Prevalence of ADHD Diagnosis and Treatment in African-American Children and Adolescents: A Systematic Review of the Literature

By
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Abstract

Purpose: To systematically review the literature to determine 1) the diagnostic and 2) treatment prevalence of attention deficit hyperactivity disorder among African American youth and compare the prevalence to Caucasian children and adolescents.

Methods: Medline, PsychInfo, and Web of Science databases were searched from 1994-present for cross-sectional studies, cohort, non-randomized clinical trials, and meta-analyses that contained information regarding the diagnostic prevalence or prevalence of treatment for ADHD and compared African-Americans children and/or adolescents with Caucasian children and/or adolescents. The author independently assessed studies for inclusion and quality.

Results: 10 studies met inclusion and quality criteria for diagnosis and/or treatment and thus received detailed evaluation. Four studies specifically compared prevalence of an ADHD diagnosis between African-Americans and Caucasians while 9 studies specifically addressed treatment rates for ADHD among different ethnic subgroups. Three of the four (75%) of the articles examining diagnostic prevalence demonstrated there was no significant difference in the likelihood of being diagnosed with ADHD between Caucasian American and African-Americans children. Of the articles examining treatment prevalence, seven of the nine (71.4%) articles demonstrated African-Americans were less likely than Caucasian Americans to receive ADHD medications. Of note, other disparities in diagnosis and treatment of ADHD such as regional and health insurance factors were noted.

Conclusions: Overall, it appears that disparities do exist in regards to ADHD treatment but not in diagnosis between African American and Caucasian youth. In addition to the need for higher quality, population-based studies that examine the disparate relationship between ADHD recognition and treatment in African American youth, further research should be dedicated to examining the factors that affect ADHD treatment rates in this group. Parental views and differential response to subtypes of ADHD treatment may play roles in this disparity.
Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is a neurobehavioral disorder characterized by six or more symptoms of inattentiveness or hyperactivity-impulsivity that have persisted for six months or more and that interfere with daily functioning (see Figure 1). It is among the most common psychiatric diagnoses of childhood in the United States and affects over two million children nationwide, or 3-5% of the population under 18 years of age. While it is estimated that African-Americans exhibit the same prevalence of ADHD as the Caucasian population, the true prevalence rate of ADHD among African-Americans is largely unknown due to lack of research aimed at group.

Deficits in research may lead to disparities in recognition and treatment of ADHD in the African-American population. Studies have shown that cultural factors influence the manifestation of ADHD in ethnic groups differently than in Euro-American groups, and thus research conducted primarily in Euro-American groups may not be generalizable to other ethnic groups. Furthermore, lack of evidence of the true prevalence of ADHD in the African-American community may lead to over- or under-diagnosis of ADHD by medical professionals and teachers. Therefore it is imperative to identify whether or not disparities truly exist by examining the prevalence of ADHD diagnosis and treatment among African-American youth compared with Caucasian youth.

Several barriers exist that can lead to potential misdiagnosis (i.e. over-diagnosis or under-diagnosis) and treatment of ADHD in African-American youth, and thus a misrepresentation of the true prevalence in this population. These include factors involving parents, health care providers, the healthcare system, teachers, and the education system. Socioeconomic factors may also play a role in possible misrepresentation of ADHD in the African-American community (Figure 2).
Figure 1. DSM IV Criteria for Attention Deficit Hyperactivity Disorder

Either (1) or (2)

(1). 6 (or more) of the following symptoms of inattention have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level:

**Inattention**

(a) often fails to give close attention to details or makes careless mistakes in schoolwork, work, or other activities
(b) often has difficulty sustaining attention in tasks or play activities
(c) often does not seem to listen when spoken to directly
(d) often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (not due to oppositional behavior or failure to understand instructions)
(e) often has difficulty organizing tasks and activities
(f) often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework).
(g) often loses things necessary for tasks or activities (e.g. toys, school assignments, pencils, books, or tools)
(h) is often easily distracted by extraneous stimuli
(i) is often forgetful in daily activities

(2) 6 (or more) of the following symptoms of hyperactivity-impulsivity have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level

**Hyperactivity**

(a) often fidgets with hands or feet or squirms in seat
(b) often leaves seat in classroom or in other situations in which remaining seated is expected
(c) often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, may be limited to subjective feelings of restlessness)
(d) often has difficulty playing or engaging in leisure activities quietly
(e) is often “on the go” or often acts as if “driven by a motor”
(f) often talks excessively

**Impulsivity**

(g) often blurts out answers before questions have been completed
(h) often has difficulty awaiting turn
(i) often interrupts or intrudes on others (e.g. butts into conversations or games)

B. Some hyperactive-impulsive or inattentive symptoms that caused impairment were present before age 7 years.

C. Some impairment from the symptoms is present in two or more settings (e.g. at school [or work] and at home).

D. There must be clear evidence of clinically significant impairment in social, academic, or occupational functioning.

E. The symptoms do not occur exclusively during the course of a Pervasive Developmental Disorder, Schizophrenia, or other Psychotic Disorder and are not better accounted for by another mental disorder (e.g. Mood Disorder, Anxiety Disorder, Dissociative Disorder, or a Personality Disorder)
Figure 2. Barriers to Diagnosis and Treatment of ADHD in African-American Youth
Potential Barriers to Diagnosis of ADHD in African-American Youth

Parent level factors

Health behavior, including demand for health services, is believed to be influenced by knowledge and beliefs held by individuals and their communities. Lack of knowledge of ADHD, including its characteristics, etiology, how it is diagnosed, and treatment options are factors that prevent parents of all ethnic and racial backgrounds from seeking help for their children with ADHD. However, this ignorance of ADHD seems to affect African-American parents to a larger extent than their Caucasian counterparts. In a study by Bussing et al., a sample of 486 parents (224 African-American parents and 262 white parents) of 2nd-4th graders at high-risk for ADHD were surveyed by telephone and subsequently participated in face-to-face interviews to examine their knowledge of ADHD. Although most parents (83%) reported having previously heard about ADHD, parental self-rated knowledge about ADHD varied considerably: 24% said they knew a lot, 30% said they knew some, 32% said they knew a little, and 14% said they knew nothing about ADHD. When the results were analyzed according to race, only 69% of African Americans had ever heard about ADHD compared to 95% of Caucasian parents (p<0.001) and fewer estimated that they knew some or a lot about ADHD (36% vs. 70%, p= <0.001).

Another parental barrier that may influence help-seeking for their children with ADHD lies in understanding the etiology of ADHD. The belief that inattention and hyperactivity/impulsivity symptoms are solely due to behavioral problems and not a medical condition may prevent parents from having the condition diagnosed by medical professionals. For instance, an interpretation of ADHD symptoms as a temporary adjustment phenomenon due to normal growth and development may lead parents to
believe that professional interventions are unnecessary. Differences in African-American parental beliefs of causation of ADHD compared to Caucasian parents’ beliefs may play a role in the discordance in help seeking for ADHD behaviors. According to Bussing and colleagues, when assessing parental beliefs of the origins of ADHD, significant differences were apparent between African American and Caucasian parents. This was especially true with regards to attributing ADHD to dietary sugar, genetics, and inherent shortcomings of their child. While more than 40% of caregivers overall incorrectly assumed excess dietary sugar to be the causal mechanism behind ADHD, twice as many African-American parents (59%) as Caucasian parents (30%) believed this to be true. A mere 10% of African-American parents were definitely sure that sugar was not the cause of ADHD compared to 37% of Caucasian parents. Bussing et al also found that African-American parents were less likely to attribute genetics as a cause of ADHD (75% vs. 91%, Fisher’s exact=0.017) and were less likely to use medical labels to refer to the disorder (25% vs. 62%, Fisher’s exact=0.000). The authors postulate that “disregarding the mainstream medical notion of ADHD may result in a lack of exchange about the disease within African American communities,” leading to a vicious cycle of misinformation about the disorder in this community.

The social stigma associated with a diagnosis of ADHD may also serve as a barrier for African-American parents to seek help for their children with symptoms of ADHD. In a market research poll conducted by Harris Interactive, 41% of African-Americans parents surveyed believed African-American children are more likely “mislabeled” as having ADHD compared to other children whereas only 13% of Caucasian parents believed Caucasian children were more likely to be “mislabeled.” Fifty-seven percent of African-
American parents cited fear of stigmatization as a major reason for not seeking diagnosis and treatment of ADHD.\textsuperscript{12}

\textit{Health Care Provider Factors}

Difficulties in standardizing a diagnostic tool for attention deficit hyperactivity disorder create a potential for cultural differences among ethnic and racial groups to influence the rate of diagnosis of ADHD. Bauermeister et al noted that both ADHD as a disorder and the instruments designed to assess it were derived from the perspective of Western professionals, using Western concepts of disorder and measurements, and without regard to cultural difference. In fact, studies have shown that behavior rating scales, one of the most common means of diagnosing ADHD, are not reliable across all ethnic groups.\textsuperscript{9}

A review of recognition of psychosocial problems in outpatient and ambulatory care settings conducted by Kelleher et al found that African-American children were identified less often as having behavioral problems by pediatricians.\textsuperscript{13} The reasons behind this may be many fold. Fear of causing additional problems via labeling of children may be a contributing factor to under-diagnosis of ADHD by physicians. In a qualitative study conducted in Great Britain involving families of children with ADHD and their physicians, Klasen and colleagues found that physicians were often reluctant to diagnose or medicalize a child’s inattentive and or hyperactive-impulsive behavior as ADHD because of the stigma attached to it.\textsuperscript{9} Another factor may be preconceived notions and stereotypes of African-American behavior. According to Bailey et al, a common misperception of African-American children is that they are more active than their peers from other backgrounds.\textsuperscript{8}
Teacher/Education System Factors

Since a large percentage of newly diagnosed ADHD cases are a result of teacher/educator referral, examining factors that may influence differences in reporting African-American and Caucasian students is essential. Similar to healthcare provider biases, teachers may have their own conscious or subconscious stereotypes of African-American youth that may potentiate misdiagnosis of ADHD. In a study examining teacher reports of DSM-IV ADHD, oppositional defiant disorder, and conduct disorder symptoms in schoolchildren, Nolan et al found teachers rated a larger percentage of African-American students as having ADHD as compared to Caucasian students (39.5% vs. 14.2%) and that this finding was consistent with previous studies. The authors note that in some cases teachers may have confused ADHD behaviors with other problems (e.g., low IQ, anxiety, psychosocial stressors).

Also similar to healthcare providers, problems with assessing cultural factors in behavioral rating scales may play a role in this seemingly over-diagnosis of African Americans students by their teachers. DuPaul et al assessed the factorial structure and normative data of a teacher rating scale containing the 18 symptoms of ADHD and found that teachers rated African American students significantly more hyperactive than Caucasian students and scored them higher on both the hyperactivity-impulsivity and inattention factors across all age ranges represented in this national sample. However, the authors recommend exercising caution in interpreting these results as validity of the structure of the test for each of the ethnic groups represented in the United States needs to be demonstrated. Similarly, in a study utilizing a behavior rating scale to identify ADHD
in Caucasian and African-American males, Reid et al found that although teachers rated African American students higher on all symptoms across all age groups, further analysis indicated the scale did not perform identically across all groups.\textsuperscript{7}

**Socioeconomic Factors**

As encountered in other health care disparities, socioeconomic factors may play a role in the proposed discrepancy in ADHD diagnosis between African-American and Caucasian youth. Knowledge about ADHD tends to be less apparent in families from low socioeconomic backgrounds compared to those from middle and high-economic backgrounds. Poorer families often have limited access to medical care and as a result underutilize health care services. Furthermore, low SES has been implicated as a risk factor for ADHD.\textsuperscript{18}

**Potential Barriers to Treatment of ADHD in African-American Youth**

According to Children and Adults with Attention Deficit/Hyperactivity Disorder (CHADD), Caucasians are three times more likely to be referred for treatment of ADHD compared to African Americans. In the few studies exploring medication rates across races, ethnic minority children are 2 to 2.5 times less likely to be medicated than their Caucasian counterparts.\textsuperscript{19} Factors at the parental level, health care system level, education system, and the media may present barriers to treatment in African-American youth as well.
Parent level factors

Aside from the factors that present barriers to diagnosis of ADHD previously described, some African-American parents may not see their child's ADHD as a large problem and thus may not be receptive to receiving treatment services for their children. Bussing et al. conducted a two-phase study in which they attempted to examine explanatory models of ADHD and model variation according to child characteristics. Interviews were conducted with parents of 182 elementary school children to gather information regarding their views on labeling and etiology of ADHD as well as their ideas of the severity of symptoms in their child, the time course for the disorder, treatment options, concerns and desired outcomes for their child's condition. The study investigators found that African-America parents voiced less concerns over academic performance than Caucasian parents (OR 0.41, 95% CI 0.19-0.91), and were less likely to request medication treatment (OR 0.26, 95% CI 0.1-0.6) or school interventions (OR 0.39, 95% CI 0.15-1.0). In general, parents of children not receiving treatment were less likely to voice emotional/behavioral concerns than parents of children receiving treatment (OR 0.34, 95% CI 0.17-0.70).

Another barrier to parents seeking treatment of their child's ADHD is intra-cultural issues of mistrust between African-Americans and the medical community. Bussing et al. postulates that because of the long history of inequitable medical treatment and abuse (e.g., Tuskegee experiment), African American parents may feel concerns over treatment options for ADHD not for lack of knowledge about its effectiveness, but because they “may not view medical professionals as trustworthy allies.”

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Impact of Misdiagnosis and Treatment of ADHD

Unrecognized and untreated attention deficit hyperactivity disorder can lead to several long-term health and behavioral consequences. Untreated ADHD often hinders a child’s ability to function and participate in school and social functions, putting them at greater risk for learning difficulties than children treated for ADHD. Symptoms of ADHD have been associated with lower IQ and poorer academic performance than their non-ADHD counterparts. Research shows that adults with untreated childhood ADHD are more than twice as likely to be arrested, twice as likely to get divorced, and twice as likely to hold 6 or more jobs in a 10-year period.

Attention deficit hyperactivity disorder is associated with comorbid psychiatric conditions such as depression, bipolar disorder, sleep problems, and phobias. These conditions are often exaggerated in children with unaddressed and/or untreated ADHD. In a study conducted by Abramowitz et al, 275 Caucasian and male inmates were interviewed and surveyed for evidence of childhood conduct problems and ADHD. The investigators found that although to a much smaller degree than conduct problems, childhood ADHD conferred a significant additional risk for the antisocial lifestyles aspects of psychopathology seen in male prison inmates. A similar study conducted by Rabiner et al sought to identify the predictors of aggressive offending persisting from adolescence into young adulthood in a sample of 622 African American male offenders over a six-year period. They found that higher rates of ADHD symptoms predict the persistence of aggressive offending into young adulthood.

There are other less legally serious comorbidities associated with ADHD that affect physical health and quality of life. Klassen et al used health-related quality-of-life (HRQL)
questionnaires, which are designed to gather information across a range of health domains, to determine quality of life across physical and psychosocial domains in a clinic-based sample of 131 children who had a diagnosis of ADHD. Physical functioning (PF), role/social limitations as a result of physical health (RP), bodily pain/discomfort (BP), and general health perception (GH) were the physical health domains evaluated using the 50-item parent version of the Child Health Questionnaire. Psychosocial domains included the following: role/social limitations as a result of emotional-behavioral problems (REB), self-esteem (SE), mental health (MH), general behavior (BE), emotional impact on parent (PTE), and time impact on parents (PTT). Additionally, a measure of limitations in family activities (FA) and family cohesion (FC) were made. Compared with children without ADHD, children with ADHD had “more parent-reported problems in terms of emotional behavioral role function, behavior, mental health, and self-esteem. In addition, the problems of children with ADHD had a significant impact on the parents’ emotional health and parents’ time to meet their own needs, and they interfered with family activities and family cohesion.”

**Purpose of Systematic Review**

The potential effects of misdiagnosed and treated attention deficit hyperactivity disorder can have astounding consequences for the African-American youth population. Before steps can be taken to address the issues presented, the true prevalence rate of diagnosis and treatment must be understood. The purpose of this review is to examine the diagnostic and treatment prevalence of attention deficit hyperactivity disorder among African-American children and adolescents and compare the prevalence to Caucasian children and adolescents.
Methods

Inclusion/Exclusion Criteria

Eligibility criteria were established a priori to identify studies that would answer the questions: Is there a difference in the prevalence or incidence rate of diagnosis of attention deficit hyperactivity disorder in African-American children/adolescents compared to Caucasian children/adolescents? Is there a difference in the prevalence/rates of treatment of attention deficit disorder in African-American children/adolescents compared to Caucasian children/adolescents? To answer both questions, criteria for studies were set to include cross-sectional studies, cohort, non-randomized clinical trials, and meta-analyses that compared African-Americans children and/or adolescents with Caucasian children and/or adolescents. Studies were considered eligible for review if they contained subjects aged 0–18 years with a diagnosis of ADD, ADD-H, or ADHD using the DSM-IV criteria, contained information regarding the diagnostic prevalence or prevalence of treatment for ADHD, and included results for both Caucasians and African-American children/adolescents in their results. See tables 1, 2, and 3 for exclusion criteria. Titles or abstracts of all potentially eligible studies were reviewed against these criteria. Possible or definitely eligible studies were retrieved and reviewed in detail by one reviewer. (Tables 1 and 2).
Table 1. General Inclusion/Exclusion Criteria

<table>
<thead>
<tr>
<th>Category</th>
<th>Inclusion</th>
<th>Exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database</td>
<td>PubMed, Web of Science, PsychInfo</td>
<td>Other databases</td>
</tr>
<tr>
<td>Languages</td>
<td>English</td>
<td>Other languages</td>
</tr>
<tr>
<td>Population</td>
<td>Humans</td>
<td>Animals</td>
</tr>
<tr>
<td>Study Design</td>
<td>Cross-sectional, cohort, non-randomized clinical trials, meta-analysis</td>
<td>RCTs, Letters, editorials</td>
</tr>
</tbody>
</table>

Table 2. Diagnostic and Treatment Prevalence Inclusion/Exclusion Criteria

<table>
<thead>
<tr>
<th>Category</th>
<th>Inclusion</th>
<th>Exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publication Date</td>
<td>1994-present (year DSM-IV criteria published)</td>
<td>Before 1994</td>
</tr>
<tr>
<td>Study Design</td>
<td>Cross-sectional, cohort, non-RCT, meta-analysis</td>
<td>RCT's letters, editorials</td>
</tr>
<tr>
<td>Outcomes of Interest</td>
<td>Prevalence or incidence rate</td>
<td></td>
</tr>
<tr>
<td>Study Population</td>
<td>Children and Adolescents (0 months-18 years)</td>
<td>Adults</td>
</tr>
</tbody>
</table>
Search Strategy

Three different search engines were used to perform the literature review: Medline, Web of Science, and PsychInfo. Medline utilized the following search terms: (African-American* OR Blacks OR Afro American) AND (ADHD OR ADD OR attention deficit hyperactivity disorder, OR attention deficit disorder) AND (adolescent* OR teen* OR pre-teen* OR children* OR child OR youngster* OR kid*). The search criteria for Web of Science included a combination of the following search terms: [TS=(ADHD OR attention deficit hyperactivity disorder OR ADD OR Attention deficit disorder) AND TS=(African American* OR Blacks OR Afro American*)] AND TS=(Children* OR adolescent* OR teenager*), while the search string for PsychInfo was similar: (ADHD OR ADD OR attention deficit hyperactivity disorder, OR attention deficit disorder) AND (African-American* OR Blacks OR Afro American). References from relevant articles were hand-searched to identify additional articles for inclusion in this review.

Methodological Quality

Quality of each study was assessed by one reviewer according to the “Quality Checklist for RCTs and Observational Studies” scale used in the AHRQ study of perinatal depression and based on a Methodological Quality checklist developed by Downs and Black, *J Epidemiology and Community Health*, 1998 (Evidence for review sheet). Items assessed included reporting (i.e. were hypothesis/aim/objective and outcomes of the study clearly described, etc.), external validity, bias, confounding, and power of the study to detect a significant difference in effect size for one or more outcome measures. According to this checklist, scores greater than or equal to 20 are considered good studies, scores
between 15 and 19 are considered fair, and scores of 14 and below are considered poor.
(Appendix 1).

Data Extraction

For reviews concerning diagnostic prevalence, data were extracted for 6 areas of
study: study characteristics (i.e. design), sample size, subject characteristics (age and sex),
outcomes measured (details about prevalence characteristics), methodological quality, and
main findings. Data were extracted similarly for reviews concerning treatment prevalence.
All extracted data for outcome measurements were rechecked against the original articles
at the time of data entry.

Results

Articles for Review

The initial Medline, Web of Science, and PsychInfo searches returned 168, 209,
and 44 articles respectively for a total of 421 articles. 335 articles were unique citations.
After reviewing titles and abstracts, 31 articles were pulled for review and their
bibliographies were examined for additional references. Seven additional relevant articles
were found. Of these 25 articles, 12 studies met initial inclusion criteria (Fig 2). These
studies were examined for quality using the Downs and Black methodological quality
checklist and studies that rated fair or better were included in the review. Thus, 11 studies
met inclusion criteria and received detailed evaluation.
Figure 3. Flow diagram of systematic literature search and assessment.

- 422 initial citations reviewed
- 31 potentially relevant studies identified for retrieval of full text
- 87 duplicate citations excluded
- 304 unique citations studies excluded on initial screen because abstracts did not address ADHD diagnosis and/or treatment in African Americans
- 11 studies met inclusion criteria for diagnosis and/or treatment
- 20 studies excluded
  - 18 did not compare rates of diagnosis and/or treatment between African Americans and Caucasians
  - 2 studies excluded because did not distinguish ADHD from other mood/anxiety disorders and only gave info for general psychotropic medications, not stimulants or ADHD meds specifically
- 10 studies met quality criteria
- 1 study excluded because it rated poor according to quality criteria
Diagnostic Prevalence

Four studies specifically compared prevalence of an ADHD diagnosis between African-Americans and Caucasians. Characteristics of these studies including study design, purpose, methods of obtaining ADHD information, and whether or not the prevalence of ADHD amongst different subgroups was a primary outcome are summarized in Table 3. The Downs and Black scores for methodological quality for these studies ranged from 18-22. While the design of the studies hindered them from getting the maximum amount of quality points, other factors contributed to the studies getting fair to good ratings. Stevens et al (2005) lost 4 points for failing to provide confidence intervals and actual probabilities for the main outcomes. Stevens et al (2004) lost 5 points for internal validity/bias. Points were deducted for failure to account for bias related to differential ascertainment of the outcome between ethnic groups and reliability, (e.g. no standard diagnostic method was mentioned in the study as used by the physician reporters), and failure to adjust for different lengths of follow-up of study participants (e.g. study investigators reported ethnic differences in the number of total visits but did not determine if total visits were due to the number of different patients or the average number of visits per patient.) Rowland et al lost 5 points for confounding, namely failure to recruit participants over the same period of time and failing to account for factors that may affect the likelihood of being diagnosed and/or treated for ADHD (e.g., presence of health insurance or access to care.) Wasserman et al lost 2 points for external validity (e.g., study participants were from a small group of children at high-risk for ADHD) and 3 points for confounding (e.g., investigators did not recruit participants over same period of time). All four studies used logistic regression to
determine the prevalence of ADHD amongst ethnic subgroups with respect to different variables such as age, gender, and health insurance. Because of the different sampling designs, formal statistical procedures and meta-analyses could not be performed. Results of the studies are summarized in Table 4.
<table>
<thead>
<tr>
<th>Author; (Year)</th>
<th>Study Design</th>
<th>Purpose/Objectives</th>
<th>Subjects/Inclusion Criteria</th>
<th>Ethnic Subgroups</th>
<th>ADHD Diagnosis</th>
<th>Method of Assessment</th>
<th>ADHD Prevalence a Primary Outcome?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stevens, J., Harman, J., and Kelleher²; 2005</td>
<td>Cross-sectional</td>
<td>To identify socio-demographic disparities in different stages of ADHD healthcare, including initial identification, follow-up physician visits, and psychotherapy visits</td>
<td>N=27,802 (# of observations) Children ages 3-18 yrs old whose parents or head of household completed the MEPS survey between 1997-2000</td>
<td>White-American 13,727(67.4%), African-American 4981 (16.5%), Hispanic-American 9094 (16.1%)</td>
<td>White American 16,406 (76%)</td>
<td>Medical Expenditure Panel Surveys (MEPS) Household Component</td>
<td>Yes</td>
</tr>
<tr>
<td>Stevens J, Harman JS, Kelleher KJ²⁶; 2004</td>
<td>Cross-sectional</td>
<td>To investigate ethnic and regional differences in childhood mental health care in primary care, particularly with regards to ADHD</td>
<td>N=26,441 (# of observations) Children 3-18 yrs old who visited primary care providers in office-based clinics or outpatient hospital clinics involved in the NAMCS and MEAMCS during</td>
<td>White American 16,406 (76%), African American 5074 (12%), Hispanic American 4117 (12%)</td>
<td>Primary care physicians</td>
<td>ICD-9 codes and physician recorded surveys of individual patient encounters</td>
<td>Yes</td>
</tr>
<tr>
<td>Rowland A et al²⁷; 2002</td>
<td>Cross-sectional</td>
<td>To estimate the prevalence of medication treatment for ADHD among public elementary school children in grades 1 through 5 and to examine how prevalence varies by grade, sex and race/ethnicity</td>
<td>N=7333 eligible children, 6099 (83% responded) Children in grades 1-5 who attended Johnston County public elementary schools; Exclusions: Johnston County children of elementary school age attending private schools, receiving home schooling, attending middle schools, children w/ severe developmental disabilities placed in self-contained classrooms, and children attending regular classes w/special ed designations for autism, mental handicap (IQ&lt;70), or severe health disabilities (i.e. traumatic head injury or childhood cancer)</td>
<td>White 4437 (72.7%); Black 1208 (19.8%); Hispanic 376 (6.2%); Other 78 (1.3%)</td>
<td>Parent</td>
<td>Two question survey</td>
<td>Yes</td>
</tr>
<tr>
<td>Wasserman RC et al(^2), 1999</td>
<td>Prospective cohort study</td>
<td>To determine the frequency of identification of attentional-hyperactivity problems (AHPs) by clinicians and to examine factors associated with clinician identification of AHPs in children recognized with psychosocial problems</td>
<td>N=22,059 entire study population; 3934 in sample population of children with psychosocial problems. Children ages 4-15 being seen for acute, chronic and health supervision visits in practices of 401 pediatric and family practice clinicians participating in the Pediatric Research in Office Settings (PROS) and Ambulatory Sentinel Practice Network (ASPN) systems.</td>
<td>Clinicians determined AHP status (see next column) by means of parent interview, child interview, school reports, observation, standardized assessment tools, or previous diagnosis by another person.</td>
<td>Yes—general term AHP (attentional and hyperactivity problems) was used instead of ADHD</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4. Results for Studies Evaluating Diagnostic Prevalence of ADHD

<table>
<thead>
<tr>
<th>Study Author</th>
<th>Quality Rating</th>
<th>ADHD Prevalence</th>
<th>OR</th>
<th>P-value</th>
<th>Confidence Interval</th>
<th>Conclusions</th>
<th>Adjustment for Confounders?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stevens et al. (2005)</td>
<td>21 (Lost points for not reporting estimates of random variability (exact p-value or a CI, reliability))</td>
<td>Caucasian American-5.1% African American-2.1% Hispanic American-1.8%</td>
<td>--</td>
<td>p&lt;0.05</td>
<td>--</td>
<td>White American children were more likely to be diagnosed with ADHD compared to African-American and Hispanic American youths (5.1% vs. 2.1% and 1.8%)</td>
<td>Yes-health insurance, region of residence, age</td>
</tr>
<tr>
<td>Stevens et al (2004)*</td>
<td>22</td>
<td>Caucasian American-2.7% African American-1.9% Hispanic American-0.8%</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>No significant difference in rates of ADHD between Caucasian American youth and African-American youth</td>
<td>Yes-health insurance, region of residence, age</td>
</tr>
<tr>
<td>Rowland et al. (2002)</td>
<td>18 (Lost points for characteristics b/w eligible pop and sample pop; inadequate adjustment for confounding according to insurance, family income, other factors that affect access to health care)</td>
<td>Caucasian American-10.8% African American-9.1% Hispanic American-4.0% Other-3.9%</td>
<td>1.0+</td>
<td>--</td>
<td>--</td>
<td>African-American children were only slightly less likely than White children to be diagnosed with ADHD (adjusted prevalence ratio=0.90, 95% CI=0.7-1.1, p=0.19) though this difference was not statistically significant</td>
<td>Yes—sex, grade, race/ethnicity</td>
</tr>
<tr>
<td>Wasserman RC et al*; (1999)</td>
<td>21 (Lost points for generalizability, confounding)</td>
<td>Caucasian American-40.8%* African American-3.7%* Hispanic American-3.5%*</td>
<td>0.954</td>
<td>0.90</td>
<td>--</td>
<td>No significant difference in rates of ADHD between Caucasian American youth and African-American youth</td>
<td>Yes—parental marital status, age, parental education level, health insurance status, region, attentional subscale on Pediatric Symptom Checklist</td>
</tr>
</tbody>
</table>

*Adjusted for sex, grade and race/ethnicity

*Percentage of children with attentional/hyperactivity problems out of a sample of children with psychosocial problems
Stevens et al. (2005) used data from the 1997-2000 Medical Expenditure Panel Survey (MEPS), a nationally representative survey of U.S. civilians, to determine if ADHD diagnoses, stimulant usage, and number of health care visits varied by age, race/ethnicity, region, and type of insurance. The authors used weighted percentages to determine the number of children diagnosed with ADHD according to age, ethnicity, region and type of insurance. They found White American children were more likely to be diagnosed with ADHD compared to African-American youths (5.1% vs. 2.1% p<0.05). They also found regional differences in ADHD diagnosis; children in the Northeast and West were less likely to be diagnosed than children in the South (3.6% and 2.9% vs. 4.8% respectively, p<0.05). Children who lived in the Midwest were more likely to be diagnosed than children in the West (4.3% vs. 2.9% respectively, p<0.05).

In a study published a year earlier by the same group, Stevens et al (2004) examined data from the 1995-2000 National Ambulatory Medical Care Survey (NAMCS) and the National Hospital Ambulatory Medical Care Survey (NHAMCS) to evaluate ethnic and regional differences in primary care visits for children with respect to the frequency of ADHD diagnosis, stimulant prescriptions, and other mental health diagnoses. Both surveys sampled nationally representative groups of visits to primary care physicians. Of the 26,441 visits, 902 of them involved a child with a diagnosis of ADHD. The authors found that the odds of an African American child being diagnosed with ADHD was 0.62 compared to White children but this was not statistically significant (p=0.83, 95% CI 0.36-1.07). Their study also found that with regards to type of health insurance, an ADHD diagnosis was more likely to be recorded during visits by children on Medicaid than for
visits by children with other types of insurance (OR-2.23, p-value=0.011, 95% CI 1.21-4.11)

Rowland et al (2002)²⁷ sought to determine the prevalence of medication treatment for ADHD among elementary school children in Johnston County, North Carolina during 1997-1998 and to see how the prevalence varied by grade, sex and race/ethnicity. Parents from 17 elementary schools in Johnston County received a 2-item questionnaire containing questions of whether a doctor or psychologist had diagnosed their child with ADHD and if their child was currently taking medication prescribed by a clinician to help with symptoms of ADHD. The authors found that African-American children were only slightly less likely than White children to have been diagnosed with ADHD (adjusted prevalence ratio=0.9, p<0.001, 95% CI 2.6, 3.7). Gender and age differences in ADHD diagnosis emerged as significant.

Wasserman et al (1999)²⁸ recruited physicians from the Pediatric Research in Office Settings (PROS) and Ambulatory Sentinel Practice Network (ASPN) groups to enroll 70 consecutive children ages 4 to 15 years who presented for non-emergency care in their clinics. The authors compared children with newly-diagnosed attentional and hyperactivity problems (AHPs) to those with other psychosocial problems using logistic regression analysis. They found no significant difference between African-American children being diagnosed with AHPs vs. White American children (OR=0.954, p=0.90). The authors also found differences in gender and age in diagnosis of ADHD.
Treatment Prevalence

Nine studies specifically addressed treatment rates for ADHD among different ethnic subgroups. Characteristics of these studies are included in Table 5. The Downs and Black scores for methodological quality ranged from 15-24; the average score was twenty-one. Similar to the diagnostic studies, the studies were either cross-sectional or longitudinal designs which precluded them from scoring perfect scores. Also other factors contributed. Safer et al and Rowland et al both had quality scores below average. Safer et al's study, which scored the lowest, lost significant points for reporting, and internal validity for bias and confounding. Safer failed to provide estimates of random variability such as confidence intervals as well as actual probability values for the main outcomes. Similar to the Stevens et al. 2004 study, the authors did not account for biases related to differential ascertainment of the outcomes between groups (e.g. several different methods of diagnosis were used by the physician reporters and were not standardized) thus making the validity and reliability of the results questionable. Safer et al also did not factor confounders such as presence or absence of health insurance or other socioeconomic factors in the analysis. Rowland et al lost 5 points for confounding as previously described. All nine studies also used logistic regression to determine treatment prevalence among different ethnic groups. Similar to the diagnostic studies, due to the difference in sampling designs, formal statistical procedures and meta-analyses could not be performed. Results of the studies are summarized in Table 6.
<table>
<thead>
<tr>
<th>Author, (Year)</th>
<th>Study Design</th>
<th>Purpose/Objectives</th>
<th>Subjects/Inclusion Criteria</th>
<th>Ethnic Subgroups No. (%)</th>
<th>ADHD Treatment Rates a Primary Outcome?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zito et al (1998)</td>
<td>Cross-sectional (retrospective analysis)</td>
<td>To identify 1) the 1991 prevalence of psychotropic medication prescribed to African-American and Caucasian Medicaid recipient youths ages 5-14, 2) the race-specific prevalence rate for the most frequently prescribed psychotropic medication classes, and 3) the race and regional distribution of psychotropic and non-psychotropic medication classes</td>
<td>Children ages 5-14 who received Medicaid in Maryland and were seen in ambulatory settings by physicians during the 1991 fiscal year</td>
<td>N=99,217 Caucasian 38,349 (38.7%) African-American 60,868 (61.3%)</td>
<td>Medication reimbursement claims and enrollment files</td>
</tr>
<tr>
<td>Bussing et al (2005)</td>
<td>Prospective cohort study</td>
<td>To describe the use and persistence of ADHD medication treatment and of relevant school services during a 2 year period, to examine how these outcomes vary by gender and race; and to explore the roles of gender and race as independent predictors of medication treatment and school services.</td>
<td>Children were eligible if they were enrolled in a particular North Central Florida public school district during the 1998-99 academic year, lived in a household with a telephone, were not receiving special education for mental retardation or autism, and were from Caucasian or African-American backgrounds. Initial No. eligible children=12,009</td>
<td>N=220 representing an overall response rate of 17% Caucasian 152 (69.1%) African-American 69 (30.9%)</td>
<td>Parents, school database and disciplinary referrals</td>
</tr>
<tr>
<td>Olfson et al (2003)</td>
<td>Cross-sectional</td>
<td>To examine national trends in the outpatient treatment of ADHD</td>
<td>Children ages 3-18 whose parents or head of households completed the household components of the 1987 and/or 1997 Medical Expenditure Panel Surveys No. from 1987 survey=8,367 No from 1997 survey=8,771</td>
<td>1987 survey (weighted samples) White American (70%) African American (15.4%) Hispanic (10.4%)</td>
<td>Parents or head of household</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Year</td>
<td>Design</td>
<td>Summary</td>
<td>Sample Description</td>
<td>Breakdown for School nurses</td>
</tr>
<tr>
<td>-----------</td>
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</tr>
<tr>
<td>LeFever et al (1999)</td>
<td>Cross-sectional</td>
<td>To determine the extent of medication use for ADHD in Southeastern Virginia</td>
<td>Public school students enrolled in grades 2 through 5 in two Southeastern Virginia cities during the 1995-1996 school year. Exclusions: students in non-graded special education placements (designed for children with severe intellectual impairments) N=5,767 in City A and N=23,967 in City B. A subset of this sample diagnosed with ADHD was used to determine rate of treatment. City A subset N=467; City B subset N=2,199</td>
<td>Breakdown for sample not available</td>
<td>School nurses recorded health-related information for all students receiving ADHD medication in school which was merged with the school districts comprehensive student database containing demographic information. A subset of this new database was made available to the principal investigator</td>
</tr>
<tr>
<td>Fox M, Foster CH. (1999)</td>
<td>Cross-sectional</td>
<td>To perform a population-based examination of psychotropic drug prescription trends among low-income youths with respect to age, ethnicity, gender, and region of residence</td>
<td>Youths less than 20 years of age enrolled in Kansas Medicaid and receiving psychotropic drug prescriptions in 1995 N=5574 Caucasian Americans-81.1% African Americans-12.5% Hispanics-3.5%</td>
<td>Kansas Medicaid prescription reimbursement claims and enrollment files</td>
<td>Person-based data set created from Medicaid prescription reimbursement claims and enrollment files</td>
</tr>
<tr>
<td>Safer DJ and Malever M (2000)</td>
<td>Cross-sectional</td>
<td>To determine the prevalence of medication administered to Maryland public school students for the treatment of ADHD</td>
<td>Children enrolled in Maryland public schools and receiving ADHD medication treatment in April 1998; N=23,771 Caucasian American-55.9% African American-36.1% Hispanic-3.72% Asian-3.97% Native American-0.32%</td>
<td>School nurses recorded demographic information on all students receiving ADHD medication during school hours and recorded it on a survey form</td>
<td>School nurses collected health-related and demographic information on all students receiving ADHD medication during school hours and recorded it on a survey form</td>
</tr>
<tr>
<td>Stevens, et al (2005)</td>
<td>Cross-sectional</td>
<td>To identify socio-demographic disparities in different stages of ADHD healthcare, including initial identification, follow-up physician visits, and</td>
<td>N=27,802 (# of observations) Children ages 3-18yrs old whose parents or head of household completed the MEPS survey between 1997-2000 White-American 13,727(67.4%), African-American 4981 (16.5%), Hispanic-</td>
<td>Parents or head of household</td>
<td>Medical Expenditure Panel Surveys (MEPS) Household Component</td>
</tr>
<tr>
<td>Study</td>
<td>Type</td>
<td>Design</td>
<td>Population</td>
<td>Sample Size</td>
<td>Race/Ethnicity</td>
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</tr>
<tr>
<td>Stevens et al (2004)</td>
<td>Cross-sectional</td>
<td>To investigate ethnic and regional differences in childhood mental health care in primary care, particularly with regards to ADHD</td>
<td>N=26,441 (# of observations) Children 3-18 yrs old who visited primary care providers in office-based clinics or outpatient hospital clinics involved in the NAMCS and MHAMCS during</td>
<td>9094 (16.1%)</td>
<td>American</td>
</tr>
<tr>
<td>Rowland A et al (2002)</td>
<td>Cross-sectional</td>
<td>To estimate the prevalence of medication treatment for ADHD among public elementary school children in grades 1 through 5 and to examine how prevalence varies by grade, sex and race/ethnicity</td>
<td>N=7333 eligible children, 6099 (83% responded) Children in grades 1-5 who attended Johnston County public elementary schools; Exclusions: Johnston County children of elementary school age attending private schools, receiving home schooling, attending middle schools, children w/ severe developmental disabilities placed in self-contained classrooms, and children attending regular classes w/special ed designations for autism, mental handicap (IQ&lt;70), or severe health disabilities (i.e. traumatic head injury or childhood cancer)</td>
<td>4437 (72.7%) White, 1208 (19.8%) Black, 376 (6.2%) Hispanic, 78 (1.3%) Other</td>
<td>White</td>
</tr>
<tr>
<td>Study Author</td>
<td>Quality Rating</td>
<td>ADHD Treatment Prevalence</td>
<td>OR</td>
<td>P-value</td>
<td>Confidence Interval</td>
</tr>
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</tr>
<tr>
<td>Zito et al (1998)</td>
<td>23 (Lost points for not reporting)</td>
<td>Caucasian American-3.76%* African American-1.49%*</td>
<td>2.3</td>
<td>--</td>
<td>--</td>
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<tr>
<td>Bussing et al (2005)</td>
<td>23</td>
<td>Caucasian American-N/R ; African American-N/R*</td>
<td>0.91, 3.46*</td>
<td>--, &lt;0.01</td>
<td>0.36-2.34; 1.31-9.09</td>
</tr>
<tr>
<td>Offson et al (2003)</td>
<td>22</td>
<td>Caucasian Americans-1.1%, 4.4%* African Americans-0.3%, 1.7%* Hispanic-0.3%, 1.5%* Other-0.2%, 0.8%*</td>
<td>--</td>
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</tr>
<tr>
<td>LeFever et al (1999)</td>
<td>24</td>
<td>Caucasian Americans-N/R African Americans-N/R Overall treatment prevalence-City A=8.2%, City B=0.9%</td>
<td>City A-Caucasian Am-2.1 City B-Caucasian Am-2.2</td>
<td>P&lt;0.001</td>
<td>1.74, 2.54</td>
</tr>
<tr>
<td>Fox M, Foster CH. (1999)</td>
<td>21</td>
<td>Caucasian Americans-African Americans-Hispanic-Other</td>
<td>1.20*</td>
<td>N/R</td>
<td>1.03, 1.40</td>
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<tr>
<td>Study</td>
<td>Sample Size</td>
<td>Caucasian Americans-</td>
<td>African Americans-</td>
<td>Hispanics-</td>
<td>Stimulant Medication</td>
</tr>
<tr>
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<td>---------------------</td>
</tr>
<tr>
<td>Safer DJ and Malever M (2000)</td>
<td>15</td>
<td>3.4%</td>
<td>1.5%</td>
<td>1.2%</td>
<td>5.2</td>
</tr>
<tr>
<td>Stevens et al (2005)</td>
<td>21</td>
<td>76.8%</td>
<td>60.5%</td>
<td>68.5%</td>
<td>NR</td>
</tr>
<tr>
<td>Stevens et al (2004)</td>
<td>22</td>
<td>74.1%</td>
<td>72.4%</td>
<td>69.6%</td>
<td>0.69</td>
</tr>
<tr>
<td>Rowland A et al (2000)</td>
<td>18</td>
<td>8.2%</td>
<td>5.1%</td>
<td>2.1%</td>
<td>1.0</td>
</tr>
</tbody>
</table>

* Refers specifically to stimulant treatment
$*$-Ratio of children receiving relevant school services for ADHD
$*$-NIR=not reported
$*$-Rate of receiving ADHD treatment in 1987 and 1997
$*$-Weighted percentage of children with ADHD

Three of the studies that reported treatment prevalence were also used in the diagnostic prevalence analysis and are described in detail in the previous section. Stevens et al (2005) found Caucasian American children with ADHD were more likely to receive at
least one stimulant prescription compared to African-Americans with ADHD (76.5% vs. 60.5%, p<0.05). Interestingly, Stevens et al (2005) also found that children with ADHD who had private insurance were more likely than children on public insurance or who had no insurance to receive at least one stimulant prescription. In the 2004 Stevens et al study, the authors found no ethnic differences in the likelihood of receiving a stimulant or non-stimulant if a child had been diagnosed with ADHD (p>0.10) but did find a difference in stimulant prescriptions relative to insurance status, identical to Stevens 2005 study.

Rowland et al found that ADHD-diagnosed African American children were 0.7 times as likely as Whites to be taking ADHD medication (p<0.001, 95% CI 0.6, 0.9).

Zito et al (1998) and Fox et al (1999) both used Medicaid data to evaluate variations in psychotropic drug use in children. Zito used Maryland Medicaid data from the 1991 fiscal year to examine the prevalence of psychotropic medications, including stimulants, prescribed to African-American and Caucasian Medicaid recipient youths ages 5-14 while Fox looked at 1995 Medicaid data from Kansas and one other Midwestern state for children under 20. With regard to stimulant use, Zito et al found that Caucasian youths with Medicaid insurance aged 5-14 years were 2.5 times more likely to use stimulants than African-American youths (no p-value or confidence intervals were reported for this measurement). Methylphenidate was the most commonly prescribed stimulant, accounting for 89.6% of stimulant use. Zito et al examined period of enrollment as a possible factor in the decreased amount of psychotropic medication use amongst African-American youth but found that “continuous enrollment favored African-Americans (55% vs. 46% for Caucasians).” Also, though not looking at stimulants specifically, the authors found that irrespective of region psychotropic medications were prescribed more often to Caucasian
youth compared to African-American youth. They postulated relatively less psychiatric follow-up care and cultural differences including family attitude towards the mental health system as possible reasons for this discrepancy. Fox found African American children were less likely to receive stimulant medication than Caucasian children (OR 0.86 vs. 1.23). No tests of statistical significance were given in comparing these odds ratios.

Bussing et al (2005)\textsuperscript{30} conducted a prospective cohort study using a gender-stratified random design from a longitudinal study of elementary school students from a North Central Florida school district to produce a representative sample of children at high-risk for ADHD (N=1276). The authors found no difference in rates of medication treatment amongst African-American and Caucasian youth though they did note that African-American children utilized more special school services for ADHD.

Similar to the Stevens (2005)\textsuperscript{25} study, Olfson et al (2003)\textsuperscript{31} used data from the Medical Expenditure Panel Survey (MEPS) to examine national trends in the outpatient treatment of ADHD and how it differs across race, gender, health insurance status, and family income. The authors examined results from the 1987 and 1997 household component of the MEPS and combined information from the two to examine relationships between the two surveys with regards to stimulant prescriptions, psychotherapy visits, and treatment visits. Samples were weighted to adjust for non-response as well as to provide unbiased national estimates. They found that White children were more than twice as likely as African-American children to receive treatment (1.1\% vs. 0.3\%, respectively for 1987 survey, 4.4\% vs. 1.7\% respectively for the 1997 survey). Odds ratios, a p-value and 95\% confidence interval were not reported for this particular result. Although there was an overall observed increase in ADHD treatment from 1987 to 1997, African-American still
lagged behind Caucasian Americans in rates of treatment, even after controlling for
economic factors such as family income and health insurance status. The authors
concluded that cultural factors may play a role in this disparity.

LeFever et al (1999) and Safer et al (2000) both assessed the prevalence of
ADHD medication use amongst students in public schools. LeFever examined elementary
school students in two school districts in Southeastern Virginia while Safer looked at use
amongst all grade levels in all Maryland public schools. LeFever found White students
were approximately twice as likely as Black students to receive ADHD medication in both
cities (City A OR 2.1, p<0.001, 95% CI 1.74, 2.54; City B OR 2.2, p<0.001, 95% CI 2.03,
2.41). Safer found the White/Black methylphenidate prevalence ratio to range from 2.0:1
in elementary school, 2.6:1 in middle school, and 5.2:1 in high school. No estimates of
random variability or statistical significance were reported.

Overall, three of the four (75%) of the articles examining diagnostic prevalence
demonstrated there was no significant difference in the likelihood of being diagnosed with
ADHD between Caucasian American and African-Americans children. Of the articles
examining treatment prevalence, seven of the nine (71.4%) articles demonstrated African-
Americans were less likely than Caucasian Americans to receive ADHD medications.
While the heterogeneity of the studies precludes firm conclusions, the trend seems to
reveal that African American youth are diagnosed with ADHD at approximately equal
rates as Caucasian youths, but they are under-treated with respect to receiving ADHD
medications.
Discussion

The objective of this review was to identify studies that compared ADHD diagnosis and treatment prevalence of African Americans with Caucasian Americans to determine if any disparities exist. Overall, despite the relatively low quality of the evidence and the inability to group study effects together in a meta-analyses, it appears that disparities do exist in regards to ADHD treatment but not in diagnosis. In addition, other disparities in ADHD were noted. Several studies reported regional and health insurance factors that contributed to differences in both diagnosis and treatment of ADHD. While many of the studies report controlling for these factors in their logistic regression models, examining whether there is a specific interaction between the race/ethnicity and these factors certainly deserves further investigation.

There are several limitations to this review. Primarily, the studies themselves were not without methodological flaws. The majority of the studies were cross-sectional or cohort designs which lends themselves to multiple biases. First, selection bias may have been present in the majority of the studies. The self-selected nature of many of the studies creates the potential for participants to be significantly different than non-participants which could have varied significantly across different ethnic subgroups. The majority of studies lacked adequate descriptions of techniques for adjusting for baseline group differences; in fact only 1 (Wasserman) out of the 10 (10%) studies specifically reported these differences. Secondly, 4 out of the 10 (40%) studies used parental surveys as a method of determining ADHD diagnosis or medication treatment and did not use other measures of validating their responses. Thus report/recall bias may have potentially
affected the results. Of the two studies that used clinician reports for diagnosis, one study reported clinicians used a variety of tools to diagnose children with attentional/hyperactivity problems. Wasserman et al. reported the DSM-IV criteria were only used to diagnose 38.3\% of subjects. This could result in significant inter-rater variability in diagnosis, which decreases the validity of this study's results. Confounding could have played a role in the interpretation of results if all extraneous factors were not adjusted for in the analysis. Access to care and socioeconomic factors have been shown to be a determinant of whether children are recognized and treated for ADHD.\textsuperscript{18} Seven of the 10 (70\%) studies factored in presence of health insurance in their analysis while only 2 of the 10 (20\%) examined family income as potential confounders. Statistical analysis varied amongst the studies. Four of the 8 treatment studies and one of the diagnostic studies did not report specific estimates of random variability which brings into question the reliability of the reported values and subsequent conclusions. Finally, the ability to generalize the results to all children was severely limited due to the widely different populations in the various studies. One study used children at high-risk for ADHD, two considered only children receiving Medicaid, three considered children enrolled in public schools, while only three reported using nationally representative data.

In addition to limitations within specific studies, this review has its own limitations. Even though three large search engines were used with rather broad search terms, there were only 10 studies identified that ultimately met inclusion and quality criteria. This could represent a paucity of published studies that specifically compare African Americans with Caucasian Americans with respect to ADHD diagnosis and treatment or a flaw in the
initial search strategy. Quality for each study was assessed by only one reviewer, whereas most systematic reviews use two or more to make the quality assessment more reliable.

In addition to the need for higher quality, population-based studies that examine the disparate relationship between ADHD recognition and treatment in African American youth, further research should be dedicated to examining the factors that affect ADHD treatment rates in this subgroup. Bussing et al\textsuperscript{11} examined parental explanatory models of ADHD to determine if differential understanding of ADHD across ethnic subgroups contributed to the cultural variations in parental help seeking for children with ADHD. Interestingly, with regards to ADHD treatment African American parents were more likely than Caucasian parents to report they did not know what type of treatment their child should receive (medication vs. psychosocial interventions vs. school interventions vs. self-care) and were less likely than Caucasian parents to request medication treatment or school interventions. In a similar study examining parental help-seeking for ADHD symptoms by Bussing et al\textsuperscript{37} published seven years later, the authors found African American parents were more likely than Caucasian parents to seek help from family members and less likely from healthcare professionals. Since more often than not parents play a major role in whether their child is treated for various conditions, perhaps parental-level factors are contributing to the disparity seen in ADHD treatment.

In a study conducted by Arnold et al\textsuperscript{38} examining the responses of different ethnic subgroups to ADHD treatment, the authors found African American children responded equally to stimulant treatment as Caucasian children but benefited more than Caucasians with a multimodal treatment strategy including medication and behavioral therapy. This
may have implications for overall treatment effectiveness of ADHD in African American children.

In summary, based on the current literature, it appears that African-American youth are equally diagnosed with ADHD but under-treated with respect to medication use. Future directions for research include producing additional high-quality population-based studies that examine disparities in ADHD diagnosis and treatment amongst ethnic subpopulations and exploring potential interactions with socioeconomic, regional and parental factors that may impact rates of ADHD treatment on African American youth. Furthermore, the development of culturally-sensitive messages in recognizing the symptoms and treatment options for ADHD may benefit the minority community and reduce the apparent disparate relationship in ADHD treatment.
Appendix 1. Methodological Quality Worksheet

Quality Checklist for RCTs and Observational Studies
(used in the AHRQ study of perinatal depression and based on a Methodological Quality checklist developed by Downs and Black, *J Epidemiology and Community Health*, 1998).

Reviewer's initials ____________
First Author ____________ Journal: ____________________________
Year published ______

### Reporting

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
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<tr>
<td>1</td>
<td>Is the hypothesis/aim/objective of the study clearly described?</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Is the underlying theory described?</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Are the main outcomes to be measured clearly described in the Introduction or Methods section?</td>
<td>1</td>
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<tr>
<td>4</td>
<td>Are the characteristics of the study population included in the study clearly described?</td>
<td>1</td>
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<tr>
<td>5</td>
<td>Are the interventions under-study clearly described?</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Was exposure to the intervention measured?</td>
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<tr>
<td>7</td>
<td>Are the distributions of principal confounders in each group of study participants to be compared clearly described?</td>
<td>2</td>
<td>1</td>
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<tr>
<td>8</td>
<td>Are the main findings of the study clearly described?</td>
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<tr>
<td>9</td>
<td>Does the study provide estimates of the random variability (e.g., standard error, standard deviation, confidence intervals, inter-quartile range) in the data for the main outcomes?</td>
<td>1</td>
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<tr>
<td>10</td>
<td>Have all important adverse events/negative outcomes that may be a consequence of the intervention been</td>
<td>1</td>
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reported?

11. Have the characteristics of study participants lost to follow up been described?  

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Have actual probability values been reported (e.g., 0.035 rather than <0.05) for the main outcomes except where the probability value is less than 0.001?

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**Total Reporting score:**

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**External Validity**

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13. Were the study participants asked to participate representative of the entire population from which they were recruited?

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14. Were study participants who agreed to participate representative of the entire population from which they were recruited?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>U/D</th>
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<tr>
<td>15</td>
<td>1</td>
<td>0</td>
<td>0</td>
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</table>

15. Were the staff, places, and facilities where the study participants received the intervention representative of the intervention the majority of subjects receive?

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<th>Yes</th>
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<tr>
<td>16</td>
<td>1</td>
<td>0</td>
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16. Were the screening criteria for study eligibility specified?

**Total External Validity Score:**

---

**Internal Validity – Bias**

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<th>Yes</th>
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</table>

Answer this 17 and 18 only if this was a
**randomized controlled trial:**

17. Was an attempt made to blind study participants to the intervention they received? | 1 | 0 | 0

18. Was an attempt made to blind those measuring the main outcomes of the intervention? | 1 | 0 | 0

**Answer alternative 17 and 18 if this was not a randomized controlled trial:**

17. Were appropriate methods used to adjust for the differences between groups with and without the intervention (to control for selection bias)? | 1 | 0 | 0

18. Were appropriate methods used to account for any biases related to differential ascertainment of the outcome in groups with or without the intervention? | 1 | 0 | 0

19. If any of the results of the study were based on "data dredging," was this made clear? | 1 | 0 | 0

20. In trials and cohort studies, do the analyses adjust for different lengths of follow-up of study participants, or in case-control studies, is the time period between the intervention and outcome the same for cases and controls? | 1 | 0 | 0

21. Were the statistical tests used to assess the main outcomes appropriate? | 1 | 0 | 0

22. Was compliance with the intervention reliable? | 1 | 0 | 0

23. Were the main outcome measures used accurate (valid and reliable)? | 1 | 0 | 0

**Total Bias Score:** ______

<table>
<thead>
<tr>
<th>Internal Validity – Confounding</th>
<th>Yes</th>
<th>No</th>
<th>U/D</th>
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<tbody>
<tr>
<td>24. Were the study participants in the different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited?</td>
<td>1</td>
<td>0</td>
<td>0</td>
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</tbody>
</table>
from the same population?

25. Were study participants in the different intervention
groups (trials and cohort studies) or were the cases
and controls (case-control studies) recruited over the
same period of time? 1 0 0

26. Were study participants randomized to intervention
groups? 1 0 0

27. **Answer this Q.27, if randomization occurred:** was
the randomized intervention assignment concealed
from both study participants and intervention staff
until recruitment was complete and irrecoverable? 1 0 0

27. **Answer this Q.27, if randomization did not occur:**
were study participants in the research or evaluation,
unaware of the study hypotheses? 1 0 0

28. Was there adequate adjustment for confounding in the
analyses from which the main findings were drawn? 1 0 0

29. Were losses of study participants to follow-up taken
into account? 1 0 0

**Total Confounding Score:**

**Power**

30. Did the study mention having conducted a power analysis to determine the sample size needed
to detect a significant difference in effect size for one or more outcome measures?

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<tr>
<td><strong>No</strong></td>
<td>0</td>
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<tr>
<td><strong>Yes, one measure</strong></td>
<td>1</td>
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<tr>
<td><strong>Yes, two or more measures</strong></td>
<td>2</td>
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<tr>
<td><strong>Total Power Score</strong></td>
<td></td>
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</tbody>
</table>
Total Quality Score: ________
(sum of all domain scores)

*P = Partially
U/D = Unable to Determine
References


