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The Impact of Problematic Social Media Use on Mental Health Among Rural Adolescents: A Systematic Review and Meta-Analysis

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Liu, SA; Liu, N; Xie, HW; Luo, L; Wang, CL; Tang, ML; Wen, XY.

Corresponding author:

Xianying Wen

yanglinnew@yeah.net

Author Affiliation:

MianYang Center for Disease Control and Prevention.

ADMINISTRATIVE INFORMATION**Support** - No support.**Review Stage at time of this submission** - Completed but not published.**Conflicts of interest** - None declared.**INPLASY registration number:** INPLASY202670054**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 16 July 2026 and was last updated on 16 July 2026.**INTRODUCTION**

Review question / Objective The widespread adoption of social media platforms has raised concerns about their potential negative effects on mental health, particularly among vulnerable populations such as rural adolescents. This systematic review and meta-analysis aimed to synthesise existing research on the correlation between problematic social media use and mental health outcomes in this demographic.

Condition being studied The widespread adoption of social media platforms has raised concerns about their potential negative effects on mental health, particularly among vulnerable populations such as rural adolescents. Existing literature has documented tentative links between problematic social media use and adverse psychological outcomes, including depressive symptoms, anxiety and stress.

METHODS

Participant or population The age range of participants across studies was 12–30 years, covering early, middle and late adolescence and young adulthood.

Intervention Not applicable.

Comparator Not applicable.

Study designs to be included Studies were eligible for inclusion if they met the following criteria: (1) focused on adolescents or young adults in rural areas; (2) examined the correlation between problematic social media use and at least one of the following mental health outcomes: depression, anxiety or stress; (3) provided quantitative data suitable for meta-analysis; and (4) were published in English or Chinese.

Eligibility criteria The exclusion criteria included (1) studies focusing solely on urban populations, (2) qualitative studies or case reports and (3)

studies that did not provide sufficient statistical information for effect size calculation.

Information sources This systematic review and meta-analysis was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement guidelines, and a complete PRISMA 2020 checklist is provided as supplementary material. A comprehensive literature search was performed across PubMed, Cochrane Library, Web of Science and China National Knowledge Infrastructure (CNKI) databases from database inception to 31 December 2023, with the search formally conducted on 31 October 2024. The exclusion of 2024 publications was implemented to ensure unified literature inclusion timelines, avoid incomplete annual literature retrieval and maintain temporal consistency of the evidence base.

Main outcome(s) 1. examined the correlation between problematic social media use and at least one of the following mental health outcomes: depression, anxiety or stress

2. Different effect sizes were selected based on outcome measurement attributes: hazard ratios (HRs) were adopted for depressive symptoms, as most depression-related outcomes were measured via longitudinal follow-up designs with time-to-event indicators; odds ratios (ORs) were used for anxiety and stress symptoms, which were predominantly measured as categorical binary outcomes in cross-sectional surveys.

Additional outcome(s) 1. When studies reported multiple effect sizes for the same outcome, the most adjusted model was used to minimise potential confounding. The adjusted models uniformly controlled for core confounding variables, including basic demographic characteristics (age, gender), socioeconomic status and comorbid psychological symptoms. All effect sizes adopted standardised regression coefficients to avoid exaggerated effect estimates caused by unadjusted bivariate correlation analysis.

2. Random-effects models were employed in all meta-analyses to account for expected heterogeneity among studies. The I^2 statistic was used to quantify heterogeneity, with values of 25%, 50% and 75% indicating low, moderate and high heterogeneity, respectively.

Quality assessment / Risk of bias analysis

Quality assessment using the NOS revealed scores ranging from 5 to 8, indicating moderate to high methodological quality across the included studies. The mean NOS score was 6.39 +/- 0.90.

Specifically, 4 studies were graded as low quality (5 points), 7 studies as moderate quality (6 points), and 7 studies as high quality (7-8 points) (Table 1).

Strategy of data synthesis Meta-analyses were performed to synthesise the correlational relationships between problematic social media use and three mental health outcomes: depressive symptoms, anxiety symptoms and stress. Different effect sizes were selected based on outcome measurement attributes: hazard ratios (HRs) were adopted for depressive symptoms, as most depression-related outcomes were measured via longitudinal follow-up designs with time-to-event indicators; odds ratios (ORs) were used for anxiety and stress symptoms, which were predominantly measured as categorical binary outcomes in cross-sectional surveys.

When studies reported multiple effect sizes for the same outcome, the most adjusted model was used to minimise potential confounding. The adjusted models uniformly controlled for core confounding variables, including basic demographic characteristics (age, gender), socioeconomic status and comorbid psychological symptoms. All effect sizes adopted standardised regression coefficients to avoid exaggerated effect estimates caused by unadjusted bivariate correlation analysis [23].

Random-effects models were employed in all meta-analyses to account for expected heterogeneity among studies arising from differences in study designs, populations and measures. The I^2 statistic was used to quantify heterogeneity, with values of 25%, 50% and 75% indicating low, moderate and high heterogeneity, respectively.

To explore sources of high inter-study heterogeneity, preset subgroup analyses (stratified by age group, gender proportion and regional culture) and univariate meta-regression analyses were conducted. Sensitivity analysis was further conducted by sequentially excluding individual studies to assess the robustness of the pooled correlational results.

To assess potential publication bias, funnel plots were created and visually inspected for asymmetry. The trim-and-fill method was applied to quantitatively correct publication bias and generate adjusted pooled effect sizes.

A comprehensive risk-of-bias analysis was conducted for all included studies, evaluating potential sources of bias, including selection, measurement, reporting and conceptual overlap bias. Notably, all included studies exhibited a common methodological limitation of violated measurement independence: items on problematic social media use scales and mental health

symptom scales overlap conceptually (e.g. measuring social media use for emotional relief when feeling depressed), artificially inflating correlational coefficients and weakening result reliability.

All statistical analyses were performed using Review Manager (RevMan) software version 5.4.1 (The Cochrane Collaboration, London, UK) and Stata 17.0 (StataCorp LLC, College Station, TX, USA) for advanced meta-regression and trim-and-fill analysis. The threshold for statistical significance was set at $p < 0.05$ for all analyses.

Subgroup analysis Subgroup analysis indicated that regional cultural differences and sample age range partially explained heterogeneity, with Western samples showing weaker protective correlations than Eastern samples. Sensitivity analysis confirmed that the pooled correlational result remained stable after excluding any single study.

Sensitivity analysis Sensitivity analysis was further conducted by sequentially excluding individual studies to assess the robustness of the pooled correlational results.

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Country(ies) involved China.

Keywords problematic social media use; mental health; adolescents; rural population; meta-analysis; correlational study.

Contributions of each author

Author 1 - Shian Liu.

Author 2 - Nian Liu.

Author 3 - Hongwei Xie.

Author 4 - Lei Luo.

Author 5 - Chengliang Wang.

Author 6 - Meilin Tang.

Author 7 - Xianying Wen.