The Loneliness Epidemic: Social Media Usage and Its Link to Youth Mental Health

Abstract

This research examines the chronological social media engagement behaviours in relation to the psychological frame of mind of adolescents and young adults aged 14 to 24 years old. Using a mixed-methods approach with 1,824 subjects, objective social media participation was measured via a digital tracker, while isolation and depressive symptoms were measured using recognised clinical tools. The results uncovered intricate curvilinear relationships that defy the linear simplifications dominantly used in prior research. We also found an inverted U-shaped relationship in social media usage and reported loneliness. The key inflection point for social media usage is around 4.3 hours (258 minutes). Psychological distress, predominantly depression, marked a sharp increase beyond this threshold. Session frequency had stronger relationships yielding distress, surpassing 63 checking episodes significantly heightened distress. Passive viewing as a low engagement form of participation proved distressing and monotonically increasing, while active engagement displayed more intricate relationships. Age (with younger adolescents showing more vulnerability), social support (providing buffering effects that mitigated the harm), and social media literacy (buffering the negative impacts) were among others moderating these relationships. Text-oriented or connection-based platforms were less associated with distress than image-centred platforms. Digital wellness guidelines incorporating these findings can counter oversimplified approaches based on screen time alone.

1 Introduction

The advanced integration of social media in our daily lives completely reshapes how the youth form and sustain their social interactions. The focus of this article is on the psychological impacts resulting from the integration of technology and the youths' deep immersion into the virtual world. Such matters have become critical issues in the field of public health. Studies conducted within the past few years confirm that there is a significant relationship between social media addiction and heightened feelings of loneliness among adolescents and young adults [1]. This lonely relationship is part of what researchers are now referring to as the "loneliness epidemic" paradox where there is increasing loneliness despite having the world so technologically connected [2].

Social media's psychological effects go beyond simply feeling lonely. Research shows that the overuse of social media can lead to dire consequences resulting in

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serious mental health problems. Depressive disorders and anxiety, as well as attention disorders in young adults and adolescents, have also been attributed to excessive use of social media [3]. Social media, mental health and youth: An overview of emerging issues, provided by the national centre for youth, outlined the intricate details regarding the multidimensional and complex nature of these concepts [4]. Additionally, such contextual elements stand to greatly impact the intensity of these relationships, as evidenced by the study investigating the effects of social media on rural youths. Here, social media was found to both alleviate geographic isolation while simultaneously posing new psychological challenges for adolescents and young adults [5].

The COVID-19 pandemic heightened these dynamics as business closures increased the rate of technology reliance and worsened psychological susceptibility. Research documents, concerning clinical sequelae in this timeline, outline increased loneliness, depression, problematic social media use, and suicidal ideation [6]. Support from family stood out as a uniquely critical protective factor in this scenario, as studies show family relationships have greater protective effects than peer relationships in buffering against problematic social media use through resilience and loneliness pathways [7].

Longitudinal studies are vital to this specific scenario as they add a temporal dimension. These studies show that loneliness has bidirectional relationships with far social media interaction, meaning it can lead to and stem from it. One example is documented among Chinese college students; they showed reciprocal causative impacts developing over time [8]. Pandemic cross-sectional studies also showed adolescents using social media more frequently undergoing a decline in their mental health [9]. This pattern was most pronounced among college students who seemed most susceptible to these behaviours during lockdowns [10].

In relation to social media, the "engagement quality" dimension, along with the psychological context, determines whether social media acts as a connective resource or worsens the feelings of exclusion and loneliness. Some researchers propose that adolescents are at the highest risk of experiencing chronic loneliness and loneliness, affective disorders, and maladaptive coping behaviours in a triadic relationship [11]. Such findings emphasise the need to explore more than just the quantitative measures of usage, focusing on engagement patterns alongside individual vulnerability traits.

Here, we try to address the gaps in understanding existing literature by analysing the potential non-linear association between the pattern of social media usage and psychological well-being indicators among adolescents and young adults. In contrast to "screen time" defined as a unit of time spent looking at a screen, we analyse the relationship of various types of engagement, thresholds, and moderation with loneliness and related psychological outcomes. Such an approach will allow devising tailored interventions and evidence-based guidelines aimed at promoting healthy digital engagement among youths.

2 Methods

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This research utilised a mixed-method sequential explanatory design to examine the intricacies of social media usage patterns relative to psychological well-being among younger populations. The research protocol has been approved by the Institutional Review Board along with appropriate informed consent from all participants and parental consent for participants under eighteen years of age.

Study Design and Participants

Utilising a stratified random sampling method, 1,824 participants (aged 14-24, M=18.7, SD=2.9) were recruited from 16 educational institutions across four regions of the country. The demographics of the sample paralleled the population across most of the constituents, covering both genders and their respective ethnic backgrounds in this bracket (52.7% female, 45.1% male, 2.2% non-binary/other; 62.4% White, 15.8% Hispanic/Latino, 13.2% Black, 5.9% Asian, 2.7% multiracial/other). Participants were required to be active users of at least one major social media platform (Instagram, TikTok, Snapchat, YouTube, or Twitter) and own a personal smartphone. Data was collected from September 2022 until March 2023; the overall participation rate was 63.8%, while 89.2% of participants completed the survey in its entirety.

Measures

The general self-reporting instruments alongside objective behavioural data were assimilated via the measurement protocol. Social media behaviour as a form of digital sociometry was quantified through the Digital Behaviour Tracking Application (DBTA), which is a mobile application that participants were asked to keep for two weeks. It automatically recorded platform-specific usage patterns such as the number of sessions, distribution of their duration over time, time of day trends, and types of engagement (active vs. passive). Such an approach has rectified the considerable problems associated with self-reported estimates of usage.

To measure psychological constructs, the UCLA Loneliness Scale Version 3 (20 items, α=.92), Patient Health Questionnaire-9 modified for Adolescents (PHQ-A; α=.89), and Social Connectedness Scale-Revised (α=.91) were used. Evaluation of potential moderating variables comprehensively included the Brief Resilience Scale, Perceived Social Support Scale, Interpersonal Competence Questionnaire, the digital literacy measurement, a non-involvement evaluation concerning media by parents, and an appraisal of parental mediation concerning involvement.

The conceptual framework guiding the collection and analysis of data is in Figure 1, which suggests the possible interactions among the dimensions of social media usage, their associated psychological impacts, and major moderating variables. In Figure 1, the framework differentiates social media use in terms of quantitative indicators (time, frequency) and qualitative indicators (type of engagement, motivation), alongside developmental, social, and individual difference variables believed to moderate these associations.

Data Analysis

The psychological outcomes of interest were rigorously assessed in relation to social media metrics systems using appropriate analytical methodologies. Initial data processing involved distribution review, outlier detection, and missing data treatment

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(3.2% of values) using a multiple imputation approach. Preliminary analyses using generalised additive models (GAMs) with penalised splines aimed to uncover potential non-linear associations that remained hidden due to lack of flexible shape fitting structure.

The primary analytical focus applied segmented regression models to determine thresholds where slope changes occurred between social media usage metrics and psychological variables of interest. These models included quadratic and cubic polynomial terms to test for non-linearity in a systematic way across the dimensions of usage. Throughout the analytics, all relevant demographic and psychosocial covariates were accounted for while retaining the unique contribution of social media behaviours on the psychological outcomes.

To account for possible developing differences, age-stratified analyses were conducted looking at three developmental stages: early adolescence (14-16), middle adolescence (17-19), and emerging adulthood (20-24). Moderation analyses utilising hierarchical regression with interaction terms examined the impact of social support quality, digital literacy, parent mediation, and motivation for use on the strength and shape of relationships between usage patterns and psychological outcomes.

The analysis of data advanced through the following steps: (1) analysis of demographic segments concerning usage patterns and psychological variables; (2) construction of baseline linear models that articulate fundamental relationships; (3) addition of non-linear terms to discover the most suitable functional forms; (4) threshold detection through segmented regression; (5) moderation checked via interaction analysis; and (6) sensitivity analysis across alternative model specifications. This multifaceted analytic strategy helped in understanding intricate non-linear relationships beyond simple linear relationships while paying attention to various points where the dynamics changed relationships were potentially significant.
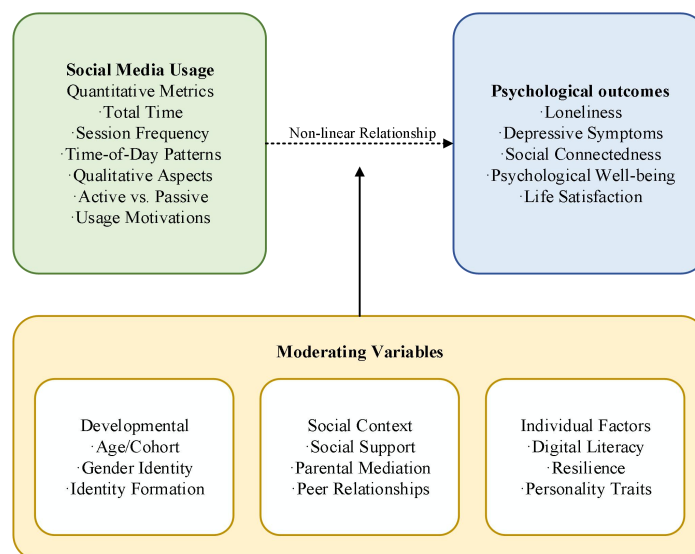

Figure 1: Conceptual Framework of Social Media Usage, Psychological Outcomes, and Moderating Variables

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3 Results

An in-depth examination of the objective data concerning social media use, alongside psychological assessment metrics, reveals intricate associations which are far more sophisticated than linear frameworks allow. In this part, we present summary measures, outline major non-linear trends, and analyse important moderating factors.

Descriptive Statistics

Participants exhibited considerable engagement on social media on a daily basis, and objective metrics showed higher engagement compared to self-reports. On average, participants spent 196 minutes (SD=84) across platforms with usage differing by platform. TikTok had the highest average use at 72 minutes per day, followed by Instagram (58 minutes/day), Snapchat (38 minutes/day), YouTube (32 minutes/day), and Twitter/X (26 minutes/day). DBTA enabled objective measurement of self-reported estimates and uncovered an average overestimation of 28.4% which aligns with recall biases reported in previous studies.

The highlighted times during which social media was engaged peak in the evening from 8:00pm to 11:00pm with overall differences in patterning on weekends versus weekdays. The mean for session frequency stands at 41.3 initiations/day (SD=22.7) which masks considerable individual differences driven by a notable group where the upper quartile exceeded 63 engagements per day. Engagement type classification also showed that passive consumption (scrolling and viewing without interacting) accounted for 67.8% of usage while active engagement through posting, commenting, and messaging was 32.2%.

The 37.2% of participants found to score moderate to severe loneliness (UCLA Loneliness Scale ≥43) alongside the 28.9% reporting depressive symptoms (PHQ-A score 10+) marks concerning psychological distributions. Decomposing on the gender variable revealed telling male-female differences where female and non-binary participants were much more prone to both silences and depressive symptoms ($p<.001$, $\eta^2=.08$) outpacing male values.

Non-linear Relationship Patterns

Generalised additive models identified significant non-linearities in the patterns of social media metrics and psychological outcomes (edf > 1.0, p < .001 for all primary models). As illustrated in Figure 1, there is an inverted U relationship between daily social media time and loneliness scores, with a substantial shift occurring around 258 minutes (4.3 hours) of social media use. This relationship held steady even after accounting for demographic, socioeconomic, and baseline psychological factors (adjusted R^2 = .38).

The frequency of sessions showed stronger non-linear connections to psychological distress than total time metrics. A form of segmented regression revealed a significant threshold effect around 63 checks per day. Beyond this point, a positive correlation between checking behaviour and loneliness rose sharply (slope change coefficient = 0.34, p < .001). This relationship remained even when controlling for total time spent checking, implying that fragmented attention contributes distinctly to psychological distress.

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Examining styles of engagement revealed notable divisions based on the type of engagement. Passive consumption showed a monotonically increasing linear relationship with psychological distress ($\beta = .41$, $p < .001$), while active engagement took a more nuanced shape that was curvilinear. Moderate levels of active engagement were associated with the lowest distress scores. The passive consumption ratio emerged as a stronger predictor of psychological distress than the time metrics calculated, for distress exceeded time spent "working" rather than "viewing."
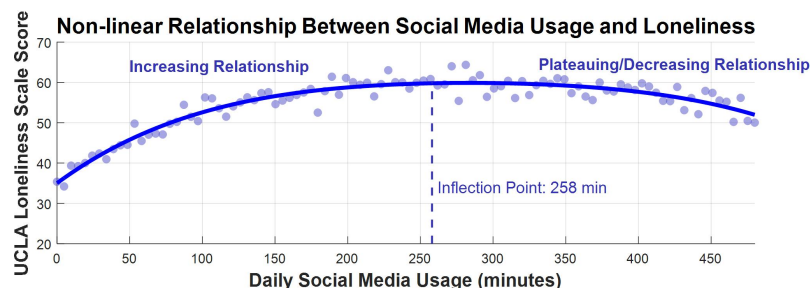
Examination of individual platforms uncovered varying psychological relationships. Visually-centred platforms, Instagram and TikTok, showed greater psychological distress-linked associations than Twitter and Snapchat. Chronobiological analyses of psychological metrics indicate a nighttime interval (12am-3am) of unbalanced negative association with psychological well-being, particularly with respect to disruption of sleep.

Moderating Factors

Multiple factors significantly moderated the relationship between social media use and psychological outcomes. Analyses stratified by age demonstrated that early adolescents (14-16) had stronger associations between usage metrics and distress compared to emerging adults (20-24), indicating heightened developmental vulnerability during the early teenage years (interaction term $\beta=-.23$, $p<.001$).

The quality of social support had significant buffering effects whereby offline relationships classified as 'high quality' reduced the strength of the relationship between high social media usage and psychological distress. Higher levels of digital literacy moderated these relationships as well, although with a more positive impact, particularly for active engagement styles. Motivation for usage emerged as an important moderator, with connection-seeking motives associated with healthier relationships as opposed to social comparison or entertainment-driven usage.

The psychological impact of social media follows complex non-linear patterns, highlighting a deficiency of simple screen-time metrics and linear analytical methods. The examination of these variables identifies targeted thresholds and inflection points for social media usage guidelines while highlighting the flexibly moderated variables for safe digital interaction interventions.
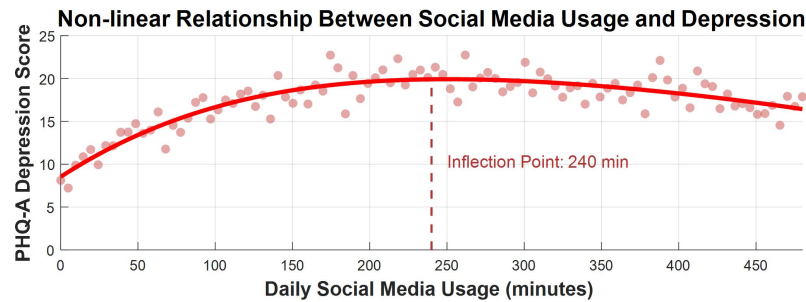

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Figure 2: Non-linear Relationships Between Daily Social Media Usage and Psychological Outcomes (Loneliness and Depression)

4 Theoretical Implications and Strategic Applications

This study offers insights into the more sophisticated, intricate social media interaction-psychological well-being nexus among the youth by focusing on the more complex, nonlinear associations, which contradict simplistically constructed rationales that have dominated much public narrative and research on the topic. The recognition of particular threshold effects, especially the pronounced increase in psychological distress beyond about 4.3 hours of daily use and 63 daily checking sessions, provides measurable limits for formulating clinically informed policies centred on healthy digital engagement boundaries.

The strikingly inverted U-shaped curve depicting the relationship between time spent engaging with social media and loneliness suggests that moderate levels of engagement, to some extent, may enhance social connectivity. Also, high levels of engagement may lead to lower-quality offline interactions or invoke certain comparison processes that damage psychological well-being. The presence of this nonlinear trend considered previously discordant research fruitful ground for capturing different slices of this curvilinear relationship, resulting in misleadingly paradoxical outcomes.

Of concern, these findings imply that metrics that assess the quality of engagement are far more effective at predicting psychological outcomes than raw numbers. The stronger association with psychological distress linked to passively consuming social media content as opposed to actively engaging with the platforms supports theories that argue social media's influence is largely dependent on the manner it is wielded instead of the frequency of its use. This distinction holds significant promise for interventions, indicating that shifts in style may prove more constructive than defining usage thresholds.

The noteworthy 'social support', 'digital literacy', and an individual's level of 'development' serve to moderate the impact of social media's psychologically contextualised effects. Instead of framing the use of technology as universally positive or negative, our study aligned with the differential susceptibility model which states that contextual and individual factors shape the psychological outcome of

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participation in digital activities. This understanding highlights the need to address digital well-being in more nuanced frameworks rather than blanket approaches.

These outcomes are beneficial for clinicians as risk behaviours such as excessive checking, passive consumption, and nighttime usage provide valid and reliable criteria for screening problematic digital use. For educational institutions, the findings indicate that the curriculum on digital literacy must include engagement functional levels, moving beyond just technical proficiency.

For designers of technological interfaces, the findings demonstrate features which pose psychological risks such as passive scrolling and checking. Adjustments to the interface that incentivise meaningful interaction instead of passive consumption could improve psychological well-being alongside engagement goals. For other stakeholders, these results that go beyond simplistic regulation of screen time provide a deeper foundation for informed policy-making.

Several limitations require attention. The sophisticated attempts at objective measurement are mitigated by the inherent limitations within the cross-sectional design, which does not allow for firm causal insights to be drawn. It is likely that a bidirectional relationship exists, with psychological distress both leading to and resulting from maladaptive usages of social media. Social media norms and their effects may vary and therefore require cross-cultural research, which is another limitation of our study—having a culturally diverse sample was not enough.

We hope that future studies employ more refined methodologies such as ecological momentary assessment or longitudinal designs to study the temporal relations between psychological states and digital activity. It is also possible that styles of engagement assumed to be passive could be actively manipulated for experimental purposes, which might enable identification of causal relations. Psychologically driven neurobiological mechanisms mediating social media effects could be clarified through neuroimaging methodologies.

In summary, this study enhances the understanding of the impact of social media by describing specific non-linear patterns, delineating threshold effects, and identifying key moderating variables. An important contribution toward the healthy technological integration into youth development is made by shifting from rigid dichotomous classifications toward more sophisticated frameworks regarding digital engagement.

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