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Prevalence and Associated Factors of Enuresis Among Primary School-aged Children in China: A Systematic Review and Meta-analysis

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ADMINISTRATIVE INFORMATION**Support** - No support.**Review Stage at time of this submission** - Completed but not published.**Conflicts of interest** - None declared.**INPLASY registration number:** INPLASY202680019**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 4 August 2026 and was last updated on 4 August 2026.**INTRODUCTION**

Review question / Objective What is the prevalence of nocturnal enuresis (NE) and what are its associated risk factors among primary school-aged children (5–12 years) in China? A systematic review and meta-analysis of cross-sectional studies was conducted to provide evidence-based data for early identification and targeted intervention in this population.

Condition being studied Nocturnal enuresis (NE), commonly known as bedwetting, is a common voiding disorder in children aged 5 years and older, characterized by involuntary urination during sleep in the absence of any underlying organic disease. It is a developmental problem with a global prevalence of approximately 4%–16%, affecting about 15% of 5-year-olds and nearly 10% of 7-year-olds. While spontaneous remission occurs in about 15% of affected children annually, approximately 1%–2% continue to have symptoms into adulthood. The etiology of NE is multifactorial, involving delayed maturation of the urinary system,

insufficient secretion of antidiuretic hormone (ADH) leading to nocturnal polyuria, detrusor overactivity, reduced functional bladder capacity, and impaired arousal from sleep. In addition to causing physical discomfort, NE is associated with significant psychological and social consequences, including shame, low self-esteem, social isolation, behavioral problems, and academic difficulties. Despite its high prevalence and substantial impact on quality of life, public awareness and treatment-seeking rates remain low. The condition is influenced by a combination of genetic, physiological, behavioral, and environmental factors, making it a complex pediatric health issue that warrants comprehensive investigation and targeted intervention.

METHODS

Participant or population Chinese primary school-aged children aged 5 to 12 years, with no restriction on gender, ethnicity, or geographic region within China. Studies involving children with organic causes of enuresis (e.g., urinary tract

abnormalities, neurological disorders, or endocrine diseases) were excluded. The target population includes both community-based and school-based samples from urban and rural settings.

Intervention This is a systematic review and meta-analysis of observational studies (cross-sectional studies) examining risk factors for nocturnal enuresis. No specific therapeutic intervention was evaluated in this review. Instead, the "exposure of interest" included demographic factors (age, gender), genetic factors (family history of NE), physiological factors (constipation, arousal dysfunction, sleep-disordered breathing, ADHD), behavioural factors (bedtime fluid intake, lack of toilet training), and environmental factors (multi-child families, geographic region). The association between each exposure and the presence of NE was assessed, with children without the exposure serving as the reference group.

Comparator Children without the exposure of interest served as the reference group. For each risk factor examined (e.g., male gender, family history of NE, constipation, ADHD, bedtime fluid intake, lack of toilet training, multi-child families), the comparison group consisted of children who did not have that specific exposure (e.g., females, no family history of NE, no constipation, no ADHD, no bedtime fluid intake, received toilet training, or fewer than three children in the household). For continuous variables such as age, the comparator was each 1-year increase in age. No active intervention was used as a comparator.

Study designs to be included Only cross-sectional studies will be included in this review. Eligible studies must be original, peer-reviewed, and published in either Chinese or English. Studies such as case reports, case series, qualitative studies, letters, conference abstracts, editorials, reviews, systematic reviews, meta-analyses, and animal or basic science studies will be excluded.

Eligibility criteria Inclusion criteria:

- (1) Study type: cross-sectional studies published in peer-reviewed journals.
- (2) Participants: Chinese primary school-aged children aged 5 to 12 years.
- (3) Diagnostic criteria: clear definition of nocturnal enuresis (NE) using any recognized diagnostic standard.
- (4) Outcome measures: the study must report the prevalence of NE and/or its associated factors.
- (5) Language: published in Chinese or English.

Exclusion criteria:

- (1) Basic research, symposium papers, narrative reviews, systematic reviews, meta-analyses, or case reports.
- (2) Duplicate publications.
- (3) Studies for which the full text is unavailable.
- (4) Studies with insufficient data for extraction.
- (5) Publications in languages other than Chinese or English.
- (6) Poor-quality studies (Agency for Healthcare Research and Quality [AHRQ] score < 4).

Information sources The following electronic databases will be searched from inception to 31 May 2026: China National Knowledge Infrastructure (CNKI), Wanfang Data Knowledge Service Platform (WANFANG), VIP Information (Chongqing VIP Information Co., Ltd.), PubMed, Embase, Web of Science, and the Cochrane Library. In addition, we will manually review the reference lists of all included studies and relevant reviews to identify any additional eligible studies. No grey literature, trial registries, or author contacts will be used.

Main outcome(s) The main outcome of this review is the pooled prevalence of nocturnal enuresis (NE) among primary school-aged children (5–12 years) in China. Prevalence will be expressed as a percentage with its 95% confidence interval (CI). In addition, the secondary outcome is the identification and quantification of risk factors associated with NE. The effect measure will be the odds ratio (OR) with 95% CI for each risk factor. All outcomes will be derived from the included cross-sectional studies, with data extracted as reported by each study. No time-related restrictions are applied to the outcomes. Meta-analyses will be performed using a random-effects model due to anticipated heterogeneity. Subgroup analyses will be conducted by gender, age, region, diagnostic criteria, and year of publication to explore potential sources of heterogeneity.

Quality assessment / Risk of bias analysis The quality of the included cross-sectional studies will be assessed using the 11-item quality appraisal checklist recommended by the Agency for Healthcare Research and Quality (AHRQ). Each item is scored as "yes" (1 point), "no" (0 points), or "unclear" (0 points), yielding a total score ranging from 0 to 11. Studies with scores of 0–3 will be classified as low quality, 4–7 as moderate quality, and 8–11 as high quality. Studies scoring below 4 will be excluded. The quality assessment will be performed independently by two reviewers. Any disagreements will be resolved through discussion or consultation with a third reviewer.

Strategy of data synthesis Data will be synthesized using RevMan 5.3 software. For prevalence estimates, the pooled prevalence with 95% confidence intervals (CIs) will be calculated. For risk factors, odds ratios (ORs) with 95% CIs will be calculated for dichotomous outcomes. Heterogeneity across studies will be assessed using the I^2 statistic. If $I^2 \leq 0.1$, a fixed-effects model will be used; otherwise, a random-effects model will be applied. Subgroup analyses will be conducted by gender, age, region, diagnostic criteria, and publication year to explore potential sources of heterogeneity. Sensitivity analyses will be performed by sequentially excluding each study to assess the robustness of the pooled estimates. Publication bias will be evaluated using funnel plots and Egger's test if at least 10 studies are included in the meta-analysis. All statistical tests will be two-sided, and a P-value < 0.05 will be considered statistically significant.

Subgroup analysis Subgroup analyses will be performed to explore potential sources of heterogeneity and to examine whether the prevalence of NE differs across key study-level and population-level characteristics. The following subgroup categories are planned:

- (1) Gender: male vs. female;
- (2) Age: 5, 6, 7, 8, 9, 10, 11, and 12 years;
- (3) Geographic region: southern China vs. northern China (delineated by the Qinling-Huai River line);
- (4) Diagnostic criteria: ICD-10, ICCS 1998, ICCS 2014, ICCS 2016, and Chinese expert consensus;
- (5) Year of publication: before 2020 vs. 2020 and later.

All subgroup analyses will be conducted using a random-effects model due to the anticipated high heterogeneity. The I^2 statistic will be used to assess the proportion of heterogeneity remaining within each subgroup. Subgroup differences will be considered statistically significant at $P < 0.05$. Subgroup analyses are limited to variables reported at the study level; individual-level subgroup analyses cannot be performed due to the nature of aggregated data.

Sensitivity analysis Sensitivity analyses will be conducted to assess the robustness and stability of the pooled prevalence and risk factor estimates. The following sensitivity analyses are planned:

- (1) Sequential study exclusion: We will perform a leave-one-out sensitivity analysis by sequentially excluding each included study and re-calculating the pooled estimates to determine whether any

single study exerts undue influence on the overall results.

- (2) Diagnostic criteria restriction: To evaluate the impact of varying diagnostic definitions, we will conduct a sensitivity analysis restricted to studies that used the International Children's Continence Society (ICCS) 2014 or 2016 criteria, which represent the most contemporary and standardized diagnostic approaches for childhood enuresis.

- (3) Geographic region restriction: To assess the influence of regional distribution on the pooled estimates, we will perform a sensitivity analysis limited to studies conducted in eastern and central China, where the majority of included studies are concentrated.

- (4) High-quality studies only: To evaluate the impact of study quality on the results, we will conduct a sensitivity analysis restricted to studies with an AHRQ quality score of 8 or above (high quality).

Results from the sensitivity analyses will be compared with the main pooled estimates to assess stability. If the results remain consistent across these analyses, the findings will be considered robust.

Country(ies) involved China.

Keywords enuresis; prevalence; risk factors; primary school-aged children; meta-analysis; China.

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