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Association between digital media use and child health and development: A systematic review and meta-analysis.

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Key Points

Question: How is digital media use, including social media and video games, associated with child health and development?

Findings: In this systematic review and meta-analysis of up to 153 longitudinal studies, results broadly evidenced poorer developmental outcomes associated with digital media use. Social media use was associated with higher depression, behavioural problems, self-injury, and substance use, and lower self-perception and academic achievement. Video gaming was linked to greater aggression and less prosocial behaviour, but modestly higher attention and executive functioning. Stronger associations were evident in early adolescence, and in more recent cohort studies.

Meaning: Digital media use shows modest but consistent links with poorer developmental outcomes, highlighting the need for nuanced, developmentally informed guidance and policy.

Abstract

Importance: This systematic review and meta-analysis synthesized global longitudinal studies to estimate associations between social media, video games, and other digital media use with health and developmental outcomes in children and adolescents.

Objective: To provide a meta-analytic synthesis of evidence on digital media use and health and developmental outcomes among individuals aged 0-18 years.

Data Sources: This review was pre-registered with PROSPERO (CRD42020200446). MEDLINE, PsycINFO, EMBASE, ERIC and grey literature were searched from 2000 to 2024.

Study Selection: Inclusion criteria were English-language longitudinal studies of participants aged 0-18 years reporting quantitative associations between digital media use and health or developmental outcomes.

Data Extraction and Synthesis: Following PRISMA guidelines, 153 studies (115 cohorts, 1,072 effect sizes) from 18,933 articles met criteria for quantitative synthesis. Random-effects meta-analyses estimated pooled correlations (*r*) with 95% confidence intervals (CIs). Heterogeneity and moderators (age, sex, measurement method, follow-up duration, year of exposure) were examined. Study quality was assessed using the NIH Quality Assessment Tool.

Main Outcome(s) and Measure(s): Primary outcomes were social-emotional, cognitive, physical and motor health and development.

Results: Social media use was associated with higher depression, externalizing and internalizing behaviors, self-injurious thoughts, problematic internet use, and substance use (*r*=0.09, [95%CI 0.06 to 0.12] to *r*=0.21, [95%CI 0.13 to 0.29]), and with lower academic achievement, poorer self-perception, and less positive development (*r*=-0.14 [95%CI, -0.26 to -0.01] to *r*=-0.07 [95%CI, -0.11 to -0.02]). Video gaming was associated with higher aggression and externalizing behaviors (*r*=0.16 [95%CI, 0.09 to 0.23] and *r*=0.17 [95%CI, 0.07 to 0.26], respectively), and higher attention/executive functioning (*r*=0.10 [95%CI, 0.03 to 0.16]). Other digital media use, including digital device use and messaging/communication media, was associated with depression (r=0.05, 95% CI, 0.00-0.09 to r=0.12; 95% CI, 0.02-0.22). Associations between social media and depression were stronger in early adolescence (β=0.09) and with self or parent-reported outcomes (β=0.09); associations between social

media and positive development were stronger with objective exposure measurement (β=0.08). More recent social media exposure years showed stronger associations with substance use (β=0.10).

Conclusions and Relevance: Digital media use is consistently associated with risks to child and adolescent health and development, particularly for social media. Findings highlight the need for targeted, multi-faceted policies and interventions to mitigate potential harms from digital media exposure.

Introduction

Digital media use has become a defining feature of contemporary childhood, with screen-based activities embedded in daily life from infancy through adolescence.[1,2] Over the past decade, use has risen steadily across all age groups,[1,2] with a 52% increase reported during the COVID-19 pandemic.[3,4] Most children now exceed recommended daily screen time guidelines issued by leading health authorities across every developmental age and stage globally.[5,6]

Importantly, the nature of children's media engagement is also shifting. While traditional broadcast media, such as television, remain widely used,[1,2] children increasingly engage with digital media featuring interactive or social elements, including video games, educational and fitness apps, and social media.[7] These formats differ in pace, interactivity, content, algorithms, and regulatory oversight compared with broadcast media, blurring the distinction between consumers and creators of content.[7] Additionally, developmental stage further shapes exposure and vulnerability: a toddler's often parent-mediated and screen limited media use differs markedly from an adolescent's engagement in online platforms while navigating their social identity.[8,9]

These shifts have prompted growing concerns among parents, educators, clinicians and global leaders about the potential benefits and harms of digital media. While some view it as a tool for learning, creativity, and connection, many worry about links with disrupted sleep, reduced physical activity, and mental health difficulties.[1,2,10] Consistent with these perspectives, prior research reports mixed findings; some studies link digital media use to negative outcomes in children and young people; yet others suggest potential cognitive or psychosocial benefits, or no effects.[11–13]

Despite a growing body of research, the evidence base remains fragmented. Prior reviews frequently aggregate all media into broad measures of screentime,[14–17] or focus narrowly on a specific digital media types.[18,19] Outcomes are often similarly restricted to specific domains, (e.g., academic performance,[16] externalizing and internalizing symptoms[14,17,20–22]), with fewer reviews spanning socio-emotional, cognitive, physical and motor outcomes, or considering how associations vary by digital media types. Developmental coverage has also been varied, with many reviews limited to specific ages,[8,14,15,20–23] whilst others rely heavily on cross-sectional data,[15,16,19,20] restricting the ability to make inferences about directionality or map developmental trends.

To address these gaps, we conducted a systematic review and meta-analysis of longitudinal studies examining associations between digital media use and child health and developmental outcomes from infancy to age 18. Our aims were to (1) quantify the strength and direction of associations for different digital media types across a comprehensive range of outcomes, including social-emotional, cognitive, physical and motor domains; and (2) examine potential moderators, including age, gender, and year of publication. In doing so, this review provides a clearer understanding of the patterns and potential links between digital media use and child outcomes, providing evidence to inform policy, clinical practice, education, and parenting in an increasingly digital world.

Method

Search strategy

This review adhered to PRISMA guidelines,[24] and a preregistered PROSPERO protocol (PROSPERO: CRD42020200446).[25] We searched MEDLINE, PsycINFO, EMBASE and ERIC and grey literature for studies published up to August 2024. Search constructs included "Children", "Digital media" and "Observational research" (full terms in Supplementary eTable 1). We included studies published after 1 January 2000 to capture contemporary digital technologies. Grey literature sources included: (1) ProQuest Dissertations and Theses; (2) the first 100 Google search results ranked by relevance; (3) backward citation analyses of included studies using Web of Science.

Selection criteria

Eligibility criteria are presented in Table 1. Title and abstracts were independently screened by authors (ST, KM, BH, DK, JK, MH, AC, HW), followed by full-text review, with disagreements resolved through discussion. A double-blind review by author ST conducted on 5% of titles and abstracts yielded a 97.8% agreement rate (Fleiss' κ=0.85 [0.79-0.92], p<.001); 50% of full-text yielded 94.6% agreement (Fleiss' κ=0.86 [0.79-0.94], p<.001). Full text exclusions are presented in Supplementary eTable 2.

Data extraction and study quality

ST, AC, and HW extracted data using a standardised pro forma, cross-checked by ST or KS. Discrepancies were resolved with the lead data analyst (KS). Extracted data included publication metadata (authors, year, title, and whether the study was part of a larger or related study), recruitment (method, representativeness, and inclusion/exclusion criteria), study characteristics (design, number of waves, period, country, sample size), participant characteristics (child age (mean, SD, range), sex distribution, sample category), digital media type and measures (quantitative estimates or binary/presence indicators), data source/informant and timing, child outcomes and measures (including informant), and reported associations (effect sizes, direction, CIs, p-values, and covariate adjustments). Study quality was assessed using the National Institutes of Health (NIH) Quality Assessment Tool for Observational Cohort and Cross-sectional Studies,[26] aligned with Cochrane Collaboration criteria.

Data synthesis

Random-effects meta-analyses estimated associations between digital media use across specific developmental subdomains (e.g., aggression within social-emotional domain). These subdomains were mapped onto four overarching developmental domains (social-emotional, cognitive, physical, motor) based on established criterion-standard child development frameworks.[27,28] Subdomains were analyzed when ≥2 studies reported relevant effect sizes. Analyses were conducted using R[29] (version 4.5.1). To account for dependence from multiple or overlapping samples, we used robust variance estimation (robumeta package, version 2.1).[30–32] Moderator analyses were performed using metafor (version 4.8) with random-effects, and studies were clustered using clubSandwich, version 0.6.[33,34] Data and code are available via Open Science Framework.[35]

We reported I^2 to assess heterogeneity.[36] Values were interpreted as follows: 0–25% low, 25–50% moderate, 50–75% substantial, and 75–100% high heterogeneity. Effects were interpreted as: very small (.05), small (0.1), moderate (0.2), large (0.3), and very large (0.4) per Cohen's guidelines.[37] Meta-regressions examined whether age at exposure (infancy, early childhood, pre-school, school age, early adolescence, late adolescence), gender (percentage female), year of first exposure (pre-2012 vs post-2012, reflecting when smartphones and social media platforms became widespread),[38] informant source (self, parent/caregiver, teacher, objective measure, researcher), and time lag (short (<1 year),

medium (1-3 years) and long-term (> 3 years)) moderated associations. For studies presenting multiple exposure frequency comparisons (e.g., low vs moderate vs high), relevant comparisons were extracted as distinct effect sizes. Sensitivity analyses were conducted for associations with ≥10 studies,[39,40] including publication bias (funnel plots, multi-level Egger's test) and outlier diagnostics (leave-one-out).

Pearson correlation coefficients (*r*) were extracted or calculated from the available effect sizes (see supplementary materials eTable 3),[41] transformed to Fisher's z-scores[42] for analysis and back-transformed for interpretation. Where two or more effect sizes were available for the same relationship, effects with more adjustments were analyzed.[43] Low-precision estimates (k<10, wide CIs) should be interpreted with caution. Results were interpreted using the meta-analytic estimate and precision indicated by 95% CIs, aligning with recommendations from the American Statistical Association.[44]

Role of the funding source

The funder had no role in study design, data collection, analysis, interpretation, or writing of the report

Results

Study selection, characteristics and quality

Of 18,933 articles screened, 1,384 underwent full-text review (eFigure 1). In total, 153 studies met eligibility criteria, including 115 unique cohorts and 1,072 effect sizes. Thirteen studies lacked sufficient data for meta-analysis (e.g., no descriptive statistics to convert into Pearson's *r*). Study characteristics are detailed in Supplementary eTable 4. Sample sizes ranged from 26 to 54,908 (*M* = 2,774.71; *SD* = 4,565.53), with participants' ages spanning 2-19 years (*M* = 12.81; *SD* = 2.79), and approximately equal proportions of boys and girls (female: *M* = 53.8%; *SD* = 17.1). Most studies were conducted in Europe (62; 40.5%) and North America (60; 39.2%), followed by Asia (22; 14.4%), Australia (5; 3.3%) and Latin America (1; 0.7%). Two spanned multiple regions. Study duration ranged from 1 day to 22 years (*M* = 2.48 years; *SD* = 3.63).

Risk of bias was generally acceptable (see Supplementary materials eTables 6-7): 40.5% (*n* = 64) were rated *good*, 48.5% *fair* (*n* = 76), and 11.1% *poor* (*n* = 17). Most studies used adequate follow-up durations, temporal ordering, and appropriate confounders and covariates (e.g., age, gender/sex, race/ethnicity, socioeconomic status, and parental factors). However, only 21.25% (*n*=34 studies) of extracted effect sizes controlled for baseline outcomes. Attrition and limited sample size justification were common limitations.

Studies were relatively balanced across exposure categories: social media (*k*=69), video games (*k*=65) and other media (*k*=60), where *k* indicates the number of studies included. The heterogenous 'other media' category included digital devices (computers, smartphones, tablets), messaging and communication platforms (instant messaging, email, SMS, videochatting), digital learning (online courses/homework), health and fitness applications (fitness apps), and general internet use. Outcomes were grouped into 16 social-emotional, three cognitive, and seven physical and motor subdomains (see Table 2).

Social media

Social media use was associated with multiple social-emotional development difficulties (Table 3), including depression, $r = 0.09$ [95% CI, 0.06–0.12], externalising behaviours, $r = 0.13$ [95% CI, 0.07–0.19], internalising behaviours, $r = 0.14$ [95% CI, 0.03–0.25], self-injurious thoughts and behaviours, $r = 0.11$ [95% CI, 0.01–0.27], and problematic internet use, $r = 0.21$ [95% CI, 0.13–0.29]. Very small-to-small negative associations were observed with positive development, $r = -0.06$ [95% CI, -0.11 to -0.02] and self-perception, $r = -0.14$ [95% CI, -0.26 to -0.01]. Heterogeneity was high ($I^2 > 70$ to 96%).

In the cognitive domain (Table 4), social media use was a weakly associated with lower academic achievement, $r = -0.07$ [95% CI, -0.11 to -0.02]; $I^2 = 34\%$. In the physical domain (Table 5), it was associated with substance use, $r = 0.14$ [95% CI, 0.08–0.19]; $I^2 = 96\%$, with no moderation by substance type (alcohol, cannabis, tobacco, e-cigarettes).

Video games

Video game use was associated with social-emotional development difficulties (Table 3), including aggression, $r = 0.16$ [95% CI, 0.09–0.23] and externalising behaviours, $r = 0.17$ [95% CI,

0.07–0.26]. These effects had high heterogeneity (I^2 > 80%). A small positive association was observed with attention and executive functioning, r = 0.10 [95% CI, 0.03–0.16], with moderate heterogeneity (I^2 = 52%). No associations were observed for any of the physical domain (see Table 5).

Other media

Other digital media use was associated with depression (r = 0.12 [95% CI, 0.02–0.22], I^2 = 99%) and poorer general health (r = -0.04 [95% CI, -0.08 to -0.01], I^2 = 34%). Given the heterogenous nature of this category, subtype analyses showed small positive associations with depression for general digital device use (r = 0.11 [95% CI, 0.01–0.21]), and messaging and communication media (r = 0.05 [95% CI, 0.00–0.09]). Full results are presented in Supplementary eTable 8.

Moderator analysis

Moderator analyses were limited by small effect counts (see supplementary materials eTable 9-15 for full analyses).

Age

For social media and depression, effects were weaker in school-age children (6–11 years) than early adolescence (12–15 years), $F(1, 6.42) = 13.57$, $p = 0.009$, β = -0.09.

Exposure informant

For social media and positive development, associations varied by exposure informant, $F(1, 4.96) = 12.4$, $p = 0.017$. Objective device-based reporting showed stronger associations (β = 0.08) than child self-report and parent report.

Outcome informant

For social media and depression, outcome source moderated effects, $F(1, 5.34) = 15.22$, $p = 0.01$. Clinician/research staff-administered tools yielded weaker effects (β = -0.10), than child self-report.

Year of exposure

For social media and substance use, post-2012 exposure showed stronger associations (β = 0.10) than pre-2012, $F(1, 2.25) = 18.47$, $p = 0.04$.

Time lag

For social media and depression, effects were stronger for short follow-up durations (≤1 year; β = 0.12) compared with medium (1–3 years; β = 0.04) and long-term follow-up (>3 years; β = 0.03), $F(3, 4.75) = 8.78$, p = 0.02. For social media use and substance use, short follow-up (β = 0.15) was stronger than medium (β = 0.10), with stronger effects again observed for long-term follow-ups (β = 0.18), $F(3, 1.11) = 258.25$, p = 0.03. Results should be interpreted cautiously due to small degrees of freedom.

Study quality

For social media and internalizing behaviors, poor quality studies showed stronger effects (β = 0.21) than good quality studies, $F(1, 2.05) = 112.28$, $p = 0.008$. Limiting analyses to fair/good-quality studies attenuated most associations, except social media and academic achievement became non-significant. When analyses were limited to good-quality studies only, associations remained for social media and substance abuse, depression, externalizing behavior, internalizing behavior, and lower self-perception. See Supplementary eTable 16.

Sensitivity analyses

While funnel plots suggested potential asymmetry (see Supplementary eTable 17), the Egger's test indicated publication bias only for social media and substance use ($p = 0.041$) and video games and aggression ($p = 0.044$). Most findings were robust to outlier removal, although the association between social media and anxiety was sensitive to one study;[45] removing this case increased precision and shifted the borderline non-significant finding ($p = .062$) to significance ($p = .006$).

Discussion

This meta-analysis of longitudinal studies provides the first comprehensive synthesis of evidence on associations between children's and adolescents' digital media use and social-emotional, cognitive, physical, and motor development. Across 115 cohorts, digital media use was predominantly associated with poorer outcomes, including depression symptoms, internalizing and externalizing behaviors, and lower positive development. Social media showed the most consistent adverse associations, while video gaming was associated with aggression and externalizing behaviors, but also

modestly higher attention/executive functioning. Given the ubiquity of digital media in children's lives, these findings have important public health implications and highlight the need for evidence-based approaches to support healthier digital engagement.

Consistent effects were observed across digital media types, with most forms associated with small but meaningful differences over time in internalizing and externalizing problems, particularly depression. Digital media use may act as a low-level transdiagnostic risk factor for social-emotional difficulties,[14,20] especially with frequent use and limited supervision or regulatory oversight.[8,46] Importantly, effect sizes were comparable to other modifiable lifestyle factors, such as physical inactivity[47] and unhealthy diets[48]. Prior cross-sectional meta-analyses have reported similar associations between digital media use and depression (e.g., [49,50]), and our findings extend these by demonstrating temporal ordering. Substantial heterogeneity suggests that content, purpose, family and peer environment, and measurement strategies influence observed effects, underscoring the need for more nuanced longitudinal research.

Social media use was associated with poorer outcomes all domains examined, including depression (r=0.09), externalizing and internalizing difficulties (r = 0.14 to r = 0.19), substance use (r = 0.14), lower self-perception (r = -0.14), self-injurious thoughts and behaviors (r = 0.11), lower academic achievement (r = -0.07) and less positive development (r = -0.06). The strongest association was with later problematic internet use (r = 0.21), suggesting early exposure may be linked with later digital media problems. The interpersonal nature of social media, emphasizing peer visibility, self-presentation, and social comparison,[9,51] may heighten feelings of inadequacy and distress, especially during early adolescence, a sensitive period for social-evaluative processes.[52–54] Exposure to self-harm and substance use content on social media may further normalize and promote these harmful behaviors, rather than protect against them.[55,56]

In contrast, video gaming showed little association with internalizing difficulties but was linked with aggression (r = 0.16) and externalizing behavior (r = 0.17), consistent with theories of media violence and behavioral disinhibition.[14,57] A small positive association with attention and executive functioning was observed (r = 0.10), potentially reflecting the cognitive demands of gaming,[58,59] although this was based on few studies and was not accompanied by higher academic achievement.

Moderation analyses revealed few differences by sex, age, respondent type, study duration, exposure year, or time lag. Associations between social media and depression were stronger in early adolescence, consistent with heightened peer sensitivity and peak onset for mental disorders during this developmental period.[60,61] Stronger associations were also observed in studies using device-logged exposure and self-reported outcomes, highlighting the importance of precise and ecologically valid measurement.[62] Evidence of moderation by exposure year for social media and substance use suggests that effects may change as platforms evolve and become more immersive.

Several limitations warrant consideration. Although all studies were longitudinal, causality cannot be inferred and residual confounding and reverse causality remain possible, particularly as many studies did not adjust for baseline outcomes. Few studies explicitly addressed bidirectionality or unmeasured confounding. Follow-up periods were typically around one year, limiting conclusions about long-term or non-linear effects. Heterogeneity reflected variation in design, samples, measurement tools, and exposure (e.g., mature-rated, risk-glorifying games [63] vs video games). Too few studies investigated other digital media beyond social media and video gaming, including emerging technologies like generative AI chatbots and virtual reality, to meta-analyze their effects across all outcomes. Social-emotional outcomes were more frequently assessed than physical, cognitive or motor outcomes, limiting conclusions across the spectrum of development. Early childhood exposures, trajectories into emerging adulthood, and objective measures were underrepresented. Most cohorts (83.7%) were from upper-middle income countries (UMIC), limiting generalizability to more diverse populations. Future longitudinal research addressing these gaps is needed, and future reviews should aim to investigate bidirectionality and the influence of factors such as race, ethnicity, and socioeconomic status to inform the generalizability of research findings.

Despite these limitations, the consistency of findings underscores growing global public health concerns regarding children's and adolescents' digital media use. Several countries are implementing age-based restrictions and considering limits on addictive design elements such as infinite scrolling and autoplay,[64–66] with our findings providing longitudinal context for these policy discussions. Although effect sizes were small to moderate, small effects can accumulate over time and at scale, contributing to

meaningful shifts in population wellbeing, particularly when observed consistently across time and cohorts.[67]

These findings also align with the bioecological model of child development, emphasizing dynamic interactions between children and their environment, including digital contexts.[68,69] Policy and clinical responses should be developmentally informed and consider sensitive periods of brain development.[61,70] Promoting healthier digital engagement will require coordinated efforts across ecological levels, including family practices (e.g., co-viewing media), school-based digital literacy, regulatory oversight of industry, and attention to cultural values and the evolving platforms. Future research should also prioritize precise, ecologically valid measurement of digital media engagement, early developmental exposures, trajectories into adulthood, and emerging media to inform timely, evidence-based responses.

Acknowledgements and Declarations

Contributors

ST, DH, AS, and KS conceptualised the study and developed the methodology. KS conducted the formal analysis, data curation, and visualisation, with validation by ST and KS. Data collection and investigation were undertaken by ST, KM, BH, DK, JK, MH, AC, and HW. ST drafted the original manuscript, and all authors critically reviewed and edited the manuscript. ST, KS, and DH supervised the project. Project administration was led by ST.

Declaration of interests

All authors declare no competing interests.

Access to Data and Data Analysis

ST and KS had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Data Sharing

Data and code for all meta-analyses are available through Open Science Framework: https://osf.io/h3rm9/overview?view_only=cca1405dd5a24f20a14ffb834cf5b1ab

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Tables

Table 1. Systematic meta-analytic review inclusion and exclusion criteria

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Table 1

Systematic meta-analytic review inclusion and exclusion criteria

Criterion Type	Description
Inclusion criteria	
Language	Available in English
Population	Human samples of children aged 0–18 years at exposure assessment
Study design	Quantitative studies reporting original empirical findings
Exposure	Reports a measure of children's digital media use, defined as media in which users can consume and create content[7]
Outcomes	Reports a measure of child health or development in at least one category: (1) Social-emotional outcomes: composite measures; externalizing and internalizing behaviors; peer problems; prosocial behavior; attachment; temperament and personality traits (positive and negative affect, emotional reactivity, regulation, surgency/extraversion); and positive development (self-esteem, resilience, coping, wellbeing) (2) Cognitive outcomes: composite; executive function/planning; decision-making; working memory; inhibition and flexibility; visual-spatial reasoning; verbal IQ; quantitative IQ; learning and memory; free recall, cued recall, recognition memory; semantic and autobiographical long-term memory; implicit learning; complex attention, sustained attention, divided attention, selective attention, and processing speed; IQ; expressive and receptive language; academic achievement (3) Physical health and developmental indicators: composite; growth and anthropometric (e.g., BMI); physical activity and fitness; sleep patterns and quality; nutrition and dietary habits; motor development; health behaviors and risk factors (smoking, alcohol, substance use); reproductive health; physiological development (e.g., blood pressure, cholesterol levels)
Temporal sequence	Longitudinal design in which digital media use precedes the health/developmental outcome
Effect estimates	Reports (or provides upon request) a bivariate association between digital media use and later child health or development outcomes
Exclusion criteria	
Clinical/medical selection	Samples recruited due to a medical condition or use of medication, alcohol, or other drugs
Intervention	Samples involved in an intervention
Exposure construct	Studies assessing digital media use exclusively as problematic or addictive use rather than frequency or duration

Table 2

Overview of developmental domains and subdomains and the corresponding number of meta-analyses by media exposure type

Subdomain	Social media	Video games	Other media
Social-emotional			
16 subdomains analysed: aggression, anxiety, depression, eating disorder and body image issues, externalizing behavior, internalizing behavior, combined externalizing and internalizing behavior, negative affect, peer problems, peer relationships, positive development, problematic internet use, prosocial behavior, self-injurious thoughts and behaviors, self-perception	15 meta-analyses	14 meta-analyses	14 meta-analyses
Physical and motor domain			
7 subdomains analysed: body composition, general health, metabolic syndrome, sleep problems, sleep quality, substance use, fine motor	4 meta-analyses	4 meta-analyses	4 meta-analyses
Cognitive domain			
3 subdomains analysed: academic achievement, attention and executive functioning and working memory	1 meta-analysis	3 meta-analyses	2 meta-analysis

Table 3

Associations between the different media types and socio-emotional outcomes

Social-emotional outcome	No. of studies (No. of effect sizes)	r	95% CI	p-value	I^2%
Social media					
Anxiety	12 (51)	0.05	0.00 to 0.11	0.062	91.2
Depression	24 (81)	0.09	0.06 to 0.12	**0.000**	91.0
Eating disorder and body image issues	3 (5)	0.08	-0.13 to 0.29	0.215	93.6
Externalizing behavior	8 (37)	0.13	0.07 to 0.19	**0.001**	94.0
Internalizing behavior	5 (27)	0.14	0.03 to 0.25	**0.025**	96.2
Internalizing and externalizing behavior	3 (6)	0.19	0.10 to 0.27	**0.011**	90.0
Self-Injurious Thoughts and Behaviors	4 (13)	0.11	0.01 to 0.21	**0.038**	95.9
Dysregulation	3 (4)	0.09	-0.02 to 0.19	0.067	85.8
Negative affect	2 (5)	0.05	-0.21 to 0.30	0.253	0.0
Prosocial behavior	3 (8)	-0.03	-0.09 to 0.04	0.175	32.6
Peer problems	3 (3)	0.06	-0.08 to 0.20	0.169	71.4
Peer relationships	4 (13)	0.06	-0.08 to 0.19	0.280	94.3
Positive development	10 (30)	-0.06	-0.11 to -0.02	0.011	91.9
Self-perception	3 (4)	-0.14	-0.26 to -0.01	**0.045**	89.8
Problematic internet use	4 (12)	0.21	0.13 to 0.29	**0.004**	70.7
Video games					
Anxiety	5 (14)	0.02	-0.09 to 0.12	0.669	98.4
Depression	10 (18)	0.09	-0.02 to 0.20	0.096	97.9
Eating disorder and body image issues	3 (4)	0.02	-0.13 to 0.16	0.640	83.6
Externalizing behavior	11 (28)	0.17	0.07 to 0.26	**0.004**	99.0
Internalizing behavior	2 (6)	0.20	-0.03 to 0.42	0.058	90.9
Internalizing and externalizing behavior	2 (4)	0.10	-0.79 to 0.85	0.486	70.0
Self-Injurious Thoughts and Behaviors	2 (5)	0.14	-0.83 to 0.90	0.404	99.2
Dysregulation	4 (8)	-0.01	-0.17 to 0.15	0.896	91.6
Negative affect	2 (4)	0.06	-0.05 to 0.17	0.094	0.0
Prosocial behavior	9 (22)	-0.13	-0.25 to 0.00	0.052	96.6
Peer problems	5 (11)	0.04	-0.07 to 0.15	0.327	84.6
Positive development	7 (11)	-0.04	-0.09 to 0.02	0.123	67.8
Self-perception	2 (3)	0.03	-0.44 to 0.48	0.595	76.3
Aggression	14 (42)	0.16	0.09 to 0.23	**0.000**	94.0

Table 4

Associations between the different media types and cognitive outcomes

Cognitive outcome	No. of studies (No. of effect sizes)	r	95% CI	p-value	I^2%
Social media					
Academic achievement	3 (19)	-0.07	-0.11 to -0.02	**0.027**	34.4
Video games					
Academic achievement	7 (14)	-0.02	-0.12 to 0.08	0.646	93.2
Attention and Executive Functioning	3 (16)	0.10	0.03 to 0.16	**0.030**	52.0
Working Memory	2 (13)	-0.09	-1.00 to 1.00	0.780	97.4

Table 5

Associations between the different media types and physical outcomes

Physical outcomes	No. of studies (No. of effect sizes)	r	95% CI	p-value	I^2%
Social media					
Sleep problems	3 (9)	0.06	-0.09 to 0.20	0.236	91.5
Sleep quality	2 (3)	0.07	-0.32 to 0.45	0.264	59.3
Substance use	10 (31)	0.14	0.08 to 0.19	**0.000**	96.3
Body composition	2 (3)	-0.41	-1.00 to 1.00	0.506	99.9
Video games					
Sleep problems	2 (5)	-0.17	-0.99 to 0.98	0.537	99.8
Substance use	4 (13)	0.04	-0.11 to 0.19	0.388	93.5
Body composition	9 (24)	-0.11	-0.38 to 0.18	0.423	99.7
Metabolic syndrome	3 (6)	-0.28	-0.91 to 0.74	0.429	99.5