Tracking Depression in the Digital Age: A PHQ-9 Analysis of Social Media's Neuropsychological Impact on Adolescents

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Introduction

Adolescents aged 13–18 are in a critical neurodevelopmental stage in which the prefrontal cortex, responsible for executive functioning and emotional regulation, is still maturing. During this window, environmental stimuli exert profound influence on neural architecture and psychological well-being. Social media platforms, designed with algorithmic reinforcement loops, trigger repeated dopaminergic surges, reinforce social comparison, and alter circadian rhythm regulation. These effects are especially pronounced in adolescents diagnosed with Major Depressive Disorder (MDD), whose neurochemical balance and cognitive schemas are already vulnerable.

Although research has extensively documented the general link between social media and adolescent mental health (Twenge & Campbell, 2018; Keles et al., 2020), there is a critical gap in studies targeting **pre-existing clinical depression** with a combined **psychological and neurobiological lens**. This proposal addresses that gap by investigating the measurable psychological outcomes and the underlying neurological correlates of prolonged social media exposure in depressed adolescents.

By integrating quantitative PHQ-9 data, qualitative emotional journaling, and literature-driven neuroanalysis, this study will reveal not only correlations but also potential mechanisms linking screen exposure to exacerbated depressive symptomatology. The findings will inform both clinical interventions and ethical technology design.

Hypothesis

Adolescents diagnosed with Major Depressive Disorder who engage in social media use exceeding three hours per day will exhibit significantly higher PHQ-9 depression scores, greater sleep disruption, and stronger indicators of emotional dysregulation compared to those with lower daily usage.

Methodology

1. ***Participants:***
   - **Sample Size:** 60 adolescents (13–18 years old), clinically diagnosed with MDD.
   - **Inclusion Criteria:** Ocial diagnosis confirmed by a licensed psychologist; active social media use.
   - **Exclusion Criteria:** Comorbid severe psychiatric disorders (e.g., psychosis), ongoing major medication changes.
2. ***Design:***
   - A **convergent mixed-methods** approach will be used to triangulate results from quantitative surveys, qualitative journaling, and literature-based neurobiological interpretation.

3. ***Quantitative Data Collection:***
    - **PHQ-9 Scale:** Administered weekly for four weeks to track depression severity. **Screen Time Measurement:** Recorded via participants' device analytics. **Statistical Analysis:** Pearson correlation, linear regression, and paired t-tests using SPSS.

4. ***Qualitative Data Collection:***
    - **Emotional Journals:** 20 participants will document daily reflections on mood and perceived impact after social media use.
    - **Thematic Coding:** Conducted with NVivo software to identify recurring themes (e.g., "comparison anxiety," "dopamine crash," "emotional blunting").
5. ***Biological Analysis:***
    - Neurobiological patterns will be interpreted in light of the literature on dopaminergic reward circuits, limbic system activation, and HPA-axis dysregulation in depressed adolescents.
6. ***Ethical Considerations:***
    - Parental consent and participant assent will be obtained.
    - Real-time access to psychological support for participants reporting acute distress or suicidal ideation.

References

1. Twenge, J. M., & Campbell, W. K. (2018). Associations between screen time and lower psychological well-being among children and adolescents. *Preventive Medicine Reports*, 12, 271–283. https://doi.org/10.1016/j.pmedr.2018.10.003
2. Keles, B., McCrae, N., & Grealish, A. (2020). A systematic review: the influence of social media on depression, anxiety and psychological distress in adolescents. *International Journal of Adolescence and Youth*, 25(1), 79–93. https://doi.org/10.1080/02673843.2019.1590851
3. Przybylski, A. K., & Weinstein, N. (2017). A large-scale test of the Goldilocks hypothesis: Quantifying the relations between digital-screen use and mental well-being in adolescents. *Psychological Science*, 28(2), 204–215. https://doi.org/10.1177/0956797616678438
4. Volkow, N. D. (2021). Dopamine and addiction: A review of recent neuroscience findings related to behavior. *Journal of Neuropsychopharmacology*, 26(3), 199–213.
5. Centers for Disease Control and Prevention. (2023, May 10). Sleep and teens. CDC. https://www.cdc.gov/sleep/teens.html
6. Beck, A. T. (1979). Cognitive therapy and the emotional disorders. Penguin.
Romer, D., Bagdasarov, Z., & More, E. (2013). Social media use and well-being: A review of the literature. Media Psychology, 16(3), 231–265. https://doi.org/10.1080/15213269.2013.801882

7. CDC (2025). Youth Risk Behavior Survey. https://www.cdc.gov/nchs/products/databriefs/db513.htm
WHO (2024). Adolescent mental health and social media report. https://www.who.int/europe/news/item/25-09-2024-teens--screens-and-mental-health

8. Pew Research Center (2025). Teens, Social Media and Mental Health. https://www.pewresearch.org/internet/2025/04/22/teens-social-media-and-mental-health/