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Refining Diagnostic Procedures for Adults with Symptoms of ADHD: A Response to “Psychometrically-Informed Approach to Integration of Multiple Informant Ratings in Adult ADHD Diagnosis in a Community-Recruited Sample”

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Abstract

Attention Deficit/Hyperactivity Disorder (ADHD) is a chronic disorder that afflicts individuals into adulthood. The field continues to refine diagnostic standards for ADHD in adults, complicated by the disorder’s heterogeneous presentation, subjective symptoms, and overlap with other disorders. Two key diagnostic questions are: from whom to collect diagnostic information and which symptoms should be contained on an adult diagnostic checklist. Using a trifactor model, Martel et al. examine these questions in a sample of adults with and without self-identified ADHD symptoms. In this response, we highlight the importance of the authors’ finding that self and informant symptom reports differ in a sample of adults who acknowledge ADHD symptoms. We also review issues that continue to face the field related to model specification, evaluating symptom utility, and sample composition, discussing how these issues influence conclusions that may be drawn from Martel et al. and similar investigations. We conclude that the paper makes an important research contribution about the nature of self and informant ADHD symptom reports, but emphasize that symptom checklist refinement must occur through a broad lens that considers work from a range of sample types and clinically informative analytic strategies.

Introduction

In the 1960’s, the modern history of Attention Deficit/Hyperactivity Disorder (ADHD) began with the publication of the Diagnostic and Statistical Manual of Mental Disorders’ second edition (DSM-II; American Psychiatric Association; APA, 1968). Clinical observations of school-aged children who were overtly overactive, distractible, and restless led to increasing recognition of what appeared to be a common syndrome (Conners, 1970). At the time of the DSM-II’s publication, “hyperkinetic reaction of childhood” was typically characterized by impairing unruly behavior at home and school and professionals were instructed that the disorder typically diminished by adolescence (APA, 1968).

In the 1970's and 1980's, a handful of longitudinal studies followed children with ADHD into adolescence and adulthood (Weiss & Hechtman, 1986; Loney, Kramer, & Milich, 1981; Satterfield, Hoppe, & Schell, 1982; Mannuzza & Gittelman, 1984). These studies laid to rest claims that symptoms of ADHD fully diminished by the end of childhood. By adulthood, many individuals with a childhood diagnosis of ADHD still experienced symptoms resembling the attention and self-control deficits they experienced as children. Some even still met full criteria for the disorder (for review see Klein & Mannuzza, 1991). Even when ADHD symptoms appeared to relent by adulthood, major life outcomes for children with ADHD were substantially impaired compared to typically developing peers. These early longitudinal studies uncovered clinically meaningful risks for criminality, substance abuse, and emergent psychiatric disorders among adults who had been diagnosed with ADHD in childhood (Klein & Mannuzza, 1991).

During the 1990's, the field accepted the notion that ADHD is a chronic disorder affecting individuals through the lifespan (Barkley, 1998). Neuroimaging, genetic, and cognitive developmental research emerged over the next two decades that solidified this understanding (Faraone et al., 2005; Li, Sham, Owen, & He, 2006; Nigg, 2001; Swanson et al., 2000; Yu-Feng et al., 2007). With increased public attention on the disorder, it also became increasingly common for individuals to present clinically with complaints of suspected ADHD for the first time in adulthood (Faraone et al., 2006).

The growing demand on professionals to assess ADHD in adulthood is complicated by several issues (Molina & Sibley, 2015). First, until the recent publication of the DSM-5 (APA, 2013), the DSM offered no guidance regarding how symptoms might present uniquely in adults. Because many ADHD symptoms are internal, somewhat subjective, overlapping with other disorders, and contextually variable (Knouse et al., 2007), determining symptom presence can be a mystifying process (Murphy & Adler, 2004). Second, honoring the chronicity of ADHD, all editions of the DSM require that symptoms be documented from childhood (APA, 1980–2013). Of course, there is a logistical burden of obtaining childhood records or accurate recollections of the individual's childhood behavior from family members (Miller, Newcorn, & Halperin, 2009). On top of this challenge, professionals also are presented with a dilemma when the individual clearly reports current symptoms but no childhood origin is apparent. In some cases, a newly presenting adult may have a history of subclinical symptoms that only became noticeable when environmental demands or risk factors increased later in life (Faraone et al., 2006; Faraone & Biederman, 2016). In other cases, the individual may be feigning symptoms to gain stimulant medications for performance enhancement or post-secondary educational accommodations (Sollman, Ranseen, & Berry, 2010; McCabe, West, Teter, & Boyd, 2014). Still others may be individuals without ADHD who misperceive normal variations in their attention or behavior as representing meaningful dysfunction (Murphy, Gordon & Barkley, 2002). Finally, there is also the possibility that symptoms are better accounted for by another disorder such as depression, substance abuse, or anxiety (Barkley, 2010). Thus, diagnosing professionals are often tasked with the challenge of establishing complicated and subjective ADHD symptoms in an individual with no clear history of the disorder.

The undertaking of diagnosing ADHD in adults is further confused by the consistent finding that adults with ADHD who were diagnosed in childhood often underreport their symptoms (Barkley, Murphy, & Fischer, 2008; Sibley et al., 2012). For example, in the Multimodal Treatment of ADHD Study (MTA; MTA Cooperative Group, 1999), only 25% of adults with persistent ADHD since childhood reported current symptoms that matched or exceeded the level indicated by their parents (Sibley et al., 2016). Despite evidence of self-reporting problems among adults with ADHD, most adult clinical settings and epidemiological studies rely solely on self-reports to diagnose ADHD in adults (Adler et al., 2006; Kessler et al., 2010; Wilens et al., 2009). As such, the recommendation has been made by us and others to consult parent or other informant reports to corroborate self reports when assessing adult ADHD symptoms (Barkley et al., 2008; Faraone & Biederman, 2016; Kooij et al., 2008; Molina & Sibley, 2015; Sibley et al., 2012; Zucker, Morris, Ingram, Morris, & Bakeman, 2002). However, we acknowledge that by definition, self-referring adults report significant ADHD symptoms, leaving unclear whether informant report adds new information to the diagnostic process in these cases. We propose that some circumstances in particular warrant these additional data (e.g., feigning ADHD, confusing ADHD and cognitive symptoms from drug abuse). However, the disconnect between the self-reporting behaviors of adults with a childhood diagnosis of ADHD and adults seeking ADHD diagnosis or treatment in clinics remains puzzling. It is likely that individuals with a childhood history of ADHD and individuals who first notice their symptoms in adulthood possess distinct characteristics related to insight, motives to report symptoms, willingness to acknowledge difficulties, or ability to thoroughly engage in assessments. As such, diagnostic recommendations derived from samples whose ADHD was apparent in childhood require replication in samples of adults who self-identify current symptoms.

Response to Martel et al. (2016)

The Martel et al. (2016) study is responsive to the need for more research on the utility of informant report when assessing ADHD among adults who acknowledge symptoms. Adults were recruited from two sources: community advertisements about a study of attention and clinics treating adults with and without attention problems. Thus, the sampling captured individuals from several of the populations mentioned above. In concert with collection of informant report, this allowed Martel and colleagues (2016) to compare the incremental utility of collateral information between adults with and without current and self-referred ADHD. Thus, the Martel study begins to fill a void in the research-practice gap. At the same time, we propose that the implications of the Martel et al. (2016) and similar investigations should be considered in light of three factors: (1) the statistical model's specification, (2) the prevailing definition of what makes a strong diagnostic symptom, and (3) the composition of the study sample. We highlight these three factors because ADHD is a heterogeneous diagnostic category comprised of individuals with varying presentations and neurocognitive profiles. As such, multiple studies with different types of samples and analytic strategies are needed to fully examine all aspects of the broader diagnostic question (i.e., how to diagnose ADHD in adults). The issues we raise below are not specific to Martel et al., (2016); they reflect a broad need for the field to draw diagnostic conclusions from cumulative evidence across multiple studies.

Model Specification

Martel et al. (2016) used latent variable modeling to test the hypothesis that informants and target adults provide distinct perspectives when reporting ADHD symptoms. They tested a trifactor model in which three latent sources of variance were presumed to cause the observed self- and informant-symptom reports: (1) an overall trait factor for ADHD, (2) two symptom dimensions (factors) representing inattention and hyperactivity/impulsivity, and (3) two factors representing self- and informant-specific perspectives. The model is a hybrid between a trifactor measurement model tested by Bauer and colleagues (2013) and a bifactor model of ADHD symptoms previously evaluated by the authors (Martel, Roberts, Gremillion, von Eye, & Nigg, 2011) and others (Toplak et al., 2009).

The Bauer et al. (2013) trifactor model was developed to partition variation in individual item responses by multiple informants into three types of orthogonal latent factors representing informant perspectives, individual item variation, and a trait factor that represents the measured construct free of perspective bias and item-specific response variability. The Martel et al. (2011) bifactor model of ADHD obliquely partitioned variation in individual item responses into (1) an overarching ADHD latent factor that represented the syndrome and (2) two factors that reflect dimensional inattention and hyperactivity/impulsivity – two distinct but often co-occurring presentations of the disorder (Martel et al., 2011; Toplak et al., 2009). In merging these two models, Martel et al. (2016) modeled three types of orthogonal latent factors: (1) an overall trait construct for ADHD, (2) individual symptom dimensions of inattention and hyperactivity/impulsivity, and (3) factors representing self- and informant-specific perspectives. The variance unique to individual questionnaire items, as recommended by Bauer et al (2013), was not modeled. Below we consider the implications of this and other modeling decisions.

The specific design of the Martel et al. (2016) trifactor model means that interpretation of its factor loadings does not directly follow the Bauer et al. (2013) framework. In Martel et al. (2016), the variance due to an individual item's unique content was not partialled out of the overall ADHD or specific dimension factor loadings; therefore, the variance due to individual items manifests as either spurious variation within one of the modeled factors or as error variance. Given that the former situation would inflate factor loadings and the latter would deflate them, the factor loadings could be biased, but the nature of this bias is unclear.

Another decision point when merging the Martel et al (2011) bifactor model of ADHD with the Bauer et al. (2013) trifactor model approach is whether to specify relationships between latent factors as orthogonal (unrelated to each other) or oblique (permitted to correlate with each other). In the bifactor model of ADHD, Martel et al. (2011) modeled the latent ADHD factors obliquely to represent contemporary models of an ADHD syndrome that possesses unique but related inattentive and hyperactive/impulsive presentations. However, in the current study, the authors chose orthogonality, presumably reflecting the Bauer approach (trait, informant perspective, and item-specific factors were orthogonal). This specification imposes a structure in which inattention and hyperactivity/impulsivity must be uncorrelated with one another, as well as being mutually uncorrelated with the overall ADHD factor. Overall, it is hard for us to conceive of inattention and hyperactivity/impulsivity factors that

are completely unrelated to a general ADHD syndrome. Thus, we are unsure how to interpret the Martel et al. (2016) conclusion that some items possess more superior psychometric properties than others because they load strongly on the specific inattention or hyperactive/impulsive, and not the general ADHD factor. From our vantage point, it is unclear whether preference should be given to high correlations with the general factor or high correlations with specific factors due to the unclear nature of these factors.

Despite these points of debate, there are a couple of very clear findings when examining item factor loadings. First, some items loaded significantly on the self factor but not the informant factor. Thus, these symptoms were more likely to be revealed by self report than by informants, particularly for hyperactivity/impulsivity symptoms. Second, self-reported symptoms tended to possess notably large loadings on the general ADHD factor, while informant report possessed a balance of moderate loadings across general ADHD, symptom dimension, and informant factors. Despite our lack of certainty about the interpretation of the ADHD latent factors, these findings demonstrate clear differences between the self and informant perspectives in this sample, extending past work in samples of children with ADHD followed longitudinally into adulthood.

As part of their modeling approach, Martel et al. (2016) estimated threshold parameters that indicated the likelihood of each item's ordinal response option (1, 2, or 3) being endorsed by each rater. They also reported the associations between each latent factor and two indicators of criterion validity: executive functioning and impairment severity. Within this context, Martel et al. (2016) concluded that informants offer unique perspectives even when the adult acknowledges his or her own symptoms. We concur with this interpretation. The threshold parameter estimates indicated that informants were more likely than target adults to consistently detect and report elevated symptoms of inattention. Thus, some adults may not acknowledge their symptom severity as much as informants. Moreover, correlations between the latent factors and criterion validity indices indicated that the general ADHD and self report factors were more related to the individual's level of impairment, whereas the specific inattention and, to a lesser extent, informant factors were more related to executive functioning. Here, although we prefer to avoid making too much of the differences in associations across the latent ADHD factors, it is clear that self- and informant-perspectives are operating differently and offer unique information.

Overall, the selected model in Martel et al. (2016) offers several pieces of interesting psychometric information about the DSM ADHD items as rated by self and informants. The challenge is integrating these pieces of information and understanding their implications for diagnostic practice. It seems clear from the data that informants and target individuals offer unique perspectives during assessments and that informants provide better detection of severe inattention symptoms based on threshold parameters. Moreover, collection of both perspectives may provide the strongest, least biased estimate of symptomatic levels. However, additional modeling is likely needed to test hypotheses about ADHD subfactor-specific variation and to consider item-level performance after partitioning out item-specific variance as in Bauer et al (2013).

Determining Strong Diagnostic Symptom

Based on factor loading patterns, Martel et al. (2016) concluded that some DSM symptoms should be emphasized more than others when diagnosing ADHD in adults. Although we have some concern about over-interpreting these results due to the comments above, their conclusion elicits a question about how one determines the value of a diagnostic symptom. There is an important distinction between what makes a strong indicator of a research construct and what makes a useful diagnostic symptom (Kraemer, 2014). The former emphasizes selection of items that streamline the reliability and validity of a single summated dimension (Spector, 1982). During scale development, items are selected in a data-driven manner to preserve the underlying unidimensionality and specificity of the measured construct (DeVellis, 2012; Gerbing & Anderson, 1988). Diagnostic symptom checklists also require establishing traditional psychometric properties (i.e., discriminant validity, inter-rater, test-retest reliability; Blais & Norman, 1997; Kraemer, 2014). However, mental disorders are not always unidimensional constructs and presentations can be heterogeneous across subjects and time (Fried & Nesse, 2015). Moreover, diagnostic symptom checklists strive for brevity of non-overlapping symptoms to streamline the diagnostic process. As such, fully but efficiently encapsulating the disorder to accurately detect cases for diagnosis is key to creating a symptom checklist. Understanding each item's ability to detect true cases of the disorder and reject false ones supersedes the need for preserving the unidimensionality of a summated symptom dimension. This is certainly true for ADHD in adulthood, because symptom profiles among valid ADHD cases are highly diverse and correlate differentially with co-occurring comorbidities and impairments (Kolla et al., 2016). Thus, the validity of an adult ADHD symptom checklist is measured by its items' collective ability to correctly detect validated diagnoses and correctly reject cases determined not to have a disorder after thorough diagnostic evaluation (Goodman, 2001; Hanley & McNeil, 1982).

As the authors point out, the findings of this study demonstrate that one can devise an ADHD checklist to specifically maximize item correlations with a latent construct. This is a boon to researchers who seek to measure dimensional constructs with items that load distinctively and strongly on separate latent factors, but in clinical settings, must be balanced by the need to correctly diagnose individuals with atypical presentations. Selecting diagnostic checklist items using only the proposed measurement model approach might fail to include less common but equally valid presentations of ADHD, which is a highly heterogeneous disorder. Doing so may also over-accentuate symptoms that lead to false positive diagnoses. For instance, some items may be frequently endorsed by individuals who present with concerns similar to ADHD, but do not possess the disorder. As a next step, analyses such as receiver operating characteristics curves (Hanley & McNeil, 1982) or person-level analytic approaches (e.g., latent class analysis; McCutcheon, 1987) could be helpful in identifying checklist items that detect valid presentations of ADHD in adulthood. These types of analyses would offer important information about the extent to which an item or set of items optimizes the balance between diagnostic sensitivity and specificity and adequately encompass the breadth of presentations that can be expected from a heterogeneous disorder like ADHD.

Sample Composition

The Martel et al. (2016) sample contains 145 individuals with diagnosable ADHD, 60 with subclinical symptoms of the disorder, and 201 without symptoms of the disorder. This sampling strategy offers a nice opportunity to fully assess low, modest, and elevated levels of ADHD-related traits. One key consideration for this sample is that while a full distribution of individuals is optimal for studying dimensional trait measurement (DeVellis, 2012), it has been recommended that studies of diagnostic checklists be largely reliant on samples of individuals who are confirmed to possess the disorder or are likely to present for possible diagnosis (Kraemer, 2014). For one, it is not necessary to establish sensitivity to variations on the lower end of trait severity during symptom checklist validation. More importantly, population-specific diagnostic issues may be masked when the majority of the sample does not possess the disorder in question. This may be particularly relevant to understanding the utility of self vs. informant reports for adults who present for an ADHD diagnosis. Namely, whereas adults with ADHD have been shown to underreport symptoms compared to informants, adults without ADHD have been shown to over-identify ADHD symptoms in themselves, (Murphy et al., 2002; Sibley et al., 2012). In a sample that over-represents adults without ADHD, ADHD-related under-reporting may go undetected, and false conclusions may be drawn about the relative utility of self vs. informant report. As another example, because factor orthogonality creates inattention and hyperactive/impulsive factors that are uncorrelated with the general ADHD syndrome, it is also possible that a primarily non-ADHD sample could encourage inattention and hyperactive/impulsive factors that are non-specific to ADHD, instead driven by other forms of these symptoms (e.g., depression related concentration problems, substance abuse related cognitive problems, mania related overactivity). Because individuals without ADHD make up the majority of the Martel et al. (2016) sample, it is unclear whether some conclusions are driven by these non-ADHD cases, are not disorder specific, and therefore should not be extended to the ADHD population.

Another issue to consider is the extent to which data from the Martel et al. (2016) sample can be generalized to directly inform a universal diagnostic procedure for adults with ADHD. Previously, it was demonstrated that sample characteristics can lead to very different items being deemed optimal for an adult ADHD diagnostic checklist, such that there are now several recommended item sets that possess little overlap (Barkley et al., 2008; Faraone et al., 2010; Kessler et al., 2010; Sibley et al., 2012). This finding is not surprising, as the reliability of diagnostic protocols is known to be sensitive to sample-specific characteristics (Kraemer, 2014). This highlights the need to compare items deemed optimal from one angle to those judged optimal from another using cumulative evidence to make recommendations. We hesitate to recommend that certain symptoms be rejected, identified as optimal for screening, or differentially weighted based on findings from a single sample or single approach to establishing checklist reliability and validity.

As we have discussed elsewhere (Molina & Sibley, 2015; Sibley et al., 2012), individuals similar to those who make up the Martel et al. (2016) sample may represent only a subset of adults with ADHD because they acknowledge their current symptoms. It is clear from research that most individuals followed into adulthood after being diagnosed with childhood ADHD (i.e., longitudinal samples) do not fully report their symptoms in adulthood (Barkley

et al., 2008; Sibley et al., 2012). Similarly, individuals who were diagnosed with ADHD in childhood may be unlikely to enroll in a study that requires self-recognition of symptoms during the recruitment process. Although the Martel et al. (2016) study used general mailings and media advertisements to attract the participation of adults with ADHD, it also seems likely that many individuals with significant ADHD symptoms would experience barriers to enrollment because they are prone to difficulties with motivation, task completion, and self-directed behavior. Samples of self-identified adults with ADHD often favor individuals who are female, possessed subclinical symptoms of ADHD in childhood that were missed or not seriously impairing, and currently display less severe impairment than those whose symptoms were evident in childhood (Faraone & Biederman, 2016). When generalizing conclusions to the ADHD population at large, it is important to recognize that samples with this composition may oversample individuals who are less severe and more forthcoming about symptoms.

Currently, the most complicated diagnostic questions in the field of adult ADHD relate to differential diagnosis and detecting false positives (Asherson, Buitelaar, Faraone, & Rohde, 2016; Molina & Sibley, 2015). As such, there is a need to identify symptom wordings that clarify the expression of ADHD in adults compared to individuals who may be purposefully feigning ADHD, possess another mental health disorder with overlapping features, may be over-reporting subclinical symptoms, or are misperceiving normative variations in cognition and behavior. To draw firm conclusions about a symptom's value, its diagnostic accuracy and ability to detect the full range of adult ADHD phenotypes must be evaluated in samples that test differential diagnosis in these challenging scenarios. In acknowledgement of the need to clarify symptom presentation in adults, the DSM-5 ADHD criteria include developmental descriptors for each symptom that enumerate adult-specific symptom manifestations (APA, 2013). One limitation of the Martel et al. (2016) study, acknowledged by the authors, is the use of DSM-IV-TR rather than DSM-5 symptom wording. It is unclear whether the DSM-5 developmental descriptors would change endorsement patterns in this sample, as it has been shown to do in others (Sibley & Kuriyan, 2016). As such, conclusions about the properties of DSM-IV-TR items must be revisited using the DSM-5 symptom checklist items.

Conclusion

In sum, we believe that the Martel et al. paper makes an important contribution to the literature by providing an initial bridge between longitudinal child studies finding a need for informant report and studies of self-referred adults where the need for informant report has been an open question. The paper also brings up important questions about how to judge the value of a diagnostic symptom for an adult disorder as heterogeneous and complicated as ADHD (Faraone & Biederman, 2016). Further work on the issues raised by Martel et al. is necessary using person-level and diagnostic classification techniques (Collins & Lanza, 2010; Kraemer, 2014) in samples with complicated presentations that resemble challenging real-life diagnostic scenarios. Until studies such as these emerge in the literature, some questions about item utility will remain unresolved. It is likely that refining the diagnostic criteria for adults with ADHD will take a cumulative multi-study effort that acknowledges the unique vantage points offered by various sample types (i.e., adults with childhood

diagnoses, self-referring adults, epidemiological samples, samples of self-referred individuals who do not meet criteria for ADHD after thorough evaluation) and various forms of analyses (i.e. factor analytic, person-level, receiver operating characteristic curve).

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