INPLASY

The Relationship between Relative Age and the Diagnosis and Treatment of ADHD in Children And Adolescents: A systematic review and meta-analysis

INPLASY2025120058
doi: 10.37766/inplasy2025.12.0058
Received: 16 December 2025
Published: 16 December 2025

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ADMINISTRATIVE INFORMATION

Support - No.

Review Stage at time of this submission - Data analysis.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY2025120058

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 16 December 2025 and was last updated on 16 December 2025.

INTRODUCTION

Review question / Objective This systematic review assesses the impact of the relative age effect (RAE) on the diagnosis and treatment of Attention-deficit/ hyperactivity disorder (ADHD). It summarizes existing evidence to quantify whether relatively younger children are significantly more likely to be diagnosed with ADHD compared to their older peers. Furthermore, the review evaluates the risks and challenges associated with RAE and offers recommendations for improving clinical practice. By systematically elaborating on the underlying mechanisms of relative age in ADHD management, this study provides a theoretical foundation for future research and the development of clinical guidelines.

Condition being studied ADHD is the most common neurodevelopmental disorder in children and adolescents (Polanczyk et al., 2014). Both its incidence and associated disease burden have increased worldwide; in China, the standardized prevalence has risen by 9.86% (Li et al., 2025; Schneider & Eisenberg, 2006). Characterized by hyperactivity, impulsivity, and inattention, ADHD significantly impairs daily functioning and academic achievement, imposing a heavy societal burden (Hyman et al., 2020). First-line treatments include behavioral interventions and pharmacotherapy; psychostimulants and atomoxetine are the most frequently prescribed medications globally (Wolraich et al., 2011). However, diagnostic and treatment practices vary markedly across regions, especially between the United States and Europe. A growing body of evidence indicates that age exerts a substantial influence on ADHD diagnosis and treatment(Frisira et al., 2025). Specifically, school-entry age and relative age within a classroom can profoundly affect children's psych.

METHODS

Search strategy Construction of Search Terms: (TI=("Attention Deficit Disorder with Hyperactivity" OR "ADHD" OR "Attention Deficit Hyperactivity

Disorder" OR "Hyperkinetic Syndrome" OR "deficit hyperactivity disorder attention" OR "ADDH" OR "Attention Deficit Disorder" OR "Minimal Brain Dysfunction"))AND((TI=("Teen" OR "Teenage" OR "Infant" OR "Baby" OR "Kid" OR "Child" OR "Teenager" OR "Juvenile" OR "Tender" OR "Adolescent" OR "Adolescence" OR "Puberty" OR "Underage" OR "Preschooler" OR "relative age" OR "relative maturity" OR "relative immaturity" OR "Young-for-grade" OR "Old-for-grade" OR "Toddler" OR "Preteen" OR "Prepubertal" OR "Preadolescent" OR "Minor" OR "Pupil")) OR AB=("Teen" OR "Teenage" OR "Infant" OR "Baby" OR "Kid" OR "Child" OR "Teenager" OR "Juvenile" OR "Tender" OR "Adolescent" OR "Adolescence" OR "Puberty" OR "Underage" OR "Preschooler" OR "relative age" OR "relative maturity" OR "relative immaturity" OR "Young-for-grade" OR "Old-for-grade" OR "Toddler" OR "Preteen" OR "Prepubertal" OR "Preadolescent" OR ".

Participant or population Children and adolescents aged 3 to 21 years.

Intervention (Relatively Younger): Children born late in the selection year relative to the cutoff date.

Comparator (Relatively Older): Children born early in the selection year relative to the cutoff date.

Study designs to be included Cohort studies and cross-sectional studies.

Eligibility criteria The inclusion criteria for the study are as follows: Population: Children and adolescents aged 3 to 21 years; Exposure (Relatively Younger): Children born late in the selection year relative to the cutoff date; Comparison (Relatively Older): Children born early in the selection year relative to the cutoff date; Outcome: The impact of relative age on the likelihood of receiving an ADHD diagnosis or being prescribed ADHD medication; Study Design: Cohort studies and cross-sectional studies. Studies were included only if they provided the original data or sufficient statistics to calculate an odds ratio (OR).

Information sources The literature screening strictly followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart (Moher et al., 2009). Two researchers (LYB and GJX) independently conducted the screening process from titles, abstracts to full texts, and recorded the final included studies. In case of disagreement, it was resolved through negotiation or third-party adjudication. Databases such as EBSCO, Embase, Ovid, PubMed, and Web of Science were searched for relevant literature. Additionally, the reference lists of relevant literature and professional databases were manually screened to supplement the grey literature.

Main outcome(s) The impact of relative age on the likelihood of receiving an ADHD diagnosis or being prescribed ADHD medication.

Data management The relevant data were independently extracted by two groups of reviewers based on a pre-designed Excel data collection form. The data included: the first author, the publication year of the survey, the research title, the research type, the grouping criteria, the sample size, the intervention types of the control group and the experimental group, the treatment and diagnostic data, the diagnostic criteria, the number of males and their proportion, and the age of the research population.

Quality assessment / Risk of bias analysis Two researchers (LYB and GJX) independently evaluated the quality and bias risk of the included cohort using the Newcastle-Ottawa Scale (NOS) (Lo et al., 2014): This scale consists of three dimensions - "selection, comparability, and outcome" - with a total of eight items, scoring up to nine stars. According to predefined criteria, those with sufficient information and rigorous methodology are awarded corresponding stars. A total score of ≥7 stars indicates low bias (high quality), 4-6 stars indicate moderate bias, and ≤3 stars indicate high bias. For cross-sectional studies, we use the 7-item Combie scale appraises cross-sectional studies: each item scores 1 (yes), 0 (no) or 0.5 (unclear), giving a maximum of 7 points. Studies ≥6 points are graded A (high quality). Disagreements were arbitrated by a third party(Crombie, 1996).

Strategy of data synthesis Statistical analyses were performed with Comprehensive Meta Analysis V3 (CMA). Odds ratio (OR) with 95% confidence interval (CI) were used to compare binary variables. For all meta-analyses, the Cochrane Q p value and I2 statistic were applied to check heterogeneity. When p value > 0.05 or I2 > 50%, there was a significant heterogeneity, a random-effect model was used to merge the results. Otherwise, a fixed-effect model was used. A p value less than 0.05 was considered statistically significant. We performed egger's test to assess publication bias (only for outcomes including ten or more studies). Subsequently, a sensitivity analysis was conducted.

Subgroup analysis We plan to conduct subgroup analyses based on factors such as age, treatment, study region, and diagnostic criteria.

Sensitivity analysis We conducted sensitivity analyses to assess the impact of each study on the overall results.

Language restriction English.

Country(ies) involved China.

Keywords ADHD treatment; ADHD diagnosis; Children; Relative age.

Contributions of each author

Author 1 - Yingbin Luo - Author 1 completed the initial draft of the paper.
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