated for each of the subscales to evaluate for inattentive presentation ADHD (items 1–9), hyperactive presentation ADHD (items 10–18), ODD (items 19–26), CD (items 27–40), and ANX/DEP (items 41–47). A composite scale of total ADHD score was also calculated (items 1–18). Scoring of the scales was done using both binary symptom counts (symptom scoring) and total scores (dimensional scoring).

Dimensional Scoring

The dimensional score sums the 0–3 Likert scale ratings for each item. Raw scores for each of the subscales were calculated: total ADHD ($M = 15.6$; $SD = 10.96$), inattentive presentation ADHD ($M = 8.1$; $SD = 5.70$), hyperactive presentation ADHD ($M = 7.5$; $SD = 6.04$), ODD ($M = 5.9$; $SD = 4.92$), CD ($M = 2.2$; $SD = 5.53$), and ANX/DEP ($M = 2.9$; $SD = 3.68$). Scores for each subscale were right (positively) skewed in distribution (see Histogram, Supplemental Digital Content 1). Each subscale demonstrated good internal consistency with Cronbach's alpha values of 0.94 (total ADHD), 0.92 (Inattentive ADHD), 0.91 (Hyperactive ADHD), 0.91 (ODD), 0.96 (CD), and 0.90 (ANX/DEP) (see Table II).

Group Differences (Dimensional Scoring)

Table III provides the mean total scores for the VADPRS subscales, with additional breakdowns by age and child sex. For the Total ADHD score, there were significant differences by age—$F(3, 1564) = 4.30$, $p = .005$, $\eta^2 = 0.008$—and sex—$F(1, 1564) = 20.03$, $p < .001$, $\eta^2 = 0.013$—of children. A post-hoc Tukey test indicated that 5- to 6-year-old children ($M = 17.1$; $SD = 10.68$) scored significantly higher than both 9- to 10-year-old ($M = 15.0$; $SD = 10.95$) and 11- to 12-year-old children ($M = 14.6$; $SD = 11.39$). For the Inattentive presentation ADHD subscale, there was a significant difference by sex of child: female ($M = 7.5$; $SD = 5.58$) versus male ($M = 8.5$; SD

Table II. *Measures of Internal Consistency*

	Dimensional scoring	Symptom scoring
Total ADHD	0.944	0.915
Inattentive ADHD	0.917	0.877
Hyperactive/Impulsive ADHD	0.909	0.856
ODD	0.909	0.869
CD	0.960	0.922
ANX/DEP	0.902	0.855

Note. ADHD = Attention Deficit/Hyperactivity Disorder; ODD = Oppositional Defiant Disorder; CD = Conduct Disorder; ANX/DEP = Anxiety/Depression.
Dimensional Scoring = Cronbach's alpha. Symptom scoring = KR-20.

Table III. *Dimensional Scoring VADPRS*

	Total ADHD (0–54)	*p*	ADHD Inattentive (0–27)	*p*	ADHD Hyperactive (0–27)	*p*	ODD (0–24)	*p*	CD (0–42)	*p*	ANX/DEP (0–21)	*p*
Total	15.6 (10.96)		8.1 (5.70)		7.5 (6.04)		5.9 (4.92)		2.2 (5.53)		2.9 (3.68)	
Child Age		.005		.874		<.001		.251		.853		.015
5–6 years	17.1 (10.68)*#		8.2 (5.51)		8.8 (5.91)*		6.2 (4.72)		2.4 (5.87)		2.5 (3.55)*	
7–8 years	16.0 (10.58)		7.9 (5.53)		8.1 (5.75)#		6.0 (4.96)		2.1 (5.57)		2.6 (3.44)	
9–10 years	15.0 (10.95)*		8.0 (5.66)		7.0 (6.02)*		5.5 (4.69)		2.1 (5.39)		3.1 (3.72)	
11–12 years	14.6 (11.39)#		8.1 (6.05)		6.5 (6.14)*#		5.8 (5.26)		2.0 (5.32)		3.2 (3.89)*	
Child Sex		<.001		<.001		<.001		.006		.545		.855
Female	14.3 (10.54)		7.5 (5.58)		6.8 (5.74)		5.5 (4.75)		2.1 (5.69)		2.9 (3.67)	
Male	16.8 (11.19)		8.5 (5.77)		8.2 (6.2)		6.2 (5.04)		2.2 (5.38)		2.9 (3.69)	

Note. Items marked with * and # were significant on Tukey post-hoc analysis. ADHD = Attention Deficit/Hyperactivity Disorder; ODD = Oppositional Defiant Disorder; CD = Conduct Disorder; ANX/DEP = Anxiety/Depression.

= 5.77)—$F(1, 1567) = 12.73$, $p < .001$, $\eta^2 = 0.008$. In the Hyperactive presentation ADHD subscale, there were significant differences by age—$F(3, 1566) = 12.79$, $p < .001$, $\eta^2 = 0.024$—and sex—$F(1, 1566) = 22.65$, $p < .001$, $\eta^2 = 0.014$. A post-hoc Tukey test revealed that 5- to 6-year-old children ($M = 8.8$; $SD = 5.91$) scored significantly higher than both 9- to 10-year-old ($M = 7.0$; $SD = 6.02$) and 11- to 12-year-old children ($M = 6.5$; $SD = 6.14$); 7- to 8-year-old children ($M = 8.1$; $SD = 5.75$) also scored significantly higher than the 11- to 12-year-old children.

With the ODD subscale, there was a significant difference by sex—$F(1, 1568) = 7.68$, $p = .006$, $\eta^2 = 0.005$—with female children ($M = 5.5$; $SD = 4.75$) scoring significantly lower than male children ($M = 6.2$; $SD = 5.04$). With the anxiety/depression subscale, there were statistically significant differences by age—$F(3, 1568) = 3.51$, $p = .015$, $\eta^2 = 0.007$. Post-hoc Tukey analysis demonstrated a significant difference specifically between 5- and 6-year-old children ($M = 2.5$; $SD = 3.55$) and 11- to 12-year-old children ($M = 3.2$; $SD = 3.89$). There was no statistical difference for the CD subscale by sex or age.

Percentiles were calculated for the raw scores of each of the subscales and are displayed in Table IV. Additional percentiles of the raw scores by age group for the subscales in which differences were significant by age are presented as Table, Supplemental Digital Content 2.

Symptom Scoring

The symptom score identifies a behavior as present if a parent rates it as "often" or "very often" corresponding to a 2 or 3 on the 0–3 Likert scale. Scores for each of the subscales were calculated: Total ADHD ($M = 3.4$; $SD = 4.62$), inattentive presentation ADHD ($M = 1.7$; $SD = 2.51$), hyperactive presentation ADHD ($M = 1.8$; $SD = 2.49$), ODD ($M = 1.1$; $SD = 2.02$), CD ($M = 0.5$; $SD = 2.01$), and ANX/DEP ($M = 0.4$; $SD = 1.28$). By the recommended cut-offs for a positive screen, 7% of children screened positive for combined presentation ADHD, 11% of children screened positive for hyperactive presentation ADHD, 11% for inattentive presentation ADHD, 12% for ODD, 5% for CD, and 6% for ANX/DEP. Scores for each subscale were right (positively) skewed in distribution. Each subscale demonstrated adequate to good internal consistency with KR-20 values of 0.92 (Total ADHD), 0.88 (Inattentive ADHD), 0.86 (Hyperactive ADHD), 0.87 (ODD), 0.92 (CD), and 0.86 (ANX/DEP) (see Table II).

Group Differences (Symptom Scoring)

The mean total scores for the VADPRS subscales with additional breakdowns by age and child sex were calculated (see Table V). There was a significant difference by sex of child for the Total ADHD scale: female ($M = 2.9$; $SD = 4.33$) versus male ($M = 3.8$; $SD = 4.83$)—$F(1, 1564) = 15.39$, $p < .001$, $\eta^2 = 0.010$). For

Table IV. *VADPRS Subscale Dimensional Scores—Percentiles (T-Scores)*

Score	Total	Inattentive	Hyperactive	ODD	CD	ANX/DEP
0	2 (29)	3 (31)	4 (32)	5 (33)	29 (45)	17 (41)
1	4 (33)	8 (36)	11 (38)	14 (39)	67 (54)	42 (48)
2	7 (35)	14 (39)	18 (41)	23 (43)	79 (58)	54 (51)
3	10 (37)	19 (41)	26 (44)	33 (46)	84 (60)	64 (54)
4	12 (38)	26 (44)	33 (46)	42 (48)	88 (62)	72 (56)
5	16 (40)	33 (46)	41 (48)	50 (50)	90 (63)	79 (58)
6	19 (41)	40 (48)	48 (50)	59 (52)	91 (63)	84 (60)
7	23 (43)	47 (49)	55 (51)	67 (54)	92 (64)	88 (62)
8	26 (44)	55 (51)	61 (53)	75 (57)	93 (65)	92 (64)
9	30 (45)	64 (54)	67 (54)	80 (58)	93 (65)	93 (65)
10	34 (46)	71 (56)	73 (56)	84 (60)	94 (66)	95 (66)
11	39 (47)	76 (57)	76 (57)	87 (61)	94 (66)	95 (67)
12	43 (48)	80 (58)	79 (58)	89 (62)	94 (66)	96 (68)
13	47 (49)	83 (60)	82 (59)	91 (63)	95 (66)	97 (69)
14	52 (51)	86 (61)	85 (60)	92 (64)	95 (67)	98 (71)
15	56 (52)	88 (62)	87 (61)	94 (66)	96 (68)	98 (71)
16	60 (53)	90 (63)	89 (62)	95 (67)	96 (68)	99 (72)
17	63 (53)	91 (63)	91 (63)	96 (68)	97 (68)	99 (73)
18	67 (54)	93 (65)	93 (65)	97 (68)	97 (69)	99 (75)
19	70 (55)	95 (66)	94 (66)	97 (69)	97 (69)	99 (77)
20	73 (56)	96 (67)	95 (67)	98 (70)	97 (69)	99 (77)
21	75 (57)	97 (68)	96 (68)	98 (71)	97 (69)	99 (81)
22	77 (57)	97 (69)	97 (69)	99 (73)	97 (69)	
23	78 (58)	98 (70)	97 (69)	99 (74)	98 (70)	
24	80 (58)	98 (71)	98 (71)	99 (78)	98 (70)	
25	82 (59)	99 (72)	99 (72)		98 (71)	
26	83 (60)	99 (73)	99 (73)		98 (71)	
27	85 (60)	99 (77)	99 (77)		98 (71)	
28	87 (61)				99 (72)	
29	88 (62)				99 (73)	
30	89 (62)				99 (74)	
31	90 (63)				99 (75)	
32	91 (63)				99 (75)	
33	92 (64)				99 (75)	
34	92 (64)				99 (75)	
35	93 (65)				99 (76)	
36	94 (66)				99 (77)	
37	95 (67)				99 (77)	
38	96 (67)				99 (78)	
39	96 (67)				99 (78)	
40	96 (68)				99 (79)	
41	97 (68)				99 (81)	
42	97 (69)				99 (85+)	
43	97 (69)					
44	98 (70)					
45	98 (71)					
46	98 (71)					
47	99 (72)					
48	99 (72)					
49	99 (73)					
50	99 (74)					
51	99 (74)					
52	99 (75)					
53	99 (76)					
54	99 (79)					

Note. Total = Total ADHD; ODD = Oppositional Defiant Disorder; CD = Conduct Disorder; ANX/DEP = Anxiety/Depression.

the Inattentive presentation ADHD subscale, there was a significant difference by sex of child: female ($M = 1.4$; $SD = 2.36$) versus male ($M = 1.8$; $SD = 2.61$)—$F(1, 1567) = 11.14$, $p < .001$, $\eta^2 = 0.007$. In the Hyperactive presentation ADHD subscale, there were significant differences by age—$F(3, 1566) = 5.14$, $p = .002$, $\eta^2 = 0.010$—and sex—$F(1, 1566) = 15.31$, $p < .001$, $\eta^2 = 0.010$. A post-hoc Tukey test revealed that 5- to 6-year-old children ($M = 2.1$; $SD = 2.54$) scored significantly higher than both 9- to 10-

Table V. *Symptom Scoring VADPRS*

	Total ADHD (0–18)	*p*	ADHD Inattentive (0–9)	*p*	ADHD Hyperactive (0–9)	*p*	ODD (0–8)	*p*	CD (0–14)	*p*	ANX/DEP (0–7)	*p*
TOTAL	3.4 (4.62)		1.6 (2.51)		1.8 (2.49)		1.1 (2.02)		0.5 (2.01)		0.4 (1.28)	
Child Age		.163		.951		.002		.625		.967		.720
5–6 years	3.8 (4.61)		1.7 (2.43)		2.1 (2.54)*#		1.1 (1.88)		0.5 (1.97)		0.4 (1.20)	
7–8 years	3.5 (4.44)		1.6 (2.38)		1.9 (2.46)		1.2 (2.10)		0.5 (2.10)		0.4 (1.21)	
9–10 years	3.2 (4.67)		1.6 (2.54)		1.6 (2.49)*		1.0 (1.92)		0.5 (2.06)		0.5 (1.32)	
11–12 years	3.2 (4.72)		1.7 (2.64)		1.5 (2.43)#		1.2 (2.18)		0.5 (1.92)		0.5 (1.38)	
Child Sex		<.001		.001		<.001		.021		.775		.732
Female	2.9 (4.33)		1.4 (2.36)		1.5 (2.33)		1.0 (1.90)		0.5 (2.11)		0.5 (1.30)	
Male	3.8 (4.83)		1.8 (2.61)		2.0 (2.61)		1.2 (2.11)		0.5 (1.92)		0.4 (1.27)	

Note. Items marked with * and # were significant on Tukey post-hoc analysis. ADHD = Attention Deficit/Hyperactivity Disorder; ODD = Oppositional Defiant Disorder; CD = Conduct Disorder; ANX/DEP = Anxiety/Depression.

year-old ($M = 1.6$; $SD = 2.49$) and 11- to 12-year-old children ($M = 1.5$; $SD = 2.43$). With the ODD subscale, there was a significant difference by sex—$F(1, 1568) = 5.31$, $p = .021$, $\eta^2 = 0.003$—with female children ($M = 1.0$; $SD = 1.90$) scoring significantly lower than male children ($M = 1.2$; $SD = 2.11$). There was no statistical difference noted for CD or ANX/DEP subscales by age or sex.

Percentiles for each of the subscales were calculated using the symptom scoring (see Table, Supplemental Digital Content 3).

Discussion

Overview

This analysis of the five subscales of the VADPRS provides a set of nationally representative norms and percentiles. The VADPRS demonstrates good internal consistency reliability, particularly when using the total score. The strength of this study is the analysis of both dimensional scoring and symptom scoring, each of which will be addressed separately.

Dimensional Scoring

The total raw score of the VADPRS provides more complete data for the researcher, and we recommend using this total score in the research setting. While a clinical screener of symptom counts has utility in identifying behaviors as present or not, there is additional value in capturing a dimensional profile across behaviors. Raw scores also allow for comparison to prior outcome studies and offer more refined information for clinical use by having norms based on sex and age. This study provides norms previously absent in the literature for total scores from the VADPRS across ADHD, ODD, CD, and anxiety/depression in a nationally representative U.S. sample.

A notable trend was observed for child age, with younger children scoring higher on the hyperactive presentation ADHD scale and lower on the anxiety/depression subscales, though the effect sizes are small. The higher score in the hyperactive presentation of ADHD is consistent with other studies, which have demonstrated higher rates of hyperactivity/impulsivity behavior in younger children with and without ADHD (Leopold et al., 2016) as well as higher rates of ADHD diagnosis and treatment among younger children than their same-grade classmates (Holland & Sayal, 2019; Sayal et al., 2018). This trend stresses the importance of considering the developmental context of a child when formulating a diagnosis of ADHD. The higher score of older children in the combined anxiety/depression subscale requires further consideration also. With older children demonstrating more symptoms consistent with anxiety and depression, it is important to both monitor these children closely for evidence of anxiety or depression requiring intervention and to consider other expressions of anxiety and depression in younger children that may not be evaluated in the VADPRS (Sequeira et al., 2020). Percentiles for these age differences were calculated (see Table, Supplemental Digital Content 2), but it appears that their additional clinical utility is modest.

The dimensional scores from the VADPRS had good internal consistency ranging from 0.90 to 0.96 across the subscales, which is adequate for screening purposes. In previous psychometric evaluation (Bard et al., 2013; Wolraich et al., 2003), the subscales as described in the development of the tool were grouped into externalizing (ODD/CD) and internalizing (anxiety/depression) in addition to the two presentations of ADHD (inattentive and hyperactive/impulsive), and yielded internal consistencies above 0.90 Thus, the internal consistency of the VADPRS dimensional scores in our sample is consistent with previous studies.

Although the original publication of the VADPRS did not use dimensional scores, those have been recommended by others for the comorbidity subscales but not the primary ADHD domains. These recommended "rule out" cut-offs were ODD <10, CD <4, and ANX/DEP <4 (Becker et al., 2012). These correspond to scores below the 84th (ODD), 88th (CD), and

72nd (ANX/DEP) percentiles in our sample. While there are no dimensional score cut-offs for the primary ADHD scales present in the literature, scores of 16 or higher in both the ADHD scales place participants at or above the 89th percentile. This percentile range corresponds to the positive screens in the symptom scoring modality.

Symptom Scoring

In the clinical setting, the VADPRS is used largely as an initial screening inventory for children with suspected ADHD, ODD, CD, or comorbid anxiety and depression, in alignment with the DSM-V criteria for ADHD, ODD, and CD. Performing a symptom count using responses of *often* or *very often* as recommended by the AAP/NICHQ (NICHQ, 2002), we were able to quantify the number of symptoms present in the average child and to examine the distribution of scores in the nationally representative sample.

The internal consistencies of the clinical subscales of the VADPRS in this U.S. nationally representative sample varied from those reported previously in the literature. Internal consistency in this study ranged from 0.86 to 0.92, compared to values all above 0.90 reported in previous analysis of community samples (Bard et al., 2013; Wolraich et al., 2003). The ADHD subscales for inattentive and hyperactive/impulsive presentation ADHD had internal consistencies of 0.88 and 0.86. With values above 0.80, we can still recommend the symptom scoring of the VADPRS as a screen for ADHD and its comorbidities in the clinical setting.

The symptom scoring cut-off values are also of importance to the clinical provider in determining which children require additional evaluation for ADHD or its comorbidities. The initially published cut-offs to meet the criteria for common comorbidities of ADHD were $\geq$6 for the ADHD subscales, $\geq$4 for ODD, $\geq$3 for CD, and $\geq$3 for ANX/DEP with 23% of children screening positive for ODD or CD and 8% screening positive for Anxiety/Depression (Wolraich et al., 2003). In our sample, these cut-offs correspond to positive screens in 7% for combined ADHD, 11% for inattentive ADHD, 10% for hyperactive ADHD, 12% for ODD, 5% for CD, and 6% for ANX/DEP. While the percent positive for comorbidities in our study is lower than in the initial tool development, this is likely due to our study being representative of the general population rather than children with teacher-identified ADHD symptoms as in the initial psychometric study (Wolraich et al., 2003). Thus, we can still recommend these cut-offs as useful in the clinical setting. Percentiles for the symptom scoring modality were calculated as well (see Table, Supplemental Digital Content 3), which can provide guidance for clinicians in comparing a child's scoring to national norms for the presence of behaviors associated with ADHD or its comorbidities. Scores above the cut-offs represent a positive screen and we would recommend additional evaluation for the presence of ADHD or a comorbid condition. Scores below the cut-off indicate a negative screen, but if clinical suspicion remains present and especially in the case of significant behavioral burden despite a negative screen, additional evaluation is appropriate. Although 11% and 10% of our samples screen positive for inattentive and hyperactive/impulsive ADHD presentations respectively, it is worth reiterating that a positive screen for ADHD behaviors does not meet criteria for diagnosis, which requires indication of impairment (not collected in this study) and presence of behaviors meeting criteria in at least two distinct settings (these data are from a single setting).

Study Strengths and Limitations

This study provides robust national norms for the VADPRS, filling a gap in the literature of the VADPRS. Furthermore, we were able to provide norms for two different scoring modalities, with utility as either a screening tool or a more comprehensive dimensional profile.

This study provides norms and percentiles for the VADPRS, which is a parent-reported measure regarding a child's behavior as witnessed by parents, usually at home. The diagnosis of ADHD requires presence of behaviors in two settings, usually home and school, as well as indication of impaired functioning. We do not provide data on impairment or collateral from another setting in this study (i.e., VADTRS data), so it is not possible to determine the rate of ADHD present in our sample, as we cannot establish than any child meets criteria for ADHD diagnosis.

This study is additionally limited to data from parents/guardians of children ages 5–12. Although the VADPRS was originally developed for children ages 6–12, it is now widely used for children ages 4–17 years. It would be of benefit for future studies to provide normative data for the VADPRS and study ADHD in additional age ranges.

The survey used in the study was administered electronically to participants. Those who are not as accustomed to using technology or who were otherwise unable to participate are absent in our data and could represent parents/caregivers who differ from those represented in our data.

Conclusion

The VADPRS provides an efficient way to screen for the diagnostic behaviors of ADHD as well as common comorbidities in a pediatric population. Our paper has provided norms on the clinical subscales of the VADPRS from a U.S. nationally representative sample

of children, filling a previous gap in the literature on this widely used scale. We have additionally provided data based on both the recommended symptom count (symptom scoring) and a raw score (dimensional scoring) modality. Given the wide use of the Vanderbilt scales in both clinical and research settings, having national norms will provide a robust comparison for those who study different patient populations and will further contribute to the reliability of the VADPRS in clinical screening.

Supplementary Data

Supplementary data can be found at: https://academic.oup.com/jpepsy.

Funding

This study was supported by a grant to the last author from the Eunice Kennedy Shriver National Institute of Child Health and Human Development (R21HD090145).

Conflicts of interest: None declared.

References

American Psychiatric Association. (2013). Neurodevelopmental disorders. In *Diagnostic and statistical manual of mental disorders*. https://doi.org/10.1176/appi.books.9780890425596.dsm01

Bard, D. E., Wolraich, M. L., Neas, B., Doffing, M., & Beck, L. (2013). The psychometric properties of the Vanderbilt Attention-Deficit Hyperactivity Disorder Diagnostic Parent Rating Scale in a community population. *Journal of Developmental and Behavioral Pediatrics: JDBP*, *34*(2), 72–82. https://doi.org/10.1097/DBP.0b013e31827a3a22

Barkley, R. A. (2014). *Attention-deficit/hyperactivity disorder: A handbook for diagnosis and treatment*. Guilford Publications.

Bartlett, J. E., Kotrlik, J. W., & Higgins, C. C. (2001). Organizational research: Determining appropriate sample size in survey research. *Information Technology, Learning, and Performance Journal*, *19*(1), 43–50.

Becker, S. P., Langberg, J. M., Vaughn, A. J., & Epstein, J. N. (2012). Clinical utility of the Vanderbilt ADHD diagnostic parent rating scale comorbidity screening scales. *Journal of Developmental and Behavioral Pediatrics: JDBP*, *33*(3), 221–228. https://doi.org/10.1097/DBP.0b013e318245615b

Chang, J. G., Cimino, F. M., & Gossa, W. (2020). ADHD in children: Common questions and answers. *American Family Physician*, *102*(10), 592–602.

Charach, A. (2020). Editorial: Time for a new conversation on stimulant use. *Journal of the American Academy of Child and Adolescent Psychiatry*, *59*(8), 929–930. https://doi.org/10.1016/j.jaac.2019.10.004

Crawford, J. R., Garthwaite, P. H., & Slick, D. J. (2009). On percentile norms in neuropsychology: Proposed reporting standards and methods for quantifying the uncertainty over the percentile ranks of test scores. *The Clinical Neuropsychologist*, *23*(7), 1173–1195. https://doi.org/10.1080/13854040902795018

Danielson, M. L., Bitsko, R. H., Ghandour, R. M., Holbrook, J. R., Kogan, M. D., & Blumberg, S. J. (2018). Prevalence of parent-reported ADHD diagnosis and associated treatment among U.S. children and adolescents, 2016. *Journal of Clinical Child and Adolescent Psychology: The Official Journal for the Society of Clinical Child and Adolescent Psychology, American Psychological Association, Division 53*, *47*(2), 199–212. https://doi.org/10.1080/15374416.2017.1417860

Felt, B. T., Biermann, B., Christner, J. G., Kochhar, P., & Harrison, R. V. (2014). Diagnosis and management of ADHD in children. *American Family Physician*, *90*(7), 456–464.

Hays, R. D., Liu, H., & Kapteyn, A. (2015). Use of Internet panels to conduct surveys. *Behavior Research Methods*, *47*(3), 685–690. https://doi.org/10.3758/s13428-015-0617-9

Holland, J., & Sayal, K. (2019). Relative age and ADHD symptoms, diagnosis and medication: A systematic review. *European Child & Adolescent Psychiatry*, *28*(11), 1417–1429. https://doi.org/10.1007/s00787-018-1229-6

Leopold, D. R., Christopher, M. E., Burns, G. L., Becker, S. P., Olson, R. K., & Willcutt, E. G. (2016). Attention-deficit/hyperactivity disorder and sluggish cognitive tempo throughout childhood: Temporal invariance and stability from preschool through ninth grade. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *57*(9), 1066–1074. https://doi.org/10.1111/jcpp.12505

Leslie, L. K., Weckerly, J., Plemmons, D., Landsverk, J., & Eastman, S. (2004). Implementing the American Academy of Pediatrics attention-deficit/hyperactivity disorder diagnostic guidelines in primary care settings. *Pediatrics*, *114*(1), 129–140. https://doi.org/10.1542/peds.114.1.129

Lindhiem, O., Vaughn-Coaxum, R. A., Higa, J., Harris, J. L., Kolko, D. J., & Pilkonis, P. A. (2019). Development and validation of the Knowledge of Effective Parenting Test (KEPT) in a nationally representative sample. *Psychological Assessment*, *31*(6), 781–792. https://doi.org/10.1037/pas0000699

NICHQ. (2002). *NICHQ – Vanderbilt Assessment Scale – Parent Information*. AAP and NICHQ.

Sayal, K., Prasad, V., Daley, D., Ford, T., & Coghill, D. (2018). ADHD in children and young people: Prevalence, care pathways, and service provision. *The Lancet Psychiatry*, *5*(2), 175–186. https://doi.org/10.1016/S2215-0366(17)30167-0

Sequeira, S. L., Silk, J. S., Woods, W. C., Kolko, D. J., & Lindhiem, O. (2020). Psychometric properties of the SCARED in a nationally representative U.S. sample of 5-12-year-olds. *Journal of Clinical Child and Adolescent Psychology: The Official Journal for the Society of Clinical Child and Adolescent Psychology, American Psychological Association, Division 53*, *49*(6), 761–772. https://doi.org/10.1080/15374416.2019.1614001

Shaw, M., Hodgkins, P., Caci, H., Young, S., Kahle, J., Woods, A. G., & Arnold, L. E. (2012). A systematic review and analysis of long-term outcomes in attention deficit hyperactivity disorder: Effects of treatment and non-

treatment. *BMC Medicine*, *10*, 99.https://doi.org/10.1186/1741-7015-10-99

Thapar, A., & Cooper, M. (2016). Attention deficit hyperactivity disorder. *The Lancet*, *387*(10024), 1240–1250. https://doi.org/10.1016/S0140-6736(15)00238-X

U.S. Census Bureau. (2019). American Community Survey 2019 1-year estimates. https://data.census.gov/cedsci/

Wolraich, M. L., Lambert, E. W., Bickman, L., Simmons, T., Doffing, M. A., & Worley, K. A. (2004). Assessing the impact of parent and teacher agreement on diagnosing attention-deficit hyperactivity disorder. *Journal of Developmental and Behavioral Pediatrics: JDBP*, *25*(1), 41–47. https://doi.org/10.1097/00004703-200402000-00007

Wolraich, M. L., Lambert, W., Doffing, M. A., Bickman, L., Simmons, T., & Worley, K. (2003). Psychometric properties of the Vanderbilt ADHD diagnostic parent rating scale in a referred population. *Journal of Pediatric Psychology*, *28*(8), 559–567. https://doi.org/10.1093/jpepsy/jsg046