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Review article

Attention-deficit/ hyperactivity disorder mobile apps: A systematic review

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Abstract

Background

Attention-Deficit/ Hyperactivity Disorder (ADHD) is a prevalent condition in children and adolescents. Although there are pharmacological and non-pharmacological treatments for this disorder, barriers in accessing evidence-based treatments are still a major problem. Digital health interventions are promising for multiple mental health problems. Recent years have brought an increase in the number of existing mobile apps designed for the management of ADHD. The aim of this study was to systematically review the existing mobile apps designed for ADHD in terms of general characteristics, empirical support for their development and efficacy/ effectiveness, and to describe the content and design of the four most downloaded ADHD apps.

Method

We conducted systematic searches on iTunes/iOS (Apple App Store), Google Play and the National Health Service Health Apps Library up to May 2017 and checked for changes in March and September 2019. We included those apps that were designed for ADHD, target assessment, treatment, or both, were in English and were functional. We identified 355 apps in the virtual stores, out of which we included 109 apps in the present systematic review. For each app we extracted the following information: target population, developer, price, number of downloads, ratings, privacy, available language other than English, category, purpose and empirical support. A second search was conducted in literature databases up to September 2019: PsycINFO, Pubmed, Scopus, Web of Science, Cochrane database.

Results

We found 109 ADHD apps in the virtual stores available to both young and adult populations, developed for children, adolescents, parents, teachers, and professionals. Most of the apps included are designed for treatment, or ADHD symptoms assessment, however, we found several apps designed for both assessment

and treatment purposes. Very few apps contained information regarding their development and none contained information regarding evidence for its efficacy/ effectiveness. Four apps were the most downloaded, with 10,000 (three apps) to 100,000–500,000 (one app) downloads. Out of 51 papers identified through systematic searches in the literature, we identified only one study that met our inclusion criteria, however, this study was published in 2018, outside of the 2017 app store search, therefore, there is no overlap between evidence in the literature and apps on the market.

Conclusions

Given the large proliferation of mental health apps and their potential benefits in terms of dissemination and costs, future research needs to be conducted in order to establish the safety and efficacy of ADHD apps available on the commercial market.

Introduction

Attention-deficit/hyperactivity disorder (ADHD) is a prevalent condition in youths and adults [1,2] and is associated with many negative consequences for both the individual suffering and his/her family [3,4]. According to the Diagnostic and Statistical Manual of Mental Disorders - 5th edition (DSM-5), core symptoms of ADHD include inattention, hyperactivity, and impulsivity [5]. Available treatments for ADHD exist, and the National Institute for Health and Care Excellence guidelines [6] recommend pharmacological treatment (e.g., stimulant, non-stimulant medication), psychological treatment, combined pharmacological and psychological treatment as a function of age (e.g., children, adults) and impairment. Effect size of standard treatments is moderate for behavioral interventions (standardized mean differences = .40). However, when blinded assessors rated the outcomes, these effects became nonsignificant [7]. Regarding pharmacotherapy, results of a network meta-analysis indicate methylphenidate as a first-choice pharmacological treatment in the short-term for youths with ADHD (large effect sizes compared to placebo) and amphetamines for adults with ADHD [8]. Furthermore, a large number of children do not respond to pharmacological treatment (approximately 30 %; for a review of clinical and neurobiological predictors of treatment-refractory ADHD see ref [9]) or have adverse reactions to it.

Developments in mental health delivery (e.g., Internet-delivered therapy) have brought important advantages, such as access to treatment in remote areas, lower costs as compared to face-to-face treatment, and numerous other benefits for both patients (e.g., they can review therapy contents whenever they want, they can receive therapist support more rapidly as compared to their weekly therapy sessions) and therapists (e.g., saved resources such as time) [10]. Digital innovations in the form of computerized interventions, Internet-delivered interventions, gamified interventions or mental health apps have become new promising paths in dealing with mental health problems [11], as they have the potential to overcome barriers in the dissemination of evidence-based interventions [12]. For instance, Internet interventions are efficient for adult anxiety and depressive disorders [13], as well as for youth populations with mental health problems [14]. However, as compared to interventions delivered for other mental health problems (e.g., anxiety disorders, depressive disorder), research on the effectiveness of digital health interventions for patients with ADHD is far more under-represented.

Internet-delivered cognitive behavioral treatment was effective in a sample of adults with ADHD [15], with a large effect size between groups for the inattention outcomes (Cohen's d = 1.21). Another intervention delivered via smartphones based on organizational skills training helped adults with ADHD to gain more structure in their lives [16]. Regarding research conducted for parents or children with ADHD, we have found in the literature preliminary support for a serious game intervention and an online intervention for parents. Namely, a serious game for iPad designed for ADHD was feasible, however, the sample was very

small (six children with ages between 8 and 12 years old [17]). Data coming from a randomized controlled trial showed that an online intervention for parents of children with ADHD symptoms was effective in reducing child ADHD symptoms and led to improvement in several parent-related outcomes [18].

Mental health apps could be cost-effective [19], associated with both direct and indirect effects on youths, parents, and professionals. A large number of apps are available for various populations such as adults or young populations [20], with different mental health problems, such as bipolar disorder [21,22], obsessive-compulsive disorders, posttraumatic stress, anxiety disorders and affective disorders [23], social anxiety [24], depression [25], and suicide prevention (for a review see [26]). The efficacy of mental health apps for individuals suffering from ADHD has only recently been tested. We found several articles that used a qualitative or quantitative approach.

Two studies conducted by the same team used qualitative analysis to investigate the suitability of the top ten ADHD apps (5 from Google Play and 5 from iTunes) [27,28]. One of the studies investigated the views of parents and clinicians working with parents on the suitability of the apps, while the other study investigated the views of ADHD-diagnosed children and of clinicians working with children on the suitability and usability of the apps.

Research is scarce regarding the effectiveness of mobile apps designed for ADHD, with several pilot studies conducted with small samples, case studies presented as conference papers or dissertations presenting initial research for several apps developed either for assessment purposes, combined assessment and intervention, or intervention alone.

Regarding assessment apps, in a pilot study conducted on 11 healthy adults, Snappy App, which incorporates a Continuous Performance Test to assess ADHD symptoms, had adequate user acceptability [29] and significant associations were found with self-reported impulsivity and sensor data on activity. Preliminary evidence of WHAAM app is presented through a conference paper. This app designed for parents, teachers, and clinicians of children with ADHD is based on behavioral therapy, which helps them with the observation of behaviors displayed in various settings [30].

For apps designed to be used both for assessment and intervention, data coming from another a small pilot study indicated that an iPad web-based app, called iSelfControl, designed to monitor and improve classroom behavioral management in a sample of children with school difficulties related to attention deficits and low self-control [31] could identify discrepancies in evaluation between children and teachers. The same study showed increases in children's self-awareness, as well as a high satisfaction with the intervention received, as 70 % of the students reported that the app helped them and that they liked it.

For mobile apps designed for intervention, we found preliminary evidence for three mobile apps on outcomes such as behavior, academic functioning, or reading motivation. For the first category, we identified in the literature a report on the app ADHD Trainer [32] presenting a case study on a child diagnosed with ADHD. The content of the app was cognitive training, and it was delivered together with medication. Results showed changes from pre-treatment to post-treatment assessments on behavior and academic functioning. The development and preliminary efficacy of an app designed to help children with ADHD to read by increasing their motivation were described in a thesis [33]. Other mobile apps were designed to improve physical activity. For instance, an intervention combining the Fitbit mHealth app, the Fitbit Flex wristband and joining a Facebook group was feasible and improved physical activity in adolescents (n = 11) with ADHD [34].

Given the potential advantages that digital innovations have in the treatment of mental health problems, the aim of the present study was to conduct a systematic review of the available mental health apps for

ADHD. Existing research conducted on mobile apps developed for mental health conditions showed that their number is increasing, and preliminary results indicated favorable outcomes. Moreover, a recent systematic review of existing technologies for children and adolescents with ADHD shows that such interventions could be useful in the management of ADHD symptoms [31]. Therefore, given the potential benefits of mobile technologies in the treatment of ADHD in children, adolescents, and adults, we aimed to answer three main research questions regarding the ADHD apps identified:

(a) What are the general characteristics of the ADHD apps available in the commercial stores (Apple App Store and Google Play), the National Health Service Health Apps Library and literature (PsycINFO, PubMed, Web of Science, Scopus, Cochrane database)?

(b) What is the empirical evidence underlying ADHD apps? In order to answer this question, we aimed to investigate evidence described in the content of the apps (how was the app developed and tested?), as well as coming from the research conducted so far.

(c) What are the main characteristics of the most downloaded ADHD apps?

Such a review could have many important implications for the clinicians and psychotherapists who wonder whether they could use the latest advances in technologies (e.g., apps) in their practice, whether it is safe to use such apps or they could do more harm, what the support of the existing apps is, or which apps they should use according to the empirical evidence. Also, this study can have important implications for users, namely parents and teachers who search for information on ADHD online or via mobile apps. Based on such a review, parents and teachers can make a more informed decision regarding which apps are safe to use according to their empirical support and which apps have not been tested so far. Therefore, even though it may be tempting to use mobile apps in the assessment or management of ADHD, app users should first question their support. Finally, as our review analyzes the content and empirical evidence of ADHD apps, this could have important implications for researchers interested in the treatment of ADHD, as it provides research directions that still need to be investigated.

Section snippets

Material and methods

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement [35]. We conducted two systematic searches, one in the marketplace and one in the literature databases.

In order to identify the relevant apps in the commercially available stores and app libraries, systematic searches were conducted on iTunes/ iOS (Apple App Store), Android (Google Play) and the National Health Service (NHS) Apps Library. The search…

Selection

Apps identified in the marketplace and digital app libraries

Fig. 1 illustrates the systematic search procedure in the databases selected. Electronic searches resulted in 355 apps (255 apps identified in Google Play, 100 apps identified in iTunes, 0 apps identified in the NHS apps database). After removing duplicates, namely apps that appeared in both stores (19 apps) and apps that appeared on different searches using each keyword, we analyzed 211 apps. The next step was to exclude 66 apps…

Discussion

Even though evidence-based assessment and treatment exist for ADHD in youths and adults, several barriers are associated with access to them [70,71]. In fact, according to a recent study on ADHD treatment offered among US children and adolescents with ADHD, results showed that only a small percentage of children with ADHD receive psychosocial interventions [72]. The efficacy of digital health interventions for mental health problems is supported by randomized controlled trials and meta-analyses …

Conclusions

The aim of this paper was to conduct a systematic review of the ADHD apps in two of the most used stores (Apple App Store and Google Play), the NHS Apps Library and the literature, to describe their characteristics, present their empirical status, as well as describe the content and design of four of the most downloaded apps. Our findings show that numerous mental health apps are available for those suffering from ADHD and their caregivers. More precisely, we identified 109 apps in virtual…

Author contributions

Study conception and design: CRP

Acquisition of data: CRP

Analysis and interpretation of data: CRP, AD, GA

Drafting of manuscript: CRP

Critical revision: GA, AD

All authors read and approved the final manuscript.…

Declaration of Competing Interest

None.…

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References (85)

J. Torous *et al.*

The digital placebo effect: mobile mental health meets clinical psychiatry

Lancet Psychiatry (2016)

S. Cortese *et al.*

European ADHD Guidelines Group (EAGG), Cognitive training for attention-deficit/hyperactivity disorder: meta-analysis of clinical and neuropsychological outcomes from randomized controlled trials

J. Am. Acad. Child Adolesc. Psychiatry (2015)

A. Bikic *et al.*

Meta-analysis of organizational skills interventions for children and adolescents with Attention-Deficit/Hyperactivity Disorder

Clin. Psychol. Rev. (2017)

J.M. Swanson *et al.*

Clinical relevance of the primary findings of the MTA: success rates based on severity of ADHD and ODD symptoms at the end of treatment

J. Am. Acad. Child Adolesc. Psychiatry (2001)

E. Schoenfelder *et al.*

Piloting a mobile health intervention to increase physical activity for adolescents with ADHD

Prev. Med. Rep. (2017)

A.C. Powell *et al.*

The economic benefits of mobile apps for mental health and telepsychiatry services when used by adolescents

Child Adolesc. Psychiatr. Clin. N. Am. (2017)

B. Moëll *et al.*

Living SMART—a randomized controlled trial of a guided online course teaching adults with ADHD or sub-clinical ADHD to use smartphones to structure their everyday life

Internet Interv. (2015)

E. Murray *et al.*

Evaluating digital health interventions

Am. J. Prev. Med. (2016)

D.C. Mohr *et al.*

Behavioral Intervention Technologies: evidence review and recommendations for future research in mental health

Gen. Hosp. Psychiatry (2013)

S.-H. Shim *et al.*

Clinical and neurobiological factors in the management of treatment refractory attention-deficit hyperactivity disorder

Prog. Neuropsychopharmacol. Biol. Psychiatry (2016)

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Cited by (22)

Screen media technology and ADHD in children and adolescents: Potential perils and emerging opportunities

2023, Encyclopedia of Child and Adolescent Health, First Edition

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Smartphone-assisted psychoeducation in adult attention-deficit/hyperactivity disorder: A randomized controlled trial

2022, Psychiatry Research

> *Citation Excerpt :*
>
> …In fact, some of the health apps currently available have even been found to pose potential clinical risks to their users, with safety concerns related to factors such as the quality of information provided, lack of expert involvement, insufficient evidence base, and poor validation (Akbar et al., 2020). For ADHD specifically, 109 mobile apps (23 covering psychoeducation) were recently systematically reviewed, with none providing scientific evidence for their effectiveness (Păsărelu et al., 2020). Moreover, there has been no systematic research on the extent to which app-based processing of psychoeducational material in ADHD might be more beneficial than traditional processing based on brochures.…

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Psychiatry Research, Volume 291, 2020, Article 113158

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