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INPLASY

# A Meta-Analysis on Electrophysiological Microstates in Autism Spectrum Disorder

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## ADMINISTRATIVE INFORMATION

**Support -** There is currently no research funding support for this study.

**Review Stage at time of this submission -** Preliminary searches.

**Conflicts of interest -** I hereby declare that I have no financial or personal relationships with other people or organizations that could inappropriately influence my work. There are no professional or other personal interests of any nature or kind in any product, service, and/or company that could be construed as influencing my actions. I have not received any form of compensation from any commercial entity related to the subject of my work. Furthermore, I have not participated in any relevant financial activities outside of my regular employment that could create a conflict of interest or the appearance of a conflict of interest related to the content of this work.

**INPLASY registration number:** INPLASY2024100034

**Amendments -** This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 9 October 2024 and was last updated on 9 October 2024.

## INTRODUCTION

**Review question / Objective** The primary objective of this meta-analysis is to systematically review and quantitatively synthesize the existing literature on electrophysiological microstates in individuals with Autism Spectrum Disorder (ASD). we aim to identify Consistent Patterns determine if there are consistent electrophysiological microstate patterns that differentiate individuals with ASD from typically developing controls. Explore the variability in findings across studies to understand the factors contributing to heterogeneity, such as age, gender, severity of ASD symptoms, and methodological differences. And offer a comprehensive overview that may contribute to the development of improved diagnostic tools for ASD.The primary objective of this meta-analysis is to systematically review and quantitatively synthesize the existing literature on electrophysiological microstates in individuals with Autism Spectrum Disorder (ASD). we aim to identify Consistent Patterns: Determine if there are consistent electrophysiological microstate patterns that differentiate individuals with ASD from typically developing controls. Examine Heterogeneity: Explore the variability in findings across studies to understand the factors contributing to heterogeneity, such as age, gender, severity of ASD symptoms, and methodological differences. Contribute to Diagnostic and Therapeutic Strategies: Offer a comprehensive overview that may contribute to the development of improved diagnostic tools for ASD.

**Condition being studied** Preliminary results have been obtained in the field of EEG microstates in ASD, and based on our search results in six databases (PubMed, WoS, EMBASE, EBSCO, Cochrane Library, and PsycInfo), 10 studies were initially included. Some potential consistent advances have been identified in these studies, such as differences in the duration and frequency of microstate B between the ASD group and the healthy control group. However, these results are also contradictory, and some studies cannot reproduce these results. Moreover, there are differences in the study design and age of the enrolled subjects, and heterogeneity cannot be tested yet. Therefore, current research will further clarify the differences in these indicators and the heterogeneity between different studies.

## METHODS

**Search strategy** ((((((Autism Spectrum Disorder[MeSH Major Topic])) OR (ASD[Title/Abstract])) OR (Autism[Title/Abstract])) OR (Autism Spectrum Disorder*[Title/Abstract])) OR (Autistic[Title/Abstract])) AND ((microstate[Title/Abstract])).

**Participant or population** Autism spectrum disorder; Autistic disorder.

**Intervention** This study aims to investigate the specificity of a diagnostic tool for identifying ASD, without involving intervention measures.

**Comparator** This is a META analysis of EEG for identifying and diagnosing ASD, which does not apply to intervention measures.

**Study designs to be included** The types of literature included in this article are mainly randomized controlled trials (RCTs) and clinical trials.

**Eligibility criteria** (a) The article is in English, (b) the participants are children, adolescents, and adults, (c) there are at least four microstate categories (A, B, C, D), (d) patient group and control group, (e) resting state condition, (f) data is provided to calculate effect size (mean and standard deviation), (g) the patient is diagnosed with ASD, Autistic disorder, and pervasive developmental disorder. The exclusion criteria are as follows: (a) the article was written in a language other than English, (b) the study population was not targeted at children, adolescents, or adults, (c) classes with less than four microstates were studied, (d) there was no control group, (e) task state EEG, (f) there was insufficient data to calculate effect size, (g) non ASD, Autistic disorder, and pervasive developmental disorder.

**Information sources** (a) PubMed: http://www.ncbi.nlm.nih.gov/pubmed/
(b) Web of Science: https://webofscience.clarivate.cn/wos/alldb/basic-search
(c) Embase: http://www.embase.com/
(d) Cochrane Library: https://www.cochranelibrary.com/
(e) EBSCO: https://www.ebsco.com/
(f) PsycInfo: https://library.harvard.edu/services-tools/psycinfo

**Main outcome(s)** Duration of times(ms), Frequency of occurence(Hz), Coverage of Microstates(%) of Microstates A, Microstates B and Microstates C.

**Quality assessment / Risk of bias analysis** In this study, randomized controlled trials (RCTs) were primarily evaluated for bias risk using Cochrane Collaboration's tool for assessing risk of bias in randomized trials (RoB), while cross-sectional studies were evaluated using Agency for Healthcare Research and Quality (AHRQ).

**Strategy of data synthesis** The random effects model was chosen as the type of meta-analysis. The Standardized mean difference (SMD) was selected to estimate the effect sizes.

**Subgroup analysis** In this study, we set up three subgroups. One is to observe the influence of age on different EEG microstate parameters in different age groups. The second is the brain topography clustering method, as different clustering methods obtain different micro state features, which can affect the duration, proportion, and frequency characteristics of micro states. The third is eye opening and eye closing, as they have an impact on the filtering and fitting of EEG data, which may also be a source of heterogeneity and will be further discussed in subgroup analysis.

**Sensitivity analysis** When the heterogeneity of meta-analysis results is moderate, sensitivity analysis will be conducted to further evaluate the robustness and reliability of the results. We may exclude studies with lower quality ratings and observe their impact on overall effect estimation. We will also consider using different measures of effect size, such as fixed effects models and random effects models, and compare the results of these different models. We will conduct stratified

sensitivity analysis on the key variables that affect the analysis results.

**Country(ies) involved** China.

**Keywords** Autism spectrum disorder, EEG, Microstate, Meta-analysis, Systematic review.

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