



**THE IMPACT OF EXCESSIVE SMARTPHONE USE ON MENTAL HEALTH:  
CIRCADIAN DISRUPTION, NEUROCHEMICAL DYSREGULATION, AND  
PSYCHIATRIC OUTCOMES**

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**Abstract:** *This study investigates the impact of smartphone usage on mental health, focusing on anxiety, depression, and sleep disturbances. Global statistics indicate that 95% of adolescents in developed countries own smartphones, with average daily screen time reaching 5–7 hours. Excessive smartphone use may disrupt neurochemical balance, increase stress responses, and affect circadian rhythms. Analysis of 15 peer-reviewed studies shows correlations between high screen time and psychological disturbances, highlighting the need for preventive strategies and clinical awareness in psychiatry. The study also examines the paradox of digital dependency in an era where technology leaders themselves restrict their children's access to screens.*

**Keywords:** *smartphone usage, mental health, depression, anxiety, screen time, circadian rhythm, neurochemical dysregulation, adolescents, digital paradox, screen time restrictions*

### **Introduction**

Over the past two decades, smartphones have become an integral part of daily life, fundamentally transforming communication, education, work, and social interaction. Global smartphone penetration has reached unprecedented levels, particularly among adolescents and young adults. In developed countries, smartphone ownership among teenagers exceeds 90%, and daily screen time often surpasses five hours. This rapid digital expansion has created new behavioral patterns and psychosocial environments that directly influence mental health outcomes.

Adolescence represents a critical neurodevelopmental period characterized by heightened emotional reactivity, ongoing prefrontal cortex maturation, and increased



sensitivity to social evaluation. During this vulnerable stage, excessive exposure to digital stimuli—including social media engagement, constant notifications, and nighttime screen use—may interfere with neurobiological regulation mechanisms. Emerging research suggests that prolonged smartphone use is associated with increased rates of anxiety, depressive symptoms, sleep disturbances, and reduced psychological well-being.

From a psychiatric perspective, digital overexposure may act as a chronic environmental stressor. Continuous social comparison, cyberbullying, fear of missing out (FOMO), and reward-based app design activate dopaminergic pathways and stress-response systems. Persistent stimulation of the hypothalamic–pituitary–adrenal (HPA) axis may lead to elevated cortisol levels, while blue light exposure suppresses melatonin secretion, disrupting circadian rhythms. These neurobiological alterations align with established pathophysiological models of mood and anxiety disorders.

Simultaneously, a growing global debate has emerged regarding the regulation of smartphone use in educational settings and at home. Several governments have introduced school-based restrictions, and notably, many technology industry leaders impose strict screen-time limitations on their own children. This phenomenon highlights a significant societal paradox: while digital technologies are promoted as essential tools for progress and connectivity, their potential psychological risks are increasingly recognized by those most familiar with their design mechanisms.

Given the rising prevalence of adolescent mental health disorders worldwide and the parallel growth in smartphone adoption, it is essential to examine this relationship through an integrated neurobiological and psychiatric framework. This study therefore aims to synthesize current statistical evidence, explore underlying pathophysiological mechanisms, and evaluate policy-level responses to the expanding influence of smartphones on mental health.

### **Aim of research**

The aim of this study is to explore the relationship between smartphone usage and mental health, integrating neurobiological and psychiatric perspectives. The focus is on understanding how prolonged screen time may contribute to anxiety, depression, and sleep disturbances through neurochemical and circadian dysregulation, while also examining global trends, policy responses, and the apparent paradox of technology leaders limiting screen access for their own children.

### **Research Materials and Methods**

Data were collected from 15 peer-reviewed studies published between 2018–2023, supplemented by global statistics from Pew Research Center, Common Sense Media, and WHO reports. Participants included 12,000 adolescents and young adults aged 12–30 from Europe and North America. Smartphone usage was recorded in hours/day and type of activity (social media, gaming, browsing). Mental health assessment tools included GAD-7 (anxiety), PHQ-9 (depression), and PSQI (sleep quality). Neurobiological markers considered: morning cortisol levels, evening melatonin secretion patterns, and heart rate.



variability (HRV). Statistical analyses included correlation coefficients, regression models, and odds ratios to determine associations.

Global Statistics: 1. Smartphone ownership: 95% of adolescents in developed countries own smartphones, with 78% receiving their first phone by age 12<sup>1</sup>.

2. Daily screen time: Average daily screen time among US teens is 7 hours 22 minutes (excluding school work), with social media accounting for 3+ hours daily<sup>2</sup>.

3. Mental health impact: Adolescent depression rates increased by 59% between 2010–2020, correlating with smartphone adoption curves<sup>3</sup>.

4. Sleep disruption: 68% of teens sleep with their phones in their bedroom, and 45% report waking during the night to check notifications<sup>4</sup>.

#### International Restrictions and School Policies:

Several countries have implemented restrictions on smartphone use in educational settings:

- France: Banned smartphones in schools for students under 15 since 2018, citing attention and well-being concerns<sup>5</sup>.

- China: Restricted minors to 2 hours of daily smartphone use and banned phones in primary schools.

- Netherlands: Announced a nationwide ban on mobile phones in secondary school classrooms starting 2024.

- United Kingdom: Leading private schools (Eton College) now provide "brick phones" (basic phones with no internet) to students.

- Italy: Banned phone use during lessons, even for educational purposes.

#### Tech Leaders Restricting Their Own Children:

A striking paradox exists where technology pioneers strictly limit screen time for their own children:

- Bill Gates (Microsoft): No smartphones for his children until age 14; banned phones at the dinner table.

- Steve Jobs (Apple): Revealed in 2010 that his young children had never used an iPad.

- Tim Cook (Apple): Stated he would not allow his nephew on social networks.

- Mark Zuckerberg (Meta): Despite creating Facebook, he limits his daughters' screen time and focuses on outdoor activities.

- Evan Williams (Twitter): Replaced iPads with hundreds of books for his children.

- Chris Anderson (TED Curator): Imposes strict parental controls and no screens in bedrooms.

This paradox—promoting digital products to the world while restricting them at home—suggests that those who understand technology best are also most aware of its potential harms<sup>6</sup>.

#### Results/ Main findings

1. Participants using smartphones more than 3 hours per day had a 1.6 times higher risk of anxiety ( $p < 0.01$ ).



2. Heavy users showed higher depression scores (mean PHQ-9:  $11.3 \pm 4.4$ ) compared to low users (mean PHQ-9:  $6.7 \pm 3.2$ ).

3. Sleep disturbances were reported by 68% of high screen-time adolescents, versus 33% of low users.

4. Neurobiological analysis showed altered cortisol patterns in heavy users, indicating chronic stress activation.

5. Melatonin secretion was delayed in adolescents with high nighttime smartphone use, suggesting circadian rhythm disruption.

6. Countries with school smartphone bans reported 15% lower rates of cyberbullying and improved academic focus<sup>7</sup>.

### **Discussion**

Excessive smartphone use may influence mental health through multiple mechanisms.

**Neurochemical dysregulation:** Prolonged exposure to blue light from screens suppresses melatonin, affecting sleep and mood regulation<sup>8</sup>. Chronic stress from social media may elevate cortisol levels, predisposing to anxiety and depression<sup>9</sup>.

**Behavioral and cognitive pathways:** Continuous notifications and multitasking increase cognitive load, reduce attention span, and enhance susceptibility to stress<sup>10</sup>.

**The digital paradox:** Technology leaders restricting their children's screen access highlights a critical awareness gap—while these innovators understand the addictive design of digital products, the general public remains largely uninformed<sup>11</sup>. This "asymmetric knowledge" creates a societal divide where the creators of technology protect their families while profiting from widespread public usage.

**Psychiatric implications:** Clinicians should consider screen time habits when evaluating adolescents for mood disorders. Digital overuse may exacerbate underlying psychiatric vulnerabilities, consistent with the diathesis-stress model of psychopathology<sup>12</sup>.

**Policy implications:** School-based restrictions in France and China demonstrate that structured digital environments can mitigate negative outcomes, suggesting the need for broader public health approaches.

**The Smartphone-Free Paradox:**

The concept of "living without a smartphone" presents a modern paradox:

- **Social necessity vs. individual choice:** While smartphones are essential for education, employment, and social connection in developed societies, a growing movement of "digital minimalists" and "Luddite communities" in the US and Europe choose feature phones ("dumb phones") to preserve mental health.

- **Economic paradox:** Low-income families often rely on smartphones as primary internet access, making digital exclusion a socioeconomic issue.

- **The "brick phone" trend:** Sales of basic phones increased by 15% in 2023 among young adults seeking digital detox.





· Psychological paradox: Smartphones simultaneously provide connection (reducing loneliness) and isolation (replacing face-to-face interaction)—a duality requiring nuanced clinical understanding.

### **Conclusion**

Excessive smartphone usage may contribute to anxiety, depression, and sleep disturbances via neurochemical imbalance and circadian rhythm disruption. Global statistics confirm rising mental health challenges paralleling smartphone adoption. The paradox of technology leaders restricting their own children's access—while promoting universal connectivity—underscores the need for critical evaluation of digital dependency. Clinical screening for screen time in psychiatric assessments and behavioral interventions are crucial for mental health preservation. School-based restrictions in several countries offer promising models for public health intervention. Future research should focus on causal mechanisms, psychiatric assessment protocols, and intervention strategies to mitigate digital-related mental health risks.

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