Family Practice, 2018, Vol. 35, No. 3, 336–341
doi:10.1093/fampra/cmx115
Advance Access publication 21 November 2017

OXFORD

Research Methods

Test–retest reliability of the adult ADHD Self-Report Scale (ASRS) v1.1 Screener in non-ADHD controls from a primary care physician practice

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Abstract

Objectives. To examine the test–retest reliability of the DSM-IV Adult ADHD Self-Report Scale (ASRS) v1.1 Screener in adults without ADHD. Prior studies have not examined test–retest reliability of the Screener in non-ADHD controls.

Methods. Subjects completed the Screener in a primary care physician (PCP) waiting room (T1); those who screened negative for ADHD (n = 104) (<4/6 significant Screener items) symptoms were further assessed on the phone (T2). T2 included phone administration of the full ASRS v1.1 Symptom Checklist (which contains the six items from the Screener). Spearman's correlations and intra-class correlation coefficients (ICCs) between T1 and T2 were calculated for the total Screener score and for each Screener item. McNemar–Bowker tests were conducted for the Screener total score and each item to check for significant changes from T1 to T2.

Results. Screener T1 and T2 total scores were significantly correlated (Spearman's rho = 0.78, $P < 0.0001$), as were individual items. Correlations remained significant when controlling for a variety of demographic factors and psychiatric conditions. Confirming the significant Spearman correlations, ICCs for Screener total score and each item were also significant (ICC = 0.75, $P < 0.0001$). The McNemar–Bowker tests showed no significant differences for Screener total score and for the IA items; however, the H-I items were somewhat higher at T1 versus T2.

Conclusions. The DSM-IV ASRS v1.1 Screener has high test–retest reliability in patients without ADHD.

Key words: Attention deficit hyperactivity disorder, control groups, screening tests, test–retest reliability.

Introduction

Attention-deficit/hyperactivity disorder (ADHD) is a chronic neuropsychiatric disorder defined by symptoms of inattention, hyperactivity and impulsivity (1). Adult ADHD is one of the most commonly occurring DSM-IV disorders in the general US population, with a prevalence ranging 6–8% of school-age children (2). About 75% of children continue to suffer from ADHD as adolescents (3), and 50–60% continuing to have it as adults (4,5). Currently, it is estimated that about 4% of the American population suffers from adult ADHD (4). Symptoms of ADHD cause distress and clinically significant impairment in daily functioning across multiple domains including school, work, home and social life. It is estimated to result

in about 120 million lost workdays per year in the United States and about $19.5 billion lost human capital per year (4).

Primary care physician (PCP) practices are fraught with many issues in diagnosing ADHD in adults including lack of clear diagnostic criteria, confidence with diagnosis and time and availability of a quick screener (6,7). The World Health Organization (WHO) Adult ADHD Self-Report Scale v1.1 (ASRS v1.1) identifies adults at risk for adult ADHD in primary care settings (Table 1) (8). The six questions in the Screener were extracted from the 18 item ASRS Symptom v1.1 Checklist based on psychometrics that best predicted DSM-IV ADHD [corresponding to the 18 DSM-IV adult ADHD criteria, including the nine hyperactive-impulsive (H-I) and nine inattentive (IA)]. It has been shown to be a useful tool in identifying adult ADHD, with a positive predictive value of 0.94 and a negative predictive value 0.24 and other good operating characteristics (sensitivity of 68.7% for the six-question screener and 56.7% for the full 18-item assessment, specificity of 99.5% versus 98.3%, respectively and total classification accuracy of 97.9% versus 96.2%, respectively (9). This self-administered scale has been translated into over 20 languages and many studies have replicated similar good operating characteristics in general population surveys both in the United States (9–11) and internationally (12–14).

One measure of a scale's ability to accurately measure ADHD symptoms is its ability to reproduce ratings when a subject is measured twice over a short period of time, during which it is unlikely that intervening events would change the degree to which symptoms and impairment are expressed. The reproducibility of tests is evaluated with a test–retest reliability which gives a measure of reproducibility, such as a correlation or kappa coefficient, where zero indicates no reproducibility and one indicates perfect reproducibility. If a measure is not reliable, it cannot be valid. Thus, it is critical to evaluate the ASRS v1.1 Screener's test–retest reliability in a variety of contexts in which it is employed.

Past studies that have examined the screener's test–retest reliability in English-speaking, Chinese, Israeli, and Korean populations (12–14). However, these studies included multiple limitations such as small sample sizes, lack of diverse demographics with regard to age and ethnic backgrounds, lack of diverse psychiatric histories and lack of control for psychiatric co-morbidities, or only using chart reviews to examine psychiatric co-morbidities. The present study aimed to examine the test–retest reliability for the ASRS v1.1 Screener in a PCP practice among a diverse American population while controlling for psychiatric co-morbidities, age, ethnic background, gender and length of retest time. The ASRS v1.1 Screener, which was designed to screen for DSM-IV adult ADHD, was used in this study, as the ASRS Screener for DSM-5 was not available at the time of study recruitment.

Methods

Participants

Adults aged 18–60, inclusive, being seen for office visits were recruited in the waiting room of a large primary care practice affiliated with NYU Langone Medical Center as part of a study to update the ASRS Screener for DSM-5 (15).

All recruitment and consent procedures adhered to the principles of the Declaration of Helsinski and the Belmont Report principles and were approved and a HIPPA waiver granted by the Institutional Review Board of NYU Langone School of Medicine permitted collection of basic information about the patient at T1 before verbal telephone consent was obtained at T2. Participants were also required to sign a release of protected health information allowing research staff to contact the participants' primary care doctor regarding any new diagnosis/diagnoses that arose during the clinical interview. Participants who refused to sign this form were excluded from the study.

ASRS Time 1: screening

Study coordinators provided the adults an information sheet about the study which contained the ASRS Screener v1.1 (ASRS T1). Patients who screened negative for ADHD based on the Screener but endorsed ASRS symptoms and consented for enrollment were scheduled for T2 phone assessment. Additionally, those who reported having a current ADHD diagnosis or who did not speak enough English to allow for a comprehensive ADHD evaluation (determined by research staff) were excluded.

ASRS Time 2: telephone clinical assessment

Participants were contacted by trained research staff between 0 and 21 days after ASRS T1. Phone assessments included 34-item expanded ASRS Symptom Checklist v1.1, the Mini International Neuropsychiatric Interview 7.0 (MINI) to screen for DSM-5 psychiatric co-morbidities and the Adult ADHD Clinical Diagnostic Scale (ACDS) v1.2 to confirm lack of current DSM-5 adult ADHD diagnosis. Demographics were also collected.

Table 1. The Adult ADHD Self-Report Scale (ASRS-v1.1) Screener

Please answer the questions below, rating yourself on each of the criteria shown using the scale on the right side of the page. As you answer each question, place an X in the box that best describes how you have felt and conducted yourself over the past 6 months.	Never	Rarely	Sometimes	Often	Very Often
1. How often do you have trouble wrapping up the final details of a project, once the challenging parts have been done?					
2. How often do you have difficulty getting things in order when you have to do a task that requires organization?					
3. How often do you have problems remembering appointments or obligations?					
4. When you have a task that requires a lot of thought, how often do you avoid or delay getting started?					
5. How often do you fidget or squirm with your hands or feet when you have to sit down for a long time?					
6. How often do you feel overly active and compelled to do things, like you were driven by a motor?					

Rating scales

To screen for adult ADHD at T1 *(through the measurement of 6 current ADHD symptoms)* and to assess current ADHD symptoms at T2, the ASRS v1.1 6-item Screener version and the expanded symptom checklist, respectively, were used. The Adult ADHD Self-Report Scale v1.1 (ASRS v1.1) was developed to ease identification of adult ADHD in primary care settings (7). The Screener was developed by extracting the six questions that psychometrically best predicted DSM-IV ADHD from the 18 item ASRS Symptom v1.1 Checklist, which corresponds to the 18 DSM-IV adult ADHD criteria [nine hyperactive-impulsive (H-I) and nine inattentive (IA)]. The Screener and the Symptom Checklist use a 5-point Likert scale to rate ADHD symptomatology (0 = Never, 1 = Rarely, 2 = Sometimes, 3 = Often and 4 = Very Often). Depending on the item, 'sometimes', 'often' and 'very often' suggests clinical impairment for that specific item. This self-administered scale has been translated into over 20 languages and has shown to have very good operating characteristics (e.g. sensitivity, specificity, total classification accuracy) in general population surveys both in the United States (9–11) and internationally (12–14).

Adult ADHD was assessed via the *Adult ADHD Clinical Diagnostic Scale* (ACDS v1.2) (16,17), a semi-structured research diagnostic interview used in multiple studies of adult ADHD (18,19). The interview begins with a retrospective assessment of all symptoms of childhood ADHD and then assessed an expanded set of recent (past year) symptoms including all DSM-5 Criterion A1 and A2 symptoms, using child and adult specific prompts for ADHD symptoms and yields a DSM-IV and DSM-5 diagnosis of adult ADHD.

The MINI is short structured clinical interview that can be used to evaluate for DSM-5 ICD-10 psychiatric co-morbidities. It has been well-validated and is widely used in a variety of studies to evaluate for psychiatric co-morbidities, including ADHD studies (20,21)

All assessments have been validated for phone assessment (22–24). All clinical interviews were administered by two coordinators with experience in adult ADHD (one with a BA and one with a BS) trained by one of the investigators (LAA). Calibration meetings were held between the coordinators to prevent rater drift and consistent ratings and validity of the interviews was established by meetings with one of the investigators (LAA). Any participants who had new diagnoses that arose from the clinical interviews were advised of their diagnoses and their PCP was notified.

Data analysis

All statistical analyses were conducted using SPSS version 22. The first six items of the ASRS Symptom Checklist (administered at T2 assessment) are the ASRS Screener questions. Thus, for present analysis used the first six items (ASRS T2). Internal consistencies of the overall ASRS Screener, four IA items (Qs 1–4) and two H-I items (Qs 5–6) at T1 and T2 were assessed by Cronbach's alpha (α). Spearman correlations were conducted to examine the relationship between T1 and T2 symptoms for the total ASRS Screener score. Intra-class correlation coefficients (ICCs) were also used to confirm the correlation between T1 and T2 scores. Spearman correlations were examined for ASRS total score between T1 and T2 for the Screener's ix items (i.e. 'total score') and each of the respective items and IA and H-I scores. The McNemar–Bowker test was also conducted to test for significant change between T1 and T2 ASRS scores. All tests were two-tailed and used a significant level of P <0.05 unless indicated otherwise.

Results

Demographic characteristics of the sample

Data from 104 people without ADHD were analysed. See Figure 1 for a description of the recruitment and the final number of subjects whose data were analysed. These data comprised the ASRS scores from the 101 ADHD subjects who completed all T1 and T2 assessments and ASRS scores from the 4 ADHD subjects who did not complete all of the T2 assessments but completed at least the T2 ASRS and ACDS. The sample was diverse in gender, age (M = 38.1 years old, SD = 10.8) and demographics, comprising of 35% male and 65% female. Additionally, 69.2% self-identified as Caucasian, 16.3% as African American, 9.6% as Asian and 4.8% unknown/other. About 15.4% of the analysed subjects self-identified as Hispanic. Past and current psychiatric co-morbidities as captured by the MINI are reported in Table 2.

Screener and item reliability

Twenty-one subjects had the T1 and T2 ASRS conducted on the same day and 84 were not on the same day [64 (1–4 days apart), 18 (6–9 days apart) and 2 (10–21 days apart)]. Internal consistencies for the ASRS total score, IA items and H-I items for T1 and T2 ASRS were fair (0.54–0.61; H-I T2 = 0.96) and generally consistent, with the exception of H-I T2 items. Average total scores and internal consistencies for the ASRS total score, IA items and H-I items for T1 and T2 ASRS are presented in Table 3.

Test–retest reliability

There was a significant correlation between T1 and T2 for ASRS total scores (Spearman's rho = 0.78, P < 0.0001) and for item-by-item analyses (Spearman's rho 0.61–0.79, Ps < 0.0001; see Table 4 for means and individual correlations). Spearman correlations remained significant when controlling for gender, race, having a psychiatric diagnosis as confirmed by the MINI, having T1 and T2 being conducted on the same day and being greater or lesser than the mean age (all Ps < 0.05).

Additionally, ICCs were high and significant for each item (0.75–0.89; Table 4) and remained high and significant when controlling for day of assessment and gender (all Ps < 0.0001). The McNemar–Bowker test demonstrated that there was not a significant change between T1 and T2 total score (P = 0.09; Table 4). Further, the McNemar–Bowker test found no significant changes for the first four ASRS items, which comprise the four adult ADHD IA items (all Ps ns, Table 4). Of note, ASRS scores for items 5 and 6, which represent the H-I items, were not as non-significant. ASRS item 5 remained non-significant (P = 0.08), yet ASRS item 6 was significant (P = 0.04).

Conclusion

The analysis presented here replicate earlier findings of high internal consistency and reliability of the ASRS v.1.1 Screener in a broad population of non-ADHD subjects seen in primary care offices. These results held up when controlling for gender, ethnicity, age and psychiatric co-morbidities. Unlike previous studies looking at the ASRS screener, the demographics in this study included a variety of ethnicities and psychiatric co-morbidities. High internal consistency was demonstrated for individual items, inattention subscores, impulsive-hyperactivity subscores and for the total score based on Cronbach's alpha and Spearman's rho coefficients, ICCs and McNemar–Bowker tests. Furthermore,

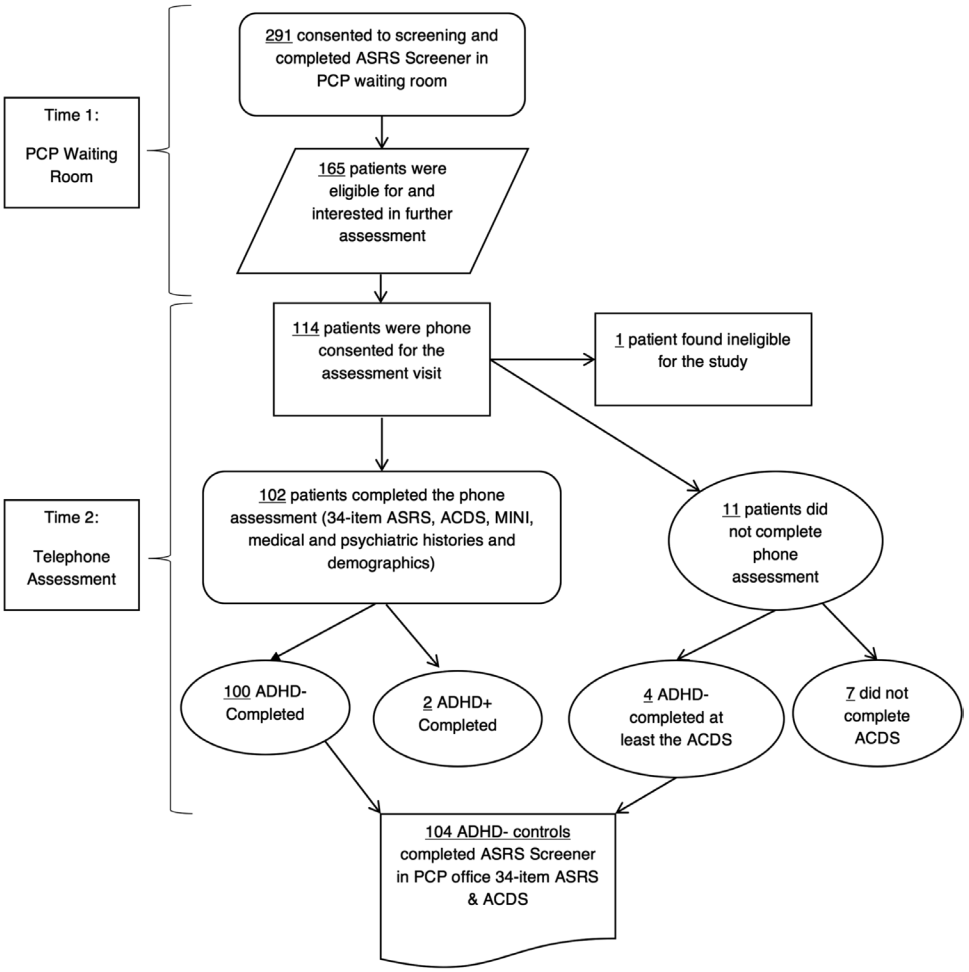

Figure 1. Flow diagram of ADHD negative control study recruitment from a primary care practice collected from 2015 to 2016. ASRS, Adult ADHD Self-Report Scale; PCP, primary care physician; ACDS, Adult ADHD Clinical Diagnostic Scale.

Table 2. Past and current psychiatric co-morbidities of the primary care patients recruited from 2015 to 2016

	N	%
Major depressive disorder (lifetime)	29	27.6
Panic disorder (lifetime)	7	6.67
Social anxiety disorder (current)	5	4.76
Generalized anxiety disorder (current)	4	3.81
Suicidality (lifetime)	3	2.86
Agoraphobia (current)	2	0.95

there was high item test–retest reliability, regardless of mode of administration (in-person or telephone) as seen by the fact that the original assessments were done in-person and the follow-up was done over the telephone. In addition, time to follow-up did not change the screener's reliability. The internal consistency coefficients and test–retest reliability as measured by ICC were similar to previous studies (12–14).

The difference in scores between the IA ASRS items (items 1–4) were much more non-significant between T1 and T2 than they were for items 5 and 6 (the H-I symptoms), which were not as insignificantly different between T1 and T2. While the score difference in ASRS item 5 between T1 and T2 still remained non-significant, it was significant for ASRS item 6. It is possible that for those without ADHD, the repetition of the question in the T2 evaluations increased patient's awareness of their lack adult ADHD symptoms, resulting in accounted for higher scores in T1 versus T2 ratings on most items, and in a significant difference for ASRS item 6. The higher ASRS item 6 baseline score may also be a result of the ASRS T1 being administered in a PCP waiting room, while patients were waiting to see their PCP. Thus, patients may have felt more fidgety and restless, which raised their T1 scores. Their H-I symptoms while at home on the phone may have been decreased, creating enough of a difference to influence the McNemar–Bowker findings between T1 and T2. The IA score differences between T1 and T2 were non-significant, so it is likely that the differences in the H-I items is driving the trend level of significance difference in the total ASRS score.

This study had a few limitations. Firstly, at ASRS T1, subjects were asked to reflect on the past 6 months, while for ASRS T2, they were asked to reflect on the past 1 month. While the different time-frames pose a weakness, it may support the ability of the ASRS to accurately measure stable ADHD symptoms, irrespective of the exact time-frame being assessed. Also, use of different time frames would have led to underestimates in reliability, not overestimates. A second limitation was that the setting of T1 and T2 were different, the first being done in the waiting room of a PCP office and the second was done over the phone. Because this difference would

Table 3. Internal consistency of the Adult ADHD Self-Report Scale (ASRS) v1.1 Screener at T1 and T2 from primary care patients recruited from 2015 to 2016

	ASRS v1.1 T1			ASRS v1.1 T2		
	Cronbach's α	Average score		Cronbach's α	Average score	
		M	SD		*M*	SD
ASRS total score	0.54	7.51	2.84	0.53	6.96	2.94
IA score	0.57	4.86	2.04	0.61	4.64	2.18
H-I score	0.59	2.66	1.70	0.96	2.32	1.82

IA, inattentive; H-I, hyperactive-impulsive; *M*, mean; SD, standard deviation.

Table 4. Test–retest reliability of ASRS v1.1 Screener symptom ratings of primary care patients recruited from 2015 to 2016 between T1 and T2

ASRS v1.1 Screener/Symptom Checklist Qs 1–6	Average scores		Reliability		
	T1 mean score (SD)	T2 mean score (SD)	Spearman's rho[a]	ICC*	McNemar–Bowker (*P*-value)
1. Trouble wrapping up the final details of a project	1.12 (0.74)	1.06 (0.80)	0.67	0.83	4.14 (0.39)
2. Difficulty with organization	1.06 (0.71)	1.06 (0.73)	0.61	0.78	1.49 (0.83)
3. Problems remembering appointments/ obligations	0.99 (0.77)	0.97 (0.80)	0.66	0.79	5.23 (0.39)
4. Delays/avoids tasks that require a lot of thought	1.70 (0.86)	1.55 (0.88)	0.67	0.82	6.02 (0.42)
5. Fidgets/squirms when seated for a long time	1.42 (1.02)	1.23 (1.10)	0.75	0.86	11.17 (0.08)
6. Driven by a motor	1.24 (1.00)	1.10 (1.02)	0.79	0.89	11.88 (0.04)
Total ASRS Screener score	7.51 (2.84)	6.96 (2.94)	0.78	0.75	4.88 (0.09)

ASRS, Adult ADHD Self-Report Scale; ICC, intra-class correlation coefficient; SD, standard deviation.
[a]All *P*s < 0.0001 unless otherwise noted.

have added more noise to the assessments, it would also have led to underestimates in reliability, not overestimates. Additionally, the T2 raters were not blinded to the participant's T1 ADHD symptom scores, which could have influenced the T2 ratings. Although the T2 ASRS ratings were self-report, bias from T2 could have influenced the way that the raters asked the questions during the evaluation. Further, characteristics of the participants assessed at T1 but not assessed at T2 (due to ineligibility, lack of interest, or other reasons) were not collected. This could result in a bias in the final sample, possibly inflating the results.

Finally, this study employed the DSM-IV version of the screener, which differs from the DSM-5 version which was recently validated (15). Although both are six item screeners, rated on a 0–4 basis, the scoring schemes and weighting of items differ. The DSM-IV version contains all items from the core 18 inattentive and hyperactive-impulsive items in the DSM, while the DSM-5 version contains four items from the core 18 items in DSM along with two items assessing executive dysfunction, which are not DSM. While the psychometric properties of the DSM-5 Screener are superior to those of the DSM-IV ASRS v1.1 Screener, the earlier version of the screener was found also to have reasonable sensitivity and specificity in identifying individuals at risk for adult ADHD. As the DSM-5 Adult ADHD Screener has just been released, there is likely to be ongoing employment of the DSM-IV version for a period of time. Therefore, these data on the test–retest properties of the original screener further establish the utility of the ASRS Screeners and the authors intend to extend the examination of the test–retest properties to the DSM-5 version of the screener in a future trial.

Notwithstanding these limitations, the results of this study confirm that the ASRS v1.1 Screener has high test–retest reliability and internal consistency, as confirmed by use of an ADHD population and the use of multiple statistical measures and this study was meant to minimize the problems of previous studies that examined these psychometrics. Each of the six items is internally consistent and reliable.

Declaration

Funding: Funding for the current analyses from DataStat, Inc., Ann Arbor, MI and NYU School of Medicine Office of Industrial Liaison.
Ethical approval: NYU School of Medicine Institutional Review Board (#s i11-00073 and i14-02111).
Conflict of interest: In the past year, LAA has had Grant/Research support from Sunovion Pharmceuticals, Enzymotec, Shire Pharmaceuticals, Lundbeck; Consultant: Sunovion Pharmaceuticals, Shire Pharmaceuticals, Enzymotec, Alcobra Pharmaceuticals, National Football League, Major League Baseball, Rhodes Pharmaceuticals; Shire Pharmaceuticals; Royalty payments (as inventor) from NYU for the license of adult ADHD scales and training materials since 2004. In the past year, SVF has received income, potential income, travel expenses continuing education support and/or research support from Lundbeck (advisory board, travel) Rhodes (consulting), Arbor (research grant) KenPharm (advisory board, travel), Ironshore (stock, consulting, advisory board, travel) Shire (research grant, advisory board, travel) Akili Interactive Labs (consulting, travel), Alcobra (advisory board, travel) VAYA (consulting) Sunovion (research grant), Neurovance (travel), CogCube (advisory board), NeurolifeSciences (advisory board) and Genomind (consulting). With his institution, he has US patent US20130217707 A1 for the use of sodium-hydrogen exchange inhibitors

in the treatment of ADHD. In previous years, he received support from Shire, Neurovance, Alcobra, Otsuka, CogCubed, McNeil, Janssen, Novartis, Pfizer and Eli Lilly. Dr Faraone receives royalties from books published by Guilford Press: *Straight Talk about Your Child's Mental Health*, Oxford University Press: *Schizophrenia: The Facts* and Elsevier: ADHD: *Non-Pharmacologic Interventions*. He is principal investigator of www.adhdinadults.com. SVF does not stand to benefit from the material success of the ASRS. He does consult to companies that might have an interest in the ASRS so that could change his consulting opportunities. He currently has pending a grant request to Shire to fund an accredited Continuing Medical Education program about the ASRS. In the past 3 years, RCK received support for his epidemiological studies from Sanofi Aventis; was a consultant for Johnson & Johnson Wellness and Prevention, Shire, Takeda; and served on an advisory board for the Johnson & Johnson Services, Inc. Lake Nona Life Project. RCK is a co-owner of DataStat, Inc., a market research firm that carries out health care research. None of the other authors has any conflicts to declare.

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