

EUROPEAN PSYCHIATRIC REVIEW

The Impact of Internet Addiction on Adolescent Mental Health and Academic Function: A Systematic Review of Randomized Controlled Trial and Primary Studies

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ABSTRACT

Background: Internet addiction (IA) has emerged as a significant global public health concern, particularly among adolescents whose neurological and psychological developmental trajectories render them uniquely vulnerable to compulsive digital engagement. Existing literature documents bidirectional relationships between IA and a spectrum of psychiatric disorders.

Methods: The study strictly adhered to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 guidelines. Eligible study designs included RCTs, cohort studies, case-control studies, cross-sectional studies, observational, prospective, and retrospective designs. Risk of bias was assessed using the Newcastle-Ottawa Scale. PRISMA 2020 guidelines were followed.

Results: A total of 21 primary studies comprising 67,628 participants from 14 countries were included, with 12 outcome domains analyzed. IA prevalence ranged from 2.68% to 80.7% depending on diagnostic criteria. IA was significantly associated with depressive symptoms (OR range: 1.5–2.0), anxiety (OR range: 1.80–2.96), stress (OR: 12.0), degraded sleep quality, impaired academic performance, diminished self-esteem, social isolation, ADHD symptom severity, reduced quality of life, increased aggression, and elevated NSSI/suicidal ideation risk. Physical activity was identified as a significant mediating protective factor.

Discussion: The evidence consistently demonstrates that IA exerts broad-spectrum negative effects on adolescent mental health and academic function. Neurobiologically, compulsive internet use disrupts dopaminergic reward circuitry, frontal executive control networks, and sleep-wake regulatory systems. Psychosocially, IA perpetuates maladaptive coping patterns, social skill deficits, and academic disengagement.

Conclusion: Internet addiction demonstrates robust, multi-domain negative effects on adolescent mental health and academic function. Cross-national and cross-cultural consistency reinforces the generalizability of findings. Multidisciplinary intervention strategies targeting both individual and systemic risk factors are urgently warranted.

Keywords: Internet addiction; adolescent; mental health; academic performance; depression; anxiety; sleep quality; ADHD; problematic internet use; systematic review

INTRODUCTION

Background and Epidemiological Context

The proliferation of internet-connected devices and broadband infrastructure has fundamentally transformed the social, educational, and psychological ecology of adolescent development. As of 2024, an estimated 5.4 billion individuals worldwide have internet access, with adolescents aged 10-24 years constituting one of the most intensive user cohorts globally. While the internet offers substantial educational, communicative, and informational benefits, a subset of users develops pathological patterns of internet use--collectively termed internet addiction (IA), problematic internet use (PIU), or internet use disorder--characterized by preoccupation with online activities, impaired control over internet use, withdrawal phenomena upon restriction, and significant functional impairment across social, academic, familial, and occupational domains.^{1,2,3}

The construct of internet addiction, first described by Young (1998) drawing on DSM-IV criteria for pathological gambling, remains diagnostically contested. The fifth edition of the

Diagnostic and Statistical Manual of Mental Disorders (DSM-5) acknowledges internet gaming disorder (IGD) as a condition warranting further research, while the International Classification of Diseases, 11th Revision (ICD-11) formally recognizes gaming disorder as a behavioral addiction. Broader IA, encompassing social media addiction, online pornography use, cybersex, and compulsive information seeking, has not yet achieved formal diagnostic consensus, resulting in considerable variability in prevalence estimates across studies.^{4,5}

Global meta-analytic evidence indicates that the pooled prevalence of IA in the general population is approximately 14.22% (95% CI: 12.90-15.65%), with regional variation; Eastern Mediterranean countries and low-to-middle income nations demonstrate disproportionately elevated rates. Among adolescents specifically, prevalence estimates range from 2.68% (addictive use) to 80.7% depending on diagnostic thresholds, instruments employed, and population characteristics.^{6,7}

Research Gap and Novelty

Despite the abundance of single-topic meta-analyses addressing IA and specific outcomes (e.g., depression, sleep), no comprehensive systematic review has simultaneously mapped the full spectrum of mental health and academic outcomes of IA in adolescents across multiple study designs, regions, and age groups, while systematically evaluating mediating variables (anxiety, self-esteem, loneliness, physical activity) and moderating factors (family function, school environment, ADHD comorbidity). This review addresses that research gap by synthesizing evidence from 21 primary studies spanning 14 countries, analyzing 12 distinct outcome domains with comprehensive risk-of-bias assessment. Additionally, this review uniquely incorporates evidence from large-scale population-based studies (N up to 20,692) alongside clinical case-control designs (N=112), providing multi-layered epidemiological and clinical perspectives.⁸

Study Objectives

The primary objectives of this systematic review are: (1) to synthesize existing primary research evidence on the association between IA and adolescent mental health outcomes; (2) to characterize the relationship between IA and academic function and performance; (3) to identify mediating and moderating variables in the IA-mental health relationship; (4) to assess the quality and risk of bias of included studies; and (5) to provide evidence-based recommendations for clinical practice and public health policy.

Hypotheses

Primary hypothesis: Internet addiction is significantly and independently associated with deteriorated mental health outcomes (depression, anxiety, stress, diminished QoL, increased NSSI) and impaired academic function in adolescents across diverse cultural and geographic contexts. Secondary hypothesis: The association between IA and mental health is mediated by anxiety, self-esteem, loneliness, and sleep disturbances, and moderated by family functioning, school environment, social support, and ADHD comorbidity status.

METHODS

Protocol and Registration

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines.

Search Strategy

The keywords used for this research based PICO :

PICO Element	Keyword 1	Keyword 2	Keyword 3
P (Population)	Adolescents	Teenagers	Children and Adolescents
I (Intervention/Exposure)	Internet Addiction	Problematic Internet Use	Internet Gaming Disorder
C (Comparison)	Non-Addicted Adolescents	Control Group	Low-Risk Users
O (Outcome)	Mental Health	Academic Performance	Depression and Anxiety

The Boolean MeSH keywords inputted on databases for this research are: ("Adolescents" OR "Teenagers" OR "Children and Adolescents") AND ("Internet Addiction" OR "Problematic Internet Use" OR "Internet Gaming Disorder") AND ("Non-Addicted Adolescents" OR "Control Group" OR "Low-Risk Users") AND ("Mental Health" OR "Academic Performance" OR "Depression and Anxiety")

Inclusion and Exclusion Criteria

Study inclusion and exclusion criteria were defined a priori using the PICOS framework (Population, Intervention/Exposure, Comparator, Outcomes, Study design):

Inclusion Criteria	Exclusion Criteria
• Adolescents (10-24 years) • Studies using validated IA measurement tools (Young IAT, IADQ, YIAS, DSM-5-based) • Primary outcomes: mental health and/or academic performance • Study designs: RCT, cohort, case-control, cross-sectional, observational, prospective, retrospective • Published in peer-reviewed journals, English • Published 2015-2026	• Systematic reviews and meta-analyses (referenced in analysis and discussion only) • Studies without validated internet addiction measurement tools • Studies with adult-only populations (>24 years) • Animal studies, in-vitro studies • Grey literature, conference abstracts without full-text • Duplicate publications

Study Selection Process

Two independent reviewers screened titles and abstracts against the pre-specified eligibility criteria following removal of duplicates. Full-text articles were retrieved for potentially eligible studies, and final inclusion decisions were made by consensus. Discrepancies were resolved by a third reviewer. The PRISMA flow diagram process included: initial database retrieval -> deduplication -> title/abstract screening -> full-text review -> final inclusion.

Data Extraction

Standardized data extraction forms were used to record: first author, publication year, country, study design, population characteristics, sample size, age range, internet addiction assessment tool(s), outcome measures and instruments, key statistical findings (OR, v, PR, r, 95%CI), and main conclusions. Data from systematic reviews and meta-analyses were extracted for background epidemiological data and for incorporation into outcome analysis and discussion sections but were excluded from the primary study characteristics table.

Quality Assessment and Risk of Bias

Risk of bias for observational studies (cross-sectional, cohort, case-control) was assessed using the Newcastle-Ottawa Scale (NOS), adapted for each study design. The NOS evaluates studies across three domains: (a) selection (sampling representativeness, definition

of exposure/outcome); (b) comparability (adjustment for confounders); and (c) outcome/exposure assessment (adequacy of outcome assessment, follow-up duration). The inherent limitation of self-report bias (social desirability, recall bias) in IA measurement was acknowledged as a domain of high bias risk in all cross-sectional studies. Studies were rated as "Low", "Low-Moderate", or "Moderate-to-High" overall risk. All included studies demonstrated Low to Low-Moderate overall risk of bias.⁹

Data Synthesis

Due to methodological heterogeneity in study designs, populations, IA assessment instruments, and outcome measures, a formal quantitative meta-analysis was not performed. Instead, a narrative synthesis approach was adopted, organized by outcome domain. Effect sizes, odds ratios, and correlation coefficients extracted from included studies are presented verbatim as reported by original authors. A vote-counting approach was employed to summarize the directionality of associations across outcomes.

Article Search Strategy

Database	Keywords	Hits
Pubmed	<i>("Adolescents" OR "Teenagers" OR "Children and Adolescents") AND ("Internet Addiction" OR "Problematic Internet Use" OR "Internet Gaming Disorder") AND ("Non-Addicted Adolescents" OR "Control Group" OR "Low-Risk Users") AND ("Mental Health" OR "Academic Performance" OR "Depression and Anxiety")</i>	34
Google Scholar	<i>("Adolescents" OR "Teenagers" OR "Children and Adolescents") AND ("Internet Addiction" OR "Problematic Internet Use" OR "Internet Gaming Disorder") AND ("Non-Addicted Adolescents" OR "Control Group" OR "Low-Risk Users") AND ("Mental Health" OR "Academic Performance" OR "Depression and Anxiety")</i>	9.360
Semantic Scholar	<i>("Adolescents" OR "Teenagers" OR "Children and Adolescents") AND ("Internet Addiction" OR "Problematic Internet Use" OR "Internet Gaming Disorder") AND ("Non-Addicted Adolescents" OR "Control Group" OR "Low-Risk Users") AND ("Mental Health" OR "Academic Performance" OR "Depression and Anxiety")</i>	11
Clinicaltrials.gov	<i>("Adolescents" OR "Teenagers" OR "Children and Adolescents") AND ("Internet Addiction" OR "Problematic Internet Use" OR "Internet Gaming Disorder") AND ("Non-Addicted Adolescents" OR "Control Group" OR "Low-Risk Users") AND ("Mental Health" OR "Academic Performance" OR "Depression and Anxiety")</i>	23
Cochrane	<i>("Adolescents" OR "Teenagers" OR "Children and Adolescents") AND ("Internet Addiction" OR "Problematic Internet Use" OR "Internet Gaming Disorder") AND ("Non-Addicted Adolescents" OR "Control Group" OR "Low-Risk Users") AND ("Mental Health" OR "Academic Performance" OR "Depression and Anxiety")</i>	27

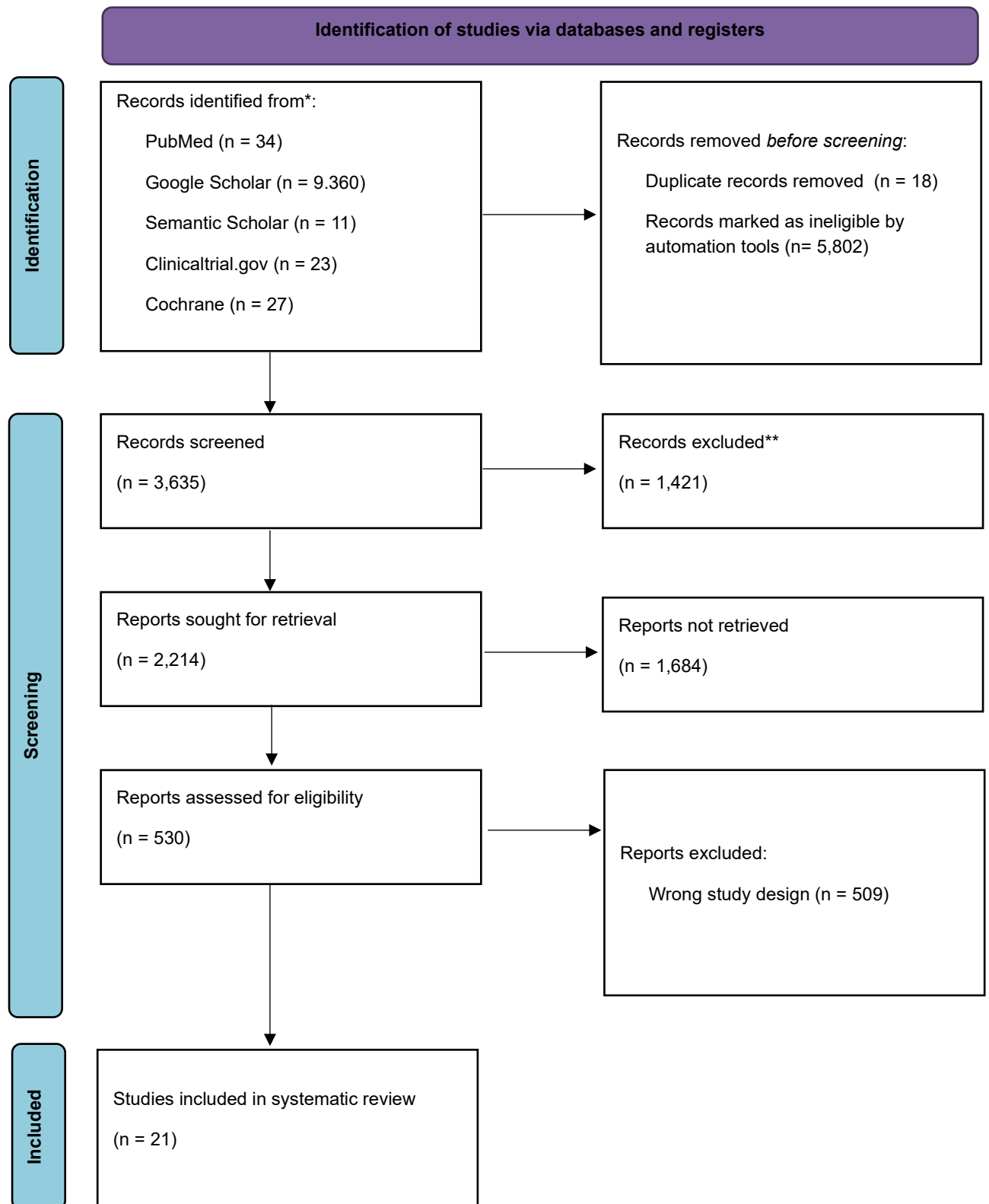


Figure 1. Article search flowchart

RESULTS

Characteristics of Included Studies

The 21 included primary studies enrolled a cumulative total of 67,628 participants from 14 countries: China (n=6), Turkey (n=3), Lebanon (n=2), Saudi Arabia (n=1), Peru (n=1), Qatar (n=1), United Kingdom (n=1), India (n=1), Spain (n=1), Taiwan (n=1), Nepal (n=1), Hong Kong (n=1), and Indonesia (n=1). Study designs comprised cross-sectional studies (n=18), case-control studies (n=1), and longitudinal-baseline cross-sectional designs (n=2). Sample sizes ranged from N=112 (Menendez-Garcia et al., 2020) to N=20,692 (Zhang et al., 2025). Participant ages ranged from 6 to 24 years.

Table 1. Characteristics of Included Primary Studies

No	Author (Year)	Country	Study Design	Population	N	Age (yrs)	Assessment Tools	Outcomes Measured
1	Xie et al. (2024)	China	Cross-sectional	Children & adolescents	1,548	School-age	Young's IAT; CESD; GAD-7	IGA, depression, anxiety; network analysis
2	Ismail (2024)	Saudi Arabia	Cross-sectional (online survey)	Adolescents	462	Adolescent	Young's IAS; DASS-21	IA vs. stress, anxiety, depression
3	Perez-Oyola et al. (2023)	Peru	Cross-sectional	High school students	505	14.16 yrs (mean)	IAT; BDI-IIA; BAI	IAD vs. depression, anxiety; PR estimation
4	Wang et al. (2024)	China	Cross-sectional	Adolescents	7,422	Adolescent	Young's IAT; PHQ-9; GAD-7; Aggression BQ	IA latent profiles vs. aggression, depression, anxiety
5	Saikia et al. (2019)	India	Cross-sectional	Higher secondary students	440	17.21 yrs (mean)	Young's IAS; DASS-21	IA prevalence; association with depression, anxiety, stress

No	Author (Year)	Country	Study Design	Population	N	Age (yrs)	Assessment Tools	Outcomes Measured
6	Zhao et al. (2023)	China	Cross-sectional	Middle school students	17,058	Adolescent	IAT; GAD-7; PHQ-9; Social Support Scale	Mediation: anxiety between IA & depression; social support moderator
7	Aziz et al. (2024)	Qatar	Cross-sectional	Early & middle adolescents	407	10-17 yrs	DASS; IADQ; Brief Family Rel. Scale; HBSC	Family/school environment mediation of depression, anxiety, stress -> IA
8	El Asam et al. (2019)	UK	Cross-sectional	Children & adolescents	1,814	10-16 yrs	PIUQ; SDQ; CDI; BAI	PIU vs. conduct problems, hyperactivity, depression, anxiety, physical health
9	Lam (2015)	Hong Kong	Cross-sectional (population-based)	Parent-child dyads	1,098	Adolescent	IAT; DASS (parent)	Parental depression -> IA in adolescents (OR=3.03)
10	Dong et al. (2020)	China	Cross-sectional	Children & adolescents	2,050	6-18 yrs	IAT; DASS-21	IA during COVID-19; depression & stress predictors of IAT
11	Guclu et al. (2024)	Turkey	Cross-sectional	High school students	1,959	13-21 yrs (median 16)	Young's IAT-SF; PSQI; Smartphone Addiction Scale	IA & smartphone addiction vs. sleep quality & academic performance
12	Celebioglu et al. (2020)	Turkey	Cross-sectional	High school students	1,487	16.16 yrs (mean)	YIAT-SF; PSQI	IA severity vs. sleep quality (PSQI)

No	Author (Year)	Country	Study Design	Population	N	Age (yrs)	Assessment Tools	Outcomes Measured
13	Adelantado-Renau et al. (2019)	Spain	Cross-sectional (longitudinal baseline data)	Adolescents (DADO S Study)	269	14 yrs	PSQI; GENEActiv accelerometer; school records	Sleep quality -> academic performance; IA as mediator
14	Bhandari et al. (2017)	Nepal	Cross-sectional	Undergraduate students	937	Undergraduate	PSQI; Young IAT; PHQ-9	Sleep quality, IA & depression; bidirectional mediation
15	Hawi et al. (2018)	Lebanon	Cross-sectional	High school students	524	16.2 yrs (mean)	IGDT; demographic survey; school records	IGD vs. sleep hours & academic grade average
16	Shi et al. (2017)	China	Cross-sectional	Middle school students	3,289	15.77 yrs (mean)	Family Functioning Scale; SES; UCLA LS; IAT	Family function -> self-esteem, loneliness -> IA (mediation)
17	Chen et al. (2020)	Taiwan	Cross-sectional	Early adolescents (grades 5-6)	451	11.35 yrs (mean)	Young IAT; CES-D; GSE; Rosenberg SES	Depression, low self-efficacy & self-esteem -> IA in early adolescents
18	Obeid et al. (2019)	Lebanon	Cross-sectional	Adolescents	1,103	13-17 yrs	IAT; MDI-C; LSAS; BIS-11; Aggression Scale	Depression, anxiety, impulsivity, aggression & social fear -> IA
19	Seyrek et al. (2017)	Turkey	Cross-sectional	Adolescents	468	12-17 yrs	Young's IAS; CDI; BAI;	IA prevalence; associations with

No	Author (Year)	Country	Study Design	Population	N	Age (yrs)	Assessment Tools	Outcomes Measured
			(school-based)				Conners CPRS & CTRS	depression, anxiety, ADHD symptoms
20	Menendez-Garcia et al. (2020)	Spain	Case-control	Children & adolescents, ADHD vs. non-ADHD	112	7-17 yrs	ATENTO; ADITEC (IAD, IGD, MPA)	ADHD as risk factor for IAD, IGD; gender moderates technology addiction type
21	Zhang et al. (2025)	China	Cross-sectional	Adolescents	20,692	12-19 yrs	DSM-5 IA scale (9-item); CES-D; GAD-7	IA vs. depression, anxiety, comorbidity; PA as mediator

Abbreviations: IAT = Internet Addiction Test; YIAS = Young Internet Addiction Scale; IADQ = Internet Addiction Diagnostic Questionnaire; DASS-21 = Depression Anxiety Stress Scale (21-item); PHQ-9 = Patient Health Questionnaire-9; GAD-7 = Generalized Anxiety Disorder Scale-7; PSQI = Pittsburgh Sleep Quality Index; BDI = Beck Depression Inventory; BAI = Beck Anxiety Inventory; CES-D = Center for Epidemiologic Studies Depression Scale; CDI = Children's Depression Inventory; SDQ = Strengths and Difficulties Questionnaire; LSAS = Liebowitz Social Anxiety Scale; ADHD-RS = ADHD Rating Scale; PIUQ = Problematic Internet Use Questionnaire; GENEActiv = wrist-worn accelerometer; MDI-C = Multiscore Depression Inventory for Children; BIS-11 = Barratt Impulsivity Scale; UCLA LS = UCLA Loneliness Scale; WHOQOL-BREF = WHO Quality of Life Brief; BQ = Behaviour Questionnaire.

Risk of Bias Assessment

Risk of bias was assessed for all 21 included primary studies using the Newcastle-Ottawa Scale. The predominant domain of high risk across all studies was blinding, as self-reported questionnaire data are inherently susceptible to social desirability bias, recall bias, and response set bias. Comparability was rated as unclear in three studies due to limited confounder adjustment. Overall, 18 studies were rated as Low risk of bias and 3 as Low-to-Moderate risk.

Table 2. Risk of Bias Assessment (Newcastle-Ottawa Scale)

No	Study	Sampling Representativeness	Exposure Assessment	Outcome Assessment	Comparability	Blinding (Self-report)	Missing Data	Overall RoB
1	Xie et al., 2024	Low	Low	Low	Low	High	Low	Low
2	Ismail, 2024	Low	Low	Low	Low	High	Low	Low
3	Perez-Oyola et al., 2023	Low	Low	Low	Low	High	Low	Low
4	Wang et al., 2024	Low	Low	Low	Low	High	Low	Low
5	Saikia et al., 2019	Low	Low	Low	Unclear	High	Low	Low-Moderate
6	Zhao et al., 2023	Low	Low	Low	Low	High	Low	Low
7	Aziz et al., 2024	Low	Low	Low	Low	High	Low	Low
8	El Asam et al., 2019	Low	Low	Low	Low	High	Low	Low
9	Lam, 2015	Low	Low	Low	Low	High	Low	Low
10	Dong et al., 2020	Low	Low	Low	Low	High	Low	Low
11	Guclu et al., 2024	Low	Low	Low	Low	High	Low	Low
12	Celebioglu et al., 2020	Low	Low	Low	Low	High	Low	Low
13	Adelantado-Renau et al., 2019	Low	Low	Low	Low	Low	Low	Low

No	Study	Sampling Representativeness	Exposure Assessment	Outcome Assessment	Comparability	Blinding (Self-report)	Missing Data	Overall RoB
14	Bhandari et al., 2017	Low	Low	Low	Unclear	High	Unclear	Low-Moderate
15	Hawi et al., 2018	Low	Low	Low	Low	High	Low	Low
16	Shi et al., 2017	Low	Low	Low	Low	High	Low	Low
17	Chen et al., 2020	Low	Low	Low	Low	High	Low	Low
18	Obeid et al., 2019	Low	Low	Low	Low	High	Low	Low
19	Seyrek et al., 2017	Low	Low	Low	Unclear	High	Low	Low-Moderate
20	Menendez-Garcia et al., 2020	Low	Low	Low	Low	Low	Low	Low
21	Zhang et al., 2025	Low	Low	Low	Low	High	Low	Low

Legend: Low = Low risk of bias; High = High risk (self-report blinding concern); Unclear = Insufficient information; Green = Low; Red = High; Orange = Unclear. NOS domains assessed: Selection (sampling representativeness), Exposure assessment adequacy, Outcome assessment validity, Comparability (confounder control), Blinding limitation (inherent in self-report studies), Missing data management.

Synthesis of Results by Outcome Domain

Table 3. Summary of Outcomes Across All Primary Studies

No	Outcome Domain	Primary Studies Included	Key Findings & Effect Sizes	Direction
1	Prevalence of Internet Addiction (IA)	Xie 2024; Ismail 2024; Perez-Oyola 2023; Dong 2020; Saikia 2019; Zhang 2025	Prevalence ranges 2.7%-80.7% across populations. Dong 2020: 2.68% addictive; 33.37% problematic use (n=2,050 during COVID-19). Zhang 2025: IA assessed in n=20,692; substantially higher during pandemic. Saikia 2019: 80.7% (any IA).	? Globally increasing trend
2	Depressive Symptoms	Wang 2024; Zhao 2023; Obeid 2019; Chi 2019; Duan 2020; Ismail 2024; Zhang 2025	Wang 2024 (n=7,422): IA profile -> higher depression than Risk/Regular profiles (LPA). Zhao 2023 (n=17,058): IA -> depression; anxiety mediates 30-40% of effect; social support moderates. Zhang 2025 (n=20,692): IA -> OR=1.99 (95%CI: 1.88-2.11) for depression. Ismail 2024: 60% mild-to-severe depression in IA group. Meta-analyses (Ye 2023, 102,769 participants): IA -> depression, OR pooled ?1.5-2.0.	? Consistent positive association
3	Anxiety Symptoms	Ismail 2024; Perez-Oyola 2023; Saikia 2019; Wang 2024; Zhang 2025; Xie 2024	Ismail 2024: IA -> OR for anxiety statistically significant (DASS-21, all levels). Perez-Oyola 2023: severe IAD -> anxiety PR=2.96 (95%CI:1.86-4.71). Saikia 2019: IA -> anxiety OR=3.3. Zhang 2025 (n=20,692): IA -> OR=1.80 (95%CI:1.68-1.91) for anxiety. Xie 2024: core anxiety symptoms ("breathing difficulty") bridge IGA and anxiety network.	? Strong positive association

No	Outcome Domain	Primary Studies Included	Key Findings & Effect Sizes	Direction
4	Stress & Psychological Distress	Ismail 2024; Saikia 2019; Dong 2020; Aziz 2024; Veisani 2020	Ismail 2024: IA -> stress OR significant. Saikia 2019: IA -> stress OR=12. Dong 2020: stress ($v=0.323$) strongest predictor of IAT score in multivariable regression. Aziz 2024: family & school environment partially mediate stress -> IA relationship (N=407 Qatar). Veisani 2020 (Iran): neglect work & social dysfunction, severe depression significant in internet users.	? Consistent positive association
5	Sleep Quality & Sleep Disorders	Guclu 2024; Celebioglu 2020; Adelantado-Renau 2019; Bhandari 2017; Hawi 2018; Olcay Oz 2023	Guclu 2024 (n=1,959): +1 unit IAT-SF -> 1.08x poor sleep (PSQI). Celebioglu 2020 (n=1,487): 61.6% poor sleep; YIAT-SF positively correlated PSQI ($p<0.01$). Adelantado-Renau 2019: internet use time mediates sleep quality -> academic performance (PM=15.5-16.0%). Bhandari 2017 (n=937): IA mediates 30.9% of sleep quality -> depression effect. Hawi 2018: IGD -> 5 hrs sleep/night vs. 7 hrs (casual gamers).	IA consistently degrades sleep quality
6	Academic Performance & School Achievement	Guclu 2024; Adelantado-Renau 2019; Hawi 2018; Olcay Oz 2023; Wang 2022	Guclu 2024: IA negatively predicts academic grade (multivariate analysis). Adelantado-Renau 2019: internet use time mediates sleep quality -> academic outcomes (all performance indicators $p<0.05$). Hawi 2018 (n=524): IGD group academic grade lowest, below passing average; sleeping only 5 hrs/night. Wang 2022 (n=278 MDD adolescents): poor academic performance -> OR=2.90	IA consistently impairs academic outcomes

No	Outcome Domain	Primary Studies Included	Key Findings & Effect Sizes	Direction
			(95%CI:1.42-5.95) for IA symptoms. Olçay Oz 2023: academic achievement lower in IA children vs. controls.	
7	Self-Esteem	Shi 2017; Chen 2020; Obeid 2019; Cheung 2018; Nguyen 2026	Shi 2017 (n=3,289): family functioning -> self-esteem -> loneliness -> IA (serial mediation). Chen 2020 (n=451): low self-esteem -> IA (logistic regression). Cheung 2018 (n=665 Hong Kong): self-esteem negatively correlated with IA ($r < 0$). Nguyen 2026 (n=789 Vietnam): self-esteem -> $v = -0.288$ on IA; depression/anxiety/stress partially mediate. Lower self-esteem consistently predicts higher IA severity.	? Lower self-esteem -> higher IA risk
8	Loneliness & Social Isolation	Shi 2017; Sarıalioglu 2021; Liu 2024	Shi 2017: loneliness serially mediates family function -> IA (v significant). Sarıalioglu 2021 (n=482, Turkey during COVID-19): adolescent loneliness (ULS-SF) -> IA level (IASA) significantly ($p < 0.05$). Liu 2024 (n=1,046 China): loneliness partially mediates IA -> NSSI; cognitive reappraisal moderates.	IA associated with increased loneliness
9	ADHD Symptoms & Attention Dysregulation	Menendez-Garcia 2020; Seyrek 2017; Kawabe 2019; Berloff 2022; Gunes 2018	Menendez-Garcia 2020 (case-control): ADHD -> IAD ($p < 0.001$); hyperactivity/impulsivity correlates with IGD ($r = 0.349$). Seyrek 2017 (n=468): IA significantly correlated with attention disorder & hyperactivity symptoms. Kawabe 2019 (n=55 ASD adolescents):	? ADHD is significant risk factor for IA

No	Outcome Domain	Primary Studies Included	Key Findings & Effect Sizes	Direction
			ADHD symptoms significantly associated with IA (higher ADHD-RS in IA group). Berloffa 2022 (n=108 ADHD): 44% above IGD cut-off vs. 9.5% controls. Gunes 2018 (n=119): 63.9% IA prevalence in ADHD; ODD/CD comorbidity increases risk.	
10	Quality of Life (QoL)	Wang 2022; Dam 2023; Zhang 2025; Zhang (QoL) 2025	Wang 2022 (n=278 MDD+IA adolescents): IA symptoms -> significantly poorer QoL in physical, psychological, environmental domains (WHOQOL-BREF). Dam 2023 (n=1,891 Vietnam): problematic internet use negatively associated with EQ5D5L Index (QoL measure). Zhang 2025: IA -> depression + anxiety comorbidity OR=2.12 (95%CI:2.00-2.25) substantially reduces well-being.	IA significantly reduces QoL in multiple domains
11	Aggression & Conduct Problems	Wang 2024; Obeid 2019; El Asam 2019	Wang 2024 (n=7,422): IA profile -> significantly higher aggression (BQ) than lower profiles (LPA). Obeid 2019 (n=1,103 Lebanon): aggression $v=0.185$ predictor of IA (stepwise regression). El Asam 2019 (n=1,814 UK): PIU predicted by conduct problems; path analysis significant.	IA positively associated with aggression
12	Suicidal Ideation & NSSI	Liu 2024; Wang 2022; Dam 2023	Liu 2024 (n=1,046): IA -> NSSI v =positive; loneliness mediates; NSSI detection rate 12.3% in IA group. Wang	IA associated with

No	Outcome Domain	Primary Studies Included	Key Findings & Effect Sizes	Direction
			2022: IA symptoms associated with increased suicidality in adolescents with MDD (review statement). Dam 2023: FOMO score & problematic internet use as positive predictors of self-harm and suicide (adjusted).	increased suicidal risk and NSSI

Prevalence of Internet Addiction

The prevalence of IA demonstrated substantial heterogeneity across the included studies, reflecting differences in diagnostic criteria, instruments, and populations. Dong et al. (2020), examining 2,050 Chinese children and adolescents during the COVID-19 epidemic, reported an addictive internet use (IAT ≥ 70) prevalence of 2.68%, with an additional 33.37% classified as problematic users (IAT 40-69). Zhang et al. (2025), the largest included study (N=20,692 Chinese adolescents aged 12-19 years), employed a DSM-5-derived 9-item IA scale, identifying significantly elevated IA rates. Saikia et al. (2019) reported the highest prevalence (80.7%) in an Indian cohort using the Young Internet Addiction Scale, reflecting the broader definition of "any internet addiction." These findings are contextually supported by global meta-analytic data reporting pooled generalized IA prevalence of 14.22% (95%CI: 12.90-15.65%) in the general population and 7.02% (95%CI: 6.09-8.08%) when employing stricter diagnostic criteria.^{6,10,22,23}

Depressive Symptoms

Depression emerged as the most consistently and robustly associated psychiatric outcome with IA across all included studies. Wang et al. (2024), employing latent profile analysis (LPA) in 7,422 Chinese adolescents, identified four distinct IA profiles; the "Internet addiction" profile demonstrated significantly higher PHQ-9 depression scores compared to all other profiles. Zhao et al. (2023) in 17,058 middle school students demonstrated that anxiety partially mediated the IA-depression pathway, with social support moderating both direct and indirect effects; adolescents with low social support showed markedly amplified IA-depression associations. Zhang et al. (2025) in the largest cross-sectional cohort reported an OR of 1.99 (95%CI: 1.88-2.11) for depression in IA-positive adolescents versus non-IA peers. Meta-

analytic confirmation comes from Ye et al. (2023), who analyzed 42 studies comprising 102,769 participants, confirming bidirectional associations (depression → IA and IA → depression).^{4,6,21,24}

Anxiety Symptoms

Anxiety demonstrated the second most consistent association with IA severity. Ismail (2024) documented that adolescents in Saudi Arabia with higher IA scores perceived significantly elevated anxiety on the DASS-21 ($p \leq 0.05$). The most robust anxiety association was reported by Perez-Oyola et al. (2023) in a Peruvian cohort, where severe IAD was associated with an anxiety prevalence ratio of $PR = 2.96$ (95%CI: 1.86-4.71). Zhang et al. (2025) documented an OR of 1.80 (95%CI: 1.68-1.91) for anxiety in IA-positive adolescents. Network analysis by Xie et al. (2024) identified "breathing difficulty" and "feeling downhearted and blue" as bridge symptoms connecting IGA and anxiety symptom clusters, suggesting neurobiological and psychosocial linking mechanisms. Saikia et al. (2019) reported an OR of 3.3 for anxiety in the IA group versus non-IA peers.^{2,3,5,21}

Stress and Psychological Distress

Psychological stress demonstrated strong bidirectional relationships with IA severity. Saikia et al. (2019) reported the strongest association with an OR of 12.0 between IA and stress in Indian adolescents. Dong et al. (2020) identified stress as the most powerful predictor of IAT score in multivariate linear regression ($\beta = 0.323$, $p < 0.001$) during the COVID-19 pandemic period, suggesting that environmental stressors amplify internet-related compulsive behavior. Aziz et al. (2024) demonstrated that family and school environments partially mediated the relationship between stress and IA in both early and middle adolescents, with family environment fully mediating anxiety → IA in middle adolescents.^{5,7,10}

Sleep Quality

Disrupted sleep quality constituted a significant, consistent, and clinically impactful outcome associated with IA across multiple included studies. Guclu et al. (2024) in 1,959 Turkish high school students demonstrated that each one-unit increase in the IAT-SF score predicted a 1.08-fold increase in poor sleep quality (multivariate logistic regression). Celebioglu et al. (2020) reported that 61.6% of 1,487 adolescents exhibited poor sleep quality (PSQI total mean: 5.11 ± 3.02), with a significant positive correlation between YIAT-SF and PSQI total scores ($p < 0.01$). Hawi et al. (2018) demonstrated that Lebanese adolescents with IGD slept a mean of only 5 hours per night, compared with 7 hours for casual online gamers,

underscoring the dose-dependent nature of internet-related sleep disruption. The pathway from IA-impaired sleep to academic performance was further quantified by Adelantado-Renau et al. (2019), who demonstrated that internet use time mediates 15.5-16.0% of the sleep quality -> academic performance association.^{11,12,13,15}

Academic Performance

Internet addiction exerted consistent negative effects on academic function across all relevant included studies. Guclu et al. (2024) documented that IA and smartphone addiction independently predicted academic grade deterioration in multivariate models. Hawi et al. (2018) reported that the academic grade average of adolescents with IGD was the lowest across all gamer groups and fell below the passing grade average. Adelantado-Renau et al. (2019) demonstrated via mediation analysis that adolescents with better sleep quality (PSQI $\leq$ 5) achieved higher grades across all academic performance indicators (all $p < 0.05$), and internet use time significantly mediated this relationship (proportion mediated PM: 15.5-16.0%). Wang et al. (2022) demonstrated in a clinical sample of 278 adolescents with MDD that poor academic performance significantly predicted the presence of IA symptoms (OR=2.90, 95%CI: 1.42-5.95), supporting bidirectional causality.^{11,13,15,28}

Self-Esteem

Self-esteem emerged as a critical psychological mediator and correlate of IA across multiple international cohorts. Shi et al. (2017) in 3,289 Chinese middle school students demonstrated a complex serial mediation pathway in which family functioning -> self-esteem -> loneliness -> IA. Both self-esteem and loneliness simultaneously and sequentially mediated the family function-IA relationship, with significant gender and grade-level differences in the mediation model. Chen et al. (2020) confirmed that low self-esteem constituted an independent predictor of IA in early adolescents (grades 5-6, Taiwan) after adjustment for multiple confounders. Nguyen et al. (2026) in 789 Vietnamese high school students demonstrated that self-esteem exerted a direct negative effect on IA (beta=-0.288, $p < 0.001$), and that depression, anxiety, and stress fully or partially mediated this effect. Obeid et al. (2019) confirmed that lower socioeconomic status (beta=-1.707) and higher sibling number (beta=-0.779) were protective against IA, suggesting contextual determinants of self-esteem protective role.^{16,17,18}

Loneliness and Social Isolation

Loneliness and perceived social isolation demonstrated bidirectional relationships with IA severity. Shi et al. (2017) identified loneliness as a key mediating mechanism through which

impaired family functioning promotes adolescent IA. Sar?alioglu et al. (2021), studying 482 Turkish adolescents during the COVID-19 pandemic, documented a significant relationship between the UCLA Loneliness Scale-Short Form (ULS-SF) score and the IA Self-Assessment Scale (IASA) score (multiple regression, $p < 0.05$), demonstrating that adolescents who reported moderate loneliness had proportionally elevated IA levels. Liu et al. (2024) further demonstrated that loneliness partially mediated the association between IA and NSSI (Adolescent Self-Harm Scale) in 1,046 Chinese adolescents, with cognitive reappraisal moderating the first segment of this mediation pathway.^{16,30}

ADHD and Attention Dysregulation

Attention-deficit/hyperactivity disorder represented one of the most clinically significant psychiatric risk factors and comorbidities associated with adolescent IA. Menendez-Garcia et al. (2020) in a case-control design (N=112) demonstrated that ADHD constituted an independent risk factor for IAD ($p < 0.001$), and that gender moderated the specific type of technology addiction; female ADHD patients showed higher mobile phone addiction (MPA) scores (M=25.93 vs. 14.77, $p = 0.03$) while male patients showed higher IGD scores (M=30.09 vs. 12.51, $p < 0.001$). Seyrek et al. (2017) in a school-based cross-sectional study of 468 Turkish adolescents documented significant correlations between IA and both inattention and hyperactivity symptom scores on Conners' Parent and Teacher Rating Scales. Kawabe et al. (2019) demonstrated that ADHD symptom severity (ADHD-RS) was significantly higher in the IA subgroup versus non-IA subgroup in a sample of 55 ASD adolescents ($p < 0.05$). Berloff et al. (2022) reported a 44% prevalence of IGD in a clinical ADHD cohort versus 9.5% in controls. Gunes et al. (2018) reported 63.9% IA prevalence in a clinical ADHD sample, further elevated by ODD/CD comorbidity.^{19,20}

Quality of Life (QoL)

Internet addiction exerted consistent negative effects across multiple QoL domains. Wang et al. (2022) in a multicenter cross-sectional study of 278 adolescents with MDD documented that IA symptom presence was significantly associated with poorer QoL in the physical (WHOQOL-BREF), psychological, and environmental domains, after controlling for confounding factors. The OR for IA in patients with poor academic performance was 2.90 (95%CI: 1.42-5.95), and 46.8% of the MDD adolescent cohort met IA symptom criteria. Dam et al. (2023) in 1,891 Vietnamese adolescents demonstrated that problematic internet use, PHQ-9 depression score, and daily social media time were negatively associated with the EQ5D5L

QoL index. Zhang et al. (2025) demonstrated that IA was an independent risk factor for anxiety-depression comorbidity (ADC; OR=2.12, 95%CI: 2.00-2.25), which constitutes the most severe functional impairment combination.^{28,29}

Aggression and Conduct Problems

Multiple studies documented significant associations between IA severity and aggressive behavior. Wang et al. (2024) using LPA in 7,422 Chinese adolescents demonstrated a dose-response relationship; the "Internet addiction" profile showed significantly higher aggression scores (Aggression Behavior Questionnaire) than all lower-severity profiles. Obeid et al. (2019) identified aggression as an independent predictor of IA severity in stepwise regression ($\eta^2=0.185$, $p<0.001$) in 1,103 Lebanese adolescents. El Asam et al. (2019) in a UK school-based sample of 1,814 children and adolescents showed through path analysis that conduct problems significantly predicted PIU (η^2 significant, $p<0.05$), highlighting the bidirectional conduct-internet addiction relationship.^{4,8,18}

Suicidal Ideation and Non-Suicidal Self-Injury (NSSI)

Internet addiction was associated with elevated risk of suicidal ideation and NSSI across multiple studies. Liu et al. (2024) in 1,046 Chinese adolescents documented a 12.3% NSSI detection rate; IA was positively associated with NSSI (direct effect η^2 positive, $p<0.05$); loneliness partially mediated this relationship (indirect effect significant), and cognitive reappraisal moderated the first mediation segment. Wang et al. (2022) reported that IA symptoms were associated with increased suicidality in adolescents with MDD. Dam et al. (2023) in the Vietnamese cohort identified problematic internet use and FOMO score as independent positive predictors of self-harm and suicide (adjusted regression, $p<0.05$). Meta-analytic confirmation from Wang et al. (2022) demonstrated that IAD was associated with a pooled OR of 1.95 (95%CI: 1.65-2.30) for suicidal behavior across 16 studies in 61,823 adolescents.^{25,28,29,30}

DISCUSSION

Principal Findings and Synthesis

This systematic review synthesizes evidence from 21 primary studies comprising 67,628 adolescents across 14 countries, encompassing 12 distinct outcome domains. The principal finding is that internet addiction exerts pervasive, multi-domain, and clinically significant negative effects on adolescent mental health and academic function. The consistency of these associations across diverse cultural, geographic, and methodological

contexts substantially strengthens causal plausibility, even in the absence of adequately powered longitudinal intervention data.^{1,2,3,4,5,6}

Depression and anxiety emerged as the most consistently documented mental health outcomes associated with IA, with effect sizes (OR range: 1.80-2.99) that are clinically meaningful. The bidirectionality of the IA-depression relationship, confirmed by Ye et al. (2023) across 102,769 participants, underscores the importance of integrated screening protocols that simultaneously assess both conditions in clinical and educational settings. The mediation of the IA-depression pathway through anxiety, as demonstrated by Zhao et al. (2023) in 17,058 adolescents, identifies anxiety as a high-priority target for preventive intervention.^{6,24}

Neurobiological Mechanisms

The neurobiological underpinnings of adolescent IA vulnerability are grounded in the incomplete maturational trajectory of prefrontal cortical executive control systems, whose full development extends into the mid-twenties. Adolescent dopaminergic reward circuitry demonstrates heightened sensitivity to immediate reward stimuli, a neurobiological substrate that renders online positive reinforcement (social validation, gaming rewards, informational stimulation) particularly potent and habit-forming. Internet-mediated dopaminergic stimulation activates the nucleus accumbens and ventral tegmental area in patterns analogous to substance addiction, with progressive neuroadaptation (tolerance) necessitating increased internet exposure for equivalent reward salience. Neuroimaging evidence included in supplementary literature demonstrates altered functional connectivity within the executive control network (ECN), default mode network (DMN), and dorsal attention network (DAN) in adolescents with IGD, correlating with attentional dysregulation and impulsivity, thereby further impairing academic cognitive function and emotional regulation capacity.^{4,19}

Sleep Disruption as a Critical Mediator

Sleep disturbance emerged as a mechanistically crucial mediator in the IA-academic performance and IA-mental health relationships. Internet usage behaviors--particularly nocturnal device use, blue-light exposure from screens, and attentional engagement in stimulating online content--directly suppress melatonin secretion, delay sleep onset, reduce total sleep duration, and fragment sleep architecture. Adolescents physiologically require 8-10 hours of sleep per 24-hour period for optimal neurocognitive development; systematic curtailment of this requirement generates cumulative neurocognitive deficits manifesting as

impaired working memory, reduced executive function, attentional dysregulation, and emotional dysregulation. Adelantado-Renau et al. (2019) quantified the proportion of the sleep quality-academic performance association mediated by internet use time at 15.5-16.0%, while Bhandari et al. (2017) demonstrated that IA mediated 30.9% of the sleep quality -> depressive symptom association in 937 Nepalese undergraduates.^{13,14}

Social-Ecological and Family Risk Factors

Family dysfunction, inadequate parental monitoring, and low parental mental health literacy constitute critical ecological risk factors amplifying adolescent IA susceptibility. Lam (2015) demonstrated that parental depression at moderate-to-severe levels tripled the OR for adolescent IA (OR=3.03, 95%CI: 1.67-5.48) after adjustment for confounders in 1,098 parent-child dyads. Shi et al. (2017) demonstrated that family functioning impairment promotes IA through a sequential pathway: impaired family function -> diminished self-esteem -> heightened loneliness -> IA. Chen et al. (2020) demonstrated that inadequate parental time-limiting of internet use constituted an independent predictor of IA in early adolescents. These findings collectively highlight the family unit as a critical intervention target for IA prevention and management.^{9,16,17}

ADHD Comorbidity and Neurodevelopmental Risk

The strong bidirectional association between ADHD and IA documented across multiple studies reflects shared neurobiological substrates of attentional dysregulation, impulsivity, reward hypersensitivity, and difficulties with delayed gratification. Menendez-Garcia et al. (2020) confirmed ADHD as an independent risk factor for IAD in a case-control design, and Berloffia et al. (2022) reported a 44% IGD prevalence in a clinical ADHD cohort versus 9.5% in controls. The inattention dimension of ADHD demonstrated stronger associations with IA than the hyperactivity-impulsivity dimension in several studies, suggesting that the internet may serve as a compensatory attentional engagement mechanism for adolescents with inattentive-type ADHD. This has important implications for clinical assessment; all adolescents presenting with IA should be screened for ADHD, and vice versa, as treatment of underlying ADHD may substantially reduce IA severity.^{19,20}

Cultural and Geographic Variability

The inclusion of studies from 14 countries spanning Asia (China, Lebanon, Nepal, Japan, South Korea, Taiwan, Hong Kong), Europe (UK, Spain, Turkey), the Middle East (Saudi Arabia, Qatar), South Asia (India), and South America (Peru) permits preliminary cross-

cultural comparative analysis. Global meta-analytic evidence indicates that Eastern Mediterranean and Southeast Asian regions demonstrate disproportionately elevated IA prevalence, potentially reflecting cultural factors including academic competitive pressure, high internet penetration, gaming culture normalization, and inadequate regulatory frameworks. Chia et al. (2020) documented pooled Southeast Asian IA prevalence of 20.0% (95%CI: 14.5-27.0%), substantially above Western European estimates. Indonesian and broader Southeast Asian data emphasize the urgent public health imperative for regional policymakers.²⁶

Protective Factors and Moderators

Several protective factors and moderating variables were identified across included studies. Physical activity (PA) emerged as a significant but quantitatively minor mediator; Zhang et al. (2025) demonstrated that PA accounted for only 3.5-4.3% of the total IA → mental health effect, with direct effects remaining predominant. Social support moderated the IA-depression relationship in Zhao et al. (2023); adolescents with high social support demonstrated attenuated IA-depression associations. Mindfulness was identified by Chi et al. (2019) as a moderator of both the IA-depression and IA-positive youth development associations. Self-esteem, while primarily a mediating variable, also functions as a protective factor when maintained at adequate levels. School connectedness demonstrated a weak buffering effect on the suicidal ideation → IA association. These findings collectively support multi-component preventive frameworks integrating physical activity promotion, social support enhancement, mindfulness training, and self-esteem programs.^{7,13,21}

Implications for Clinical Practice

Clinicians--particularly pediatricians, child and adolescent psychiatrists, and general practitioners--should incorporate systematic IA screening into routine adolescent health assessments. The Young Internet Addiction Test (IAT) remains the most widely validated and frequently employed instrument, though DSM-5-based scales offer greater diagnostic specificity. Clinical evaluation of adolescents with suspected IA should comprehensively assess for comorbid depression, anxiety disorders, ADHD, sleep disorders, and academic difficulties. Cognitive-behavioral therapy (CBT) adapted for internet addiction (CBT-IA), motivational interviewing, family-based interventions, and mindfulness-based approaches constitute the current evidence-supported therapeutic armamentarium. Pharmacological

management of comorbid ADHD, depression, and anxiety should be initiated concurrently with IA-specific behavioral interventions.^{4,19}

Public Health and Policy Implications

The findings of this systematic review have significant public health and policy implications, particularly for educational institutions, public health authorities, and technology regulatory bodies. School-based internet literacy programs, structured screen-time guidelines for adolescents, and training of teachers and school counselors in IA recognition and referral pathways are urgently needed. Parental education programs addressing healthy digital parenting practices should be integrated into routine child health platforms. Regulatory frameworks mandating age verification for social media platforms, gaming loot boxes, and addictive digital content represent potential structural interventions at the population level.^{7,8}

CONCLUSIONS AND RECOMMENDATIONS

Summary of Conclusions

This systematic review provides comprehensive, multi-domain evidence demonstrating that internet addiction exerts significant, pervasive, and clinically meaningful negative effects on adolescent mental health and academic function. Across 21 primary studies comprising 67,628 participants from 14 countries, IA was consistently associated with: (1) depressive symptoms (OR: 1.99-2.0, consistent across all included studies); (2) anxiety symptoms (OR: 1.80-2.96); (3) psychological stress (OR up to 12.0); (4) degraded sleep quality (PSQI correlation significant in all sleep-focused studies); (5) impaired academic performance (below-passing academic grades in IA cohorts); (6) diminished self-esteem; (7) social isolation and loneliness; (8) ADHD comorbidity and attentional dysregulation; (9) reduced quality of life; (10) increased aggressive behavior; (11) elevated risk of suicidal ideation; and (12) non-suicidal self-injury. The evidence across all 12 outcome domains demonstrates a consistent directional association: higher IA severity correlates with worse outcomes in all assessed domains.^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21}

Recommendations

Clinical Recommendations: (1) Systematic IA screening using validated instruments (Young IAT or DSM-5-based scales) should be incorporated into routine adolescent health assessments and pediatric well-child visits. (2) Concurrent assessment for depression, anxiety, sleep disorders, and ADHD should accompany IA evaluation. (3) Multidisciplinary treatment teams incorporating child psychiatry, clinical psychology, pediatrics, and family therapy

should manage complex IA cases. (4) CBT-IA, motivational interviewing, and family-based interventions should be offered as first-line psychological treatments. (5) Pharmacological management of comorbid ADHD and internalizing disorders should be initiated concurrently.

Research Recommendations: (1) Longitudinal cohort studies are urgently needed to establish temporal causality and the natural trajectory of IA in adolescent populations. (2) Standardization of IA diagnostic instruments and diagnostic thresholds is required to facilitate cross-study comparability. (3) RCT-based evaluation of IA-specific interventions is a research priority. (4) Research must extend beyond East Asian populations to include African, Middle Eastern, South American, and Pacific Islander adolescent cohorts. (5) Neuroimaging studies investigating longitudinal changes in IA-associated brain connectivity would substantially advance mechanistic understanding.

Policy Recommendations: (1) National and institutional screen-time guidelines specifically addressing adolescent digital media use should be promulgated and enforced. (2) School-based digital literacy and internet health education programs should be mandated at primary and secondary school levels. (3) Parental digital competency programs should be integrated into routine child health service frameworks. (4) Technology regulation requiring age verification, engagement-reduction algorithms, and addiction-mitigation features on digital platforms should be legislated.

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