

PAPER

Difficulties in Treating Ethnic Minority Children with ADHD and the Role of Mobile Applications

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ABSTRACT

There is proof that kids and teens from ethnic minorities get less health care than their non-minority peers, despite the fact that Attention Deficit Hyperactivity Disorder (ADHD) is more common in these populations. Minority children might not receive timely, adequate ADHD intervention because of the low socioeconomic position of minority parents, their lack of awareness regarding ADHD, and the available remedial techniques. People are looking to the digital world for answers to challenges in their daily lives as the number of mobile applications grows. People with impairments now have equal access to learning opportunities because to technological advancements. The majority of their time is now spent on mobile devices by kids. As a result, using mobile applications to solve their problems would be quite successful. Mobile learning, also known as e-learning programs that utilize mobile devices, can be employed as a form of therapy to enhance both executive functioning and general well-being. Also, by practicing cognitive and metacognitive task abilities more frequently, they increase motivation in kids and teenagers. Also, the understanding and retention of the presented information might be aided by the audiovisual stimuli offered through smartphone applications. They may therefore serve as crucial learning aids for kids with ADHD. The current study examines the function and efficacy of mobile applications in enhancing the quality of life of children from ethnic minorities who have Attention Deficit Hyperactivity Disorder (ADHD), as well as the barriers that may impede or delay their access to treatment services.

KEYWORDS

attention deficit hyperactivity disorder (ADHD), social/emotional development, ICTs, mobile applications, learning, metacognition, ethnic minority children, intercultural education

1 INTRODUCTION

Individuals whose ethnicity, religious beliefs, language, or ethos are different compared to that of the mainstream population are referred to as “ethnic minority” [1]. This term encompasses a variety of individuals and social groups, including historical national minorities, immigrants, migrant workers, refugees, and asylum seekers

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who live in a variety of social and political contexts. Ethnic minority children are evaluated and treated for ADHD symptoms considerably less frequently than their nonminority peers, according to cross-cultural research conducted in the United States [2–3]. Also, compared to non-immigrant children, immigrant children have lower rates of ADHD diagnosis as well as therapy, according to studies conducted in Europe [4–7]. Other studies indicate that minority children are over-diagnosed with neurological conditions and impairments and are disproportionately represented in special education [8], despite growing concerns about the misdiagnosis and negative health outcomes of ADHD among some minority populations [9–10].

Attention Deficit Hyperactivity Disorder is one of the neurological conditions that affect children and adolescents the most (ADHD). Even yet, it still has a complex character, and we don't yet have a complete knowledge of how it works. According to the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5) [11], lack of concentration and impulsivity are the primary signs and symptoms of ADHD, which are brought on by a disruption in the executive functions of the parts of the brain that control particular skills. For a person to be in good socio-emotional health, executive abilities like short-term memory, flexibility in thought as well as self-control are crucial [12]. Moreover, cognitive capacity is a known determiner of academic achievement, but a child's worse academic attainment due to individual weaknesses appears to be a contributing factor to low self-esteem [13]. Early growth and control of these abilities establish the groundwork for attention, ability for organizing, focused attention on specific assignments, mood regulation, and self-evaluation [12]. Emotional intelligence is also linked to self-regulation, a crucial area where children with ADHD struggle. The control panel for perceiving, thought, cognition, problem-solving, and judgment is emotional intelligence. It also highlights the characteristics of self-regulating, such as the ability to delay pleasure, put up with irritants, and control impulsive behavior (power of the ego). According to their research, Drigas & Papoutsi [14] suggest a hierarchically leveled approach for the development of emotional intelligence that shows how a person develops through time. This approach can be used in real-world settings as a therapeutic tool for dealing with issues in special education, social interactions, and many other aspects of life. These levels are more precisely associated with receiving and identifying emotional cues, self-awareness, self-management, empathy, social skills, and self-actualization. According to Maslow's hierarchy of needs, self-actualization is the maximum level of possible realization, self-fulfillment, and achievement of one's own prosperity [15–16]. A multilevel metacognition model put forth in another study by Drigas & Mitsea [17–19] contends that attention is at the "center" of metacognitive abilities and takes part in operations like choosing, filtering, suspending, processing, storing, retrieval, predicting, monitoring, adjusting, adapting, recognizing, differentiating, remembering, and knowledge transformation. Each level in this paradigm illustrates a superior control system that demonstrates the person's development in metacognition. The development of a more complicated control system results from the shift in self-awareness and self-observation that occurs as one advances from the lowest to the highest levels of metacognition. Individuals are unable to include the necessary cognitive and socioemotional abilities that are required for social integration, unless they have developed these metacognition pillars. The most crucial instrument for self-education, self-growth, and self-medication is metacognition. Therefore, it ought to serve as the focal point of a unique intervention program that encourages holistic learning. By fostering metacognitive abilities, medication is regarded as the first line of treatment for easing ADHD symptoms. However, because of the side effects and addiction risk, it has a number of drawbacks. On the other hand, modern technology-based intervention techniques like mobile applications have shown to be as successful.

2 DETERRENT FACTORS IN THE TREATMENT OF ETHNIC MINORITIES WITH ADHD

Due to the complexity of ADHD, a number of factors may be involved, making both the assessment and therapy of its symptoms in kids of color more challenging. 4,852 kids who were diagnosed with ADHD had their individual educational records examined by Mandell et al. [20]. Despite having similar clinical presentations, African American kids were found to be less likely than white kids to obtain medical and therapeutic care. Morgan et al. reported similar results as well. [21] Compared to white students, Black American kids have lower possibilities to acquire special education assistance. It is significant to note that a number of factors may lead to an overdiagnosis or misdiagnosis of ADHD symptoms in minority children [22]. For instance, research has shown that while the severity of ADHD symptoms varies by gender and racial background of patients, diagnostic instruments like ADHD rating scales treat all groups uniformly without taking into account distinctions between them [23]. In fact, very few research have examined how these characteristics might affect the diagnosis and management of ADHD [24].

2.1 Parents' perceptions

Because they think that the symptoms of ADHD are just a natural part of a child's development, some parents fail to recognize them as indicators of attention problems. In fact, African American parents have expressed their ignorance of ADHD symptoms more frequently than white parents [25]. Also, due to how differently African American parents interpret symptoms associated with ADHD than white parents, they grade their kids differently [26].

Parent assessments of ADHD symptoms are typically more subject to prejudice than instructor assessments [27]. Moreover, in some African American and Latino families, where people are more prone to get guidance from relatives, neighbors, or religious figures, a lack of awareness regarding ADHD may make the symptoms in children worse [28].

In minority households, the level of medical care they seek is mostly influenced by cultural views and a lack of understanding of ADHD [29]. For instance, minority parents are concerned about drug use and prefer to look for alternatives, hence minority kids are less likely than non-minority kids to seek mental health services. In contrast, non-minority parents advise others to take ADHD medication since they are aware of its success in symptom management [30]. Regardless of worries about its adverse effects, African-Americans are one example of a minority community that uncontrollably consumes ADHD drugs. They also think that using stimulants to manage children's behavior could eventually result in addiction, primarily as a result of overusing the substance [31]. Also, there are differences among groups in the understanding and attitudes of minority parents regarding ADHD. For instance, Bussing et al. [32] found that African American families were ten times less likely to be conversant with the symptoms of ADHD than those of Caucasian families.

They make minimal attempts to learn about ADHD from teachers or on social media. Further analyses made by Hervey-Jumper et al. [33] showed that African Americans are also more likely to wait a long time before receiving treatment and are less likely to disclose details regarding a family background of ADHD. Moreover, opinions concerning ADHD and school intervention were found to differ between Caucasians and

African Americans [32]. Yet, it appears that other minority groups, like Hispanics and Latinos, are experiencing a different situation. Due to their lack of familiarity with the system and problems with citizenship, Hispanic youngsters frequently miss out on the chance to receive mental health services [34]. Latinos are aware of the primary signs of ADHD and understand that they need to seek expert assistance. Unfortunately, they lack sufficient knowledge regarding the causes of ADHD and are unsure of the best treatments [35]. Also, because it emphasizes a person's flaws, some parents see ADHD as a source of guilt. Because of this, people do not ask for assistance. Because parents can transmit this attitude to their kids, issues may get worse [36].

2.2 Socioeconomic status of parents

Marital status, a lack of English fluency, neighborhood security, and family economic position may all have an impact on how minorities' parents describe their children's ADHD symptoms [37]. Both instructors and parents of children from poorer socioeconomic backgrounds frequently describe them as hyperactive or impulsive, as well as being unfocused [38]. Martel [39], who discovered that there is a direct connection between poor parents' income and greater ADHD symptoms and a consequent decrease in treatment seeking, also noted the link between family income and ADHD. Any social, economic, or environmental factors on the family, community, or societal level can either function as obstacles to or supporters of behavior involving seeking out assistance, according to Srebnik, et al. [40]. More obstacles to getting assistance for health care disorders are connected with lower socioeconomic position in households of ethnic minorities. The use of mental health is influenced by socioeconomic level in a number of different ways.

Firstly, having a lower socioeconomic position makes it more likely that people and families won't have health insurance [41], which has an impact on access to mental health care. Low socioeconomic level indirectly contributes to limited access to healthcare, in addition to geographical and financial limitations. People in poverty may have fewer time and energy resources, so they make the most of what they have and have restricted access to mental health care [42].

2.3 Experts' stance

Disparities in access to healthcare may result from factors other than parental views, such as racial stigma and discrimination against minorities [43]. Racism is a major cause of inequality, and Kendall and Hatton [44] have stressed the importance of addressing it. They propose that the connection between learning and behavioral difficulties is frequently regarded as a medical concern in non-minority children by using ADHD research as an illustration of how racism interferes with treatment choices. As a result, stereotypes about it being caused by subpar parenting, a lower IQ, drug usage, violence, or poverty in African American children are more likely to be true. Such detrimental discrepancies in how professionals and researchers identify and interpret ADHD symptoms may add to parental worry and cause delays in a proper diagnosis and course of treatment.

Understanding among educators can aid minority families in getting their kids treatment. It is crucial to keep in mind that doctors should comprehend how parents view ADHD. Thus, both professionals and investigators should address the various origins of families and how to influence the families' attitudes toward getting treatment in order to build reliable interventions [29].

Professionals should concentrate on delivering accurate diagnosis and recommending appropriate educational modifications while training families on behavioral control and medication therapies in order to enhance ADHD care for minority children [45]. To accomplish this, clinicians should be aware that parents of children with ADHD may encounter obstacles that keep them from seeking assistance [46]. Professionals should also be aware that racial, regional, sociodemographic, and economic characteristics may influence how often ADHD is diagnosed and treated [47]. They should also be aware that minority families may evaluate their kid's conduct differently and may have varying degrees of confidence in healthcare and educational professionals [48]. Consequently, promoting parent-professional cooperation can enable kids to benefit from therapeutic interventions both at home and in the classroom. This demonstrates the significance of early childhood interventions that are attentive to kid's necessities in order to lessen ADHD symptoms [49].

In order to adapt behavioral therapies for use in schools, Pffiffer et al. [50] proposed further forms of collaboration involving health professionals and schools. In order to lessen stigma associated with mental illness among members of ethnic minorities, professionals can also use the media as a potent education tool [51]. By utilizing an entertainment strategy designed to provide messages that amuse and teach people, raise their knowledge of important issues, promote appropriate attitudes, and positively modify their behavior in specific areas, they can achieve this purpose. [52]. Also, in situations that are supportive, mental health professionals and educators should use their resources to teach and support families about ADHD [53]. A healthy community must employ a variety of techniques to raise awareness about ADHD.

2.4 Lack of culturally appropriate services

Lack of cultural understanding of current treatments for kids with mental health issues is one of the main reasons of the neglect of ADHD treatment in minority populations. First, language and communication barriers between patients and healthcare professionals may make it difficult to accurately identify ADHD-related symptoms, and failing to thoroughly explain the diagnosis and treatment plan to parents and kids might have unfavorable effects [36, 54]. Second, a shortage of providers with various racial and ethnic backgrounds may make it more difficult for them to understand or reflect the cultural norms or family values that are specific to minority communities. Counselors from the predominately western society may misuse terms like "lack of boundaries" and "dependent personality" in traditional collectivist countries [55–56], where interpersonal dependence and interdependence are highly prized. Similar to how overemphasizing independence and estrangement from parents as developmental goals by counselors can impair minority's sense of belonging and damage family connections [57]. Third, western mental health systems rarely incorporate alternative mental health care modalities (such as religious or spiritual therapy), which ethnic minority cultures may support [58].

2.5 Treatment adherence

Over 80% of kids with ADHD who are diagnosed use stimulant medication [59]; this drug is frequently regarded as the first line of therapy for kids with ADHD. Nonetheless, research findings revealed that ethnic minority children's medication rates were lower than those of white kids, and that minority ethnicity was linked to a shorter duration of medication use [54]. Poor income level, restricted opportunities

for medical care, and variations in coverage of medical insurance, as was previously noted in this study, may contribute to these inequalities [60–61].

According to multiple research in this area [62–65], ethnic minority children were less likely to utilize ADHD-related medication after diagnosis and had a greater dropout rate than those getting psychological or psychopharmacological treatment. For instance, according to a recent study by Cummings et al. [66], African American and Hispanic adolescents (ages 6 to 12) were more likely than white youth to obtain combined therapy for ADHD, but they were also more likely to stop taking their medication and stop participating in the program.

A poor cultural perception of therapeutic efficacy or adverse reactions to medicines is more likely to explain differences in prescription frequency or cost than differences in the efficacy of ADHD medication [67–68]. The effectiveness and necessity of behavioral therapy varied between socioeconomic and cultural groups, according to Arnold et al. (2003).

In particular, the majority of middle-class Caucasians who did not have comorbid anxiety and conduct disorder, and in particular those who did not have severe parent-child issues, only needed carefully administered pharmacological intervention and did not significantly benefit from the addition of behavioral therapy. However, adding behavioral therapy was beneficial for children from racial or ethnic minority backgrounds, as well as those who had comorbid anxiety and disruptive behavior disorder. Moreover, research indicates that parents of ethnic minorities tend to embrace behavioral therapies as the preferred approach of ADHD treatment more than parents of Caucasians [69–70].

3 MOBILE APPLICATIONS: ADHD AND COGNITIVE SKILLS

A 10-year-old boy with attention deficit hyperactivity disorder (ADHD) and a video game addiction was the subject of research by Ruiz-Manrique et al. [71]. The young person started taking methylphenidate (40 mg daily) medication and started participating in TCT, a novel approach to cognitive training based on mobile applications (Tajima Cognitive Treatment). The “ADHD Trainer” application was specifically created to improve cognitive abilities like concentration, working memory, processing speed, numerical aptitude, reasoning, and visual-motor coordination. The goal of this research was to cure video game addiction as well as to show how cognitive training on cellphones can help youngsters with ADHD with some of their cognitive deficiencies. Parents complained about their children’s severe video game addiction prior to treatment, reporting daily usage of four hours. Due to the child’s poor social skills, their academic achievement was impaired. In light of this, the kid used the aforementioned software for daily cognitive practice. He was only permitted to engage in the video game for a limit of four hours every day for the first month because there were no signs of addiction (tolerance, withdrawal, or cognitive decline). The child spent an average of one hour per day playing the video game. The intention was to engage in gaming every day for roughly 10 minutes over the following few months [71]. The Conners Parent and Teacher Rating Scales [72] evaluation scales were used to compare the kid’s behavior and educational achievement before and after the implementation. Conners Continuous Performance Test (CPT) scores were also used to assess attentiveness [73]. Video game misuse substantially dropped in less than two months, limiting usage to weekends and always lasting no longer than four hours in total. Also, following six months of TCT cognitive training, the child’s school and family reported a considerable improvement [71].

In order to enhance organization and attention abilities, the “Living Smart” smartphone application was used in a study by Moll et al. [74] on adults with ADHD. Adults over 18 from Sweden ($n = 57$) with significant organization and attention issues participated in the study. Participants were divided into two groups at random: the intervention group ($n = 29$) and the control group ($n = 28$), with questionnaires and phone interviews serving as the assessment tools. A supervisor assisted the participants in the 6-week intervention in developing a pattern for using a smartphone to plan their everyday lives. At the conclusion of the session, four supervisors used a modified version of the Clinical Global Impressions-Improvement scale to evaluate the improvement in the participants’ organization and attention issues [75]. Using the Adult ADHD Self-Report Scales (ASRS), attention and hyperactivity were evaluated [76]. The HADS-A scale was used to assess depressive and agitation symptoms [77]. Finally, the Sheehan Disability Scale (SDS) [78] was used to assess the general level of functioning and quality of life. For use on iPhone and Android smartphones, the lessons have been modified. At first, participants accessed the course materials online and spoke with the instructor via a message service. Throughout the course, “Google Calendar” was the major tool used by every participant. If the participant so desired, some portions of the diary could be shown to the course instructor. Another essential component of the intervention was teaching participants how to utilize the “G-tasks” to-do list app. A number of different applications focusing on particular aspects of ADHD were provided and used optionally by individuals in addition to these fundamental and required apps. G-tasks were supplemented by the usage of “Evernote,” a tool for taking notes and recollecting ideas. The working memory training method “N-back” has previously produced encouraging outcomes [79]. Adults with ADHD who use “SimplyNoise” report improved concentration [80]. Leechblock and Stayfocused, two web browsers that block distracting websites, were released. Also featured were general management programs like “Dropbox”, finance, and mobility. Participants received assignments on the techniques and applications covered during the seminar. The ASRS inattention subscale indicated a substantially more dramatic reduction in participants in the “Living Smart” group compared to the control group. Also, there were noticeably bigger gains on the HADS depression scale and the ASRS Hyperactivity subscale. The remaining assessment domains that dealt with anxiety, stress, and general functioning did not show any appreciable changes. The majority of the participants thought the courses were going well and that the intervention was effective. While some participants claimed they needed more direction, others claimed the course helped them see their weaknesses and was useful [74].

The goal of the study by Butt et al. [81] was to use the mobile app “Say-it and Learn” to keep kids interested in learning. The average age of the five children with ADHD who participated in the study was 6.4 years. After that, interviews with these children’s parents and caregivers were done to gauge their level of satisfaction with and acceptance of the application’s educational material. There is a program called “Say-it and Learn” that uses facial recognition technology. Children select to connect with their face at startup after entering their name. There are three key sections in the application. The first half focuses on learning English letters, the second section teaches basic math tasks, and the final section teaches shapes. Children can take tests on the subjects they have learnt in the application in addition to the tasks. Children’s interest is piqued when using the application because students’ participation is retained with catchy music. The app also encourages kids to do other good things like drink milk and water, eat nuts, read books, and play more. Children are encouraged to be more active by these reminder messages. The application also

features a variety of evaluation methods and activities for kids' success in these areas [81]. All respondents were questioned during the post-survey evaluation, and their answers were graded on a 5-Likert scale. Children's perceptions of the app were the subject of the questions. The software, according to all the kids, made learning new things easier. It wasn't boring, as evidenced by the fact that none of the children claimed they wouldn't use the app again. Instead, they admitted that it had a positive impact on learning and engagement. The therapist who took part in this procedure also mentioned how soothing and beneficial the music in the background was for the children's learning. As part of the research phase that followed, parents and other adult caregivers were told to provide the app to children for the following six days while monitoring them. They were questioned regarding their children's overall changes on the seventh day. All of the families gave excellent feedback and mentioned that their kids had progressed in the individualized lessons provided by the app. Also, they stated that "Say-it and Learn" had satisfied them. The outcomes demonstrated that, in comparison to conventional teaching approaches, the application is engaging and appealing while also enhancing the learning capacity of kids with ADHD. According to all ADHD physicians and professionals who examined the software, Say-it and Learn will be useful for all children with ADHD in their school programs, hospitals, and houses [81].

4 DISCUSSION

In conclusion, we emphasize the importance of all digital technologies in the field of education and in ADHD training. These technologies are highly effective and productive and facilitate and improve assessment, intervention, and educational procedures through mobile devices that bring educational activities anywhere [85–87], various ICTs applications that are the main supporters of education [88–94], and AI, STEM, and ROBOTICS that raise educational procedures to new performance levels [95], and friendly games [96, 99]. In addition, the development and integration of ICTs with theories and models of metacognition, mindfulness, meditation, and the development of emotional intelligence [97–112], as well as with environmental factors and nutrition [82–84], accelerates and improves educational practices and results more than those, particularly in minority children with ADHD, treating.

More specifically, many cultures have varied approaches to treating ADHD symptoms, and behaviors that are considered harmful in one culture may not be in another [4–7]. A cross-cultural study carried out in the United States has shown that ethnic minority children are assessed and treated for ADHD symptoms far less frequently than their nonminority counterparts [2–3]. This study of the literature was conducted to assess the efficacy of mobile device applications in the treatment of ADHD as well as any potential obstacles preventing minority children from receiving an appropriate diagnosis and treatment for the condition. Executive function and overall wellness can both be improved by the use of mobile learning, commonly referred to as e-learning programs that make use of mobile devices [71]. The aim of the study is to come up with ideas to help professionals and families deal with these problems. Additionally, given that existing professional intervention strategies are insufficiently constructed to address various cultural traits among minority children [20–24], the intricacy of ADHD symptoms may combine with cultural concerns that are not taken into account.

Moreover, socioeconomic status and family knowledge frequently stand out as significant variables that may have an impact on minority children's ADHD

diagnoses and treatments [37–42]. Yet, in order to overcome these difficulties, all people should have access to ADHD diagnoses and treatment options that are tailored to their individual needs. To do this, specialists must assess the reliability and validity of the currently available ADHD intervention techniques to determine their suitability for use with minority children [45–53].

New intervention techniques that employ standardized criteria and are intended to include varied communities that contain minority groups must also be developed [62–65]. Practitioners and instructors need to be thoroughly taught to administer and understand the outcomes of these tools while taking into account the disparities between minority and non-minority students in order to successfully deploy these tools [36, 54–58]. Applications for mobile devices that promote the growth of cognitive and metacognitive skills seem to be a promising treatment for ADHD [81]. Yet, more investigation is required to comprehend the circumstances that can make it difficult for minority children to access healthcare and educational services, as well as the potential effects of mobile device applications.

Researchers and experts should also endeavor to create a perfect framework that schools may use to offer health care and school services to pupils with ADHD in ordinary settings. Last but not the least, more study is required to raise people's awareness, which can be a component of an all-encompassing strategy for ADHD education in ethnic populations.

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