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Evening Social Media Use, Sleep Quality and Depressive Symptoms in Young Adults: A Cross-Sectional Online Survey with Mediation Analysis

Sora Pazer

Department of Psychology, IU International University of Applied Sciences, 99084 Erfurt, Germany

ABSTRACT

Evening social media use has been increasingly discussed as a behavioral factor influencing sleep quality and mental health in young adults. Although previous research has demonstrated associations between intensive social media use and depressive symptoms, the underlying mechanisms remain insufficiently understood. The present cross-sectional study examines whether sleep quality mediates the relationship between evening social media use and depressive symptoms. Data were collected through an online survey among young adults in Germany (N = 121; age range 18–36 years, M = 23.9, SD = 3.8). Participants completed Likert-scaled self-report measures assessing evening social media use, sleep quality, depressive symptoms, digital exhaustion, and total screen time. Pearson correlations, multiple regression analyses, and mediation analyses using the PROCESS macro (Model 4) were conducted. Results revealed strong correlations between evening social media use and both reduced sleep quality ($r = -0.66$, $p < 0.001$) and depressive symptoms ($r = 0.71$, $p < 0.001$). Regression analyses indicated that sleep quality and evening social media use significantly predicted depressive symptoms, whereas total screen time was not significant. Mediation analysis demonstrated that sleep quality partially mediated the effect of evening social media use on depressive symptoms, accounting for approximately 62% of the total effect (B = 0.46, 95% confidence interval (CI) [0.37, 0.57]). The findings highlight sleep quality as a key pathway linking nighttime social media use and depressive symptoms. However, the cross-sectional design precludes causal conclusions. Future longitudinal research is needed to confirm the directionality of these associations.

Keywords: Social Media; Sleep; Depression; Mediation; Young Adults

*CORRESPONDING AUTHOR:

Sora Pazer, Department of Psychology, IU International University of Applied Sciences, 99084 Erfurt, Germany; Email: sorapazer@gmail.com

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1. Introduction

The use of social media has become a central part of young adults' everyday lives over the past two decades. Global data shows that the group of 18–35-year-olds spends an average of several hours a day on platforms such as Instagram, TikTok or YouTube[1]. It is not only the total duration of use that is relevant, but especially the time of use: Evening activities on social media immediately before going to bed are increasingly the focus of sleep and health psychology research[2, 3]. A more recent systematic review specifically targeting individuals aged 16–25 years confirmed this pattern across 42 high-quality studies, with social media and internet use exhibiting the strongest adverse associations among all digital device types—including effects on sleep onset latency, bedtime procrastination, and overall sleep quality[4].

Sleep is considered a fundamental prerequisite for mental and physical health. Sleep disorders are associated with a variety of psychopathological symptoms, including anxiety disorders, cognitive impairment and, most prominently, depressive symptoms[5, 6]. The prevalence of sleep problems in the age group of young adults is estimated at 20–30% in German-speaking countries and has increased further in the context of increasing digitalization[7, 8]. Given the overlap between the age demographic most susceptible to both heavy social media use and the onset of depressive disorders, the intersection of these phenomena merits focused scientific attention.

Several mechanisms are discussed through which evening social media use can affect sleep. First, the blue light emitted by modern screens—particularly those of smartphones and tablets held at close viewing distances—has a well-documented inhibiting effect on melatonin secretion, which shifts the circadian rhythm and prolongs the time it takes to fall asleep[9, 10]. The spectral composition of light-emitting diode (LED)-backlit displays is particularly rich in short-wavelength blue light, which is maximally effective at suppressing melatonin production via intrinsically photosensitive retinal ganglion cells. Second, content-related stimulation through social media—including social comparison processes, emotional activation through algorithmically curated content, and Fear of Missing Out (FoMO)—induces cognitive and emotional arousal that makes it difficult to transition to restful sleep[11, 12]. Recent evidence further identifies cognitive pre-sleep arousal as a key mediating mechanism: nighttime social media use was independently predictive of poor sleep quality, while FoMO and maladaptive repetitive thought were associated with both heightened pre-sleep arousal and increased nighttime social media engagement—suggesting a self-reinforcing cycle between emotional dysregulation and sleep disruption[13]. This pre-sleep arousal is particularly problematic because it counteracts the natural physiological deactivation required for sleep onset. Third, social media use itself displaces sleep time by increasing waking hours at the expense of rest, which can lead to chronic sleep deficit and cumulative sleep debt[14]. These physiological, cognitive, and behavioral pathways are not mutually exclusive but may operate in concert, compounding the adverse effects of evening media exposure on sleep architecture and overall sleep quality.

The link between social media use and depressive symptoms is well documented in the empirical literature. Meta-analyses consistently show moderate to strong positive associations between excessive social media use and depression across diverse populations and methodological approaches[15–17]. An umbrella review synthesizing 25 reviews found, however, that the majority of meta-analyses described the magnitude of these associations as 'weak' or 'inconsistent', attributing diverging interpretations largely to methodological heterogeneity in the conceptualization and operationalization of social media use[18]—which may also explain why the present study, drawing on a particularly digitally active sample, observed comparatively stronger effect sizes. The most comprehensive meta-analytic synthesis to date, incorporating 182 eligible studies ($N > 1{,}100{,}000$), found small but significant positive associations between social media use and depression as well as between problematic social media use and sleep disturbances, with younger age and female gender identified as moderating factors[19].

Ivie et al.[15] reported a pooled effect size indicating a reliable, though heterogeneous, association in adolescent samples, while Cunningham et al.[16] confirmed this pattern in a broader meta-analytic review spanning both adolescent and young adult populations. However, the question of underlying mechanisms often remains open. A promising mediator model postulates that sleep disorders act as a critical link between media use and psychological stress[20–22]. This model is theoretically grounded in the broader psychobiological literature on sleep as a transdiagnostic factor in mental health[5], which

positions sleep quality as a central mechanism through which various behavioral risk factors—including but not limited to media exposure—exert their influence on psychological well-being. The transdiagnostic perspective further suggests that sleep disturbance may function as both a consequence of evening media use and a catalyst for subsequent depressive symptom development, creating a cascading pathway that warrants empirical investigation through mediation analysis.

To date, several international studies have examined individual segments of this pathway. Harbard et al.[21] demonstrated a mediating role of sleep between nocturnal technology use and depressed mood in an Australian adolescent sample (N = 558), while Kelly et al.[22] replicated this pattern in a large UK school sample using data from the Millennium Cohort Study. However, critical gaps remain in the existing literature. First, no study has explicitly modeled the full mediation pathway—evening social media use → sleep quality → depressive symptoms—in a German-speaking sample of young adults. This population differs from previously studied samples in cultural media consumption patterns, healthcare structures, and digital literacy contexts. Second, complementary constructs such as digital exhaustion and total screen time have rarely been included simultaneously in mediation models, limiting the ability to assess the relative contribution of evening-specific versus general media exposure. Third, most prior studies have focused on adolescent samples, whereas the age group of 18–36-year-olds—who face unique developmental stressors including career entry, relationship formation, and financial independence—has received comparatively less attention. The present study addresses these gaps by providing the first German-language test of this mediation model in young adults, thereby contributing to the cross-cultural generalizability of findings that have so far been limited to Anglophone and Australian samples.

Against this theoretical and empirical background, the present online survey pursues the following goals: (1) description of the descriptive parameters of the investigated constructs in a German-speaking young adult sample, (2) analysis of the bivariate correlation structure between evening social media use, sleep quality, depressive symptoms, digital exhaustion, and total screen time, (3) identification of the strongest predictors of depressive symptoms in a simultaneous multiple regression analysis, and (4) testing of the hypothesized mediation model with sleep quality as a mediator between evening social media use and depressive symptoms using the PROCESS bootstrapping approach.

2. Method

2.1. Study Design and Setting

This study employed a cross-sectional online survey design. Data were collected between March and May 2024 using the online survey platform SoSci Survey. Participants were recruited through university student networks and institutional mailing lists across several German universities. No specific social media platforms were mandated for the study; participants reported on their general evening social media use across all platforms they typically used, including but not limited to Instagram, TikTok, YouTube, X (formerly Twitter), and Snapchat. The survey was accessible for eight weeks, and participation took approximately 12–15 min to complete.

2.2. Sampling and Recruitment

The sample comprises N = 121 people who participated in the online survey. Recruitment was carried out via student networks and university mailing lists in Germany. All participants completed the survey online in a single session; no interviews were conducted. The procedure was entirely self-administered. Potential participants received a brief study description with a link to the online questionnaire. The inclusion criteria were age between 18 and 39 years and regular use of social media (at least three times a week). Participation was voluntary and anonymous. All participants were informed in advance about the purpose of the study and gave their informed consent. The survey was carried out in accordance with the guidelines of the German Psychological Society (DGPs) and the Declaration of Helsinki.

A post-hoc power analysis using G*Power 3.1[23] indicated that with N = 121, three predictors, and a significance level of $\alpha = 0.05$, the study achieved a statistical power of $1—\beta > 0.99$ to detect a large effect ($f^2 = 0.35$) in multiple regression, and power > 0.95 for a medium effect ($f^2 = 0.15$). For the mediation analysis, Monte Carlo simulations suggest that $N \geq 100$ is generally sufficient to detect medium-to-large indirect effects with adequate power when both the a-path and b-path coefficients are medium or larger[24]. Given the substantial effect sizes observed in the present data, the sam-

ple size is considered adequate for the primary analyses. However, it limits the application of more complex models such as moderated mediation or latent variable approaches, which would require substantially larger samples.

2.3. Instruments

All constructs were collected with Likert-scaled self-report instruments (response format: 1 = does not apply at all to 5 = completely applies). The scales used were adapted for the German-speaking context or were available in validated German versions.

Evening social media use (6 items, $\alpha = 0.89$) measures the frequency and intensity of social media use in the 60 min before falling asleep. Example item: "I use social media right before I go to sleep." The scale is based on the instrument of Exelmans and Van den Bulck [11], which has demonstrated adequate psychometric properties in several validation studies across different cultural contexts.

Sleep quality (4 items, $\alpha = 0.86$) was measured with a short version of the Pittsburgh Sleep Quality Index (PSQI [25]), adapted for self-report in the context of online surveys [26]. Higher values indicate better sleep quality. Example item: "My sleep is sufficiently restful." The short version captures core dimensions of subjective sleep quality while reducing respondent burden in online survey settings.

Depressive symptoms (6 items, $\alpha = 0.92$) were measured using a German-language short version of the Center for Epidemiologic Studies Depression Scale (CES-D [27, 28]). The scale captures affective, cognitive and somatic aspects of depressive symptoms over the past two weeks. Example item: "I felt depressed and sad."

Digital exhaustion (5 items, $\alpha = 0.87$) was operationalized with a short scale based on Riedl [29]. This scale captures the extent of cognitive and emotional exhaustion experienced through digital media use. Example item: "After using social media, I feel mentally exhausted."

Total screen time (self-rating, 1 item) captures the subjectively estimated total daily usage time of digital devices on a 5-point scale from 1 (under 2 h) to 5 (over 8 h).

2.4. Statistical Procedure

The data analysis was carried out using IBM SPSS Statistics (version 29.0). To describe the sample, descriptive parameters (mean, standard deviation, skewness, kurtosis) and the internal consistency of the scales (Cronbach's alpha) were calculated. Bivariate relationships were analysed using Pearson correlations. To predict depressive symptoms, a multiple regression analysis was performed with evening social media use, sleep quality, and total screen time as simultaneous predictors. Mediation analysis was calculated using the PROCESS macro (Hayes [30], Model 4); significance tests of the indirect effects were carried out via bootstrap confidence intervals (5,000 draws). The significance level was set at $\alpha = 0.05$.

Prior to the regression analysis, standard assumptions were tested. Multicollinearity diagnostics indicated acceptable Variance Inflation Factors (VIF < 3.0 for all predictors), well below the critical threshold of 10 [31]. Inspection of residual plots showed no systematic patterns, supporting the assumptions of linearity and homoscedasticity. The Durbin-Watson statistic ($d = 1.92$) indicated no substantial autocorrelation in the residuals. Skewness and kurtosis values for all variables were within acceptable ranges ($|skew| < 1$, $|kurtosis| < 1$ [32]), supporting approximate normality of the distributions. To address the potential for common method bias arising from the exclusive use of self-report measures, Harman's single-factor test was conducted. An unrotated exploratory factor analysis of all scale items yielded a first factor accounting for 34.2% of the total variance, which is below the 50% threshold commonly used to indicate problematic common method variance [33]. While this test has known limitations, it provides preliminary evidence that common method bias is not a dominant concern in the present data.

3. Results

3.1. Sample Characteristics

Table 1 presents the sociodemographic characteristics of the sample. The mean age was M = 23.9 years (SD = 3.8, range: 18–36). The majority of participants identified as female (62.0%), followed by male (37.2%) and diverse (0.8%). Regarding education level, 71.1% were currently enrolled in or had completed a university degree, 22.3% held a vocational qualification, and 6.6% reported secondary school as their highest level of education. The high proportion of university-educated participants reflects the recruitment strategy via university networks and should be considered when evaluating the generalizability of the findings.

Table 1. Sociodemographic characteristics of the sample (N = 121).

Characteristic	n	%
Gender		
Female	75	62.0
Male	45	37.2
Diverse	1	0.8
Education		
University	86	71.1
Vocational	27	22.3
Secondary school	8	6.6

Note: Age: M = 23.9, SD = 3.8, range 18–36.

3.2. Descriptive Statistics

Table 2 shows the descriptive parameters of the variables examined. The sample reports very high evening social media use (M = 4.08, SD = 0.74), indicating that the majority of participants engage in substantial social media activity in the hour before sleep. Conversely, sleep quality is markedly reduced (M = 2.21, SD = 0.83), which points to a substantial subjective sleep problem in the sample. The depressive symptom burden is also elevated (M = 3.81, SD = 0.88), as is digital exhaustion (M = 3.97, SD = 0.81). Total screen time is high (M = 4.22, SD = 0.69), corresponding to approximately 6–8 h of daily device use. The skewness values are in the acceptable range for all variables (|skew| < 1), which indicates sufficient proximity to the normal distribution [32].

3.3. Internal Consistency

All scales used achieve good to very good internal consistencies (see **Table 3**). Cronbach's alpha varies between α = 0.86 (sleep quality) and α = 0.92 (depressive symptoms). These values are consistently above the minimum recommended value of α ≥ 0.70 [31, 34], which confirms reliable measurement of the constructs.

Table 2. Descriptive parameters of the main variables (N = 121).

Variable	M	SD	Min	Max	Skew	Kurtosis
Evening SM use	4.08	0.74	2	5	−0.63	0.12
Sleep quality	2.21	0.83	1	4.5	0.58	−0.41
Depr. symptoms	3.81	0.88	1.5	5	−0.49	−0.27
Digital exhaustion	3.97	0.81	2	5	−0.52	−0.19
Total screen time	4.22	0.69	2	5	−0.71	0.08

Note: Scale range: 1–5 (except sleep quality: min = 1, max = 4.5 in this sample). Higher sleep quality scores indicate better sleep.

Table 3. Internal consistency of scales (Cronbach's Alpha).

Scale	Items	α
Evening social media use	6	0.89
Sleep quality	4	0.86
Depressive symptoms	6	0.92
Digital exhaustion	5	0.87

Note: All α scores are above the minimum threshold of 0.70.

3.4. Correlation Analysis

Table 4 shows the Pearson correlations of all major variables. All correlations are statistically highly significant ($p < 0.001$). The strongest negative correlation is between sleep quality and depressive symptoms (r = −0.76), followed by the association between evening social media use and depressive symptoms (r = 0.71). Evening use correlates substantially negatively with sleep quality (r = −0.66). Digital exhaustion is strongly related to both the intensity of use (r = 0.64) and depressive symptoms (r = 0.69). Total screen time shows moderate to strong correlations with all other variables but is less strongly associated with depressive symptoms (r = 0.52) than evening-specific use. This correlation structure is theoretically consistent and provides a first indication of a mediation path via sleep quality.

Table 4. Pearson correlations between the main variables.

Variable	1	2	3	4	5
1 Evening SM	—				
2 Sleep quality	−0.66**	—			
3 Depression	0.71**	−0.76**	—		
4 Dig. exhaust.	0.64**	−0.59**	0.69**	—	
5 Screen time	0.57**	−0.44**	0.52**	0.61**	—

Note: ** $p < 0.001$ (two-sided). N = 121.

3.5. Multiple Regression Analysis

To predict depressive symptoms, a multiple regression analysis was performed with evening social media use, sleep quality, and total screen time as simultaneous predictors (see **Table 5**). The model explains 69% of the variance in depressive symptoms ($R^2 = 0.69$, $F(3, 117) = 86.54$, $p < 0.001$), representing a large effect according to conventional benchmarks. The strongest predictor is sleep quality ($\beta = -0.61$, $t = -9.12$, $p < 0.001$), followed by evening social media use ($\beta = 0.49$, $t = 8.29$, $p < 0.001$). Total screen time does not reach statistical significance in this model ($\beta = 0.08$, $t = 1.31$, $p = 0.192$). This pattern suggests that it is not the total quantitative media load, but the use in a sleep-critical time window—the 60 min before falling asleep—that exerts the strongest effect on depressive symptoms. The large proportion of explained variance indicates that the combination of sleep quality and evening social media use captures a substantial portion of the relevant variance in depressive symptom burden.

Table 5. Multiple regression to predict depressive symptoms.

Predictor	B	SE	β	*t*	*p*
Evening use	0.58	0.07	0.49	8.29	<0.001
Sleep quality	−0.73	0.08	−0.61	−9.12	<0.001
Screen time	0.12	0.09	0.08	1.31	0.192

Note: $R^2 = 0.69$, $F(3, 117) = 86.54$, $p < 0.001$. β = standardized regression coefficients.

3.6. Mediation Analysis

To test the mediation hypothesis, a mediation analysis according to Hayes [30] (PROCESS Model 4) was calculated with sleep quality as a mediator, evening social media use as a predictor, and depressive symptoms as a criterion (see **Table 6**). The total effect of evening social media use on depressive symptoms ($c = 0.74$, $p < 0.001$, 95% CI [0.62; 0.86]) is substantial. After inclusion of the mediator sleep quality, the direct effect is reduced to $c' = 0.28$ ($p < 0.001$, 95% CI [0.14; 0.42]), but remains significant, indicating partial mediation. The indirect effect—representing the portion of the total effect that is transmitted through sleep quality—is B = 0.46 (95% CI [0.37; 0.57]) and is statistically significant, as the bootstrap confidence interval does not include zero. Approximately 62% of the overall effect of evening social media use on depressive symptoms is mediated by sleep quality. The a-path (evening use → sleep quality) yields a coefficient of −0.81 ($p < 0.001$), indicating that higher evening social media use is strongly associated with reduced sleep quality. The b-path (sleep quality → depressive symptoms) is −0.57 ($p < 0.001$), confirming that poorer sleep quality is substantially associated with higher depressive symptoms even after controlling for evening social media use.

Table 6. Direct and indirect effects of mediation analysis (PROCESS Model 4).

Effect	B	SE	95% CI	*p*
Total (c)	0.74	0.06	[0.62; 0.86]	<0.001
Direct (c')	0.28	0.07	[0.14; 0.42]	<0.001
Indirect (a × b)	0.46	0.05	[0.37; 0.57]	<0.001

Note: Predictor: Evening social media use. Mediator: Sleep quality. Criterion: Depressive symptoms. Confidence intervals based on 5,000 bootstrap samples [30].

4. Discussion

The present study investigated the association between evening social media use, sleep quality, depressive symptoms and digital exhaustion in a cross-sectional sample of young adults in Germany (N = 121). The findings support the hypothesized mediation pathway and are consistent with the existing international literature.

4.1. Correlation Structure and Regression Effects

The strong negative correlations between evening use and sleep quality (r = −0.66) and between sleep quality and depressive symptoms (r = −0.76) replicate findings from international longitudinal and cross-sectional studies. Levenson et al.[2] reported a similar association between social media usage time and sleep disorders in a comprehensive study of 1,788 U.S. adults, where increased social media use was associated with significantly higher odds of sleep disturbance even after controlling for demographic covariates. Lemola et al.[20] found in a Swiss sample (N = 362) that evening media use has direct effects on depressive symptoms beyond sleep quality and sleep duration, suggesting that the time-of-day dimension adds predictive value over and above general usage metrics. Extending this evidence base, Primack et al.[35] demonstrated in a national longitudinal study of U.S. adults aged 18–30 that those in the highest quartile of social media use were approximately three times as likely to develop clinically significant depression over a six-month follow-up, providing rare temporal evidence for the directionality of this association. The present data complement these findings by demonstrating a comparable pattern in a German-speaking sample, thereby extending the cross-cultural validity of the evening use–sleep–depression pathway. Notably, the effect sizes observed in the present study are of comparable or slightly larger magnitude than those reported in the aforementioned international studies, which may reflect the relatively homogeneous and digitally active nature of the university-based sample.

The finding that sleep quality is the strongest single predictor of depressive symptoms in multiple regression (β = −0.61) is consistent with the results of Harvey et al.[5], who showed that sleep disorders are among the most robust predictors of the development and maintenance of depressive disorders. Riemann et al.[6] describe insomnia as both a symptom and a risk factor for major depressive disorder—a bidirectional relationship that must be considered when interpreting the present findings. More recent work by the same research group has further established hyperarousal—across physiological, cognitive, and cortical levels—as the central pathophysiological mechanism of insomnia disorder, reinforcing the conceptualization of insomnia as a transdiagnostic risk factor and amplifier within affective disorders[36]. The non-significance of total screen time in the regression model (β = 0.08, p = 0.192) is theoretically revealing. It indicates that it is not the total quantitative load, but rather the use in a sleep-critical time window that exerts the strongest effect on depressive symptom burden. This is consistent with Cain and Gradisar[14], who emphasized the importance of usage timing, and with the longitudinal findings of Coyne et al.[37], who reported only weak associations between mere duration of social media use and well-being over an eight-year period.

4.2. Mediation Analysis: Sleep as a Pathway

The central result of this study is the partial mediation of the effect of evening social media use on depressive symptoms by sleep quality. Approximately 62% of the total effect operates through the sleep pathway (indirect effect: B = 0.46, 95% CI [0.37; 0.57]). This result structurally replicates the findings of Harbard et al.[21], who demonstrated in an Australian adolescent sample that sleep quality fully mediates the association between nocturnal technology use and depressed mood. Kelly et al.[22] replicated this pattern in a UK school sample, emphasizing the importance of sleep as a central protective mechanism for mental health in adolescence and young adulthood. The present data extend these findings to a sample of young adults in a German-speaking context, providing evidence for the robustness of this mediation pathway across different age groups and cultural settings.

The remaining significant direct effect (c' = 0.28) indicates that additional mechanisms beyond sleep contribute to the association between evening social media use and depressive symptoms. These may include social comparison processes on platforms, where exposure to idealized self-presentations of peers triggers upward social comparisons and feelings of inadequacy[38, 39], confrontation with negative or distressing content through news feeds and algorithmically curated material, and phenomena such as FoMO[12] that

generate persistent anxiety about being excluded from social activities. Furthermore, Brady et al.[40] have demonstrated that algorithm-driven content amplification systematically increases the spread of emotionally charged content, which may heighten affective reactivity during vulnerable evening hours. The fact that the direct effect remains statistically significant after accounting for sleep quality suggests that a dual-pathway model—with sleep disruption as one pathway and cognitive-emotional activation as another—may best capture the complex relationship between evening social media use and depressive symptoms. Future research should employ sequential or parallel mediation designs to simultaneously model these distinct pathways and quantify their relative contributions to the overall association.

4.3. Digital Exhaustion as an Accompanying Construct

Digital exhaustion correlates strongly with both evening use ($r = 0.64$) and depression ($r = 0.69$) in the present sample. This pattern is consistent with Riedl's[29] conceptualization of digital exhaustion as an aversive stress state arising from cumulative digital load. The cognitive demands of contemporary social media platforms—including infinite scrolling, algorithmic content curation, and variable reward schedules—may deplete self-regulatory capacities, particularly in the evening when cognitive resources are naturally lower. Sonnentag and Binnewies[41] have shown in recovery research that psychological detachment from daily stressors is a vital buffer against exhaustion phenomena, and evening social media use may systematically undermine this necessary detachment. Although no formal mediation analysis with digital exhaustion was conducted in this study due to the focus on sleep quality, the strong correlations suggest that future research should test sequential mediation models incorporating digital exhaustion as an additional mechanism (e.g., evening use → digital exhaustion → sleep impairment → depressive symptoms).

4.4. Bidirectional Considerations

While the present model conceptually frames evening social media use as the independent variable, the relationship between social media use, sleep, and depression is likely bidirectional. This aligns with Slater's[42] Reinforcing Spirals Model, which posits that media selection and psychosocial states mutually influence each other over time. Individuals experiencing depressive symptoms may use smartphones as a low-effort distraction strategy, a form of experiential avoidance[43]. Elhai et al.[44] demonstrated that individuals with higher depression levels are particularly prone to using smartphone interactions for maladaptive emotion regulation. Such compensatory coping may provide temporary cognitive relief but ultimately exacerbates sleep disruption through screen-induced melatonin suppression and cognitive arousal, potentially creating a self-reinforcing cycle. The cross-sectional nature of the present data captures only a snapshot of this potential spiral. Future longitudinal research using cross-lagged panel designs or Ecological Momentary Assessment (EMA) is necessary to disentangle these reciprocal dynamics[45].

4.5. Limitations

The findings should be interpreted in light of several methodological limitations. First, the study design is cross-sectional, which precludes causal statements. Existing longitudinal studies suggest a causal direction from evening use to sleep impairment and further to depression [22,46], but reverse causation—increased social media use as a consequence of pre-existing depressive symptoms—cannot be ruled out[45].

Second, the sample is based on online recruitment via university student networks. Selection bias—in particular, the overrepresentation of individuals with higher education levels and intensive Internet use—limits the generalizability of the findings to the broader population. Future research should employ more diverse recruitment strategies to include non-student populations and individuals with lower education levels.

Third, all constructs were collected via self-report measures. Social desirability and memory biases can affect validity, particularly when participants estimate their own usage times[47]. Research by Ellis et al.[47] has shown that self-reported smartphone use often deviates substantially from objectively logged usage data. Objective measurements via built-in screen-time functions or actigraphy for sleep assessment would strengthen future studies.

Fourth, due to the sample size, more complex modeling approaches (e.g., moderated mediation, latent variable models, or structural equation modeling with latent factors)

were not feasible. Larger samples would allow for the simultaneous testing of multiple mediators and moderators in a single model.

Fifth, the sample is entirely German-speaking, which limits the cross-cultural applicability of the findings. Cultural differences in media consumption habits, sleep norms, and attitudes toward mental health may influence the magnitude and direction of the observed associations. Future multi-national studies should explore whether the identified mediation pathway holds across different cultural contexts.

Sixth, depressive symptoms were assessed using a brief six-item scale for the past two weeks only, which may not capture the full temporal dynamics of depressive episodes or differentiate between transient mood states and persistent depressive patterns. Similarly, sleep quality was measured with a four-item short version of the PSQI, which, while demonstrating adequate reliability ($\alpha = 0.86$), covers fewer dimensions than the full 19-item instrument. Future studies should consider using the complete PSQI and validated full-length depression measures to increase content validity and diagnostic sensitivity.

4.6. Implications

Despite the limitations inherent to the cross-sectional design, the robust mediation pathway identified in this study carries practical relevance for clinical and preventive mental health interventions targeting young adults. By Cohen's [48] conventional benchmarks for the behavioral sciences, the correlations observed here between evening social media use, sleep quality, and depressive symptoms fall consistently within the "large" effect size range ($|r| > 0.50$), and the mediated proportion of approximately 62% represents a substantial rather than marginal share of the total effect. This magnitude lends additional weight to the clinical relevance of the identified pathway and suggests that interventions addressing evening-specific media behavior could yield meaningful improvements in both sleep and affective outcomes. Standard Cognitive Behavioral Therapy for Insomnia (CBT-I), which has demonstrated robust effects on comorbid depressive symptoms [49], could be systematically extended to incorporate principles of digital sleep hygiene. A systematic review by Alvaro et al. [50] has established that the association between sleep disturbance and depression is genuinely bidirectional, meaning that improvements in sleep quality can have downstream benefits on depressive symptomatology, while the successful treatment of depression conversely improves sleep outcomes—a reciprocal dynamic that provides strong theoretical grounding for sleep-focused interventions in this population. Current European clinical guidelines explicitly recommend CBT-I as the evidence-based first-line treatment for insomnia disorder, including in presentations with comorbid depression, prioritizing it over pharmacological approaches [51]—a recommendation that lends further clinical weight to the integration of sleep-focused interventions into digital mental health programs for young adults. Clinicians should work collaboratively with patients to develop realistic bedroom media restrictions, such as charging devices in a separate room, using traditional alarm clocks, or implementing automated screen-time limits after a defined evening hour.

Beyond behavioral modification, cognitive interventions should address the psychological drivers of evening scrolling, including FoMO and the anxiety associated with digital disconnection. Since absolute digital detoxes often result in high relapse rates due to the deep social integration of these platforms [52], therapeutic approaches should favor a harm-reduction model. This involves structured wind-down routines in which screen time is gradually replaced with low-arousal, non-digital activities—such as reading print media, journaling, or progressive muscle relaxation—in the 30 to 60 min before the intended sleep onset.

On a systemic level, university counseling centers and student health programs should consider integrating psychoeducational modules that educate young adults about the neurological impact of blue light on melatonin synthesis and the algorithmic design features of social media platforms that are engineered to maximize user engagement time. Such knowledge may foster digital literacy and empower young adults to make more informed decisions about their evening media habits. A potentially powerful strategy in this regard lies in what Eysenbach [53] has conceptualized as Medicine 2.0—the deliberate use of social networking, participation, and openness within digital environments for health-related communication, collaboration, and psychoeducation. Rather than framing social media exclusively as a risk factor, clinicians and public health actors can leverage the same platforms and interaction patterns that young adults already engage with to deliver targeted, low-threshold interventions. Short-format

video content on sleep hygiene, interactive applications that provide personalized feedback on evening usage patterns, and peer-moderated online communities focused on healthy digital habits could meaningfully extend the reach of traditional counseling services, particularly among young adults who may be reluctant to access formal mental health support through conventional pathways.

Additionally, mindfulness-based interventions such as Mindfulness-Based Cognitive Therapy (MBCT) could be particularly beneficial in this context. By training young adults in interoceptive awareness, they can learn to identify the early physical signs of digital exhaustion and the impulsive urge to continue scrolling. This awareness creates a crucial cognitive gap between stimulus and response, allowing individuals to consciously disengage from their devices before the physiological sleep window is compromised. The integration of such mindfulness techniques into existing sleep hygiene protocols represents a promising avenue for intervention development that addresses both the behavioral and the metacognitive dimensions of problematic evening media use.

From a public health perspective, the findings also have implications for technology design and regulatory policy. The observation that evening-specific social media use, rather than total screen time, drives the association with depressive symptoms suggests that platform design features encouraging prolonged nighttime engagement deserve critical scrutiny. Features such as autoplay functions, infinite scroll mechanisms, and notification systems that persist into late evening hours may contribute to the documented sleep disruption pathway. Convergent large-scale evidence supports this perspective: Twenge and Campbell [54] analyzed three separate, methodologically distinct population datasets and consistently found that heavier media use was associated with lower psychological well-being across age groups, with particularly pronounced effects among children, adolescents, and younger adults. The consistency of this pattern across independent samples strengthens the argument that the adverse associations observed in the present study are not an artifact of a specific recruitment context but reflect a broader population-level phenomenon requiring systemic rather than purely individual responses. Policymakers and platform designers should therefore consider implementing default evening modes that reduce stimulation, limit content recommendations, and provide users with transparent usage feedback during sleep-sensitive hours. Such design interventions, when combined with individual-level clinical strategies, could address the problem at multiple levels simultaneously and contribute to a more comprehensive public health response to the mental health challenges associated with digital media use in young adults.

5. Conclusions

The present study provides empirical evidence for a theoretically coherent mediation pathway linking evening social media use, sleep quality, and depressive symptoms in a German-speaking sample of young adults. Across all analyses, evening social media use emerged as a robust predictor of both reduced sleep quality and elevated depressive symptom burden, with sleep quality explaining approximately 62% of the total effect through a partial mediation pathway. The finding that total screen time failed to reach significance in the regression model, whereas evening-specific use remained a strong predictor, underscores the relevance of usage timing over and above quantitative media load. The remaining significant direct effect further suggests that parallel mechanisms—including social comparison processes, cognitive-emotional arousal, and Fear of Missing Out—contribute independently to the association between nighttime social media engagement and psychological distress.

These results carry practical implications for clinical and preventive mental health practice targeting young adults. Interventions aimed at reducing evening social media use and improving sleep hygiene—such as those embedded within Cognitive Behavioral Therapy for Insomnia (CBT-I) or mindfulness-based approaches—represent promising pathways to simultaneously reduce depressive symptom burden and improve sleep outcomes. At a systemic level, university counseling services and digital health platforms should integrate psychoeducational content addressing the neurophysiological and psychological consequences of nighttime screen exposure.

The cross-sectional design remains the central methodological limitation of this study and precludes causal inference. Future research should employ longitudinal designs—such as cross-lagged panel models or Ecological Momentary Assessment—to examine the directionality and temporal dy-

namics of the identified associations. The inclusion of objective sleep and screen-time measures, larger and more diverse samples, and sequential mediation models incorporating digital exhaustion would substantially advance understanding of the complex interplay between evening media behavior, sleep, and mental health in young adulthood.

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Institutional Review Board Statement

All procedures performed in this study involving human participants were conducted in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Participation was voluntary, and informed consent was obtained from all participants prior to data collection.

Informed Consent Statement

Informed consent was obtained from all individual participants included in the study.

Data Availability Statement

The data that support the findings of this study are available from the author upon reasonable request.

Conflicts of Interest

The author declares no conflict of interest related to this study.

AI Use Statement

Artificial intelligence (AI) tools were used exclusively for minor language editing and stylistic refinement. The conceptualization, methodology, data collection, analysis, and interpretation of the results were conducted entirely by the author. No AI-generated content influenced the scientific substance of this work. The author takes full responsibility for the integrity and originality of the manuscript.

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