International Platform of Registered Systematic Review and Meta-analysis Protocols

INPLASY

Artificial intelligence and machine learning in pediatric epilepsy- a systematic review

INPLASY2025100020

doi: 10.37766/inplasy2025.10.0020

Received: 7 October 2025

Published: 7 October 2025

Corresponding author:
Justyna Paprocka

jpaprocka@sum.edu.pl

Author Affiliation:
Pediatric Neurology Department, Faculty of Medical Sciences, Medical University of Silesia in Katowice.

Malik, E; Wizner, M; Karpierz, JI; Pająk, Z; Roszkowska, M; Rojek, M; Paprocka, J.

ADMINISTRATIVE INFORMATION

Support - Statutory work of the Medical University of Silesia No BNW-1-123/N/3/K and BNW-1-180/K/4/.

Review Stage at time of this submission - In pediatric population with epileptic seizures, how can artificial inteligence based algorithms analysing EEG be implemented in the clinical setting and how effective are they?

Conflicts of interest - None declared.

INPLASY registration number: INPLASY2025100020

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 7 October 2025 and was last updated on 7 October 2025.

INTRODUCTION

Review question / Objective In pediatric population with epileptic seizures, how can artificial inteligence based algorithms analysing EEG be implemented in the clinical setting and how effective are they?

Rationale Data on accuracy, specificity, sensitivity, precision, recall rate and other measurements were extracted from the research papers as given by the authors and summarized in the form of a table. A comprehensive descriptive summary of the possibilities of the AI models was prepared and sectioned into seizure detection, electrical status epilepticus in sleep detection, wearable devices, seizure prediction, surgery for epilepsy, and neonatal monitoring. The review has shown that developing machine learning algorithms for diagnosing and monitoring epileptic seizures can provide results of great accuracy, specificity and sensitivity. Therefore, studies on larger populations are warranted to implement the models in the clinical setting.

Condition being studied Epilepsy, epileptic seizures - Epilepsy is a chronic disease of the brain that affects around 50 million people worldwide. The symptoms depend on the location of the first disturbance and its spread and can include loss of awareness or consciousness, and disturbances of movement, sensation (including vision, hearing and taste), mood, or other cognitive functions. When it comes to the pediatric population, epilepsy is one of the most common neurological disorders, with almost 10,5 million children suffering from it. There are many possible causes of epilepsy and EEG is one of the most important tools available to support its diagnosis after considering the clinical history.

METHODS

Search strategy This review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to provide a comprehensive and transparent synthesis of the literature. A systematic search was performed using PubMed, Embase, and Scopus databases to identify studies on the application of artificial intelligence in pediatric neurology, particularly in terms of electroencephalography (EEG) analysis. Customized search strategies were developed for each database to maximize retrieval of relevant papers, incorporating keywords such as "electroencephalography," "artificial intelligence," "pediatrics," "child," "adolescent," "infant," as well as corresponding Medical Subject Headings (MeSH) to enhance search sensitivity and specificity. Studies were included if they met the following criteria: they assessed themes or proposed technical solutions related to the implementation of artificial intelligence in pediatric neurology; they were mainly original research papers, followed by reviews, commentaries, conference abstracts, or expert opinions; they analyzed more than five patients or EEG signals using AI-based methods and specifically addressed pediatric epilepsy. The retrieved papers were imported into the Rayyan Review Web App and independently screened in a blinded manner by three independent investigators. Duplicate records were manually identified and removed. The selection process entailed a rigorous evaluation of titles, abstracts, and full manuscripts, with each decision made independently by three reviewers. In cases of disagreement, the lead author determined the eligibility of the study based on the predefined inclusion criteria. Notably, no automated tools were employed during the selection process.

Participant or population The review addresses the pediatric population.

Intervention Not reported.

Comparator Not reported.

Study designs to be included We include methodological and computational studies that apply machine learning, signal processing, or algorithmic approaches to EEG data for epileptic seizure detection or prediction, whether retrospective or prospective, using publicly available or clinical datasets. Editorials, commentaries, conference abstracts, case reports were excluded.

Eligibility criteria Not reported.

Information sources PubMed, Embase, and Scopus databases were searched.

Main outcome(s) Data on accuracy, specificity, sensitivity, precision, recall rate and other measurements were extracted from the research articles as given by the authors and summarised in form of a table. A comprehensive descriptive summary of the AI models' possibilities was prepared and sectioned into seizure detection, electrical status epilepticus in sleep detection, wearable devices, seizure prediction, surgery for epilepsy, neonatal monitoring. The review has shown that developing machine learning algorithms for diagnosing and monitoring epileptic seizures can give results of great accuracy, specificity and sensitivity. We pointed out that post research was done on small and recurrent patient populations, therefore there need to be larger population studies in order to implement the models in clinical setting.

Additional outcome(s) Not reported.

Data management The retrieved papers were imported into the Rayyan Review Web App and independently screened in a blinded manner by three independent investigators. Duplicate records were manually identified and removed. The selection process was associated with a rigorous evaluation of titles, abstracts, and full manuscripts, with each decision made independently by three reviewers. In cases of disagreement, the lead author determined the eligibility of the study based on the predefined inclusion criteria. Notably, no automated tools were employed during the selection process.

Quality assessment / Risk of bias analysis The PROBAST+AI questionnaire, a tool specified for the assessment of research on artificial intelligence, was used to assess the quality of all the studies. A summary was prepared in a table.

Strategy of data synthesis A narrative synthesis was prepared to report to the reader the possible uses of AI algorithms. Their performance was presented in a form of a table with epilepsy type, epileptic and non-epileptic groups, age span, algorithm goal and algorithm used, and results given by the authors of the studies.

Subgroup analysis A comprehensive descriptive summary of the AI models' possibilities was prepared and sectioned into seizure detection, electrical status epilepticus in sleep detection,

wearable devices, seizure prediction, surgery for epilepsy, neonatal monitoring.

Sensitivity analysis Impact of excluding the studies with high risk of bias will be analyzed.

Language restriction N0.

Country(ies) involved Poland.

Keywords artificial intelligence; pediatric; child; neonate; electroencephalography; EEG; epilepsy; seizures.

Dissemination plans The findings of this systematic review will be disseminated through publication in a peer-reviewed scientific journal and presentation at relevant national and international conferences. Where appropriate, we will share a summary of findings with clinical and research networks focused on epilepsy and EEG analysis. To maximize accessibility, we will aim for open-access publication and provide supplementary materials when possible.

Contributions of each author

Author 1 - Emilia Malik - project management, quality and risk of bias appraisal, conceptualisation, data selection, data extraction, data synthesis, data curation, writing - original draft.
Email: s82971@365.sum.edu.pl
Author 2 - Michał Wizner - project management, quality and risk of bias appraisal, conceptualisation, data selection, data extraction, data synthesis, data curation, writing - original draft. The contributions of the second author are equal to the first author.
Email: s83225@365.sum.edu.pl
Author 3 - Julia Izabela Karpierz - literature search, project management, methodology design, conceptualisation, data selection, data extraction, data synthesis, data curation, writing - original draft.
Email: s84029@365.sum.edu.pl
Author 4 - Zuzanna Pająk - data selection, data extraction, data curation, data synthesis, writing - original draft.
Email: s83047@365.sum.edu.pl
Author 5 - Monika Roszkowska - quality and risk of bias appraisal, data selection, data extraction, data synthesis, data curation, writing - original draft.
Email: s84148@365.sum.edu.pl
Author 6 - Marcin Rojek - data extraction, data description, data curation, writing - original draft, writing - commentary and validation.
Email: d201268@365.sum.edu.pl
Author 7 - Justyna Paprocka - supervision, conceptualisation, text correction, funding aquisition, writing - original draft, writing - commentary and validation, corresponding author.