INPLASY PROTOCOL

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None declared.

A Mini Review on the Challenges, Opportunities, and Explainability of Machine Learning in Pediatric Healthcare

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Review question / Objective: **To systematically assess the challenges, opportunities, and explainability of Artificial Intelligence (AI) in pediatric medicine.**
Condition being studied: **The eligibility criteria for this review adhered to specific inclusion and exclusion criteria to ensure the selection of relevant information. The inclusion criteria comprised peer-reviewed journals obtained from scholarly databases, publications in the English language, publications within the timeline of the last 7 years (2016-2022), and information directly aligned with the research objectives. Conversely, the exclusion criteria encompassed non-peer-reviewed sources, publications in languages other than English, publications outside the specified timeline, and information that was not directly relevant to the research objectives. By applying these criteria, the review aimed to include high-quality, scholarly publications that provided valuable insights into the topic of interest.The data collection process followed specific inclusion and exclusion criteria. These criteria were employed to select relevant information for the review: Inclusion Criteria: Peer-reviewed journals sourced from scholarly databases. Publications in the English language. Publications within the timeline of the last 7 years (2016-2022). Information directly relevant to the research objectives. Exclusion Criteria: Non-peer-reviewed sources.Publications in languages other than English.Publications outside the specified timeline.Information not directly relevant to the researchobjectives.**

INPLASY registration number: This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 11 May 2023 and was last updated on 11 May 2023 (registration number INPLASY202350045).

INTRODUCTION

Review question / Objective: **To systematically assess the challenges, opportunities, and explainability of Artificial Intelligence (AI) in pediatric medicine.**

Rationale: **The rationale for this study is driven by the significant advancements in**

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Artificial Intelligence (AI), particularly in the field of Machine Learning (ML). ML has revolutionized various industries by enabling computers to learn and make decisions without explicit programming. In the healthcare sector, ML has shown great promise, with emerging tools like ChatGPT, Bard, and Glass AI 2.0 facilitating human-machine conversations and potentially transforming healthcare delivery.

Within pediatrics, there are unique challenges such as complex comorbidities, rising emergency admissions, and limited access to specialized care providers. These challenges can impede the delivery of high-quality and timely care to pediatric patients. While ML technologies offer opportunities to enhance pediatric healthcare, there are concerns regarding the implications of AI, including unintentional biases present in the data and underperforming algorithms, which may have detrimental effects on patient care. It is essential, therefore, to critically evaluate the explainability of AI models and assess the potential benefits, as well as challenges, associated with the integration of ML in healthcare, particularly in the context of pediatrics.

By conducting this study, we aim to explore the applications of ML, such as ChatGPT, in addressing the practical challenges faced in pediatric care. We also seek to assess the ethical considerations and potential risks associated with the use of ML, ensuring that patient care and outcomes are not compromised. Through a comprehensive evaluation of the integration of ML in pediatrics, we aim to provide insights into the opportunities, limitations, and areas that require further research and development to optimize the use of ML in pediatric healthcare.Science and technology have made significant advancements with the introduction of Artificial Intelligence (AI), and Machine Learning (ML) has been a game-changer. ML has enabled computers to learn without explicit programming by combining computer science and statistics. ML has gained momentum in many fields, including healthcare, thanks to emerging tools like ChatGPT, Bard and Glass AI 2.0. These tools are transforming industries by enabling conversations between humans and machines. ChatGPT, a large language model (LLM), has immense potential to assist in healthcare, including helping patients with mental health issues and aiding healthcare providers in decision-making.

Pediatrics is a field with practical challenges like complex comorbidities, increasing emergency admissions, and a lack of access to pediatric care providers, which could hinder the provision of quality and timely care. Although technological advancements are expanding the integration and scope of ML in pediatrics, there are challenges associated with the implications of AI, such as unintentional bias from data, like racial segregation and underperforming algorithms, which could jeopardize patient care. Therefore, it is crucial to evaluate the explainability of AI models, potential opportunities, and challenges when integrating ML in healthcare, especially for the pediatric population.

Condition being studied: None.

METHODS

Search strategy: In this review, the focus is on assessing the challenges and opportunities of machine learning in pediatrics. To gather relevant information, a search was conducted using authentic electronic databases. The search strategy involved utilizing a combination of keywords and Boolean operators (e.g., using OR and AND) to refine the search results.

The following keywords were employed during the search process to target the desired topic of challenges and opportunities of machine learning in pediatrics: "machine learning AND pediatrics," "machine learning," "challenges faced during pediatrics care AND technology," "significance of machine learning AND pediatrics care," "pediatrics AND machine learning history," and "machine learning AND future in pediatrics care."

The search was conducted using PubMed Central and Europe PubMed Central

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databases. To ensure a systematic approach, the data extraction process adhered to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The selection criterion for inclusion of relevant information encompassed peer-reviewed journals sourced from scholarly databases, English-language publications, a timeline spanning the last 7 years (2016-2022), and information directly relevant to the research objectives. These criteria were applied to filter and select pertinent data during the search process.

In this review, the focus is on assessing the challenges and opportunities of machine learning in pediatrics. The search was performed through authentic databases to get the relevant information. The search strategy was based on using a set of keywords and Boolean operators (e.g., using OR & AND).

Keywords that were used during the search for the desired topic that is challenges and opportunities of machine learning in pediatrics are: "machine learning AND pediatrics", "machine learning", "challenges faced during paediatrics care AND technology", and "significance of machine learning AND paediatrics care", "paediatrics AND machine learning history", "machine learning AND future in paediatrics care".

The databases that were used during the searching process include PubMed Central and Europe PubMed Central. PRISMA guidelines for systematic reviews were used [8] for the data extraction process. The selection criterion defining the inclusion of relevant information is peer-reviewed journals from scholarly databases, the English publication language, the timeline of the last 7 years (2016-2022), and the information relevant to the research objectives. The aforementioned criteria are considered while searching for relevant data.

Participant or population: None.

Intervention: None.

Comparator: None.

Study designs to be included: To address the objective of this review on machine learning in pediatrics, the study design includes a qualitative approach. This approach allows for the exploration and interpretation of research findings using non-numeric data. The review primarily relies on secondary analysis, utilizing evidence-based literature review techniques and associated analysis. The data collection process follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, ensuring a systematic and comprehensive review of relevant studies in the field.

Eligibility criteria: The eligibility criteria for this review adhered to specific inclusion and exclusion criteria to ensure the selection of relevant information. The inclusion criteria comprised peer-reviewed journals obtained from scholarly databases, publications in the English language, publications within the timeline of the last 7 years (2016-2022), and information directly aligned with the research objectives. Conversely, the exclusion criteria encompassed non-peer-reviewed sources, publications in languages other than English, publications outside the specified timeline, and information that was not directly relevant to the research objectives. By applying these criteria, the review aimed to include high-quality, scholarly publications that provided valuable insights into the topic of interest.The data collection process followed specific inclusion and exclusion criteria. These criteria were employed to select relevant information for the review: Inclusion Criteria: Peer-reviewed journals sourced from scholarly databases. Publications in the English language. Publications within the timeline of the last 7 years (2016-2022). Information directly relevant to the research objectives. Exclusion Criteria: Non-peer-reviewed sources.Publications in languages other than English.Publications outside the specified timeline.Information not directly relevant to the research objectives.

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Information sources: The primary information sources are electronic databases, with a focus on databases such as PubMed Central and Europe PubMed Central. Furthermore, grey literature, which includes reports, conference proceedings, dissertations, and other non-peer-reviewed sources, are also considered as a potential source of information.

Main outcome(s): The main outcomes of the review include: (1) a comprehensive understanding of the current state-of-the-art functioning of machine learning (ML) algorithms in pediatric medicine, (2) an exploration of the challenges associated with ML algorithm deployment in this field, and (3) insights into the future outlook of ML in pediatric medicine.

Quality assessment / Risk of bias analysis: For this study on machine learning in pediatrics, the quality assessment of primary studies will involve evaluating the methodological rigor, relevance to the research objectives, and reporting standards. This will ensure that the included studies provide reliable and credible information related to the challenges and opportunities of machine learning in pediatrics.

Strategy of data synthesis: The data analysis in this study will involve examining and analyzing the information based on specific categories, including the Type (state of the art, challenge, or opportunity), Author, Year, Aim, Methodology, Outcomes, and Findings of each included study. The analysis process will follow these steps:
Data Extraction: Relevant data points, including the Type, Author, Year, Aim, Methodology, Outcomes, and Findings, will be extracted from each study included in the review.
Categorization: The extracted data will be categorized based on the identified Type (state of the art, challenge, or opportunity) for each study. This categorization will help in organizing and grouping the data according to the specific themes or categories.
Comparison and Summarization: The data will be compared and summarized within each category to identify commonalities, differences, and patterns. This step will involve examining the Aim, Methodology, Outcomes, and Findings of each study and extracting key information.
Synthesis and Interpretation: The synthesized data will be analyzed and interpreted to draw overall conclusions and insights. This will involve identifying trends, themes, and significant findings across the studies.
Reporting and Discussion: The analyzed data will be reported and discussed in a clear and concise manner, highlighting the main findings, implications, and any notable observations. This step will involve presenting the relevant information in a coherent narrative and providing a comprehensive overview of the state of the art, challenges, and opportunities identified in the studies.

Subgroup analysis: Subgroup analysis may not be directly relevant to our research objective.

Sensitivity analysis: Since our study is a qualitative literature review, sensitivity analysis is not performed.

Country(ies) involved: United Kingdom.

Keywords: machine learning; pediatrics; artificial intelligence; ChatGPT; Bard; Glass AI; AI; ML.

Contributions of each author:
Author 1 - Yashaswini Balla - Played a pivotal role in conceptualizing and formulating the idea to conduct the review. Additionally, YB contributed to the clinical aspects of the paper, leveraging their expertise in the field of healthcare to provide insights and perspectives on the application of machine learning in the context of pediatric patient care.
Email: yashaswiniballa@doctors.org.uk
Author 2 - Santosh Tirunagari - Contributed to the data analysis of the paper. This contribution involved analyzing the articles included in the context of the study. Additionally, ST was involved in structuring the discussion part of the paper.
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Author 3 - David Windridge - Contributed to the explainable AI (XAI) and data bias aspects of the paper. DW provided insights and expertise in understanding the technical aspects of AI and ML in the context of the review.
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