INPLASY PROTOCOL

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Conflicts of interest:
None declared.

Computer-based cognitive training programs: effects on executive functions in children with attention deficit hyperactivity disorder (ADHD)

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Review question / Objective: **This systematic review aimed to synthesize the existing literature reporting the effects of computer-based cognitive training on the executive functions of children with ADHD.**
Condition being studied: **Attention Deficit Hyperactivity Disorder (ADHD) is the most common neurodevelopmental disorder diagnosed in childhood, characterized by a persistent pattern of inattention, hyperactivity, and impulsivity. Today it is recognized that ADHD is associated with an alteration in the volume and level of activation in prefrontal areas related to executive functions. Based on these clinical findings, some authors suggest that ADHD is not a disorder of primary attention origin but instead responds to an alteration in the synaptic circuits of some brain areas, including the prefrontal neocortex, areas involved in cognitive regulation and control, and processes known as executive functions.**

INPLASY registration number: This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 12 October 2022 and was last updated on 12 October 2022 (registration number INPLASY2022100046).

INTRODUCTION

Review question / Objective: **This systematic review aimed to synthesize the existing literature reporting the effects of computer-based cognitive training on the executive functions of children with ADHD.**

Rationale: **Cognitive training is one of the most implemented interventions to improve EF and reduce symptoms of impulsiveness and inattention in children with Attention Deficit Hyperactivity Disorder (ADHD). This type of intervention seeks to improve cognitive functioning through the practice of intentional instructions, either task-based or strategy-based. In recent years,**

multiple cognitive training alternatives have emerged that have incorporated the use of computer systems. However, studies about the effects of this kind of intervention on the cognitive functions of children with ADHD have shown contradictory results. Despite previous reviews that have sought to study the cognitive effects of Computer-based Cognitive Training (CCT) in children with ADHD, few of these have been exclusively interested in executive functions, nor have they evaluated the risk of bias or the quality of the evidence. Consequently, and added to the inconsistency of the findings reported to date, this study aimed to answer the question: What is the effect of cognitive training programs based on computational systems on executive functions in children withADHD?

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METHODS

Search strategy: The primary sources used were electronic databases and editorial platforms: Scopus, Science Direct, Pubmed, Springer, and Taylor & Francis. The DeCS (Descriptors in Health Sciences) and MeSH (Medical Subject Headings) health-related descriptor pages were consulted and the search parameters for data collection were determined. The descriptors used were: Executive Functions, Children, ADHD, and the conceptual categories: computerized/ computer-based cognitive training. All descriptors and conceptual terms were combined with Boolean operators "AND" and "OR".

Participant or population: Children with attention deficit hyperactivity disorder (ADHD) between the ages of 5 to 13.

Intervention: Computer-based cognitive training (CCT).

Comparator: None.

Study designs to be included: Experimental studies: controlled clinical trials, open clinical trials.

Eligibility criteria: Inclusion criteria: 1). Studies with the participation of a child sample with an age range between 5 and 13 years, of any sex, with a diagnosis or compliance with clinical criteria for ADHD according to DSM 5, who had received treatment to train some EF, through a cognitive training program based on a computer system. 2). Articles published between the period 2016 to 2021. 3) published in English. 4) Study status completed with published results.Exclusion criteria: 1). Short articles, letters to the editor, reviews, or protocols; two). Review articles or meta-analyses; 3). Studies that included adolescent or adult population samples; 4). Diagnoses other than ADHD did not present specific results for each diagnosis; 5). Quasi-experimental methodological designs; 6) Studies without a control group.

Information sources: The primary sources used were electronic databases and editorial platforms: Scopus, Science Direct, Pubmed, Springer, and Taylor & Francis. We searched the following clinical trial registry bases: ClinicalTrials.gov, the EU Clinical Trials Registry, and PharmNet.Bund and the International Clinical Trials Registry Platform (ICTRP) Search Portal of the World Health Organization (WHO) to determine if they had information published in scientific journals. In order to include all relevant research, the references of included studies were also checked. In some cases

it was necessary to contact the authors via email to request relevant information missing in the article.

Main outcome(s): Effect size measures showing the effects of computer-based cognitive training on the executive functions of children with ADHD were extracted from the results of the studies.

Additional outcome(s): The following data was retrieved: 1). General information of the study; 2). Methodological characteristics of the study: description of the sample, methodological quality of the studies, primary measures implemented, type of statistical analysis performed; 3) Training characteristics: Type of intervention, duration, frequency, digital devices implemented; trained executive function; 4). Secondary results and the conclusions obtained.The following data was retrieved: 1). General information of the study: author, title, year of publication, country where the study was carried out; two). Methodological characteristics of the study: description of the sample, methodological quality of the studies, primary measures implemented, type of statistical analysis performed; 3) Training characteristics: Type of intervention, duration, frequency, digital devices implemented; trained executive function; 4). Secondary results and the conclusions obtained.

Data management: The researchers designed a documentary matrix in which the following data extracted from the articles were recorded: author, title, year of publication, the country where the study was conducted, description of the sample, the methodological quality of the studies, type of article, objectives of the article, characteristics of the training and its phases, trained executive function, instruments used in the measurement of the variables, type of statistical analysis performed, effects on the main results, secondary results and the conclusions.
The total result of the records in each database was transferred to the Mendeley application. Once imported, they were organized by folders according to the database, subsequently duplicates were eliminated, thus achieving the definitive list for this study.
The study selection process was based on a screening of the titles and abstracts based on the inclusion criteria carried out by the principal investigator. Afterward, a full article reading was carried out. The three researchers carried out this process, and in cases where disagreements arose, arbitration was requested from the study advisor.

Quality assessment / Risk of bias analysis: The methodological evaluation of the studies will be carried out independently by each researcher; based on the recommendation of the Cochrane Collaboration, checklists will be avoided. The Cochrane Collaboration's "risk of bias tool" was used, which is a domain-based critical appraisal to assess the potential risk of the following biases: selection bias (Type of sequence generation and concealment of The assignment); performance bias (about blinding of participants and research staff); detection bias (regarding blinding of assessors to group results); attrition bias (if results are incomplete) and reporting bias (selective reporting of results). An assessment will be assigned concerning the risk of bias for each item with the following categories: “Low risk”, “High risk” or “Unclear risk”. The researchers will discuss their individual evaluations and establish the concordance index between the three evaluators. In case of disagreements, the concept of an external methodological advisor will be requested.

Strategy of data synthesis: The data will be synthesized through tables for the presentation of the results.

Subgroup analysis: In the event that the authors discriminate results by age ranges, by ADHD subtype or by comorbidity, an analysis by subgroups will be performed.

Sensitivity analysis: Not applicableNo apply.

Language restriction: English.

Country(ies) involved: Colombia.

Keywords: Executive functions, computerized / computer-based cognitive training, childhood, cognitive stimulation, systematic review.

Dissemination plans: An article with the research results is expected to be published in a high-impact journal.

Contributions of each author:

Author 1 - Carolina Robledo-Castro - Formulation of search strategy, execution of search chain, retrieval of articles, review of titles and abstracts of all retrieved articles, first filter in data extraction, exhaustive reading of each article, Quality assessment / Risk of bias analysis, qualitative analysis.
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Author 2 - Gisella Bonilla-Santos - Formulation of search strategy, retrieval of articles, review of titles and abstracts of all retrieved articles, second filter in data extraction, exhaustive reading of each article, Quality assessment / Risk of bias analysis, qualitative analysis.
Email: gisella.bonilla@usco.edu.co
Author 3 - Piedad Rocío Lerma-Castaño - Second filter in data extraction, exhaustive reading of each article, Quality assessment / Risk of bias analysis, qualitative analysis.
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