

Entry

Digital and Substance Dependence in the Post-Digital Era

Vincenzo Maria Romeo ^{1,2,3} 

¹ Department of Culture and Society, University of Palermo, Viale Delle Scienze, Ed. 15, 90128 Palermo, Italy; vincenzomaria.romeo@unipa.it; Tel.: +39-3405803854

² School of Psychoanalytic and Groupanalytic Psychotherapy S.P.P.G., Via Fontana n° 1, 89131 Reggio Calabria, Italy

³ Neurosinc, Via P. Bentivoglio n° 62, 95125 Catania, Italy

Definition

Digital dependence and substance use may co-occur in post-digital cohorts when platform design, peer norms, stress exposure, and individual vulnerabilities converge to reinforce dysregulated patterns of reward seeking, self-regulation failure, and affective coping. This Entry defines their co-occurrence as a multidetermined phenomenon in which digital environments, including algorithmic feeds, notifications, social comparison, and variable rewards, interact with developmental vulnerabilities such as identity formation, impulsivity, reward sensitivity, and emotional dysregulation. Psychiatric comorbidities, particularly depression, anxiety, Attention-Deficit/Hyperactivity Disorder, and personality pathology, may increase susceptibility, while socioeconomic disadvantage and unequal access to care can intensify harm. Current evidence suggests that problematic digital use and substance use are more strongly related to functional impairment, coping motives, peer norms, and contextual stressors than to screen time alone. This Entry therefore organizes the available evidence around structural determinants, individual mechanisms, mental-health mediators, and prevention strategies, with emphasis on proportionate regulation, digital literacy, culturally adapted interventions, and integrated clinical pathways.

Keywords: digital dependence; substance use; adolescents; attention economy; social media; behavioral addiction; peer influence; mental health; socioeconomic inequalities; digital literacy

1. Introduction

Since the early 2000s, young people born and socialized in the post-digital era have experienced a rapid expansion of screen-based activities, including social networking, short-form video, livestreaming, and algorithmic newsfeeds. These changes have occurred alongside evolving patterns of psychoactive substance use. This overlap has renewed scientific debate on whether contemporary digital environments only correlate with risk, or whether they also contribute to shaping risk pathways in adolescents and emerging adults. Developmental neuroscience and population studies emphasize that adolescents' sensitivity to social reward, identity exploration, and peer evaluation may amplify the impact of platform design features during critical windows of socio-cognitive maturation [1]. In parallel, psychiatric classification systems now include at least one diagnosis related to digital behavior: Gaming Disorder. Its inclusion in ICD-11, and its conceptual proximity to the DSM-5 framework, supports clinical and epidemiological research on addiction-like online behaviors [2].



Academic Editors: Kum Fai Yuen,
Xueqin Wang and Xue Li

Received: 12 October 2025

Revised: 5 July 2026

Accepted: 14 July 2026

Published: 21 July 2026

Copyright: © 2026 by the author.
Licensee MDPI, Basel, Switzerland.
This article is an open access article
distributed under the terms and
conditions of the [Creative Commons
Attribution \(CC BY\)](https://creativecommons.org/licenses/by/4.0/) license.

Several psychological and neuroscientific models help explain why digital dependence and substance use may cluster. The I-PACE model (Interaction of Person–Affect–Cognition–Execution) conceptualizes problematic online behaviors as emerging from interactions among person-level vulnerabilities, affective responses, cognitive biases, cue reactivity, learning processes, and reduced executive control [3]. In substance use disorders, a complementary neurobiological synthesis highlights adaptations within reward, stress, and executive circuits that bias salience attribution, habit formation, and negative reinforcement cycles [4]. The incentive-sensitization framework explains how dopamine-related processes may separate craving from pleasure. This means that repeated cues can increase “wanting” even when pleasure decreases, a mechanism that may apply both to psychoactive drugs and to some digital rewards, such as notifications and intermittent feedback [5]. Together, these accounts predict partially overlapping vulnerabilities and cross-sensitization between digital and substance-related reinforcement environments.

At the social and platform level, the contemporary attention economy can magnify these vulnerabilities through interactions between users and algorithms. Recommender systems often prioritize content that captures attention because it is emotionally charged, identity-relevant, or novel. This can create feedback loops between user attention and algorithm-driven amplification [6]. Large-scale field experiments and platform-scale studies, while methodologically heterogeneous, show that feed algorithms can measurably alter exposure patterns and downstream attitudes/behaviors, including the diffusion of low-credibility content, though effects vary by context and outcome [7]. For adolescents and young adults, such curation may increase social comparison, fear of missing out, and exposure to repeated cues. These processes may strengthen triggers for compulsive checking and for substance-use norms within peer networks.

Empirically, meta-analytic evidence indicates that problematic Internet/social-media use (PIU/PSMU)—as opposed to mere time online—is moderately associated with internalizing symptoms (depression, anxiety), stress, and reduced well-being in student and youth samples [8,9]. Moving beyond cross-sectional associations, stronger designs are emerging: a recent longitudinal cohort analysis found that addictive patterns of digital use predicted subsequent suicidal ideation, net of confounders, underscoring clinical salience even when effect sizes are modest at the population level [10]. These data situate problematic digital use as a plausible mediator/moderator within broader pathways to psychopathology and health-risk behaviors.

Direct links to substance use are increasingly documented. A systematic review and meta-analysis reported significant associations between Internet addiction and drinking and smoking among adolescents and young adults, with convergent results across correlational and logistic models [11]. Complementing this, a 2024 meta-analysis of self-posting alcohol-related content on social media found small-to-moderate relationships with youth drinking behaviors, suggesting bidirectional processes of social learning, identity signaling, and reinforcement (both offline and online) [12]. In early adolescents from the ABCD Study, problematic social-media use (but not time on social media) was associated with stronger alcohol expectancies, a known cognitive antecedent of initiation and escalation [13]. Collectively, these findings support a clustering model in which digital compulsivity and substance-related cognitions/behaviors co-occur through shared reinforcement contingencies, peer-norm transmission, and stress-coping motives.

Crucially, these processes unfold within structural inequities. The pandemic foregrounded a digital access gradient, where constrained device/connection access and low digital literacy predicted worse mental-health outcomes in youth, likely compounding other adversities [14]. Socioeconomic position also shapes substance-use risk through multiple pathways (stress exposure, neighborhood norms, alternative reinforcement, and

opportunity structures), with systematic reviews detailing heterogeneous but meaningful SES–substance links across adolescence [15]. Any explanatory model of co-occurring digital dependence and substance use must therefore integrate contextual determinants—income, schooling, platform governance, and public policy—alongside individual differences. From a prevention standpoint, evidence-informed digital–mental-health interventions tailored to socioeconomically and digitally marginalized youth offer promise but require careful adaptation, co-design, and equitable implementation to avoid widening the very divides they aim to bridge [16].

In sum, evidence from clinical psychology, developmental science, behavioral economics, and policy analysis suggests that post-digital environments can increase exposure to powerful rewards, repeated cues, and peer signals. These environments may interact with pre-existing vulnerabilities and socioeconomic constraints, increasing the likelihood that digital dependence and substance use co-occur. The present Entry synthesizes the existing literature, clarifies mechanisms and boundary conditions, and outlines implications for targeted public policies, digital-literacy education, and culturally adapted prevention capable of mitigating intertwined risks without pathologizing normative digital participation.

To improve accessibility for non-specialist readers, the main explanatory models used in this Entry are summarized in Table 1. These models provide the conceptual bridge between individual vulnerabilities, platform-level reinforcement, affect regulation, adolescent development, and structural determinants of health.

Table 1. Core explanatory models used in this Entry.

Model/Framework	Concise Definition	Relevance to This Entry
I-PACE model [3]	Problematic online behaviors emerge from interactions among person-level vulnerabilities, affective responses, cognitive biases, cue reactivity, and reduced executive control.	This model explains how individual vulnerability, emotional states, cognitive appraisal, and control processes may transform high digital engagement into dysregulated or addiction-like use.
Dual-systems model [17,18]	Adolescent risk-taking is partly explained by heightened reward sensitivity combined with still-maturing cognitive-control capacities.	This model helps clarify why adolescents and emerging adults may be especially sensitive to immediate digital rewards, peer feedback, and substance-related cues.
Incentive-sensitization theory [5]	Repeated exposure to rewarding cues can increase cue-triggered “wanting” even when pleasure or “liking” decreases.	This theory supports the comparison between substance-related craving and some digital reward loops, such as notifications, likes, feed refreshes, and variable reinforcement.
Compensatory Internet Use model [19]	Digital engagement may become problematic when it is used primarily to regulate distress, loneliness, rejection, boredom, or dysphoria.	This model explains how digital overuse and substance use may both function as short-term coping strategies maintained by negative reinforcement.
Structural determinants framework [14–16,20–24]	Individual risk is shaped by broader social, economic, technological, and policy conditions, including platform design, inequality, access, labor conditions, education, and regulation.	This framework prevents an exclusively individualistic interpretation of risk and supports population-level prevention, safer defaults, equitable access to care, and culturally adapted interventions.

These models are complementary rather than mutually exclusive. Together, they indicate that co-occurring digital dependence and substance use should be interpreted as the outcome of interactions between developmental sensitivity, reward learning, affective coping, psychiatric vulnerability, platform architecture, and structural inequalities.

2. Macro-Structural Determinants

Addictive patterns involving digital media and substances emerge within a complex set of platform designs, social environments, work changes, and access or price conditions. This section examines these macro-level factors and explains how they may shape individual vulnerability and behavior in post-digital cohorts, as summarized in the conceptual map (see Figure 1).

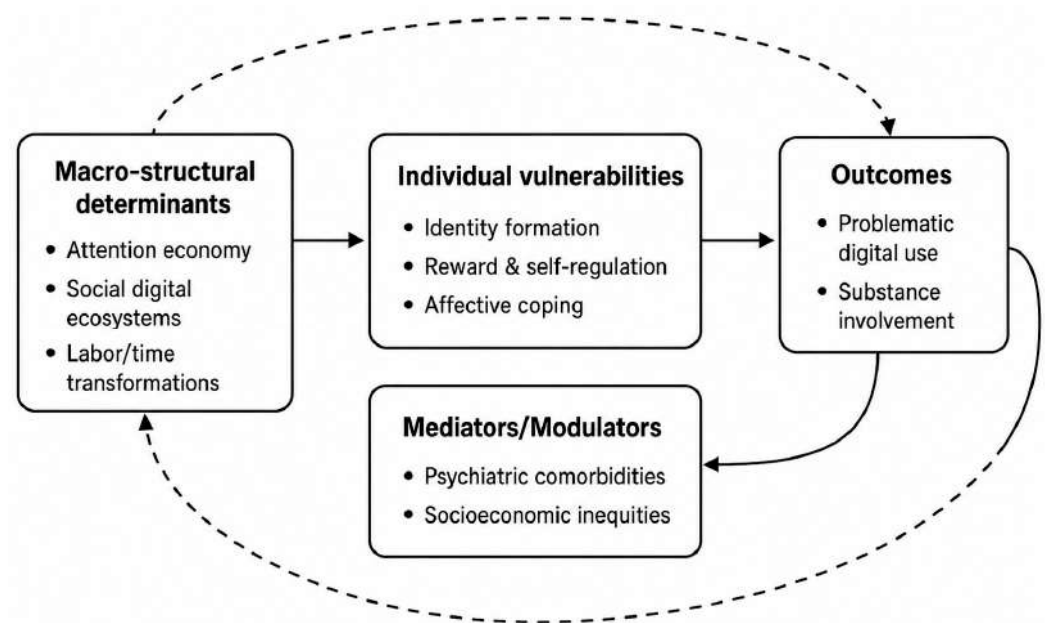


Figure 1. Conceptual map: structural determinants, individual vulnerabilities, mediators, and outcomes (problematic digital use & substance use). Solid arrows indicate primary directional influences from structural and individual factors toward mediators and outcomes. Dashed arrows indicate feedback loops through which outcomes may reinforce individual vulnerabilities and macro-structural determinants.

2.1. Attention Economy and Platforms: Attention Capture, Algorithmic Amplification, Notifications, and Variable Rewards

Digital platforms designed to capture attention often aim to increase time spent online and repeated use. They do this through ranking systems, recommendations, and interface cues that compete for limited attention. Early large-scale observational evidence showed that algorithmic ranking changes both the diversity and the prominence of information seen in social feeds. These effects influence exposure to content from different viewpoints and suggest that ranking itself, alongside homophily and user choice, helps determine what users see and click [25]. Recent audits further suggest that recommender systems can give greater visibility to posts linking to low-credibility sources. This increases the reach of sensational and polarizing content that is likely to be shared repeatedly [26].

These exposure regimes intersect with reward-learning mechanisms that make intermittent, uncertain rewards especially potent. Dopamine activity helps signal when a reward is better or worse than expected. Unpredictable rewards can strengthen learning and approach behavior, a mechanism long implicated in habit formation and addiction [27]. Feed refreshes, variable social feedback, such as likes and comments, and irregular push

alerts operate as variable reward schedules. These schedules may repeatedly reinforce checking and scrolling.

At the behavioral/attentional level, even passive cues can degrade performance. A brief, task-irrelevant phone notification imposes measurable costs on attention under experimental control, comparable to the decrement observed during active phone use [28]. Moreover, the mere presence of one's own smartphone can reduce available cognitive capacity for working memory and fluid intelligence. This creates a continuous attentional burden that increases when the device is nearby [29]. Syntheses of laboratory and field studies converge on the conclusion that contemporary smartphone/app ecosystems, via salience and reinforcement design, encourage frequent, short checking episodes triggered by cues, which is non-trivially associated with mind-wandering, performance costs, and compulsive checking [30].

Together, algorithmic prioritization of engaging content, variable rewards from social feedback and alerts, and repeated digital cues create an environment in which attention capture becomes predictable and self-reinforcing. For some users, especially those with impulsivity or emotion-regulation difficulties, these patterns may support escalation from high engagement to dysregulated and addiction-like use that co-occurs with substance use.

2.2. Digital Social Ecosystems: Online/Offline Peer Norms, Imitation, Viral Challenges, and Fear of Missing Out

Adolescence and emerging adulthood are characterized by heightened reward sensitivity to social context. Experimental neuroimaging demonstrates that peer presence selectively increases adolescents' risk taking by potentiating activity in ventral striatal/orbitofrontal circuits during decision making; adults do not show this peer-specific potentiation [31]. In always-connected environments, peer presence can become continuous. Notifications, group chats, live streams, and "seen/read" indicators can make audiences feel constantly present and evaluative. This may create sustained social pressure and increase preference for immediate rewards.

Fear of Missing Out (FoMO) describes concern that others are having rewarding experiences without one's participation. It has been measured empirically and linked to heavier social-media engagement and problematic use [32]. Platform features that publicize others' activity (status dots, streaks, "now" badges) can heighten comparative self-evaluation and urgency to connect, thereby strengthening social reinforcement loops. In parallel, viral challenges and imitation can turn perceived peer norms into behavior through social proof and status-related incentives, sometimes diffusing risky behaviors quickly through hybrid online/offline networks. Under such conditions, norms around binge drinking, cannabis "tolerance challenges," or polydrug use at events can be rapidly constructed and made to appear ubiquitous, increasing perceived prevalence and acceptability.

These processes matter clinically because the same social reinforcement that escalates compulsive screen behaviors can also lower thresholds for initiating or intensifying substance use. The neural systems involved in valuing social rewards are also relevant to drug-related cues. For this reason, digital rewards and substance-related cues may strengthen each other in vulnerable individuals, especially when they occur close in time.

2.3. Transformations of Work and Time: Precarity, Gig Modalities, Hyper-Connection, and Technostress

Labor markets have shifted toward flexible, on-demand, and platform-mediated work, with algorithmic management setting pace, evaluation, and availability expectations. Precarity (job insecurity, income volatility) and "always-reachable" norms impose psychosocial demands that can impair well-being and push coping toward quick-acting reinforcers (digital or pharmacological). A seminal information-systems program identi-

fied “technostress creators” (techno-overload, invasiveness, complexity, uncertainty) that degrade performance and well-being, and clarified mitigating organizational levers [33]. Meta-analytic updates corroborate that technostress is reliably associated with burnout, strain, and decreased job satisfaction across sectors and technologies [34].

Pandemic-era remote/hybrid arrangements intensified these exposures. A systematic review of technostress during strict lockdowns highlights the confluence of blurred boundaries, the intensification of digital monitoring, and role conflict, with downstream effects on mental health and coping behaviors [35]. In parallel, sociological analyses of platform work document elevated job insecurity, unstable schedules, and low bargaining power—conditions associated with dependency and hardship that predict stress-related outcomes [36].

These work–time pressures interact with platform design. Push notifications, “presence” indicators, and algorithmic prompts to respond quickly can fragment time and reduce personal control. Fragmented time can increase distress. Short-term relief through immediate rewards, such as short videos, gaming loops, nicotine, or stimulants, may then become an accessible coping strategy, increasing co-occurrence of digital overuse and substance use under high demand/low control conditions. For young people entering work through digital platforms, these exposures may begin earlier and occur more continuously. This may strengthen habits before self-regulation and stable routines are fully developed.

2.4. Access, Costs, and Availability: How Digital Infrastructure and Substance Markets Shape Exposure and Vulnerability

Structural access to high-speed connectivity and device ecosystems determines exposure intensity to digital rewards. Reviews of the digital divide emphasize that infrastructural, economic, and skills dimensions jointly shape engagement patterns and outcomes; when connectivity becomes ubiquitous, time-at-risk for reinforcement schedules increases, whereas unequal skills and precarious access can concentrate risky engagement in specific subgroups [20].

For substances, availability and price are canonical levers of population use. A recent synthesis across unhealthy commodities (including tobacco and alcohol) confirms robust price elasticities—higher prices/taxes reduce consumption, with larger effects among lower-income groups—underscoring costs as macro-determinants of exposure [37]. Region-specific reviews similarly show that raising tobacco taxes/prices in South-East Asia reduces affordability and tends to lower consumption, while also indicating substitution dynamics across product types that policymakers must anticipate [38].

Policy liberalization can also change exposure landscapes. A systematic review of the recreational cannabis legalization (RCL) literature reports mixed but non-trivial consequences—e.g., increases in young-adult use and certain cannabis-related healthcare encounters—while noting minimal short-term effects on adolescent prevalence in several settings [39]. Beyond formal markets, cryptomarkets on the dark web have diffused supply chains by enabling pseudo-anonymous, reputation-mediated transactions; empirical analyses show these markets can facilitate “hidden wholesale,” altering geography and scale of distribution and potentially seeding offline markets [40]. Although cryptomarkets still account for a small fraction of global drug trade, their growth and logistics efficiencies may increase harms under certain conditions (e.g., access to higher-potency products, adulteration risks), particularly when combined with social-media-based marketing and direct-to-consumer channels [41].

Crucially, digital infrastructures and substance markets are not independent. Platforms serve as informal “brokerages” for norms, tips, vendors, and harm-reducing or harm-amplifying content; algorithmic amplification of sensational material can raise the visibility of both risky challenges and high-potency products. Where connectivity and e-commerce

systems are highly developed, the effort required to obtain digital or chemical rewards can become very low. Conversely, well-designed fiscal and access policies (price floors, taxation, age gates, throttling of illegal marketing) can raise barriers and attenuate co-reinforcement between screens and substances.

3. Individual Vulnerabilities and Psychological Mechanisms

3.1. Identity Development in Digital-Native Cohorts

For post-digital cohorts, identity development occurs within digital and social environments that can both accelerate and complicate normative developmental tasks. Meta-analytic and longitudinal syntheses indicate that adolescence remains a critical window for movement across identity statuses (exploration, commitment, moratorium, diffusion) and consolidation of self-concept structure [42,43]. Neurodevelopmental evidence suggests that, during this period, self-related and value-based processes involve prefrontal and anterior cingulate circuits. These processes support the increasing importance of self-relevant goals and roles for motivated behavior [44]. In contemporary contexts, social media platforms add a persistent, archived, and algorithmically curated audience to identity performance. A systematic review shows that the quality of online engagement (e.g., authenticity, active content creation, social comparison) bears a stronger relation to identity exploration and self-concept clarity than quantity (time spent), with authenticity linked to higher clarity and comparison linked to identity distress [45]. This suggests that identity development may be shaped by platform features that organize feedback, visibility, and peer evaluation. These features may support adaptive exploration, but they may also increase rumination and distress. These patterns dovetail with dual-systems models in which the adolescent shift toward socially valued goals and reputational concerns amplifies reward-valuation processes at a time when regulatory control is still maturing [17,18]. Collectively, these data indicate that digital features may amplify typical identity-related sensitivities. Depending on the context, they may support resilience or increase risk (via contingent self-worth and evaluative threat).

3.2. Reward, Self-Regulation, Impulsivity: Shared Neurobehavioral Substrates

Substance use and high-engagement digital behaviors share partly overlapping motivational mechanisms. Dual-systems accounts posit a relative imbalance between a sensitized socioemotional reward system and a protractedly maturing cognitive-control system in mid-adolescence, creating a period of elevated approach tendencies and diminished top-down regulation [17,18]. Dimensional models divide impulsivity into different components, including motor disinhibition, delay discounting, and reflection impulsivity. These components are linked to partly distinct cortico-striatal circuits and may confer different levels of risk for addictive behaviors [46,47].

Prospective population data indicate that lower childhood self-control forecasts later substance dependence, financial and health problems, and justice involvement, independent of IQ and social class, underscoring the transdiagnostic significance of early regulatory capacities [48]. Translational evidence suggests that trait-like impulsivity for reward and exaggerated learning from rewarding feedback predict the transition from use to dependence, with dopaminergic dysregulation hypothesized as a shared mechanism [49]. In digital contexts designed around variable rewards and salient social feedback, these same vulnerabilities may appear as persistent cue-triggered checking, escalation of use, and difficulty disengaging. Over time, habit formation can shift behavior from goal-directed choice to more automatic stimulus–response patterns. This reduces sensitivity to delayed costs and is also central to substance addiction [46,47].

Importantly, not all impulsivity is alike: adolescents exhibiting steep delay discounting may be drawn to immediate digital or pharmacological rewards, whereas those with reflection impulsivity may initiate risky behaviors under uncertainty. Careful assessment of these dimensions has implications for targeted interventions (e.g., cognitive remediation of inhibitory control, contingency management emphasizing delayed reward salience) and for policy levers that modulate reinforcement density in youth-facing platforms. Taken together, convergent models support a shared neurobehavioral core—heightened reward sensitivity plus lagging control—that renders digital-native adolescents particularly susceptible to both behavioral and substance addictions when embedded in high-incentive, always-on environments [17,46–49].

3.3. *Coping, Affect Regulation, and Stress: Digital Stressors and Self-Medication*

Beyond primary reward, adolescents may use both substances and digital media to regulate emotions. The Compensatory Internet Use model proposes that problematic engagement may emerge when online activities are used mainly to reduce low mood, loneliness, rejection, or psychosocial stress, rather than for pleasure or practical purposes, thereby reinforcing maladaptive coping loops [19]. Within social platforms, negative social comparison and feedback-seeking patterns are robustly associated with depressive symptoms, with rumination mediating the link between comparison exposure and mood disturbance [50]. Algorithmic curation and public metrics may further strengthen self-esteem that depends on external feedback. This can make mood more sensitive to changes in online evaluation.

Concurrently, cyber-aggression constitutes a chronic interpersonal stressor with unique features—permanence, anonymity, and scale. Meta-analytic evidence documents reliable associations between cybervictimization and internalizing symptoms; some studies indicate stronger links with suicidal ideation than traditional bullying, plausibly via 24/7 intrusion and audience amplification [51]. In individuals with limited adaptive coping repertoires, the self-medication hypothesis predicts the instrumental use of psychoactive substances to modulate negative affect or arousal, which acutely relieves distress but increases long-term risk for dependence through negative reinforcement pathways [52]. Analogously, high-salience digital engagement may provide rapid anxiolytic or mood-elevating effects (distraction, social soothing), inadvertently reinforcing excessive use in response to stressors such as cyberbullying, performance comparison, or social exclusion.

These mechanisms may interact with socioeconomic stress. Scarcity and instability can increase chronic stress, reduce cognitive resources, and strengthen preference for immediately soothing choices (scrolling, substances). Clinically, this argues for integrated, mechanism-targeted prevention: (i) skills to diversify coping (problem-solving, acceptance-based strategies), (ii) psychoeducation on comparison and algorithmic dynamics, (iii) platform-level friction to disrupt ruminative checking, and (iv) screening for victimization with clear referral pathways. The overarching implication is that affect-regulatory motives—triggered by digital stressors and maintained by negative reinforcement—are central drivers of comorbidity between digital overuse and substance use in vulnerable youth [19,50–52].

3.4. *Peer Influence: Belonging, Status, and Normative Beliefs*

Adolescents' risk behavior is deeply embedded in peer environments where belonging and status are highly influential. Seminal reviews show that peer processes operate through multiple pathways—overt offers, modeling, and social norms—with descriptive and injunctive norms shaping the perceived typicality and acceptability of substance use [53]. Digital platforms intensify these dynamics by making peers' behaviors hyper-

visible (stories, streaks), quantifying approval (likes), and enabling rapid diffusion of risky challenges, thereby updating perceived norms in real time. In the alcohol domain, personalized normative feedback that corrects misperceptions about peer drinking reliably reduces consumption, demonstrating the causal leverage of normative beliefs [54]. By analogy, counter-normative messaging and authenticity-promoting cues in digital spaces may recalibrate perceived norms around incessant connectivity and high-risk trends (e.g., challenge participation).

Status-seeking further entwines with identity work and reward sensitivity: behaviors that confer visibility or group belonging can acquire disproportionate incentive value, especially when reinforced by public metrics. Interventions that (a) shift salient reference groups (e.g., highlighting quiet majority behaviors), (b) dampen public signals that fuel status competitions, and (c) scaffold prosocial status routes (mentoring, creator roles) are therefore poised to reduce both problematic digital use and substance use. In sum, peer norms act as immediate social influences. They can support prevention when online and offline informational environments are deliberately designed to correct misperceptions and promote safer behaviors [53,54].

4. Intersections with Mental Health and Inequalities

4.1. *Psychiatric Comorbidities as Mediators (Depression, Anxiety, ADHD, Personality Disorders)*

Across post-digital cohorts, the link between problematic digital use and substance use is rarely linear. It is often shaped by psychiatric vulnerabilities that cut across diagnoses, increase sensitivity to rewards, reduce control, and strengthen stress responses. Meta-analytic evidence indicates that symptoms of attention-deficit/hyperactivity disorder (ADHD)—especially inattention and impulsivity—are robustly associated with problematic internet use (PIU), suggesting the existence of partially shared self-regulatory mechanisms (e.g., delay aversion, impaired inhibitory control) that generalize from screen-based behaviors to psychoactive consumption [55]. Longitudinal observations in clinically characterized girls add further nuance to this link, showing concurrent ties between social PIU and inattentive symptoms, but weaker bidirectional effects over multi-year follow-up, implying that ADHD may function primarily as a predisposing trait while digital overuse variably exacerbates attentional difficulties depending on contextual demands and developmental stage [56].

The literature on ADHD and substance use disorder (SUD) shows earlier onset, faster progression, and greater SUD severity among individuals with childhood-onset ADHD, mediated by impulsivity, sensation seeking, and self-medication of dysphoria or arousal states [57]. This continuity model is compatible with the idea that algorithmically delivered small rewards may exploit similar neurocognitive vulnerabilities. Some young people may therefore be susceptible both to compulsive media routines and to early experimentation with psychoactive substances.

Beyond neurodevelopmental risk, personality pathology is also relevant. Borderline personality disorder (BPD) is consistently overrepresented among people with SUDs, and pooled evidence documents high co-occurrence with dyscontrol, emotional instability, and identity disturbance. In these phenotypes, digital hyper-stimulation may intensify rejection sensitivity, rumination, and cue-driven craving via social-affective contingencies, thereby potentiating substance misuse episodes as short-term emotion regulation attempts [58].

Internalizing psychopathology also functions as a mediator. Social anxiety shows graded associations with problematic social media use. This is consistent with online interaction being used to compensate for anxiety and to avoid offline distress. The same mechanism plausibly increases vulnerability to anxiolytic (e.g., alcohol, benzodiazepine) use in peer-evaluation contexts [59]. A multilevel synthesis further positions depression

and anxiety as common causes and consequences of SUD. These symptoms may interact with cognitive biases, sleep disruption, and lack of belonging, all of which may be amplified by always-available digital platforms [59].

Taken together, psychiatric comorbidities may act as mediators and moderators. They can increase exposure to highly rewarding digital routines, make substances more likely to become part of coping behavior, and reduce the ability to learn from negative consequences, for example, by sustaining hypervigilance, impulsive choice, and affect-driven decision-making.

4.2. Socioeconomic Gradient: Poverty, Educational Exclusion, Geographic Inequalities

The social distribution of risk is not random. Digital exclusion (insufficient device access, unstable connectivity, low skills) tracks with socioeconomic disadvantage and predicts worse adolescent mental-health trajectories during periods of forced online reliance; adolescents without a computer for schooling displayed steeper increases in difficulties at the height of pandemic restrictions, even after covariate adjustment [60]. This pattern suggests that, when key developmental tasks are digitally mediated, resource scarcity may contribute to psychological distress. This distress may increase the appeal of maladaptive coping, including compulsive screen use or substance use.

Cross-national cohort analyses corroborate a graded association between lower family income and poorer adolescent health indicators, suggesting the existence of constrained coping resources and elevated exposure to stressors (housing precarity, food insecurity) that render immediate-reward activities more attractive and long-term self-regulation costlier [61]. At the population level, economic inequalities in internalizing symptoms are evident across many countries and vary by the SES indicator used, underscoring that “which inequality we measure” (income, education, material deprivation) matters for identifying high-risk groups and tailoring prevention [62]. These structural gradients also interact with unequal access to timely, evidence-based mental-health care. Costs, transportation barriers, and uneven service distribution can produce treatment gaps and prolonged untreated illness—conditions under which both digital and chemical reinforcers can become chronic self-management tools. The Lancet Commission’s framework situates these disparities within a wider social-determinants perspective, linking poverty, education, and health-system capacity to the incidence and course of mental and substance-use conditions over the life course [21].

Geographic inequalities (peri-urban, remote, or underserved neighborhoods) compound risk via dual channels: the paucity of enriching offline alternatives and high saturation of low-cost, high-availability digital content. In such contexts, the attention economy may exploit scarcity of time, space, and care. It offers immediate and personalized rewards to adolescents who may also face barriers to extracurricular activities, psychotherapy, or early intervention for substance use. Consequently, policies that address device access alone are insufficient. They should be combined with digital-literacy education, school-based psychosocial support, and equitable mental-health services to reduce the risk that disadvantage becomes translated into combined digital and substance-use problems.

4.3. Cultural and Gender Aspects: Intersectional Differences and Culture-Bound Practices

Gender-patterned vulnerabilities are consistently observed. Meta-analytic data suggest that males are more likely to exhibit generalized internet addiction and, more specifically, internet gaming disorder (IGD), whereas females show relatively greater propensity toward social-media-centered problematic use—differences plausibly rooted in gendered motivational profiles (competition/achievement vs. social affiliation/appearance), peer norms, and platform ecologies [63,64]. Complementary cohort evidence indicates stronger

links between heavy social-media use and depressive symptomatology in girls—partly mediated by cyber-victimization, body image, and sleep disruption—while boys' risk tends to cluster around gaming-related contingencies and externalizing pathways [65]. These patterned contingencies have implications for substance use: social drinking/vaping in girls may be embedded in status- and appearance-related contexts (e.g., image management at gatherings), whereas boys may escalate stimulant or cannabis use around gaming marathons, performance, and group norms.

An intersectional perspective helps clarify how gender interacts with class, race/ethnicity, and sexuality to produce different patterns of exposure and vulnerability. Intersectionality theory in public health warns against treating “women” or “minorities” as homogeneous categories; instead, multiple social identities interact with structural oppression (e.g., sexism, racism, heterosexism) to shape who is algorithmically targeted, who is shielded by resources, and who is policed rather than cared for when harms surface [66]. This framework supports culturally adapted prevention that is sensitive to language, values, and local stressors, and that can address digital and substance-use risks in specific communities.

Finally, culture-bound and culture-shaped practices illustrate how sociocultural scripts mediate digital–mental-health linkages. The phenomenon of *hikikomori* (prolonged social withdrawal) originated in Japan but now appears internationally; proposed diagnostic criteria emphasize chronic isolation and functional impairment, which can be amplified by online immersion that substitutes for offline role attainment [67]. Recognition of such patterns matters for dual-addiction prevention, as sustained withdrawal may increase reliance on digital reinforcement while elevating risk for sedative or cannabis coping.

In sum, psychiatric comorbidities help explain how digital environments may become linked to substance use. Socioeconomic gradients, gender- and culture-related norms, and geographic inequalities shape how severe and persistent these harms become. Effective mitigation demands layered strategies—treating comorbid disorders early, reducing structural barriers to care, and tailoring interventions to culturally specific motivational profiles.

5. Evidence from Recent Studies

Recent longitudinal, cross-cultural, and digital-trace studies have refined previous claims about the relationship between digital engagement, mental health, and psychoactive substance use among post-digital cohorts. Overall, the best current evidence suggests three main conclusions. First, screen time and problematic digital use show small but reliable prospective associations with adverse mental-health indicators, although the magnitude of these associations varies by type of digital activity, developmental stage, and sociodemographic context [68–71]. Second, youth substance-use trends are heterogeneous across countries and products, with reductions in some traditional substances and substitutions toward newer products such as e-cigarettes or nicotine pouches [72,73]. Third, studies relying only on self-reported digital exposure are limited by substantial measurement error, because self-reported screen time often diverges from logged or passively collected device data [74–76]. For these reasons, the current evidence supports a cautious ecological interpretation rather than a simple causal model in which digital use directly produces substance use or psychopathology.

5.1. Longitudinal and Cross-Cultural Trends

Large prospective cohort studies provide the strongest available evidence on the temporal relationship between digital activity and later mental-health outcomes. In the Adolescent Brain Cognitive Development Study, higher baseline screen time was prospectively associated with small increases in depressive, attention-deficit/hyperactivity, and conduct-related symptoms over a two-year follow-up period [68]. Importantly, the effect

sizes were modest, and associations differed by type of screen activity. Video viewing, gaming, texting, and video chat showed stronger associations than other forms of digital engagement, suggesting that “screen time” should not be treated as a unitary exposure [68]. To make the empirical basis of this synthesis explicit, Table 2 summarizes selected longitudinal, surveillance, cross-national, and meta-analytic evidence that directly informs the relationship between digital engagement, mental-health outcomes, and substance-related variables. The table is descriptive rather than exhaustive; it emphasizes study design, exposure measurement, main findings, and key methodological limitations. Particular attention is given to the distinction between total screen time and problematic or addictive patterns of digital use, because this distinction is central to interpreting the current evidence.

Table 2. Selected recent cohort, surveillance, cross-national, and meta-analytic evidence on digital engagement, mental health, and substance-related outcomes in post-digital cohorts.

Study/Source (Ref.)	Region/Setting	Design/Sample	Digital Exposure	Outcome(s)	Main Finding and Key Limitation
ABCD Prospective Cohort [68]	USA	Prospective cohort; approx. 9500 children/adolescents, 9–13 years	Self-reported screen time by modality	Depressive, ADHD, and conduct symptoms	Small prospective associations after adjustment; stronger for some modalities. Limitation: self-reported exposure and small absolute effects.
National adolescent cohort [10]	USA	Multi-year prospective adolescent cohort	Addictive use of digital devices	Suicidal ideation	Addictive digital use predicted later suicidal ideation after adjustment. Limitation: residual confounding and measurement non-equivalence across subgroups.
UK Millennium Cohort Study [65]	UK	Large cohort; age-14 sweep	Hours/day of social-media use	Depressive symptoms, cyber-victimization, sleep	Associations were stronger in girls and partly mediated by cyber-victimization and sleep. Limitation: cross-sectional sweep and self-reported exposure.
Multi-dataset re-analyses [69,70]	UK/USA	Re-analysis of large adolescent datasets	Digital technology/social-media use	Life satisfaction and well-being	Average associations were close to zero, with substantial between-person heterogeneity. Limitation: operational heterogeneity and analytic sensitivity.
NYTS Surveillance [72]	USA	Repeated national cross-sectional surveillance	Tobacco/nicotine product use	E-cigarette, cigarette, and nicotine pouch use	E-cigarette use declined, while nicotine pouches emerged as an important product. Limitation: self-report and rapidly changing product landscape.
Nordic adolescents/ESPAD-related trends [73]	Nordic countries	Repeated cross-sectional and trend analyses	Alcohol and cannabis use indicators	Co-use and secular substance-use trends	Mixed trends, with some alcohol declines and persistence of high-risk subgroups. Limitation: policy and cultural heterogeneity across countries.

Table 2. Cont.

Study/Source (Ref.)	Region/Setting	Design/Sample	Digital Exposure	Outcome(s)	Main Finding and Key Limitation
ABCD Early Adolescents [13]	USA	Cross-sectional cohort analysis	Problematic social-media use vs. time online	Alcohol expectancies	PSMU was associated with alcohol expectancies, whereas time alone was less informative. Limitation: expectancies are cognitive antecedents, not substance-use behavior.
Social media alcohol-content meta-analysis [12]	Multi-country	Systematic review and meta-analysis	Self-posting/viewing alcohol-related social-media content	Drinking behaviors	Small-to-moderate associations with drinking behaviors. Limitation: mostly observational evidence and residual confounding.
Boniell-Nissim et al. [77]	42 countries, HBSC	Cross-national study; 190,089 adolescents aged 11, 13, and 15	Intense and problematic social-media use	Mental/social well-being and substance use	Problematic users showed the least favorable well-being profile and highest substance use. Limitation: cross-sectional design and regional heterogeneity.
Zhong et al. [78]	39 countries, HBSC	Latent class analysis; 157,717 adolescents	PSMU profiles	Smoking, drunkenness, cannabis use	Different PSMU profiles were associated with adolescent substance use across countries. Limitation: cross-sectional data and possible measurement differences across cultures.
Zewde et al. [79]	Africa	Systematic review and meta-analysis; 28 studies, 10 countries, 14,946 students	Internet addiction	Prevalence and associated factors	High pooled prevalence of internet addiction; associated with male sex, urban residence, and >4 h/day use. Limitation: high heterogeneity and limited direct substance-use outcomes.
dos Santos et al. [80]	Brazil	Cross-sectional adolescent study	Screen time by activity type	Alcohol and tobacco use	Social media use was associated with higher odds of smoking and alcohol use, whereas screen time for studying showed inverse associations. Limitation: cross-sectional design and no causal inference.

Legend: PSMU, problematic social media use; ADHD, attention-deficit/hyperactivity disorder; HBSC, Health Behaviour in School-aged Children. Positive association indicates increased risk; negative association indicates decrease or inverse association where reported. The table is a descriptive synthesis of selected studies and does not represent a quantitative meta-analysis.

Other longitudinal studies similarly indicate that addictive or dysregulated patterns of digital device use may be more clinically informative than time online alone. A recent national adolescent cohort study found that addictive use of digital devices predicted subsequent suicidal ideation after adjustment for confounders, although the observed associations remained small in absolute terms [10]. This finding is clinically relevant because it supports the distinction between normative high-frequency digital participation and problematic use characterized by impaired control, persistence despite harm, and functional impairment [10].

At the same time, large-scale re-analyses of adolescent digital technology use have cautioned against overestimating the effect of digital media on well-being. Orben and Przybylski found that associations between digital technology use and adolescent well-being were, on average, very small and sensitive to analytic choices [70]. In a related longitudinal study, Orben, Dienlin, and Przybylski reported limited enduring effects of social media use on adolescent life satisfaction, with substantial variation between individuals and developmental periods [69]. These findings suggest that the relationship between digital engagement and mental health is not uniform, and that individual vulnerability, social context, and type of use may be more important than total duration [69,70].

Cross-national evidence further complicates the picture. International studies show that increases in adolescent mental-health difficulties have occurred alongside increased digital engagement, but the temporal and causal coupling between these phenomena is weak, heterogeneous, and probably bidirectional [71]. This indicates that digital media should be understood as one component within a broader ecology of adolescent development, rather than as an isolated determinant of mental health or substance use [71].

Youth substance-use trends also show considerable heterogeneity. The 2024 National Youth Tobacco Survey documented a historically low prevalence of current tobacco product use among U.S. middle- and high-school students, with current e-cigarette use declining from 7.7% in 2023 to 5.9% in 2024, while nicotine pouches emerged as the second most commonly used tobacco product at 1.8% [72]. These data show that adolescent substance use is responsive to product availability, regulation, marketing, and substitution dynamics [72]. Similarly, Nordic trend analyses based on ESPAD and related surveillance data indicate changing patterns of alcohol and cannabis co-use, with declines in some alcohol indicators but persistence of high-risk subgroups and possible shifts toward cannabis use in selected populations [73]. Therefore, the relationship between digital environments and substance use must be interpreted within changing market, regulatory, and cultural contexts [72,73].

Taken together, longitudinal and surveillance studies support a balanced conclusion. Digital engagement is not uniformly harmful, and screen time alone is a weak explanatory variable. However, problematic or addictive patterns of digital use, especially when combined with psychiatric vulnerability, peer reinforcement, sleep disruption, or substance-related norms, may contribute to clinically meaningful risk trajectories in a subset of adolescents and young adults [10,68–73].

5.2. Digital-Behavior Analytics and Observational Trace Data

Digital-behavior analytics provide a more precise approach to exposure measurement than conventional self-report. A systematic review and meta-analysis comparing logged and self-reported digital media use found only moderate correspondence between the two, with particularly weak agreement for problematic use measures [74]. This implies that many studies based exclusively on self-report may misclassify exposure, either overestimating or underestimating the relationship between digital use and mental-health or substance-related outcomes [74].

Independent validation studies confirm this limitation. Ellis and colleagues showed that commonly used smartphone-use scales were weak predictors of objectively recorded behavior, raising concerns about the validity of questionnaire-based exposure estimates [75]. More recent adolescent data also demonstrate substantial inaccuracies in daily end-of-day and single-time self-reported smartphone use, even when participants report their behavior close to the time of use [76]. These findings are methodologically important because measurement error may distort associations between digital use, psychopathology, and substance use [74–76].

Digital phenotyping provides a more nuanced picture. In an intensive longitudinal study using passive sensing, within-person fluctuations in objective smartphone use showed little evidence of predicting later increases in negative mood [81]. Rather than supporting a simple exposure-harm model, these findings suggest that adolescents may use smartphones in different ways depending on mood, context, and interpersonal needs [81]. Ecological momentary assessment research similarly indicates that real-world smartphone use can sometimes coincide with mood improvement, particularly when digital engagement serves communicative or social-support functions [82]. These findings reinforce the need to distinguish between amount of use, type of use, subjective motive, and functional impairment [81,82].

Platform-level experiments also clarify the role of digital architecture. Large-scale randomized studies conducted during the 2020 U.S. election showed that feed algorithms and resharing mechanisms can substantially change exposure to political news and low-credibility sources, even when downstream effects on attitudes or beliefs are modest [7,83,84]. Other experimental work demonstrated that nudging recommendation algorithms can increase the quality of news content surfaced to users, indicating that design choices can alter information exposure independently of user traits [85]. Although these studies were not designed primarily to assess substance use, they provide strong evidence that platform architecture can shape attention, cue exposure, and social norms, which are plausible mechanisms linking digital environments to health-risk behaviors [7,83–85].

Therefore, digital-trace and platform-level studies strengthen one of the central claims of this Entry: digital risk cannot be understood only as a property of the individual user. It is also shaped by interface design, recommendation systems, notification structures, and the broader attention economy [7,74–76,81–85]. This has direct implications for prevention, because interventions limited to individual self-control may be insufficient when the digital environment itself increases cue frequency, salience, and reinforcement density.

5.3. Conceptual and Measurement Limitations

A major limitation of the current literature is the heterogeneity of definitions used to describe problematic digital use. Studies variously refer to problematic Internet use, problematic social media use, smartphone addiction, Internet addiction, gaming disorder, and compulsive digital engagement, often with different criteria, scales, and thresholds [86–89]. This definitional variability makes it difficult to compare prevalence estimates, synthesize findings across countries, or determine when digital behavior should be considered clinically significant [86].

The distinction between high engagement and disorder is especially important. ICD-11 Gaming Disorder provides one of the clearest examples of an impairment-based approach, requiring impaired control, increasing priority given to gaming, persistence despite negative consequences, and significant functional impairment [87]. Broader proposals regarding “other specified disorders due to addictive behaviors” similarly emphasize that clinical relevance and functional impairment should be central criteria, rather than time spent or moral concern about new technologies [88]. Pathway models of problematic mobile phone use also suggest that different mechanisms may lead to similar behavioral outcomes, including impulsive pathways, excessive reassurance seeking, social-maintenance motives, and emotion-regulation loops [89].

This conceptual caution is crucial for interpreting the evidence reviewed above. If problematic use is defined too broadly, research may pathologize normative digital participation and inflate prevalence estimates. If it is defined too narrowly, clinically relevant patterns of dysregulation, impairment, and comorbidity may be missed. A more precise

approach should separate quantity of use, content, context, motive, impaired control, and functional consequences [86–89].

Another limitation concerns bidirectionality. Mental-health symptoms may increase problematic digital use, while problematic digital use may worsen sleep, emotion regulation, social comparison, and exposure to risky peer norms [68–71,81,82]. Similarly, substance use may be both an outcome and a contributor to problematic digital use, especially when intoxication, impulsivity, peer reinforcement, or online substance-related content interact in real time [12,13,72,73]. Future studies should therefore model reciprocal pathways rather than assuming a single direction of causality.

Finally, the existing evidence base remains geographically uneven. Many longitudinal and digital-trace studies come from Western, high-income settings, particularly the United States, the United Kingdom, and Northern Europe [68–73]. This limits external validity because platform ecologies, family mediation practices, digital access, school systems, socioeconomic inequalities, and substance-use norms differ across regions. Future research should include more data from Asia, Africa, Latin America, and low- and middle-income countries, using culturally validated measures and locally relevant definitions of impairment.

5.4. Synthesis

The most defensible interpretation of recent evidence is that digital engagement and substance use are linked through small, heterogeneous, and context-dependent pathways. Screen time alone is a weak predictor. In contrast, problematic digital use, addictive patterns of device engagement, social comparison, sleep disruption, peer norms, psychiatric comorbidity, and structural disadvantage appear more clinically meaningful [10,68–73]. Objective telemetry and passive sensing further show that self-reported digital exposure is often imprecise, and that the function of digital use may matter more than duration [74–76,81,82].

At the population level, even small associations may be relevant when exposures are widespread, repeated, and developmentally timed. At the individual level, risk is likely concentrated among adolescents and young adults with high reward sensitivity, poor self-regulation, affective distress, ADHD symptoms, social anxiety, or exposure to substance-normalizing peer environments [10,13,55–59,68]. At the structural level, platform design can modify cue exposure and reinforcement schedules, while substance markets and regulatory environments shape availability, affordability, and product substitution [7,72,73,83–85].

In conclusion, recent evidence does not support alarmist or monocausal interpretations. It supports an ecological and clinically nuanced model in which digital dependence and substance use may co-occur when platform design, peer influence, psychiatric vulnerability, and structural disadvantage converge. Future progress will require harmonized definitions, impairment-based thresholds, objective digital-behavior measures, cross-cultural sampling, and longitudinal designs capable of testing reciprocal pathways between digital use, mental health, and substance use [68–76,81–89].

6. Implications for Policies and Practice

A credible response to the co-occurrence of digital dependence and psychoactive substance use in post-digital cohorts requires an integrated public-health strategy. Individual self-control alone is insufficient when digital environments are designed to increase engagement, when peer norms are continuously amplified online, and when socioeconomic disadvantage limits access to protective resources. Effective prevention should therefore combine regulatory protections, safer digital choice environments, school-based digital literacy, and stepped clinical pathways. These measures should follow the principle of pro-

portional universalism: universal protections for all adolescents, with additional intensity for groups exposed to higher psychiatric, social, or economic risk.

6.1. Regulatory Guardrails

Regulatory action should first address the structural features of digital environments that increase exposure to harm among minors. A rights-based baseline is provided by General Comment No. 25 of the UN Committee on the Rights of the Child, which emphasizes children's rights to privacy, safety, non-discrimination, and age-appropriate protection in digital environments [22]. The UK Age-Appropriate Design Code translates similar principles into operational requirements, including high privacy by default, data minimization, and the avoidance of design choices that pressure children toward unnecessary data sharing or prolonged engagement [23]. From a data-protection perspective, GDPR scholarship further highlights that automated profiling and multi-stage algorithmic decision-making require transparency, proportionality, and meaningful possibilities for contestation, particularly when children and adolescents are involved [24].

These principles are directly relevant to the prevention of problematic digital use and substance-related risk. Profiling-based engagement systems can intensify exposure to emotionally arousing content, substance-related cues, risky challenges, or peer norms that normalize alcohol, nicotine, cannabis, or other psychoactive substances. Regulatory measures should therefore limit hyper-personalized targeting of minors, restrict personalized advertising based on inferred vulnerabilities, require age-appropriate default settings, and mandate independent audits of high-risk design features. Such measures do not aim to pathologize ordinary digital participation. Rather, they aim to reduce avoidable exposure to digital environments that intensify compulsive use, social comparison, unsolicited contact, or substance-normalizing content.

The main regulatory and privacy levers are summarized in Table 3. These measures aim to reduce minors' exposure to excessive profiling, unsolicited contact, location-based risks, and algorithmically intensified persuasive design. They should be understood as population-level protections rather than as restrictions on normative digital participation.

Table 3. Regulatory and privacy levers for reducing digital and substance-related risk in post-digital cohorts.

Policy Lever	Concrete Measure	Mechanism	Expected Outcome	Equity Consideration
Profiling limits	Ban personalized advertising to minors; allow contextual advertising only.	Reduces commercial targeting based on inferred vulnerability, impulsivity, or affective state.	Lower exposure to persuasive or age-inappropriate content; reduced compulsive purchasing, loot-box spending, and substance-normalizing advertising.	Audits should include minority-language segments, low-literacy users, and transparent enforcement procedures.
Age assurance and safer defaults	Use risk-tiered, privacy-preserving age assurance; set non-personalized feeds as default for under-16 accounts.	Constrains recommender personalization and reduces amplification of high-arousal or mature content.	Reduced exposure to mature content, binge-scrolling, and risky viral challenges.	Age assurance should avoid exclusion of undocumented youth, low-income families, or users without formal identity documents.
Privacy by default	Set profiles to private by default; turn off direct messages from non-contacts for under-16 accounts.	Reduces unsolicited contact, grooming risk, cybervictimization, and social-evaluative pressure.	Fewer unsolicited messages and harassment reports; lower anxiety and distress linked to online victimization.	Reporting and appeal systems should be accessible, multilingual, and non-punitive.
Location and geotagging protection	Turn location sharing off by default; require opt-in geotagging with clear friction for minors.	Reduces doxxing, stalking risk, and place-based social comparison.	Fewer location-based safety incidents; stronger privacy-protective behaviors.	Interfaces should use simple language and icons for low-literacy users and younger adolescents.

Table 3. *Cont.*

Policy Lever	Concrete Measure	Mechanism	Expected Outcome	Equity Consideration
Independent auditability	Require external audits of ad delivery, feed composition, age-gating performance, and high-risk engagement design.	Creates accountability for platform-level exposure and prevents hidden amplification of risky content.	Improved transparency; earlier detection of harmful design patterns or unequal exposure across groups.	Audits should assess differential effects by gender, socioeconomic status, language, disability, and geographic location.
Illegal marketing and harmful content controls	Throttle or remove illegal substance marketing; apply friction before mature-rated or substance-normalizing content.	Increases friction and reduces repeated exposure to substance-related cues.	Reduced visibility of risky challenges, high-potency product promotion, and peer-normalizing substance content.	Controls should be transparent and include appeal mechanisms to avoid over-removal of legitimate harm-reduction information.

Legend: Regulatory and privacy levers refer to structural measures aimed at reducing exposure to high-risk digital environments, especially among minors. These measures include profiling limits, age assurance, privacy-by-default settings, and restrictions on location sharing or unsolicited contact. Expected outcomes should be monitored through privacy-preserving audits, transparency reports, school safeguarding data, and validated psychosocial indicators.

As shown in Table 3, regulatory measures are most useful when they target structural exposure rather than individual moral responsibility. Their purpose is not to eliminate digital participation, but to make default digital environments safer, less intrusive, and less dependent on profiling-based engagement.

6.2. Choice Architecture and Digital Nudging

Regulation should be complemented by behaviorally informed changes in digital choice environments. Digital nudging refers to interface-level modifications that guide behavior while preserving user choice [90]. In the context of youth-facing platforms, these strategies can reduce the frequency and salience of cues that maintain repeated checking, scrolling, and late-night engagement. A broad meta-analysis of choice-architecture interventions shows that such measures can produce small-to-moderate behavioral effects, especially when they modify decision structure through defaults, ordering, friction, or simplified options [91]. Evidence on default effects similarly suggests that default settings can influence behavior substantially, although their effectiveness varies according to context, ease of reversal, and user endorsement [92].

In digital environments, choice architecture is clinically relevant because compulsive engagement is often maintained by repeated exposure to cues and variable rewards. Autoplay, infinite scroll, push notifications, public metrics, and algorithmic recommender systems can increase the frequency of short engagement episodes and reduce opportunities for intentional disengagement. Safer design would include autoplay off by default, notification bundling, night-time quiet hours, session-length prompts, chronological or less personalized feeds for minors, and additional friction before accessing age-inappropriate or highly arousing content. These strategies should be transparent, reversible where appropriate, and independently auditable.

Table 4 translates these choice-architecture principles into concrete digital nudging strategies. The aim is to reduce cue frequency, variable reward density, nocturnal engagement, and automatic scrolling, while preserving user autonomy and the possibility of intentional digital use.

These strategies are particularly relevant because they intervene on the design features that maintain repeated checking, scrolling, and cue-triggered engagement. In clinical and educational contexts, they may support self-regulation by reducing the environmental load placed on adolescents' still-developing executive-control capacities.

Table 4. Digital nudging and choice-architecture strategies for reducing compulsive engagement.

Policy Lever	Concrete Measure	Mechanism	Expected Outcome	Equity Consideration
Safe defaults	Set autoplay off and activate night-time quiet hours, for example, 22:00–07:00, for under-16 accounts.	Reduces variable reward density, automatic continuation, and nocturnal cueing; preserves sleep opportunity.	Less after-bed scrolling, fewer late-night notifications, improved sleep duration and regularity, and lower daytime sleepiness.	Defaults should apply across low-cost devices and major platforms to avoid unequal protection by device or vendor.
Notification bundling	Bundle notifications and deliver them in scheduled windows, for example, three times per day, with emergency bypass.	Reduces cue frequency and attentional fragmentation while preserving access to important communication.	Fewer daily interruptions, better on-task behavior, lower perceived technostress, and improved academic engagement.	Must work in low-data/offline contexts and allow emergency exceptions for family, health, or safeguarding needs.
Session-length prompts	Introduce prompts after 20–30 min of continuous use with an easy “take a break” option.	Interrupts habit loops, increases self-monitoring, and introduces light friction before prolonged sessions.	Shorter continuous sessions, increased perceived control, and lower problematic digital use severity.	Prompts should be non-stigmatizing, localizable, accessible, and easy to dismiss when use is purposeful.
Chronological or less-personalized feed option	Use chronological or less-personalized feeds as default for minors; make algorithmic feeds opt-in.	Reduces algorithm-driven amplification and lowers exposure to high-arousal or polarizing content.	More diverse content exposure, lower binge-scrolling risk, and reduced susceptibility to viral harms or challenges.	Feed options should be understandable to young users and available regardless of subscription status.
Quality labels and content friction	Apply quality labels to low-credibility links and add friction before resharing or engaging with substance-normalizing content.	Slows impulsive sharing and encourages reflection before exposure or dissemination of risky material.	Lower reshares of low-credibility content; increased critical evaluation; reduced normalization of risky behaviors.	Labels must be culturally sensitive, independently governed, and avoid bias against non-mainstream but legitimate sources.
Rate-limiting social reward metrics	Limit rapid refresh cycles and delay or batch display of likes, views, streaks, or similar social metrics.	Reduces immediate social reinforcement and lowers status-driven checking loops.	Lower compulsive checking, reduced comparison pressure, and improved capacity to disengage from platforms.	Design should avoid penalizing youth creators, minoritized voices, or educational uses of social platforms.

Legend: Digital nudging refers to interface-level changes that guide behavior without removing user choice. The strategies listed in this table are designed to reduce automaticity, attentional fragmentation, sleep disruption, and repeated exposure to variable digital rewards. Implementation should be transparent, age-appropriate, reversible where possible, and independently auditable.

6.3. Education and Digital Literacy

Education systems are the natural setting for primary prevention. Pediatric guidance has moved beyond generic screen-time limits toward structured media planning, family involvement, and skills-based approaches [93]. This shift is important because the risk associated with digital use depends not only on duration, but also on content, context, motive, developmental stage, and functional impairment. School-based education should therefore help students understand how platforms capture attention, how algorithms shape exposure, how peer norms are constructed online, and how commercial design can influence behavior.

Digital literacy should include several integrated components. First, students need critical advertising and data literacy, including the ability to recognize targeted marketing, influencer-based persuasion, gambling-like design features, and substance-normalizing content. Second, they need social-emotional skills to manage comparison, FoMO, rejection

sensitivity, cybervictimization, and pressure to participate in risky online trends. Third, they need practical privacy skills, such as managing permissions, location sharing, direct messages, and data traces. Fourth, they need norm-correction strategies, because adolescents often overestimate the prevalence and approval of both risky digital behaviors and substance use among peers.

Evaluations of structured digital citizenship curricula indicate that school-based programs can improve children's knowledge and competencies in online safety, privacy, and responsible participation [94]. More broadly, meta-analytic evidence suggests that media-literacy interventions improve media knowledge and critical processing, with additional effects on attitudes, intentions, and some health-risk behaviors when programs explicitly address those outcomes [95–97]. Therefore, education should not be limited to isolated awareness events. It should be delivered through repeated, age-graded curricula that are adapted across school years and coordinated with families.

Parental mediation should also be framed carefully. Purely restrictive approaches may reduce exposure in the short term but can be less effective when they undermine autonomy or fail to teach self-regulation. Autonomy-supportive mediation, by contrast, combines limits with explanation, shared planning, and gradual transfer of responsibility. In this sense, school and family interventions should aim to strengthen adolescents' capacity to recognize digital triggers, evaluate online norms, and choose adaptive coping strategies before problematic use or substance involvement becomes entrenched.

6.4. *Prevention and Clinical Care*

Clinical prevention should be stepped, integrated, and sensitive to comorbidity. The co-occurrence of problematic digital use and substance-related risk is more likely among adolescents with impulsivity, ADHD symptoms, depression, anxiety, personality vulnerability, social withdrawal, sleep disruption, or limited coping resources. For this reason, screening should not focus only on time spent online. It should assess impaired control, persistence despite harm, functional impairment, coping motives, sleep interference, exposure to substance-related digital content, and co-occurring substance use.

Selective and indicated prevention programs are particularly relevant for adolescents with known trait-level vulnerabilities. Personality-targeted interventions addressing sensation seeking, impulsivity, anxiety sensitivity, and hopelessness have shown preventive effects on adolescent alcohol misuse and binge-drinking trajectories [98]. These approaches are important because they intervene on mechanisms that may also increase vulnerability to problematic digital use, including reward sensitivity, poor inhibitory control, distress intolerance, and maladaptive coping.

Stepped-care pathways can organize prevention and treatment according to severity. For mild or emerging difficulties, low-intensity supports may include psychoeducation, self-monitoring, sleep stabilization, digital-use planning, parental guidance, and brief cognitive-behavioral or emotion-regulation modules. For moderate impairment, blended interventions may combine digital CBT, motivational interviewing, family work, and school-based support. For more severe or comorbid presentations, referral to specialized youth mental-health or addiction services is required. Systematic reviews suggest that internet-delivered interventions can reduce depression, anxiety, stress, and related symptoms in student populations, although effects vary by target, guidance, and baseline risk [99]. Large youth mental-health service models also show that accessible, integrated, and youth-friendly systems can improve distress and functioning when they combine rapid triage, low-intensity support, and escalation pathways [100,101].

Clinical care should therefore avoid separating digital harms, mental health, and substance use into disconnected silos. Adolescents who present with problematic gaming,

compulsive social-media use, vaping, binge drinking, cannabis use, or mood symptoms often require an integrated formulation. This formulation should ask what the behavior does for the young person: whether it regulates distress, creates belonging, provides status, reduces boredom, supports avoidance, or increases exposure to substance-related peer norms. Treatment should then target both the behavior and its function.

The educational and clinical implications of this framework are summarized in Table 5. These strategies move from universal prevention to selective and indicated care, integrating digital literacy, school-based prevention, dual-diagnosis screening, stepped care, and culturally adapted interventions.

Table 5. Educational and clinical pathways for prevention and care.

Policy Lever	Concrete Measure	Mechanism	Expected Outcome	Equity Consideration
Media and privacy literacy	Deliver age-graded modules on privacy, data trails, advertising, recommender systems, and the attention economy.	Builds critical understanding of persuasive design and strengthens privacy-protective behavior.	Improved media knowledge, critical processing, privacy skills, and resistance to risky online norms.	Materials should be low-bandwidth, multilingual, disability-accessible, and adapted to the platforms used locally.
School digital citizenship curriculum	Implement spiraled school curricula integrating social–emotional learning, norm correction, sleep hygiene, and peer-influence literacy.	Addresses risk before problems emerge and reframes digital behavior as part of psychosocial development.	Greater self-regulation, healthier peer norms, reduced cybervictimization, and lower risk of problematic use.	Curricula should be co-designed with students, caregivers, and communities facing socioeconomic or territorial disadvantage.
Routine dual-risk screening	Screen for problematic digital use, sleep problems, mood/anxiety symptoms, ADHD traits, substance use, and online victimization.	Identifies comorbidity early and prevents separation of digital and substance-related problems into disconnected care pathways.	Earlier detection, better referral accuracy, and improved monitoring of adolescents with combined risks.	Screening must be confidential, non-punitive, trauma-informed, and connected to accessible services.
Stepped-care pathway	Use a stepped model: psychoeducation and self-help; brief digital CBT or motivational modules; clinician-guided intervention; specialist referral when impairment is significant.	Matches intervention intensity to severity and reduces treatment barriers.	Reduced symptom scores, improved functioning, higher care retention, and lower escalation to severe SUD or behavioral addiction.	Care should be no-cost or low-cost, available after hours, and supported by interpreters where needed.
Nudge to care	Offer opt-in prompts to chatlines, school counselors, or youth clinics after repeated harm signals, such as harassment, sleep disruption, or self-reported distress.	Reduces help-seeking friction at the moment of need while preserving consent.	Increased linkage to brief interventions; reduced PSMU severity, binge drinking, vaping episodes, or crisis escalation.	Must use explicit consent, privacy-preserving analytics, and clear safeguards against punitive consequences.
Culturally adapted prevention	Adapt prevention content to local language, values, family norms, dominant platforms, substance-use patterns, and community resources.	Improves engagement by aligning intervention content with deep cultural structures and local explanatory models.	Higher acceptability, better adherence, improved family involvement, and more equitable prevention uptake.	Adaptation should include youth from minority, rural, low-income, migrant, and marginalized communities.

Legend: Educational and clinical pathways refer to interventions delivered through schools, families, youth mental-health services, community settings, and digital or blended-care platforms. Universal prevention targets all adolescents, selective prevention targets groups with elevated vulnerability, and indicated prevention targets individuals with early signs of impairment or comorbidity. Cultural tailoring should include linguistic accessibility, community participation, and adaptation to local digital and substance-use ecologies.

As summarized in Table 5, prevention should not be limited to information about risks. It should combine digital literacy, social–emotional learning, norm correction, early screening, and accessible clinical pathways. This integrated approach is especially important for adolescents with psychiatric comorbidity, socioeconomic disadvantage, or early signs of both problematic digital use and substance involvement.

6.5. Cultural Tailoring and Equity

Digital and substance-related risks are not distributed evenly across populations. Socioeconomic disadvantage, geographic inequalities, educational exclusion, family stress, minority status, and unequal access to care can all shape both exposure and harm. For this reason, prevention and clinical pathways must be culturally adapted and equity-oriented. Foundational work on cultural sensitivity distinguishes surface-level adaptation, such as language and imagery, from deeper adaptation to values, explanatory models, family structures, and community norms [102,103]. Evidence-based intervention frameworks similarly emphasize community partnership, iterative adaptation, and fidelity with flexibility [104,105].

In practice, cultural tailoring should operate at multiple levels. School curricula should be co-designed with students from different socioeconomic and cultural backgrounds. Parental resources should be linguistically accessible and sensitive to different family structures, migration histories, and levels of digital literacy. Clinical services should provide low-cost and geographically accessible pathways, including after-hours support, youth-friendly entry points, and referral systems that do not stigmatize adolescents or families. Community partners, including schools, youth organizations, primary care services, and local mental-health providers, should be involved in adapting prevention strategies to the platforms, substances, norms, and stressors most relevant in each context.

Equity is also central to digital prevention. A policy that requires high-end devices, constant connectivity, paid parental-control tools, or high levels of technical literacy may unintentionally widen disparities. Similarly, clinical monitoring based on digital data must avoid reproducing excessive surveillance or profiling, especially among marginalized groups. Privacy-preserving monitoring, explicit consent, transparent data use, and non-punitive support are therefore essential. The goal is not to monitor adolescents more intensively, but to create safer environments, better skills, and accessible care pathways.

Overall, policy and practice should move beyond individual blame and beyond simple screen-time reduction. The most coherent strategy is multi-level: regulate high-risk design, reshape digital choice environments, teach critical and emotional competencies, screen early for comorbidity and substance use, and adapt interventions to cultural and socioeconomic context. This integrated approach is most consistent with the evidence that digital dependence and substance use emerge from the convergence of platform design, developmental vulnerability, peer norms, psychiatric comorbidity, and structural inequality.

7. Outlook/Research Gaps

Three domains stand out for advancing a rigorous, policy-relevant science of co-occurring digital dependence and substance use in post-digital cohorts.

Mixed-methods designs. First, we need designs that integrate qualitative and quantitative strands to capture mechanisms at multiple levels (platform architecture, social ecologies, individual trajectories). Methodological work details concrete strategies for integration—through convergent, explanatory, and exploratory sequences; multistage and participatory frameworks; and joint displays that align inferences across strands [106]. Beyond technique, mixed methods constitute a third methodological community that enables meta-inferences greater than the sum of parts, particularly when investigating context-sensitive phenomena (e.g., platform governance changes, youth subcultures) [107]. In practice, this implies pairing device logs and policy/algorithm audits with ethnographic fieldwork in schools and youth communities, and embedding realist evaluation questions (what works, for whom, in which contexts) from the outset.

Behavioral addiction nosology and measurement. Second, behavioral-addiction criteria require sharpening to reduce false positives and enhance clinical utility. The ICD-11 deci-

sion on Gaming Disorder provides an exemplar but also underscores the need for functional impairment and clinical relevance as central anchors for any candidate behavioral addiction (e.g., problematic social-network use, buying–shopping disorder) [87,88]. Pathway models emphasize heterogeneity—impulsive/compulsive routes, social-maintenance motives, and affect-regulatory loops—which should be reflected in the specification of criteria and in differential assessment, rather than unitary “time-spent” thresholds [89]. Agreed crosswalks between ICD-11 specifiers and research constructs (craving, withdrawal-like phenomena, persistence despite harm), plus harmonized cut-points anchored to impairment, would improve comparability across cohorts and cultures and clarify when dysregulated digital behavior warrants a disorder label versus targeted psychoeducation.

Open data and ethical AI for public health. Third, progress depends on interoperable, reusable data and transparent analytics. The FAIR principles formalize machine-actionable standards for findability, accessibility, interoperability, and reusability—standards that digital-behavior and youth-health datasets seldom meet today [108]. Digital epidemiology shows the promise—and pitfalls—of repurposing passively generated traces for population inference; translation to adolescent mental health requires careful bias auditing, sampling frames, and governance [109]. In parallel, responsible AI must be treated as public-health infrastructure: ethical analyses highlight obligations for privacy protection, explainability, and accountable oversight in clinical and population applications [110,111]. Concrete reporting tools—model cards for model transparency and datasheets for datasets—exist to document provenance, intended use, performance, and known biases; adopting these across health, education, and platform research would markedly raise evidentiary quality and reproducibility [112,113]. Where AI supports interventions (screening, triage, just-in-time adaptive support), study protocols and trial reports should follow SPIRIT-AI and CONSORT-AI extensions so that safety, human–AI interaction, and error analysis are explicit and auditable [114,115].

Cross-cutting limitations and priorities. Key gaps include (i) insufficient triangulation across telemetry, surveys, and qualitative accounts in diverse settings; (ii) definitional heterogeneity around “problematic use,” often conflating quantity with harm; (iii) underpowered subgroup analyses that obscure intersectional differences; and (iv) limited open repositories linking de-identified digital traces to longitudinal health outcomes under robust consent and governance. A feasible agenda would (a) convene consensus panels to operationalize impairment-anchored criteria for candidate behavioral addictions, (b) fund mixed-method cohort platforms that co-produce protocols with youth and caregivers, (c) mandate FAIR-compliant data management and the adoption of model cards/datasheets in funded AI projects, and (d) require SPIRIT-AI/CONSORT-AI reporting for any AI-enabled prevention or care evaluated in youth populations. Collectively, these steps would replace polarized narratives with cumulative, ethically grounded science capable of informing proportionate policies and scalable interventions.

8. Conclusions

This Entry synthesizes convergent evidence that co-occurring digital dependence and substance use in post-digital cohorts arise from the intersection of digital platforms designed to capture attention, peer-norm ecologies, and transforming labor/time regimes with individual liabilities in reward sensitivity, self-regulation, and affective coping. Psychiatric comorbidities (e.g., ADHD, depression, personality pathology) frequently mediate these links, while socioeconomic gradients, geographic inequalities, and gender- and culture-related norms modulate both exposure and harm. Longitudinal and digital-trace studies generally indicate small but policy-relevant effects, constrained by definitional heterogeneity and measurement bias when “use” is captured via self-report rather than telemetry.

Take-home messages. (i) Quantity of use is not equivalent to harm: impairment and context must anchor assessment and intervention. (ii) Structural features—ranking, defaults, notification cadence, and micro-targeting—shape behavior independently of user traits and therefore constitute legitimate levers for population protection, especially for minors. (iii) Prevention and care are most effective when they integrate digital-literacy competencies, norm correction, and stepped, dual-diagnosis-capable services, delivered with proportional intensity to groups facing structural disadvantage.

Priorities for action. Regulators should limit the hyper-profiling of minors, mandate safer defaults (e.g., autoplay and nocturnal notifications off), and require independent audits of high-risk design. Education systems should adopt spiraled curricula that couple critical advertising/data literacy with socio-emotional skills and autonomy-supportive parental mediation. Health services should implement blended stepped-care pathways with routine screening for screen-related harms and substance use, clear escalation criteria, and privacy-preserving monitoring. Research funders and journals should incentivize mixed-methods cohort platforms, impairment-anchored criteria for behavioral addictions, FAIR-compliant open data, and transparent, ethically governed AI (model cards/datasheets; SPIRIT-AI/CONSORT-AI) to enable cumulative, equitable, and implementable science.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Acknowledgments: The author thanks the School of Psychoanalytic and Groupanalytic Psychotherapy (SPPG) for administrative support provided during manuscript preparation.

Conflicts of Interest: V.M.R. is a co-founder of Neurosinc, Via P. Bentivoglio No. 62, 95125 Catania, Italy. Neurosinc had no role in the conceptualization, preparation, writing, interpretation, or decision to submit this manuscript. No financial support, honorarium, grant, consultancy fee, or other compensation was received from Neurosinc for this work. The author declares no conflicts of interest related to this manuscript.

Abbreviations

The following abbreviations are used in this manuscript:

ADHD	Attention-Deficit/Hyperactivity Disorder
CBT	Cognitive Behavioral Therapy
FAIR	Findable, Accessible, Interoperable, Reusable (Guiding Principles for scientific data management)
FoMO	Fear of Missing Out
GDPR	General Data Protection Regulation (EU Regulation 2016/679)
KPI	Key Performance Indicator
PIU	Problematic Internet Use
PSMU	Problematic Social Media Use
RCL	Recreational Cannabis Legalization (legalization of non-medical cannabis)
SUD	Substance Use Disorder

References

- Orben, A.; Blakemore, S.-J. How social media affects teen mental health: A missing link. *Nature* **2023**, *614*, 410–412. [\[CrossRef\]](#) [\[PubMed\]](#)
- Borges, G.; Orozco, R.; Benjet, C.; Martínez, K.I.; Contreras, E.V.; Pérez, A.L.; Uribe, P.C.H.; Couder, M.A.C.D.; Méndez, E.; Medina-Mora, M.E.; et al. (Internet) Gaming Disorder in DSM-5 and ICD-11: A case of the glass half empty or half full. *Can. J. Psychiatry* **2021**, *66*, 477–484. [\[CrossRef\]](#) [\[PubMed\]](#)
- Brand, M.; Wegmann, E.; Stark, R.; Müller, A.; Wölfling, K.; Robbins, T.W.; Potenza, M.N. The Interaction of Person–Affect–Cognition–Execution (I-PACE) model for addictive behaviors: Update, generalization to addictive behaviors beyond Internet-use disorders, and specification of the process character of addictive behaviors. *Neurosci. Biobehav. Rev.* **2019**, *104*, 1–10. [\[CrossRef\]](#) [\[PubMed\]](#)
- Volkow, N.D.; Koob, G.F.; McLellan, A.T. Neurobiologic Advances from the Brain Disease Model of Addiction. *N. Engl. J. Med.* **2016**, *374*, 363–371. [\[CrossRef\]](#) [\[PubMed\]](#)
- Berridge, K.C.; Robinson, T.E. Liking, wanting, and the incentive-sensitization theory of addiction. *Am. Psychol.* **2016**, *71*, 670–679. [\[CrossRef\]](#) [\[PubMed\]](#)
- McLoughlin, K.L.; Brady, W.J. Human-algorithm interactions help explain the spread of misinformation. *Curr. Opin. Psychol.* **2024**, *56*, 101770. [\[CrossRef\]](#) [\[PubMed\]](#)
- Guess, A.M.; Malhotra, N.; Pan, J.; Barberá, P.; Allcott, H.; Brown, T.; Crespo-Tenorio, A.; Dimmery, D.; Freelon, D.; Gentzkow, M.; et al. How do social media feed algorithms affect attitudes and behavior in an election campaign? *Science* **2023**, *381*, 398–404. [\[CrossRef\]](#) [\[PubMed\]](#)
- Cai, Z.; Mao, P.; Wang, Z.; Wang, D.; He, J.; Fan, X. Associations Between Problematic Internet Use and Mental Health Outcomes of Students: A Meta-analytic Review. *Adolesc. Res. Rev.* **2023**, *8*, 45–62. [\[CrossRef\]](#) [\[PubMed\]](#)
- Shannon, H.; Bush, K.; Villeneuve, P.J.; Hellemans, K.G.C.; Guimond, S. Problematic Social Media Use in Adolescents and Young Adults: Systematic Review and Meta-analysis. *JMIR Ment. Health* **2022**, *9*, e33450. [\[CrossRef\]](#) [\[PubMed\]](#)
- Xiao, Y.; Meng, Y.; Brown, T.T.; Keyes, K.M.; Mann, J.J. Addictive Screen Use Trajectories and Suicidal Behaviors, Suicidal Ideation, and Mental Health in US Youths. *JAMA* **2025**, *334*, 219–228. [\[CrossRef\]](#) [\[PubMed\]](#)
- Wang, J.; Hao, Q.; Tu, Y.; Peng, W.; Wang, Y.; Li, H.; Zhu, T.-M. Assessing the Association Between Internet Addiction Disorder and Health Risk Behaviors Among Adolescents and Young Adults: A Systematic Review and Meta-Analysis. *Front. Public Health* **2022**, *10*, 809232. [\[CrossRef\]](#) [\[PubMed\]](#)
- Cheng, B.; Lim, C.C.W.; Rutherford, B.N.; Huang, S.; Ashley, D.P.; Johnson, B.; Chung, J.; Chan, G.C.K.; Coates, J.M.; Gullo, M.J.; et al. A systematic review and meta-analysis of the relationship between youth drinking, self-posting of alcohol use and other social media engagement (2012–21). *Addiction* **2024**, *119*, 28–46. [\[CrossRef\]](#) [\[PubMed\]](#)
- Nagata, J.M.; Smith, N.; Zamora, G.; Sajjad, O.M.; Ganson, K.T.; Testa, A.; Jackson, D.B. Problematic social media use and alcohol expectancies in early adolescents (ABCD Study). *BMC Public Health* **2023**, *23*, 1597. [\[CrossRef\]](#) [\[PubMed\]](#)
- Metherell, T.E.; Ghai, S.; McCormick, E.M.; Ford, T.J.; Orben, A. Digital access constraints predict worse mental health among adolescents during COVID-19. *Sci. Rep.* **2022**, *12*, 19088. [\[CrossRef\]](#) [\[PubMed\]](#)
- Nawi, A.M.; Ismail, R.; Ibrahim, F.; Hassan, M.R.; Manaf, M.R.A.; Amit, N.; Ibrahim, N.; Shafurdin, N.S. Risk and protective factors of drug abuse among adolescents: A systematic review. *BMC Public Health* **2021**, *21*, 2088. [\[CrossRef\]](#) [\[PubMed\]](#)
- Piers, R.; Williams, J.M.; Sharpe, H. Review: Can digital mental health interventions bridge the “digital divide” for socioeconomically and digitally marginalised youth? A systematic review. *Child Adolesc. Ment. Health* **2023**, *28*, 90–104. [\[CrossRef\]](#) [\[PubMed\]](#)
- Steinberg, L. A dual systems model of adolescent risk-taking. *Dev. Psychobiol.* **2010**, *52*, 216–224. [\[CrossRef\]](#) [\[PubMed\]](#)
- Shulman, E.P.; Smith, A.R.; Silva, K.; Icenogle, G.; Duell, N.; Chein, J.; Steinberg, L. The dual systems model: Review, reappraisal, and reaffirmation. *Dev. Cogn. Neurosci.* **2016**, *17*, 103–117. [\[CrossRef\]](#) [\[PubMed\]](#)
- Kardefelt-Winther, D. A conceptual and methodological critique of Internet addiction research: Towards a model of compensatory Internet use. *Comput. Hum. Behav.* **2014**, *31*, 351–354. [\[CrossRef\]](#)
- Lythreath, S.; Singh, S.K.; El-Kassar, A.-N. The digital divide: A review and future research agenda. *Technol. Forecast. Soc. Change* **2022**, *175*, 121359. [\[CrossRef\]](#)
- Patel, V.; Saxena, S.; Lund, C.; Thornicroft, G.; Baingana, F.; Bolton, P.; Chisholm, D.; Collins, P.Y.; Cooper, J.L.; Eaton, J.; et al. The Lancet Commission on Global Mental Health and Sustainable Development. *Lancet* **2018**, *392*, 1553–1598. [\[CrossRef\]](#) [\[PubMed\]](#)
- Ayalew, Y.E.; Verdoodt, V.; Lievens, E. General Comment No. 25 on Children’s Rights in Relation to the Digital Environment: Implications for Children’s Right to Privacy and Data Protection in Africa. *Hum. Rights Law Rev.* **2024**, *24*, ngae018. [\[CrossRef\]](#)
- Information Commissioner’s Office. *Age Appropriate Design: A Code of Practice for Online Services*; Information Commissioner’s Office: Wilmslow, UK, 2020.
- Binns, R.; Veale, M. Is that your final decision? Multi-stage profiling, selective effects, and Article 22 of the GDPR. *Int. Data Priv. Law* **2021**, *11*, 319–332. [\[CrossRef\]](#)

25. Bakshy, E.; Messing, S.; Adamic, L.A. Exposure to ideologically diverse news and opinion on Facebook. *Science* **2015**, *348*, 1130–1132. [[CrossRef](#)] [[PubMed](#)]
26. Corsi, G. Evaluating Twitter’s algorithmic amplification of low-credibility content: An observational study. *EPJ Data Sci.* **2024**, *13*, 18. [[CrossRef](#)]
27. Schultz, W.; Dayan, P.; Montague, P.R. A neural substrate of prediction and reward. *Science* **1997**, *275*, 1593–1599. [[CrossRef](#)] [[PubMed](#)]
28. Stothart, C.; Mitchum, A.; Yehnert, C. The attentional cost of receiving a cell phone notification. *J. Exp. Psychol. Hum. Percept. Perform.* **2015**, *41*, 893–897. [[CrossRef](#)] [[PubMed](#)]
29. Ward, A.F.; Duke, K.; Gneezy, A.; Bos, M.W. Brain Drain: The Mere Presence of One’s Own Smartphone Reduces Available Cognitive Capacity. *J. Assoc. Consum. Res.* **2017**, *2*, 140–154. [[CrossRef](#)] [[PubMed](#)]
30. Wilmer, H.H.; Sherman, L.E.; Chein, J.M. Smartphones and cognition: A review of research exploring the links between mobile technology habits and cognitive functioning. *Front. Psychol.* **2017**, *8*, 605. [[CrossRef](#)] [[PubMed](#)]
31. Chein, J.; Albert, D.; O’Brien, L.; Uckert, K.; Steinberg, L. Peers increase adolescent risk taking by enhancing activity in the brain’s reward circuitry. *Dev. Sci.* **2010**, *14*, F1–F10. [[CrossRef](#)] [[PubMed](#)]
32. Przybylski, A.K.; Murayama, K.; DeHaan, C.R.; Gladwell, V. Motivational, emotional, and behavioral correlates of fear of missing out. *Comput. Hum. Behav.* **2013**, *29*, 1841–1848. [[CrossRef](#)]
33. Tarafdar, M.; Pullins, E.B.; Ragu-Nathan, T.S. Technostress: Negative effect on performance and possible mitigations. *Inf. Syst. J.* **2015**, *25*, 103–132. [[CrossRef](#)]
34. Nastjuk, I.; Trang, S.; Grummeck-Braamt, J.-V.; Adam, M.T.P.; Tarafdar, M. Integrating and synthesising technostress research: A meta-analysis on technostress creators, outcomes, and IS usage contexts. *Eur. J. Inf. Syst.* **2024**, *33*, 361–382. [[CrossRef](#)]
35. Bahamondes-Rosado, M.E.; Cerdá-Suárez, L.M.; Dodero Ortiz de Zevallos, G.F.; Espinosa-Cristia, J.F. Technostress at work during the COVID-19 lockdown phase (2020–2021): A systematic review of the literature. *Front. Psychol.* **2023**, *14*, 1173425. [[CrossRef](#)] [[PubMed](#)]
36. Glavin, P.; Schieman, S. Dependency and Hardship in the Gig Economy: The Mental Health Consequences of Platform Work. *Socius* **2022**, *8*, 23780231221082414. [[CrossRef](#)]
37. Akter, S.; Rahman, M.M.; Rouyard, T.; Aktar, S.; Nsashiyi, R.S.; Nakamura, R. A systematic review and network meta-analysis of population-level interventions to tackle smoking behaviour. *Nat. Hum. Behav.* **2024**, *8*, 2367–2391. [[CrossRef](#)] [[PubMed](#)]
38. Nazar, G.P.; Sharma, N.; Chugh, A.; Abdullah, S.M.; Lina, S.; Mdege, N.D.; John, R.M.; Huque, R.; Bauld, L.; Arora, M. Impact of tobacco price and taxation on affordability and consumption of tobacco products in the South-East Asia Region: A systematic review. *Tob. Induc. Dis.* **2021**, *19*, 97. [[CrossRef](#)] [[PubMed](#)]
39. Farrelly, K.N.; Wardell, J.D.; Marsden, E.; Scarfe, M.L.; Najdzionek, P.; Turna, J.; MacKillop, J. The impact of recreational cannabis legalization on cannabis use and associated outcomes: A systematic review. *Subst. Abuse. Res. Treat.* **2023**, *17*, 11782218231172054. [[CrossRef](#)] [[PubMed](#)]
40. Aldridge, J.; Décary-Héту, D. Hidden wholesale: The drug diffusing capacity of online drug cryptomarkets. *Int. J. Drug Policy* **2016**, *35*, 7–15. [[CrossRef](#)] [[PubMed](#)]
41. Aldridge, J.; Stevens, A.; Barratt, M.J. Will growth in cryptomarket drug buying increase the harms of illicit drugs? *Addiction* **2018**, *113*, 789–796. [[CrossRef](#)] [[PubMed](#)]
42. Kroger, J.; Martinussen, M.; Marcia, J.E. Identity status change during adolescence and young adulthood: A meta-analysis. *J. Adolesc.* **2010**, *33*, 683–698. [[CrossRef](#)] [[PubMed](#)]
43. Meeus, W. The study of adolescent identity formation 2000–2010: A review of longitudinal research. *J. Res. Adolesc.* **2011**, *21*, 75–94. [[CrossRef](#)]
44. Pfeifer, J.H.; Berkman, E.T. The Development of Self and Identity in Adolescence: Neural Evidence and Implications for a Value-Based Choice Perspective on Motivated Behavior. *Child Dev. Perspect.* **2018**, *12*, 158–164. [[CrossRef](#)] [[PubMed](#)]
45. Avci, H.; Baams, L.; Kretschmer, T. A systematic review of social media use and adolescent identity development. *Adolesc. Res. Rev.* **2025**, *10*, 219–236. [[CrossRef](#)] [[PubMed](#)]
46. Dalley, J.W.; Everitt, B.J.; Robbins, T.W. Impulsivity, compulsivity, and top-down cognitive control. *Neuron* **2011**, *69*, 680–694. [[CrossRef](#)] [[PubMed](#)]
47. Dalley, J.W.; Robbins, T.W. Fractionating impulsivity: Neuropsychiatric implications. *Nat. Rev. Neurosci.* **2017**, *18*, 158–171. [[CrossRef](#)] [[PubMed](#)]
48. Moffitt, T.E.; Arseneault, L.; Belsky, D.; Dickson, N.; Hancox, R.J.; Harrington, H.; Houts, R.; Poulton, R.; Roberts, B.W.; Ross, S.; et al. A gradient of childhood self-control predicts health, wealth, and public safety. *Proc. Natl. Acad. Sci. USA* **2011**, *108*, 2693–2698. [[CrossRef](#)] [[PubMed](#)]
49. Poulton, A.; Hester, R. Transition to substance use disorders: Impulsivity for reward and learning from reward. *Soc. Cogn. Affect. Neurosci.* **2020**, *15*, 1182–1191. [[CrossRef](#)] [[PubMed](#)]

50. Feinstein, B.A.; Hershenberg, R.; Bhatia, V.; Latack, J.A.; Meuwly, N.; Davila, J. Negative social comparison on Facebook and depressive symptoms: Rumination as a mechanism. *Psychol. Pop. Media Cult.* **2013**, *2*, 161–170. [\[CrossRef\]](#)
51. Kowalski, R.M.; Giumetti, G.W.; Schroeder, A.N.; Lattanner, M.R. Bullying in the Digital Age: A Critical Review and Meta-Analysis of Cyberbullying Research among Youth. *Psychol. Bull.* **2014**, *140*, 1073–1137. [\[CrossRef\]](#) [\[PubMed\]](#)
52. Khantzian, E.J. The self-medication hypothesis of substance use disorders: A reconsideration and recent applications. *Harv. Rev. Psychiatry* **1997**, *4*, 231–244. [\[CrossRef\]](#) [\[PubMed\]](#)
53. Borsari, B.; Carey, K.B. Peer influences on college drinking: A review of the research. *J. Subst. Abus.* **2001**, *13*, 391–424. [\[CrossRef\]](#) [\[PubMed\]](#)
54. Neighbors, C.; Larimer, M.E.; Lewis, M.A. Targeting misperceptions of descriptive drinking norms: Efficacy of a computer-delivered personalized normative feedback intervention. *J. Consult. Clin. Psychol.* **2004**, *72*, 434–447. [\[CrossRef\]](#) [\[PubMed\]](#)
55. Augner, C.; Vlasak, T.; Aichhorn, W.; Barth, A. The relationship between problematic internet use and attention deficit, hyperactivity and impulsivity: A meta-analysis. *J. Psychiatr. Res.* **2023**, *168*, 1–12. [\[CrossRef\]](#) [\[PubMed\]](#)
56. Halkett, A.; Hinshaw, S.P. Problematic social Internet use and associations with ADHD symptoms in girls: A longitudinal observational study. *BMC Public Health* **2024**, *24*, 2850. [\[CrossRef\]](#) [\[PubMed\]](#)
57. Wilens, T.E. Attention-deficit/hyperactivity disorder and the substance use disorders: The nature of the relationship, subtypes at risk, and treatment issues. *Psychiatr. Clin. N. Am.* **2004**, *27*, 283–301. [\[CrossRef\]](#) [\[PubMed\]](#)
58. Trull, T.J.; Freeman, L.K.; Vebares, T.J.; Choate, A.M.; Helle, A.C.; Wycoff, A.M. Borderline personality disorder and substance use disorders: An updated review. *Borderline Personal. Disord. Emot. Dysregulation* **2018**, *5*, 15. [\[CrossRef\]](#) [\[PubMed\]](#)
59. Ding, H.; Cao, B.; Sun, Q. The association between problematic internet use and social anxiety within adolescents and young adults: A systematic review and meta-analysis. *Front. Public Health* **2023**, *11*, 1275723. [\[CrossRef\]](#) [\[PubMed\]](#)
60. Cheshmehzangi, A.; Zou, T.; Su, Z. The digital divide impacts on mental health during the COVID-19 pandemic. *Brain Behav. Immun.* **2022**, *101*, 211–213. [\[CrossRef\]](#) [\[PubMed\]](#)
61. Okamoto, S. Parental socioeconomic status and adolescent health in Japan: A cross-sectional study. *Sci. Rep.* **2021**, *11*, 12089. [\[CrossRef\]](#) [\[PubMed\]](#)
62. Steare, T.; Evans-Lacko, S.; Araya, M.; Cueto, S.; Dang, H.-A.H.; Ellanki, R.; Garman, E.; Lewis, G.; Rose-Clarke, K.; Patalay, P. Economic inequalities in adolescents' internalising symptoms: Longitudinal evidence from eight countries. *Lancet Psychiatry* **2024**, *11*, 890–898. [\[CrossRef\]](#) [\[PubMed\]](#)
63. Su, W.; Han, X.; Jin, C.; Yan, Y.; Potenza, M.N. Are males more likely to be addicted to the Internet than females? A meta-analysis involving 34 global jurisdictions. *Comput. Hum. Behav.* **2019**, *99*, 86–100. [\[CrossRef\]](#)
64. Su, W.; Han, X.; Yu, H.; Wu, Y.; Potenza, M.N. Do men become addicted to internet gaming and women to social media? A meta-analysis examining gender-related differences in specific internet addiction. *Comput. Hum. Behav.* **2020**, *113*, 106480. [\[CrossRef\]](#)
65. Kelly, Y.; Zilanawala, A.; Booker, C.; Sacker, A. Social Media Use and Adolescent Mental Health: Findings from the UK Millennium Cohort Study. *eClinicalMedicine* **2018**, *6*, 59–68. [\[CrossRef\]](#) [\[PubMed\]](#)
66. Bowleg, L. The Problem With the Phrase “Women and Minorities”: Intersectionality—An Important Theoretical Framework for Public Health. *Am. J. Public Health* **2012**, *102*, 1267–1273. [\[CrossRef\]](#) [\[PubMed\]](#)
67. Kato, T.A.; Kanba, S.; Teo, A.R. Defining pathological social withdrawal: Proposed diagnostic criteria for hikikomori. *World Psychiatry* **2020**, *19*, 116–117. [\[CrossRef\]](#) [\[PubMed\]](#)
68. Nagata, J.M.; Al-Shoaibi, A.A.A.; Leong, A.W.; Zamora, G.; Testa, A.; Ganson, K.T.; Baker, F.C. Screen time and mental health: A prospective analysis of the Adolescent Brain Cognitive Development (ABCD) Study. *BMC Public Health* **2024**, *24*, 2686. [\[CrossRef\]](#) [\[PubMed\]](#)
69. Orben, A.; Dienlin, T.; Przybylski, A.K. Social media's enduring effect on adolescent life satisfaction. *Proc. Natl. Acad. Sci. USA* **2019**, *116*, 10226–10228. [\[CrossRef\]](#) [\[PubMed\]](#)
70. Orben, A.; Przybylski, A.K. The association between adolescent well-being and digital technology use. *Nat. Hum. Behav.* **2019**, *3*, 173–182. [\[CrossRef\]](#) [\[PubMed\]](#)
71. Mojtabai, R. Problematic social media use and psychological symptoms in adolescents. *Soc. Psychiatry Psychiatr. Epidemiol.* **2024**, *59*, 2271–2278. [\[CrossRef\]](#) [\[PubMed\]](#)
72. Jamal, A.; Park-Lee, E.; Birdsey, J.; West, A.; Cooper, M.R.; Cowan, H.; Wang, J.; Sawdey, M.D.; Cornelius, M.E.; Cullen, K.A.; et al. Tobacco Product Use Among Middle and High School Students—National Youth Tobacco Survey, United States, 2024. *MMWR Morb. Mortal. Wkly. Rep.* **2024**, *73*, 917–924. [\[CrossRef\]](#) [\[PubMed\]](#)
73. Raitasalo, K.; Rossow, I.; Moan, I.S.; Bye, E.K.; Svensson, J.; Thor, S.; Ekholm, O.; Pisinger, V.; Arnarsson, Á.; Bloomfield, K. Changes in co-use of alcohol and cannabis among Nordic adolescents in the 21st century: Results from the European School Survey Project on Alcohol and Other Drugs study. *Drug Alcohol Rev.* **2024**, *43*, 616–624. [\[CrossRef\]](#) [\[PubMed\]](#)
74. Parry, D.A.; Davidson, B.I.; Sewall, C.J.R.; Fisher, J.T.; Mieczkowski, H.; Quintana, D.S. A systematic review and meta-analysis of discrepancies between logged and self-reported digital media use. *Nat. Hum. Behav.* **2021**, *5*, 1535–1547. [\[CrossRef\]](#) [\[PubMed\]](#)

75. Ellis, D.A.; Davidson, B.I.; Shaw, H.; Geyer, K. Do smartphone usage scales predict behavior? *Int. J. Hum.-Comput. Stud.* **2019**, *130*, 86–92. [\[CrossRef\]](#)
76. Tkaczyk, M.; Tancoš, M.; Šmahel, D.; Elavsky, S.; Plhák, J. (In)accuracy and convergent validity of daily end-of-day and single-time self-reported estimations of smartphone use among adolescents. *Comput. Hum. Behav.* **2024**, *158*, 108281. [\[CrossRef\]](#)
77. Boniel-Nissim, M.; van den Eijnden, R.J.J.M.; Furstova, J.; Marino, C.; Lahti, H.; Inchley, J.; Šmigelskas, K.; Vieno, A.; Badura, P. International perspectives on social media use among adolescents: Implications for mental and social well-being and substance use. *Comput. Hum. Behav.* **2022**, *129*, 107144. [\[CrossRef\]](#)
78. Zhong, W.; Tian, N. Problematic Social Media Use Profiles and Adolescent Substance Use Across Countries: A Latent Class Analysis with Multilevel Models. *J. Adolesc.* **2026**, online ahead of print. [\[CrossRef\]](#) [\[PubMed\]](#)
79. Zewde, E.A.; Tolossa, T.; Tiruneh, S.A.; Azanaw, M.M.; Yitbarek, G.Y.; Admasu, F.T.; Ayehe, G.W.; Amare, T.J.; Abebe, E.C.; Muche, Z.T.; et al. Internet addiction and its associated factors among African high school and university students: Systematic review and meta-analysis. *Front. Psychol.* **2022**, *13*, 847274. [\[CrossRef\]](#) [\[PubMed\]](#)
80. Santos, P.C.; da Costa, B.G.G.; Lopes, M.V.V.; Malheiros, L.E.A.; Arundell, L.; Silva, K.S. Cross-sectional associations of screen time activities with alcohol and tobacco consumption among Brazilian adolescents. *Int. J. Public Health* **2023**, *68*, 1605816. [\[CrossRef\]](#) [\[PubMed\]](#)
81. Rodman, A.M.; Burns, J.A.; Cotter, G.K.; Ohashi, Y.-G.B.; Rich, R.K.; McLaughlin, K.A. Within-person fluctuations in objective smartphone use and emotional processes during adolescence: An intensive longitudinal study. *Affect. Sci.* **2024**, *5*, 332–345. [\[CrossRef\]](#) [\[PubMed\]](#)
82. Minich, M.; Moreno, M.A. Real-world adolescent smartphone use is associated with improvements in mood: An ecological momentary assessment study. *PLoS ONE* **2024**, *19*, e0298422. [\[CrossRef\]](#) [\[PubMed\]](#)
83. Allcott, H.; Gentzkow, M.; Mason, W.; Wilkins, A.; Barberá, P.; Brown, T.; Cisneros, J.C.; Crespo-Tenorio, A.; Dimmery, D.; Freelon, D.; et al. The effects of Facebook and Instagram on the 2020 election: A deactivation experiment. *Proc. Natl. Acad. Sci. USA* **2024**, *121*, e2321584121. [\[CrossRef\]](#) [\[PubMed\]](#)
84. Guess, A.M.; Malhotra, N.; Pan, J.; Barberá, P.; Allcott, H.; Brown, T.; Crespo-Tenorio, A.; Dimmery, D.; Freelon, D.; Gentzkow, M.; et al. Reshares on social media amplify political news but do not detectably affect beliefs or opinions. *Science* **2023**, *381*, 404–408. [\[CrossRef\]](#) [\[PubMed\]](#)
85. Yu, X.; Haroon, M.; Menchen-Trevino, E.; Wojcieszak, M. Nudging recommendation algorithms increases news consumption and diversity on YouTube. *PNAS Nexus* **2024**, *3*, pgae518. [\[CrossRef\]](#) [\[PubMed\]](#)
86. Bekalu, M.A.; Sato, T.; Viswanath, K. Conceptualizing and Measuring Social Media Use in Health and Well-being Studies: Systematic Review. *J. Med. Internet Res.* **2023**, *25*, e43191. [\[CrossRef\]](#) [\[PubMed\]](#)
87. Rumpf, H.-J.; Achab, S.; Billieux, J.; Bowden-Jones, H.; Carragher, N.; Demetrovics, Z.; Higuchi, S.; King, D.L.; Mann, K.; Potenza, M.N.; et al. Including gaming disorder in the ICD-11: The need to do so from a clinical and public health perspective. *J. Behav. Addict.* **2018**, *7*, 556–561. [\[CrossRef\]](#) [\[PubMed\]](#)
88. Brand, M.; Rumpf, H.-J.; Demetrovics, Z.; Müller, A.; Stark, R.; King, D.L.; Goudriaan, A.E.; Mann, K.; Trotzke, P.; Fineberg, N.A.; et al. Which conditions should be considered as disorders in the ICD-11 designation of “other specified disorders due to addictive behaviors”? *J. Behav. Addict.* **2020**, *11*, 150–159. [\[CrossRef\]](#) [\[PubMed\]](#)
89. Billieux, J. Problematic Use of the Mobile Phone: A Literature Review and a Pathways Model. *Curr. Psychiatry Rev.* **2012**, *8*, 299–307. [\[CrossRef\]](#)
90. Weinmann, M.; Schneider, C.; Vom Brocke, J. Digital Nudging. *Bus. Inf. Syst. Eng.* **2016**, *58*, 433–436. [\[CrossRef\]](#)
91. Mertens, S.; Herberz, M.; Hahnel, U.J.J.; Brosch, T. The effectiveness of nudging: A meta-analysis of choice architecture interventions across behavioral domains. *Proc. Natl. Acad. Sci. USA* **2022**, *119*, e2107346118. [\[CrossRef\]](#) [\[PubMed\]](#)
92. Jachimowicz, J.M.; Duncan, S.; Weber, E.U.; Johnson, E.J. When and why defaults influence decisions: A meta-analysis of default effects. *Behav. Public Policy* **2019**, *3*, 159–186. [\[CrossRef\]](#)
93. Council on Communications and Media; American Academy of Pediatrics. Media use in school-aged children and adolescents. *Pediatrics* **2016**, *138*, e20162592. [\[CrossRef\]](#) [\[PubMed\]](#)
94. Jones, L.M.; Mitchell, K.J.; Beseler, C.L. The Impact of Youth Digital Citizenship Education: Insights from a Cluster Randomized Controlled Trial Outcome Evaluation of the Be Internet Awesome (BIA) Curriculum. *Contemp. Sch. Psychol.* **2024**, *28*, 509–523. [\[CrossRef\]](#)
95. Jeong, S.-H.; Cho, H.; Hwang, Y. Media literacy interventions: A meta-analytic review. *J. Commun.* **2012**, *62*, 454–472. [\[CrossRef\]](#) [\[PubMed\]](#)
96. Vahedi, Z.; Sibalís, A.; Sutherland, J.E. Are media literacy interventions effective at changing attitudes and intentions towards risky health behaviors in adolescents? A meta-analytic review. *J. Adolesc.* **2018**, *67*, 140–152. [\[CrossRef\]](#) [\[PubMed\]](#)
97. Xie, X.; Gai, X.; Zhou, Y. A meta-analysis of media literacy interventions for deviant behaviors. *Comput. Educ.* **2019**, *139*, 146–156. [\[CrossRef\]](#)

98. Conrod, P.J.; O'Leary-Barrett, M.; Newton, N.; Topper, L.; Castellanos-Ryan, N.; Mackie, C.; Girard, A. Effectiveness of a selective, personality-targeted prevention program for adolescent alcohol use and misuse: A cluster randomized controlled trial. *JAMA Psychiatry* **2013**, *70*, 334–342. [[CrossRef](#)] [[PubMed](#)]
99. Harrer, M.; Adam, S.H.; Baumeister, H.; Cuijpers, P.; Karyotaki, E.; Auerbach, R.P.; Kessler, R.C.; Bruffaerts, R.; Berking, M.; Ebert, D.D. Internet interventions for mental health in university students: A systematic review and meta-analysis. *Int. J. Methods Psychiatr. Res.* **2019**, *28*, e1759. [[CrossRef](#)] [[PubMed](#)]
100. Rickwood, D.; McEachran, J.; Saw, A.; Telford, N.; Trethowan, J.; McGorry, P. Sixteen years of innovation in youth mental healthcare: Outcomes for young people attending Australia's headspace centre services. *PLoS ONE* **2023**, *18*, e0282040. [[CrossRef](#)] [[PubMed](#)]
101. Skinner, A.; Perez-Bennetts, E.; Iorfino, F.; Varidel, M.; Richards, M.; Occhipinti, J.-A.; Song, Y.J.C.; Rosenberg, S.; Scott, E.M.; Hickie, I.B. Reshaping youth mental health care for optimal system-level outcomes: A dynamic modelling analysis. *PLoS Ment. Health* **2025**, *2*, e0000232. [[CrossRef](#)] [[PubMed](#)]
102. Resnicow, K.; Baranowski, T.; Ahluwalia, J.S.; Braithwaite, R.L. Cultural sensitivity in public health: Defined and demystified. *Ethn. Dis.* **1999**, *9*, 10–21. [[PubMed](#)]
103. Kagawa-Singer, M.; Valdez Dadia, A.; Yu, M.C.; Surbone, A. Cancer, culture, and health disparities: Time to chart a new course? *CA Cancer J. Clin.* **2010**, *60*, 12–39. [[CrossRef](#)] [[PubMed](#)]
104. Bernal, G.; Domenech Rodríguez, M.M. (Eds.) *Cultural Adaptations: Tools for Evidence-Based Practice with Diverse Populations*; APA: Washington, DC, USA, 2012. [[CrossRef](#)]
105. Kreuter, M.W.; Wray, R.J. Tailored and targeted health communication: Strategies for enhancing information relevance. *Am. J. Health Behav.* **2003**, *27*, S227–S232. [[CrossRef](#)] [[PubMed](#)]
106. Fetters, M.D.; Curry, L.A.; Creswell, J.W. Achieving integration in mixed methods designs—Principles and practices. *Ann. Fam. Med.* **2013**, *11*, 557–564. [[CrossRef](#)] [[PubMed](#)]
107. Johnson, R.B.; Onwuegbuzie, A.J. Mixed methods research: A research paradigm whose time has come. *Educ. Res.* **2004**, *33*, 14–26. [[CrossRef](#)]
108. Wilkinson, M.D.; Dumontier, M.; Aalbersberg, I.J.J.; Appleton, G.; Axton, M.; Baak, A.; Blomberg, N.; Boiten, J.-W.; da Silva Santos, L.B.; Bourne, P.E.; et al. The FAIR Guiding Principles for scientific data management and stewardship. *Sci. Data* **2016**, *3*, 160018. [[CrossRef](#)] [[PubMed](#)]
109. Salathé, M.; Bengtsson, L.; Bodnar, T.J.; Brewer, D.D.; Brownstein, J.S.; Buckee, C.; Campbell, E.M.; Cattuto, C.; Khandelwal, S.; Mabry, P.L.; et al. Digital epidemiology. *PLoS Comput. Biol.* **2012**, *8*, e1002616. [[CrossRef](#)] [[PubMed](#)]
110. Vayena, E.; Blasimme, A.; Cohen, I.G. Machine learning in medicine: Addressing ethical challenges. *PLoS Med.* **2018**, *15*, e1002689. [[CrossRef](#)] [[PubMed](#)]
111. Floridi, L.; Cows, J.; Beltrametti, M.; Chatila, R.; Chazerand, P.; Dignum, V.; Luetge, C.; Madelin, R.; Pagallo, U.; Rossi, F.; et al. AI4People—An ethical framework for a good AI society. *Minds Mach.* **2018**, *28*, 689–707. [[CrossRef](#)] [[PubMed](#)]
112. Mitchell, M.; Wu, S.; Zaldivar, A.; Barnes, P.; Vasserman, L.; Hutchinson, B.; Spitzer, E.; Raji, I.D.; Gebru, T. Model cards for model reporting. In Proceedings of the Conference on Fairness, Accountability, and Transparency (FAccT), Atlanta, GA, USA, 29–31 January 2019. [[CrossRef](#)]
113. Gebru, T.; Morgenstern, J.; Vecchione, B.; Vaughan, J.W.; Wallach, H.; Iii, H.D.; Crawford, K. Datasheets for datasets. *Commun. ACM* **2021**, *64*, 86–92. [[CrossRef](#)]
114. Liu, X.; Rivera, S.C.; Moher, D.; Calvert, M.J.; Denniston, A.K.; SPIRIT-AI and CONSORT-AI Working Group. Reporting guidelines for clinical trial reports for interventions involving artificial intelligence: The CONSORT-AI Extension. *BMJ* **2020**, *370*, m3164. [[CrossRef](#)] [[PubMed](#)]
115. Cruz Rivera, S.; Liu, X.; Chan, A.-W.; Denniston, A.K.; Calvert, M.J.; SPIRIT-AI and CONSORT-AI Working Group. Guidelines for clinical trial protocols for interventions involving artificial intelligence: The SPIRIT-AI Extension. *BMJ* **2020**, *370*, m3210. [[CrossRef](#)] [[PubMed](#)]

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.