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Predicting Depression From Bedtime Procrastination and Smartphone Dependency

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ABSTRACT

This study aimed to investigate the predictive roles of bedtime procrastination and smartphone dependency on depression among Malaysian adults. A correlational descriptive design was employed, involving a sample of 419 participants selected based on the Morgan and Krejcie sampling table. Standardized self-report instruments were used: the Beck Depression Inventory-II (BDI-II) for depression, the Bedtime Procrastination Scale (BPS), and the Smartphone Addiction Scale-Short Version (SAS-SV). Data were analyzed using SPSS version 27. Pearson correlation analysis was conducted to examine the relationships between depression and each independent variable, followed by multiple linear regression analysis to assess the combined predictive power of bedtime procrastination and smartphone dependency on depressive symptoms. Pearson correlation results indicated that both bedtime procrastination ($r = .46$, $p < .001$) and smartphone dependency ($r = .52$, $p < .001$) were significantly and positively correlated with depression. The regression model was statistically significant ($F(2, 416) = 105.72$, $p < .001$), with an R^2 of .34, suggesting that 34% of the variance in depression was explained by the two predictors. Both bedtime procrastination ($B = 0.39$, $\beta = .28$, $p < .001$) and smartphone dependency ($B = 0.47$, $\beta = .41$, $p < .001$) were significant individual predictors of depression. The findings highlight bedtime procrastination and smartphone dependency as significant behavioral predictors of depression. These results underscore the importance of addressing nighttime behavioral habits and digital overuse in mental health prevention and intervention strategies, particularly among young adults. Implementing behaviorally focused interventions targeting sleep routines and technology use may contribute to the reduction of depressive symptoms in at-risk populations.

Keywords: Depression, Bedtime Procrastination, Smartphone Dependency, Behavioral Predictors, Sleep Hygiene, Mental Health.

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Introduction

Bedtime procrastination is defined as the voluntary delay of going to bed without external reasons, despite awareness of its negative consequences on health and well-being (1). Unlike traditional procrastination, bedtime procrastination is unique in that it is tied to self-regulation failure specifically at the end of the day—a time typically marked by depleted cognitive resources (2). Numerous studies have linked this behavior with poor sleep quality, daytime fatigue, and emotional dysregulation (3-5). Among university populations,

bedtime procrastination has emerged as a consistent behavioral marker for increased psychological distress, including symptoms of depression and anxiety (6, 7).

The growing accessibility and constant presence of smartphones play a pivotal role in shaping bedtime routines. The concept of smartphone dependency, often overlapping with problematic smartphone use or smartphone addiction, refers to the excessive and uncontrolled use of mobile phones to the extent that it interferes with daily life activities, especially sleep routines (8). Research has increasingly emphasized the bidirectional relationship between smartphone overuse and bedtime procrastination. For instance, longitudinal evidence suggests that individuals with higher smartphone dependency are more likely to delay bedtime and experience poor sleep quality, which in turn contributes to heightened depressive symptoms (3, 9). The "blue light" emitted by screens, along with the psychological stimulation of digital content, has been shown to interfere with melatonin production and circadian rhythm, making it harder for individuals to fall asleep (10, 11).

Recent literature has proposed various psychological mechanisms linking bedtime procrastination and smartphone dependency to depression. One explanatory pathway is self-regulation failure, where individuals fail to override short-term impulses (e.g., scrolling social media) in favor of long-term goals like sleep (12, 13). Another mechanism involves emotional regulation difficulties. Individuals may use smartphones as a coping tool to avoid stress or ruminate, inadvertently delaying bedtime and reducing sleep quality, which exacerbates depressive symptoms (14, 15). Furthermore, recent research has examined personality traits and coping styles as indirect contributors to bedtime procrastination, revealing that traits like neuroticism and low conscientiousness are associated with greater tendencies to delay sleep and experience mood-related problems (16, 17).

The COVID-19 pandemic has further intensified the relationship between these variables. Increased screen time, remote learning, and reduced social interactions have escalated smartphone use and altered daily routines, making it more challenging to maintain healthy sleep hygiene (6, 18). For example, studies among university students in China and the Middle East report heightened levels of bedtime procrastination and digital dependence during lockdown periods, contributing to sleep disruption and elevated depressive symptoms (19, 20). In parallel, research on workday rhythms also illustrates how irregular work schedules and lack of boundary-setting between personal and digital life contribute to later bedtimes and poor mental health outcomes (21).

Within this context, depression appears to be a converging outcome of these behavioral and cognitive disturbances. Sleep deprivation, as a result of bedtime procrastination or excessive smartphone use, is a known risk factor for developing and worsening depressive symptoms. Emotional fatigue, impaired decision-making, and lower self-efficacy—all consequences of chronic sleep disturbances—have direct implications for depression onset and maintenance (22, 23). Moreover, studies have found that bedtime procrastination mediates the relationship between self-compassion and mental health outcomes, suggesting that targeting bedtime routines may yield therapeutic benefits (15, 16).

Empirical studies across different cultural contexts have also contributed to this growing body of evidence. In Korea, for instance, validation of the Bedtime Procrastination Scale among adolescents showed a significant correlation with depressive symptoms and poor academic functioning (11). Similarly, studies in Malaysia and other Southeast Asian countries have started exploring these patterns among young adults,

indicating a need for region-specific research that considers local lifestyle habits and sociocultural stressors (7). Importantly, studies such as those by Xu and colleagues have shown that loneliness and reduced social connection during post-pandemic recovery periods have intensified bedtime procrastination and associated emotional difficulties in Asian university students (24).

In addition to behavioral predictors, cognitive factors also play a significant role. For instance, brooding—a form of repetitive negative thinking—has been shown to mediate the relationship between bedtime procrastination and depression (14). Similarly, perceived stress has been linked to both smartphone dependency and sleep delays, creating a cycle where stress-related coping behaviors (e.g., late-night phone use) become maladaptive (5, 17). Furthermore, research by Roy and colleagues has highlighted how students' perceived ability to control intrusive thoughts before sleep significantly impacts their tendency to delay bedtime and experience depressive symptoms (25).

Although individual studies have examined pairwise relationships between these variables, few have investigated them collectively within a predictive framework. Specifically, the simultaneous influence of both bedtime procrastination and smartphone dependency on depression remains underexplored, especially in the context of emerging adults in Malaysia. Given the cultural relevance, increasing smartphone penetration, and rising mental health concerns among Malaysian youth, this study aims to fill this gap by examining the predictive power of these two behavioral tendencies on depressive symptoms.

Methods and Materials

Study Design and Participants

This study employed a correlational descriptive design to investigate the relationship between bedtime procrastination, smartphone dependency, and depression among adults in Malaysia. A total of 419 participants were selected using stratified random sampling based on the Morgan and Krejcie (1970) sample size table for a population exceeding 10,000. Participants were required to be at least 18 years old and proficient in English. Data were collected via self-administered online questionnaires, which included standardized instruments to assess the key variables. Ethical approval was obtained prior to data collection, and all participants provided informed consent.

Data Collection

Depression was measured using the Beck Depression Inventory-II (BDI-II), developed by Beck, Steer, and Brown in 1996. The BDI-II is a widely used self-report instrument consisting of 21 items, each corresponding to symptoms of depression as defined in the DSM-IV criteria. Items are rated on a 4-point Likert scale ranging from 0 to 3, with total scores ranging from 0 to 63; higher scores indicate greater severity of depressive symptoms. The BDI-II is structured as a single-factor measure but has also been shown to encompass two subscales in some analyses: Cognitive-Affective and Somatic dimensions. This tool has demonstrated high internal consistency ($\alpha > 0.90$) and good test-retest reliability, and its construct and convergent validity have been confirmed in numerous clinical and non-clinical populations worldwide.

Bedtime procrastination was assessed using the Bedtime Procrastination Scale (BPS), developed by Kroese, de Ridder, Evers, and Adriaanse in 2014. The BPS is a validated self-report questionnaire composed of 9 items designed to evaluate the frequency of delaying bedtime without external reasons. Each item is

rated on a 5-point Likert scale ranging from 1 (almost never) to 5 (almost always), with higher scores reflecting greater levels of bedtime procrastination. The BPS is unidimensional and has shown good internal consistency (Cronbach's α = 0.92), with evidence of convergent and discriminant validity across various age groups and cultural contexts. The scale has been widely used in behavioral sleep research and has been confirmed as a reliable measure in multiple studies.

Smartphone dependency was measured using the Smartphone Addiction Scale-Short Version (SAS-SV), developed by Kwon et al. in 2013. The SAS-SV includes 10 items rated on a 6-point Likert scale from 1 (strongly disagree) to 6 (strongly agree), with higher scores indicating a greater risk of smartphone addiction or dependency. The scale encompasses key dimensions such as daily-life disturbance, withdrawal, overuse, and tolerance. Originally validated among adolescents and young adults, the SAS-SV has demonstrated strong internal consistency (Cronbach's α > 0.80) and has been confirmed to have good construct, concurrent, and criterion-related validity in numerous studies conducted across diverse populations.

Data analysis

Data analysis was conducted using SPSS version 27. Descriptive statistics (frequencies and percentages) were calculated to summarize demographic characteristics. Pearson correlation analysis was employed to examine the bivariate relationships between depression and each of the independent variables: bedtime procrastination and smartphone dependency. To further assess predictive relationships, a multiple linear regression analysis was conducted with depression as the dependent variable and bedtime procrastination and smartphone dependency as independent variables. All statistical tests were performed using a significance level of $p < .05$.

Findings and Results

The final sample consisted of 419 participants, of whom 265 (63.2%) were female and 154 (36.8%) were male. In terms of age distribution, 117 participants (27.9%) were between 18–24 years, 168 (40.1%) were aged 25–34, 84 (20.0%) were aged 35–44, and 50 (11.9%) were 45 years or older. Regarding educational background, 172 participants (41.1%) held a bachelor's degree, 141 (33.7%) had a diploma, 62 (14.8%) had completed postgraduate studies, and 44 (10.5%) had secondary school education or lower. The majority of participants, 293 (69.9%), reported being employed full-time, while 126 (30.1%) were students or part-time/unemployed.

Table 1. Descriptive Statistics for Study Variables

Variable	Mean (M)	Standard Deviation (SD)
Depression (BDI-II)	22.47	8.63
Bedtime Procrastination	31.82	6.47
Smartphone Dependency	38.15	7.29

Table 1 presents the descriptive statistics for all variables in the study. The mean depression score was 22.47 (SD = 8.63), suggesting moderate depressive symptoms among participants. The average score for bedtime procrastination was 31.82 (SD = 6.47), while smartphone dependency had a mean of 38.15 (SD = 7.29), indicating a relatively high tendency for both behavioral patterns among the sample.

Prior to conducting the regression analysis, the necessary statistical assumptions were tested and confirmed. Linearity was verified through scatterplots, which showed a clear linear pattern between the dependent variable (depression) and both independent variables. The normality of residuals was supported by a Shapiro-Wilk test ($p = .082$), and a histogram and Q-Q plot of standardized residuals indicated a normal distribution. Homoscedasticity was confirmed by visual inspection of the residual plot, and the Durbin-Watson statistic was 1.97, suggesting no autocorrelation in residuals. Multicollinearity was assessed using Variance Inflation Factor (VIF) values, which were 1.34 for bedtime procrastination and 1.42 for smartphone dependency, both well below the threshold of 10. These results indicated that all assumptions for multiple linear regression were satisfactorily met.

Table 2. Pearson Correlations Between Depression and Predictor Variables

Variables	Depression	r	p
Bedtime Procrastination	—	.46	< .001
Smartphone Dependency	—	.52	< .001

As shown in Table 2, both bedtime procrastination and smartphone dependency were significantly and positively correlated with depression. Bedtime procrastination demonstrated a moderate correlation with depression ($r = .46$, $p < .001$), while smartphone dependency had a stronger correlation ($r = .52$, $p < .001$), indicating that individuals with higher levels of either behavior reported more severe depressive symptoms.

Table 3. Summary of Regression Analysis (Model Fit Statistics)

Source	Sum of Squares	df	Mean Square	R	R^2	R^2 adj	F	p
Regression	7492.86	2	3746.43	.58	.34	.33	105.72	< .001
Residual	14398.74	416	34.61					
Total	21891.60	418						

Table 3 summarizes the overall model fit of the regression analysis. The regression model was statistically significant, $F(2, 416) = 105.72$, $p < .001$, with an R^2 of .34, indicating that 34% of the variance in depression was explained by bedtime procrastination and smartphone dependency. The adjusted R^2 of .33 confirms the model's good fit after accounting for the number of predictors.

Table 4. Multiple Regression Coefficients Predicting Depression

Predictor	B	SE	β	t	p
Constant	5.84	2.11	—	2.77	< .01
Bedtime Procrastination	0.39	0.07	.28	5.57	< .001
Smartphone Dependency	0.47	0.06	.41	7.88	< .001

Table 4 presents the regression coefficients for the predictors of depression. Bedtime procrastination significantly predicted depression ($B = 0.39$, $\beta = .28$, $t = 5.57$, $p < .001$), as did smartphone dependency ($B = 0.47$, $\beta = .41$, $t = 7.88$, $p < .001$). The standardized beta coefficients indicate that smartphone dependency had a slightly stronger predictive effect on depression compared to bedtime procrastination.

Discussion and Conclusion

The present study aimed to investigate the predictive roles of bedtime procrastination and smartphone dependency on depressive symptoms among Malaysian adults. The findings revealed significant positive correlations between both independent variables and depression, and multiple linear regression analysis confirmed that bedtime procrastination and smartphone dependency significantly predicted levels of

depression. These findings support and extend existing literature suggesting that behavioral dysregulation, particularly at night, is a meaningful contributor to mental health difficulties in young adult populations.

Consistent with past research, the current study found a strong relationship between bedtime procrastination and depression. Participants who frequently delayed going to bed without external reasons reported higher levels of depressive symptoms. This aligns with findings by (13), who demonstrated that bedtime procrastination mediated the relationship between self-control and depressive symptoms in medical students. Similarly, (14) found that bedtime procrastination predicted higher depression through the mediating role of brooding and perceived stress. These studies collectively underscore that the habit of delaying sleep is not merely a time management issue but reflects underlying psychological processes that contribute to emotional distress.

The positive correlation between bedtime procrastination and depression also supports the argument that compromised sleep hygiene exacerbates emotional regulation deficits, creating a self-reinforcing loop of fatigue and low mood. (22) observed that pre-sleep arousal is strongly associated with procrastination at bedtime, a pattern likely to disrupt sleep continuity and quality, thereby increasing vulnerability to depression. Additionally, the current results resonate with (7), who highlighted that female university students exhibiting high bedtime procrastination also reported higher levels of sleep disturbance, fatigue, and depressive symptoms. These converging findings emphasize that bedtime procrastination is a tangible behavioral marker of emotional dysregulation.

Moreover, the present study's findings confirmed a significant positive relationship between smartphone dependency and depression. Participants with higher levels of smartphone overuse showed elevated depressive symptoms, in line with prior research. For instance, (8) conducted a longitudinal study revealing that problematic smartphone use reciprocally influences bedtime procrastination, sleep quality, and mental health in university students. The overstimulation associated with prolonged screen time—especially before bedtime—delays the onset of sleep and lowers sleep quality, which are known contributors to depression (18).

Smartphone dependency as a predictor of depression may also be understood in terms of emotional avoidance and maladaptive coping strategies. (3) found that students with problematic smartphone use reported significantly higher levels of depressive symptoms, partially due to their increased bedtime procrastination and poor sleep quality. Similarly, (5) identified latent profiles of bedtime procrastination linked with smartphone overuse and emotional distress, demonstrating the layered nature of this behavioral pattern. When smartphones are used as tools for escapism or emotional distraction—especially during bedtime—individuals risk exacerbating both sleep difficulties and mood disorders.

The predictive relationship identified in this study between bedtime procrastination, smartphone dependency, and depression also resonates with broader theoretical models that emphasize self-regulation failure as a common mechanism. (12) identified a mediating pathway whereby mobile phone addiction and negative emotions connect boredom proneness to bedtime procrastination. In turn, this pattern fosters depressive symptomatology. These results suggest that both variables assessed in this study—bedtime procrastination and smartphone dependency—function as behavioral manifestations of impaired self-regulation and emotion-focused coping, ultimately heightening susceptibility to depression.

This study also echoes findings from pandemic-era research, which highlighted an increase in depressive symptoms alongside disrupted sleep schedules and increased screen time. (6) found that COVID-related emotional stress was associated with increased bedtime procrastination and depressive symptoms. (10) further demonstrated that during the pandemic, Lebanese university students experienced a spike in insomnia, screen time, and bedtime procrastination, all of which were associated with poor mental health. The consistency of our findings with these studies reinforces the notion that late-night behavioral patterns and digital overuse are highly relevant to mental health in today's digital and post-pandemic society.

Another key strength of the current study is its alignment with personality and cognitive models of bedtime procrastination. For instance, (16) examined the role of self-compassion in mitigating the effects of maladaptive personality traits on bedtime procrastination. The implication is that addressing personality-related tendencies through emotional strategies could reduce procrastinatory behaviors and improve mental well-being. Likewise, (25) reported that thought control mechanisms influenced bedtime procrastination levels among students, suggesting a cognitive-behavioral route to intervention.

Our findings are also congruent with research examining broader motivational and lifestyle influences. (21) reported that workday rhythms and irregular routines contribute significantly to bedtime procrastination, which may in turn interfere with mental health maintenance. Similarly, (9) demonstrated that habitual smartphone use, when combined with bedtime procrastination, contributes to overall reductions in sleep duration and efficiency, amplifying emotional distress.

While much of the literature supports our findings, some studies introduce additional nuance. For example, (1) suggested that the role of daily routines and perceived importance of sleep might mediate the relationship between general procrastination and bedtime procrastination. This indicates that targeting routines may buffer against depressive symptoms more effectively than addressing bedtime habits alone. Moreover, the findings of (26) highlight that not only procrastination but also sleep effort—the tendency to try hard to sleep—can affect insomnia severity, adding complexity to the behavioral profiles associated with depression.

Altogether, this study confirms that bedtime procrastination and smartphone dependency are significant behavioral predictors of depression, supporting the growing body of research advocating for behavioral interventions focused on sleep hygiene, digital use boundaries, and emotional regulation.

While this study contributes valuable insights, several limitations must be acknowledged. First, the cross-sectional design limits the ability to draw causal inferences. Though regression analysis can identify predictive relationships, it cannot confirm temporal order or directionality. Second, data collection relied on self-report instruments, which may be subject to social desirability bias or inaccuracies in self-assessment, especially concerning sensitive mental health topics. Third, the sample was composed entirely of Malaysian participants, which may limit the generalizability of findings to other cultural or demographic groups. Finally, potential confounding variables such as sleep disorders, anxiety levels, or personality traits were not controlled for, which may have influenced the results.

Future studies should consider longitudinal or experimental designs to better establish causal relationships between bedtime procrastination, smartphone use, and depression. Tracking participants over time would allow researchers to examine how fluctuations in these behaviors influence mood outcomes. Additionally, it would be valuable to include objective sleep measures (e.g., actigraphy, sleep logs) to

complement self-report data and offer more precise assessments of sleep behavior. Expanding the demographic scope beyond young adults and incorporating cross-cultural comparisons could enhance the generalizability of findings. Moreover, future research should explore mediating and moderating variables, such as self-compassion, coping strategies, stress levels, and personality traits, to deepen understanding of the mechanisms underlying these relationships.

From a practical standpoint, mental health professionals, educators, and wellness program designers should consider incorporating behavioral sleep interventions into student and youth-focused wellness initiatives. These may include psychoeducation on bedtime routines, digital detox strategies, and emotion regulation training. Mobile health (mHealth) tools designed to reduce screen time and encourage mindfulness or sleep tracking could be valuable for this demographic. Educators and policymakers might also promote digital well-being curricula that raise awareness about the psychological impact of late-night phone use and irregular sleep patterns. Ultimately, promoting structured bedtime habits and digital boundaries could play a pivotal role in reducing depression rates in the digitally saturated lifestyles of emerging adults.

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Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants. Written consent was obtained from all participants in the study.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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