Into the Night with TikTok: Exploring the Relationship between Social Media Use and Sleep – A Case Study

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Abstract

This study investigates the relationship between social media usage, specifically TikTok, and sleep quality in a male aged 28. The research is grounded in the growing body of literature, highlighting the potential impact of digital media consumption on sleep patterns and psychological well-being. The study aims to understand the correlation between social media usage before bedtime and various sleep parameters, including sleep onset latency, total sleep duration, REM sleep, deep sleep, and resting heart rate. The research also explores the relationship between these sleep parameters and psychological variables such as irritability, attention, concentration, and overall feeling. The research employs a combination of sleep tracking technology and self-reported diaries to gather data over 22 days. The data was analysed using non-parametric tests due to the non-normal distribution of several variables. The results reveal significant correlations between excessive social media use and various sleep parameters. A later bedtime was significantly correlated with a longer total sleep duration ($p < .01$***) and a higher OURA sleep score ($p < .01$***). Social media use before bedtime showed a significant negative correlation with time to fall asleep ($p = .0177$*) and the lowest resting heart rate ($p = .0622$). Furthermore, total sleep duration displayed a strong positive correlation with wake-up time ($p < .0001$***) and the duration of REM sleep ($p < .01$***). The study highlights the importance of considering digital media consumption habits in discussions and interventions related to sleep health and psychological well-being.

Keywords: social media, sleep quality, OURA, TikTok

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Introduction

The incorporation of social media use into daily life has become commonplace for many individuals, with approximately 5.3 billion active users globally interacting with various social media platforms (Kemp, 2022). TikTok, in particular, has seen explosive growth in its user base. By the close of 2022, the platform reported 1.4 billion active users monthly, with projections estimating this number to increase to 1.8 billion by the end of 2023 (Chaffey, 2023). With digital trends arriving rapidly, younger generations, especially Gen Z and Millennials, are at the forefront of driving these evolutions, being the most active users of social media. Recognized as a multifunctional tool, social media provides significant benefits. It primarily serves as an information and news conduit, keeping users abreast of global developments. In addition, it provides a platform for creativity cultivation and personal expression (Gulzar et al., 2021). Simultaneously, social media holds a crucial role in fostering community as it enables individuals to share their thoughts, ideas, and experiences, thereby creating a sense of belonging and social support (Vaingankar et al., 2022). It is these aspects that establish social media as a positive force. For instance, these platforms have significantly contributed to sparking social and political activism, organizing movements, and initiating societal changes (Miani & Namer, 2021; Piat, 2019).

Social media's utility spans personal empowerment to commercial indispensability, emphasizing its multidimensional function in modern society. Businesses and organizations, recognizing this, use these platforms as indispensable tools for advertising, building customer relationships, and market expansion (Dwivedi et al., 2021). On a personal level, social media contributes positively to mental well-being by bridging geographical gaps and alleviating feelings of loneliness and isolation (Roeder, 2020). It also serves as a venue for self-expression and affirmation, providing users with opportunities to engage in positive self-talk and thus fostering happiness and overall well-being (Bailey et al., 2020). Thus, the multifaceted impact of social media underlines its significant role in contemporary society.

However, despite the potential benefits of social media use, there is also a growing concern about its impact on sleep patterns and overall health and well-being. Research has identified several potential side effects of long-term online and social media exposure. For

instance, intense social media usage has been linked to increased risk for depression and anxiety (Sharma et al., 2020). Additionally, spending excessive amounts of time online has been associated with negative mental health outcomes such as loneliness, social isolation, and reduced well-being (Pandya & Lodha, 2021). The World Health Organization (WHO) has highlighted the potential negative health consequences of heightened screen usage. The WHO claims that such increase in digital engagement may supplant beneficial routines, including regular physical activity and consistent sleep patterns. Possible negative impacts vary from sleep cycle disruption to physical discomfort such as headaches and neck pain. Risks to eye health, such as the development of myopia and digital eye syndrome, are also associated with prolonged screen time. Moreover, it has been noted that sedentary time in adults can increase due to high screen usage, which can potentially provoke cardiovascular risk factors, including obesity, high blood pressure, and insulin resistance (World Health Organization, 2020). Other negative effects of long-term online and social media exposure include exposure to cyberbullying, sleep disturbances, and decreased attention span (Craig, 2020; Levenson et al., 2016; Usmani et al., 2022). Particularly, sleep disturbances, insomnia, and other negative health outcomes have been linked to social media use before bedtime. Prior research has established that screen time, especially before bedtime, can negatively affect sleep. The light emitted by screens can disrupt the body's circadian rhythm, an internal clock regulating sleep and wakefulness, resulting in difficulties in falling asleep and reduced sleep quality (Alonzo et al., 2020; Hysing et al., 2015; Liu et al., 2018; Scott et al., 2019). As such, it is important to carefully consider the potential risks and benefits of social media use, particularly in relation to sleep and mental health.

The emergence of short-form video content, represented by platforms like TikTok, where videos are predominantly less than 60 seconds in duration, but can extend up to three minutes, has introduced a new era of digital communication and interaction. This transformative shift in media consumption, characterized by brief and concise video content, signifies a novel mode of engagement that is reshaping the dynamics of human interaction and communication in the digital realm. Despite the popularity of short-form videos among the population, there remains a significant lack of scholarly understanding regarding the implications of short-form video content.

Research has yet to fully explore the psychological mechanisms and implications of short-form video content across various social media platforms. Most studies focus on established

platforms and general user motives, leaving the new phenomenon of short-form video content, spearheaded by TikTok, largely unexamined (Montag et al., 2021).

Similarly, the impact of short-form video content use on self-esteem is another under-researched area. This is concerning given the popularity of these platforms among younger users, indicating a vital need for research in this context (Savira et al., 2022). Moreover, despite numerous studies on potential social media risks for adolescents, research specifically on the impact of short-form video content remains sparse.

Furthermore, the harmful effects documented for general social media use may not fully apply to short-form video content, due to its recent emergence and unique nature (Montag et al., 2021). To address this, a comprehensive understanding of this new content's psychological effects is necessary, focusing on both active and passive user interactions. This includes active engagement, where users generate and share content, and passive engagement, involving primarily viewing and interacting with others' content, as each may influence user well-being differently (Valkenburg et al., 2021).

The health impacts of short-form video use, particularly in relation to sleep and mental health, are still largely unknown, necessitating further exploration. For instance, it's known that social media use close to bedtime can interfere with sleep due to the stimulating effects of light from digital screens (Bhat et al., 2018; Wahl et al., 2019). However, how short-form video use specifically contributes to this issue is not yet clear (Wang & Scherr, 2021).

Lastly, there is a notable absence of comparative studies between different social media platforms, particularly regarding the impact of short-form video content. Given the relative novelty and centrality of short-form video content to TikTok's success, it's critical to understand how its effects may differ from traditional social media content (Bhandari & Bimo, 2022).

Understanding the impact of social media, particularly platforms featuring short-form video content like TikTok, on various demographics is crucial for comprehensive research. Focusing on specific age groups can provide insight into the differential impacts of these platforms. This study aims to investigate the effect of short-form video content usage on an individual aged 28, who represents a demographic particularly engaged with social media. Furthermore, a single-case study approach allows for a deep and intensive analysis of this individual's specific interaction with social media, offering valuable insights that could inform broader understandings of social media usage patterns and their consequences. By focusing on a

single case, it is possible to uncover the complex interactions between variables and gain an understanding of the mechanisms in use.

While the potential impacts of short-form video content on psychological well-being and self-esteem are under-studied areas, so too are the health implications, particularly concerning sleep quality. In this context, the relationship between short-form video content, particularly late into the night, and sleep disruption becomes a critical point of investigation.

Sleep disruption and insomnia are prevalent issues affecting millions of individuals globally. According to various studies, 10%–30% of the population suffer from some form of sleep disorder, with insomnia being the most prevalent (Morin & Jarrin, 2022; Yuan et al., 2022). Characterized by difficulty falling or staying asleep, insomnia often results in poor sleep quality and daytime fatigue (American Psychiatric Association, 2013). Chronic insomnia can significantly impact an individual's health and well-being, increasing the risk of conditions like depression, anxiety, obesity, diabetes, and cardiovascular disease (Ramar et al., 2021). Thus, the intersection of social media use, specifically short-form video content, and its potential implications for sleep health, forms an essential area of further exploration.

In recent years, the widespread use of electronic devices and social media has emerged as a potential disruptor of sleep patterns, specifically leading to insomnia, particularly among adolescents aged 12 to 17 (Gaya et al., 2023). The prevalence of social media use within this group is significant, with the average user dedicating approximately 6 hours and 54 minutes daily to various platforms (Kemp, 2022). Multiple studies have proposed that excessive social media use, especially in the hours preceding bedtime, may negatively affect sleep quality and foster the development of insomnia (Levenson et al., 2016; Liu et al., 2018; Scott et al., 2019).

Although the specific mechanisms underlying social media-induced sleep disruption remain not fully understood, several theories exist. One theory suggests that the use of electronic devices, particularly before bedtime, can disrupt sleep patterns due to the blue light they emit. Blue light is part of the spectrum of visible light, notable for its shorter wavelength and higher energy. Exposure to this type of light can suppress the production of melatonin, a crucial hormone that regulates sleep-wake cycles (Figueiro et al., 2011; Gooley et al., 2011).

Melatonin, naturally produced by the body, serves as a key component in the circadian rhythm, the inherent biological clock that manages sleeping and waking times. Melatonin production increases in the evening with darkness, signalling that it is time for sleep, and

decreases in the morning with daylight, indicating that it is time to wake (Pevet et al., 2021). However, the blue light from electronic screens can interfere with this cycle, leading the brain to believe it is still daytime, which results in a delay in melatonin production (Figueiro et al., 2011). This disruption can result in difficulty falling asleep or staying asleep, and subsequently poorer sleep quality (Pirdehghan et al., 2021). Another theory proposes that the emotionally charged or stressful content within social media use heightens arousal and anxiety levels, thereby interfering with falling asleep or maintaining sleep (Keles et al., 2020). The type of content consumed, particularly if it's disturbing or stressful news, could potentially heighten anxiety and stress levels, subsequently affecting overall sleep quality. Furthermore, "social jetlag", a phenomenon resulting from disrupted sleep schedules due to the need for maintaining online social network connections, may also contribute to this disruption (Przybylski et al., 2013).

The theoretical framework of this study is grounded in the intersection of media psychology, sleep research, and cognitive behavioural science. Central to our understanding of how short-form video social media use may impact sleep is the cognitive arousal theory, which posits that cognitive hyperarousal, caused by worry or rumination, can lead to difficulties initiating or maintaining sleep (Harvey, 2002). Late-night social media use, particularly on highly engaging platforms like TikTok, can stimulate cognitive processes that increase arousal and consequently interfere with sleep. Similarly, the displacement theory in media psychology holds that time spent on media activities displaces time that could be spent on other activities, such as sleep (Hill & Zheng, 2017; Kraut et al., 1998). If TikTok use, particularly at bedtime, is engaging and time-consuming, it may displace necessary sleep time, leading to short sleep duration, and potentially to insomnia.

Furthermore, the study draws on the concept of Technostress, which argues that technology use can lead to stress-related outcomes due to constant connectivity, leading to a "never off" phenomenon (Riedl, 2013). This could manifest in sleep disturbances, especially if the individual feels compelled to check social media platforms like TikTok frequently, even at night.

Despite the potential negative impacts of social media use on sleep, there is limited research that has examined the specific content consumed on social media before bed and its relationship to sleep outcomes. Specifically, there is a lack of research on the impact of short-form video content on sleep outcomes. This gap is particularly noticeable given the popularity of

short-form video content platforms like TikTok among students who might be more susceptible to sleep disturbances related to screen time.

The following research questions will guide this study:

1. To what extent does the duration of short-form video content use, particularly before bedtime, correlate with specific sleep parameters such as sleep onset latency, total sleep duration, and sleep quality in an individual aged 28?
2. How do end-of-day psychological variables, such as irritability, attention, concentration, and overall feeling, correlate with specific sleep parameters (i.e., sleep onset latency, total sleep duration, and sleep quality) in an individual aged 28 who uses short-form video platforms before bedtime?

This study aims to provide a comprehensive understanding of the relationship between short-form video content use and sleep outcomes. By examining the duration of social media use and the impact on sleep parameters, as well as the relationship between psychological variables and sleep outcomes, this research will contribute to the emerging body of knowledge around the impact of short-form video use on sleep. This study will focus on a 28-year-old male, providing an in-depth examination of the social media-sleep relationship within this demographic.

Method

2.1 Study Design

This research, approved by the Ethics Committee from the Faculty of Behavioural, Management, and Social Sciences (BMS), Domain of Humanities and Social Sciences (HSS), employs a single-case, observational study design with daily measurements over a period of three weeks (22 days). The study aims to investigate the potential impact of pre-bedtime social media use on sleep quality, insomnia symptoms, and day-to-day psychological experiences. For the study following inclusion criteria applied: regular social media use, willingness to fill out daily sleep and psychological diaries, willingness to wear an OURA ring during sleep for data collection, fluency in English, and no known sleep disorders or conditions that could affect sleep quality.

The focus is on the effects of the independent variables, namely social media use, content type, and usage type, on the dependent variables, which include sleep onset latency, wake after sleep onset, total sleep time, REM sleep, deep sleep, and resting heart rate. These variables are measured through the sleep diary and OURA ring data.

2.2 Participant

The participant in this study is a 28-year-old male who actively uses social media, thereby meeting the study's inclusion criteria. He has agreed to provide daily measurements throughout the duration of the study. His selection was achieved through purposive sampling, based on his availability, willingness to engage in the study, and the fulfilment of the necessary inclusion criteria. Given the single-case study design, the sample size in this study is one.

2.3 Materials

2.3.1 Primary Measures

Sleep Parameters and Social Media Use. The primary measures for this study included various sleep parameters and social media usage, recorded using a daily sleep diary. Upon waking, the participant filled out the diary, answering questions about bedtime, sleep onset latency, wake after sleep onset, total sleep duration, REM sleep, deep sleep, and lowest resting heart rate. Additionally, the diary recorded social media use before bedtime, encompassing the duration and type of social media platforms used, the nature of content consumed, and the mode of usage. The participant also noted any experienced symptoms of insomnia, and any significant events from the previous day that might have influenced sleep. The complete questionnaire is provided in Appendix A.

Sleep Quality Measure. In this study, the sleep quality was assessed using the third-generation OURA ring (Firmware Version 2.8.56, February 23, 2023). The study participant was educated to use the OURA ring effectively, including device charging. The advanced wearable technology gathered a variety of physiological measurements, including heart rate, body temperature, and movement data. OURA's advanced algorithms analysed these measurements to reveal the participant's unique sleep patterns. This includes light, deep, and REM sleep analysis.

To provide an overarching view of the participant's sleep quality, the device assigned a sleep score. This score was based on total sleep duration, sleep efficiency (the proportion of time the participant spent sleeping during the night), sleep latency (the time it takes to fall asleep), restfulness, and sleep timing. A complex algorithm evaluated sleep quality using all acquired data (OURA, 2020).

The OURA ring's reliability and validity are well-established, providing an objective measure of sleep quality (De Zambotti et al., 2017; Cao et al., 2022). The OURA ring's objective sleep data, the sleep diary's subjective data, and the End-of-Day questionnaire's psychological

measures provided an in-depth understanding of the participant's sleep patterns. This helped determine how pre-bedtime social media use impacts sleep quality.

2.3.2 Secondary Measures

End-of-Day Questionnaire. The End-of-Day questionnaire, a secondary measure, was utilized to assess daily psychological well-being. The End-of-Day questionnaire, while reliant on self-report, offered valuable subjective insight into the participant's psychological experiences. The End-of-Day questionnaire's 5-point Likert scale quantified subjective measures, thereby providing a standardized representation of the participant's psychological state. Also, the questionnaire included items measuring irritability, attention span, concentration, and overall mood. The participant rated their daily irritability on a scale from 1 (*not at all*) to 5 (*extremely*). The attention span was assessed with ratings from 1 (*very poor*) to 5 (*very good*), as was concentration. The overall mood was rated from 1 (*very negative*) to 5 (*very positive*). The complete questionnaire is provided in Appendix B.

The questionnaire displayed high internal consistency, with a Cronbach's alpha of 0.8, suggesting good reliability of the measure. Confidence intervals for the alpha value ranged from 0.61 to 0.91 (Feldt) and from 0.69 to 0.90 (Duhachek), demonstrating the stability of this measure. Removing any one item from the questionnaire resulted in a Cronbach's alpha ranging from 0.68 (when concentration was excluded) to 0.85 (when feeling was excluded), which indicates that all items significantly contribute to the questionnaire's reliability. The End-of-Day questionnaire was used to explore the correlation between sleep parameters and End-of-Day psychological states.

2.4 Procedure

2.4.1 Participant Recruitment and Consent

The participant for this single-case observational study was recruited voluntarily. Before beginning the study, the participant was presented with a detailed information sheet explaining the nature of the study, its aims, and what would be required of him during the study. After reviewing this information, the participant provided informed consent to participate in the study.

2.4.2 Data Collection Methods and Schedule

Prior to the initial sleep data collection, the participant provided socio-demographic information. Three primary methods were used for data collection over a period of 22 consecutive days: a daily sleep diary, a wearable device called the OURA ring, and an End-of-

Day questionnaire. Every morning, immediately upon waking, the participant filled out the sleep diary, which captured subjective data on sleep parameters and social media use. This diary was filled out through a digital form on Qualtrics, accessed via a web browser on the participant's Android phone (version 12). Reminders were set on the participant's phone to ensure timely completion of the diary each morning.

Concurrently, the OURA ring, which the participant wore throughout the night, automatically collected objective data on the participant's sleep quality. This data was synced to the OURA app (version 4.11.1) on the participant's phone. Each evening, the participant completed the End-of-Day questionnaire to assess daily psychological well-being. Like the sleep diary, this questionnaire was filled out through a digital form on Qualtrics, accessed via a web browser on the participant's phone. Reminders were also set for the completion of these questionnaires.

2.4.3 Data Processing and Diagnostics

Data collected from the sleep diary, OURA ring, and End-of-Day questionnaire was systematically recorded and processed using Qualtrics. Only self-reported data was taken as the basis of this study. Upon submission of each diary entry and questionnaire, the data was automatically saved and organized within the Qualtrics platform. Prior to analysis, the data underwent preliminary checks for completeness and consistency. Outliers or inconsistent responses were identified and examined. In the event of missing data, the participant was informally reminded and asked to provide the necessary information.

2.5 Data Analysis

The data analysis was conducted using RStudio (2023.03.1+446). For the statistical analyses a significance level of 0.05 was chosen. The initial step involved analysing the socio-demographic data through descriptive statistics, including measures such as mean, median, standard error, variance, and standard deviation.

Before analysing the data, it was important to determine if the variables were normally distributed before choosing the appropriate statistical method. The core of the inferential statistics was focused on examining correlations between several key variables. For the first research question, a Spearman correlation analysis was conducted between the duration of social media use and sleep parameters, as well as the OURA score. For the second research question, a

Spearman correlation analysis was carried out between sleep parameters and end-of-day psychological variables.

Results

Data Inspection and Cleaning

The dataset used in this case study comprised 22 observations per variable and 18 variables. The physiological continuous variables included date, bedtime, time to fall asleep, number of night-time awakenings, wake-up time, total sleep duration, OURA sleep score, duration of REM sleep, duration of deep sleep, lowest resting heart rate, and social media use before bedtime. The nominal variables incorporated, social media platform, content type on social media, and type of social media usage. Lastly, while the psychological variables irritability, attention, concentration, and overall feeling were ordinal in nature, they were being treated as continuous for the purpose of analysis.

In the raw dataset the variables were denoted as followed. As, *bedTime* referred to the time at which individuals went to bed, while *sleepOnsetLatency* represented the duration it took for individuals to fall asleep after going to bed. *NightWakeups* indicated the number of times individuals woke up during the night, and *wakeupTime* denoted the time at which individuals woke up in the morning. *TotalSleepHours* reflected the overall duration of sleep measured in hours, and *ouraSleepScore* quantified the overall quality of sleep using a numerical score.

The dataset also encompassed *remSleepMinutes*, which denoted the duration of rapid eye movement (REM) sleep in minutes, and *deepSleepMinutes*, representing the duration of deep sleep in minutes. *LowestRestingHR* recorded the lowest resting heart rate observed during sleep. *SocialMediaBeforeBedtime* measured the number of minutes the individual spent on social media before going to bed. *SocialMediaPlatform* identified the specific social media platform that the participant predominantly used. *ContentTypeSocialMedia* categorized the primary type of content the participant consumed on social media before bedtime, such as news, personal updates, entertainment, or educational content. *SocialMediaUsageType* presents the participant's engagement with social media before bedtime, characterized as active usage (posting, commenting, messaging), passive usage (scrolling, reading, watching videos), or no usage.

Furthermore, the dataset included four psychological variables: irritability, attention, concentration, and feeling. These variables were rated on a 5-point Likert scale and provided insight into individual levels of irritability, attention span, concentration, and overall feelings.

The data set was complete, with no missing entries. Due to the participant's exclusive use of TikTok for passive consumption of entertainment content before bed, variables such as social media platform, content type on social media, and type of social media usage were omitted from the analysis.

Table 1

Descriptive Statistics

Variable	Mean	Median	SE	Var	SD
sleepOnsetLatency	9.05	7.5	1.06	24.81	4.98
nightWakeups	1.55	1.5	.25	1.4	1.18
totalSleepHours	7.54	7.52	.23	1.15	1.07
ouraSleepScore	80.86	81.5	1.35	40.22	6.34
remSleepMinutes	101.09	102.5	6.24	855.9	29.26
deepSleepMinutes	204.82	209	10.12	2253.87	47.47
lowestRestingHR	61.36	61	.69	10.43	3.23
socialMediaBeforeBedtime	69.32	82.5	5.13	579.27	24.07

Note. The descriptive statistics presented in the table represent the mean, median, standard error (SE), variance (Var), and standard deviation (SD) for each variable.

A Shapiro-Wilk normality test was used to determine if the data meet parametric assumptions. The test revealed that several variables departed significantly from normality. Specifically, the bedtime ($W = 0.53$, $p < .001$), number of night-time awakenings ($W = 0.87$, $p = .009$), lowest resting heart rate ($W = 0.91$, $p = .041$), and social media use before bedtime (**W** = 0.82, $p = .001$) distributions significantly deviated from normality. On the other hand, several variables did not provide enough evidence to reject the assumption of normality. This included time to fall asleep ($W = 0.92$, $p = .063$), Wake-up time ($W = 0.94$, $p = .233$), total sleep duration ($W = 0.96$, $p = .416$), OURA sleep score ($W = 0.98$, $p = .888$), duration of REM sleep ($W = 0.95$, $p = .278$), and duration of deep sleep ($W = 0.97$, $p = .817$). Based on this outcome, a non-parametric test was used.

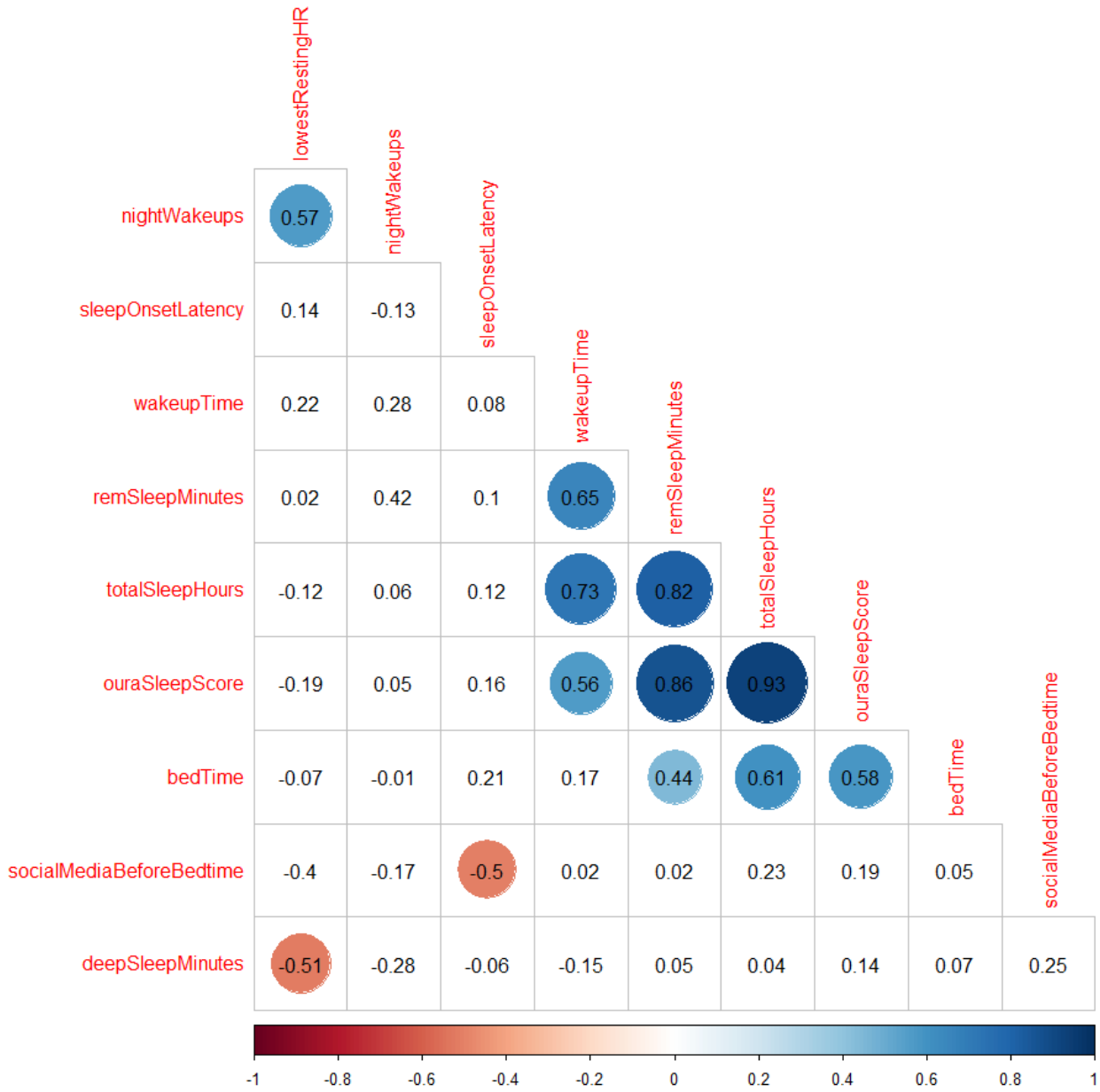
Figure 1 shows the correlations between various sleep and physiological measures. For clarification the noted significance levels are indicated as follows: an asterisk (*) signifies a significance level of $p < 0.1$, two asterisks (**) signify a significance level of $p < 0.05$, and three asterisks (***) signify a significance level of $p < 0.01$.

A later bedtime was significantly correlated with a longer total sleep duration ($r = .61$, $p < .01$***) and a higher OURA sleep score ($r = .58$, $p < .01$***). The time it takes to fall asleep had a moderate positive correlation with bedtime ($r = .21$, $p = .3451$) and a negative correlation with night-time awakenings ($r = -.13$, $p = .5535$). Night-time wakeups were positively correlated with lowest resting heart rate ($r = .57$, $p = .0058$**).

Later wake-up time was positively correlated with total sleep duration ($r = .73$, $p < .0001$***) and duration of REM sleep ($r = .65$, $p < .01$***), suggesting that a later wakeup time is associated with longer total sleep hours and more REM sleep minutes. Social media use before bedtime showed a significant negative correlation with time to fall asleep ($r = -.50$, $p = .0177$*) and lowest resting heart rate ($r = -.40$, $p = .0622$).

Figure 1

Spearman Correlation Matrix of the Sleep Diary



Note. The figure presents Spearman's correlation coefficients (r) for various measures of sleep and physiological measures. The coefficients range from -1 to 1. All values are rounded to two decimal places.

Figure 2 presents the correlation matrix between various physiological and psychological measures. Total sleep duration showed a moderate positive correlation with bedtime ($r = .31$, $p <$ .01***), and a strong positive correlation with wake-up time ($r = .65$, $p < .001$***). The time to fall asleep displayed a slight negative relationship with social media use before bedtime ($r = -.41$, $p < .001$***), while the number of night-time awakenings correlated positively with the lowest

resting heart rate ($r = .45$, $p < .05$*), but negatively with the duration of deep sleep ($r = -.23$, $p = .24$).

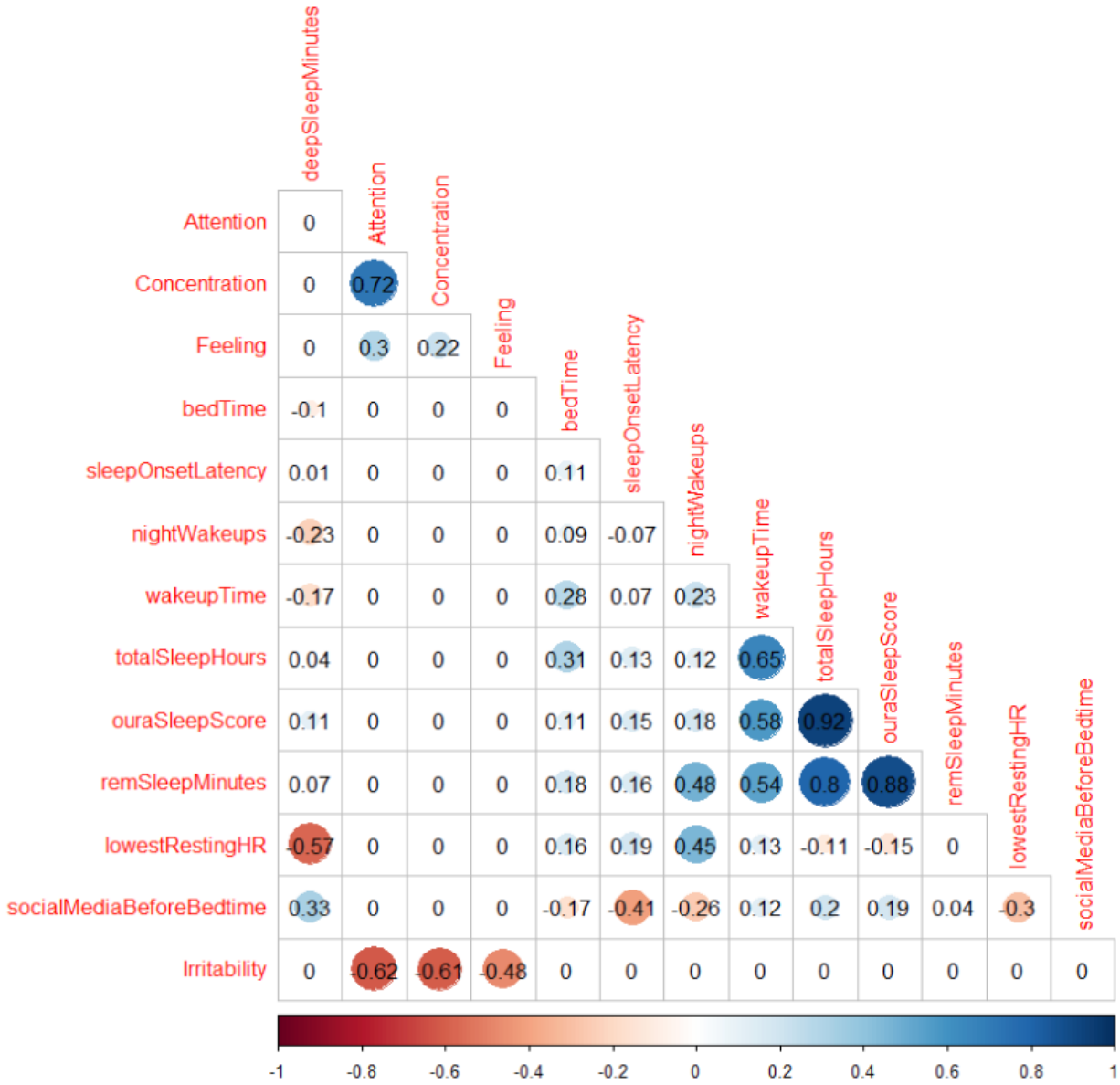
In the context of sleep quality, as assessed by the OURA sleep score, a strong positive correlation was found with total sleep duration ($r = .92$, $p < .001$***) and wake-up time ($r = .58$, $p < .001$***). Conversely, the lowest resting heart rate revealed a slight negative association with the OURA sleep score ($r = -.15$, $p = .81$) and total sleep duration ($r = -.11$, $p = .27$).

Regarding the duration of REM sleep, there were moderate to strong positive associations with total sleep duration ($r = .80$, $p < .001$***), OURA sleep score ($r = .88$, $p < .001$***), and wake-up time ($r = .54$, $p < .001$***). However, there was almost no correlation between the duration of REM sleep and the lowest resting heart rate ($r = .003$, $p = .92$). The duration of deep sleep showed a slight positive association with the OURA sleep score ($r = .11$, $p = .57$) and a moderate positive correlation with social media use before bedtime ($r = .33$, $p < .05$*). However, it was negatively correlated with the number of night-time awakenings ($r = -.23$, $p = .24$) and the lowest resting heart rate ($r = -.57$, $p < .001$***).

The use of social media before bedtime revealed a moderate negative association with the lowest resting heart rate ($r = -.30$, $p < .01$**) and time to fall asleep ($r = -.41$, $p < .001$***), yet it correlated moderately positively with the duration of deep sleep ($r = .33$, $p < .05$*). The nominal variables, namely social media platform, content type on social media, and type of social media usage, showed no correlation with any other parameters. The psychological variables such as irritability, attention, concentration, and overall feeling also showed no correlation with any other parameters in the matrix.

Figure 2

Spearman Correlation Matrix of the Sleep Diary and the End-of-Day Questionnaire



Note. The figure presents Spearman's correlation coefficients (r) for various physiological and psychological measures. The coefficients range from -1 to 1. All values are rounded to two decimal places.

Figure 4 shows the OURA sleep score as provided by the algorithm of the OURA app. The analysis of OURA sleep scores across the studied period revealed a range of OURA sleep scores from 69 to 94. The highest recorded OURA sleep score was 94, obtained on May 8th, 2023. This was associated with a bedtime at 11:15 p.m., 11 minutes to fall asleep, two instances of night-time awakenings, a wake-up time at 9:16 a.m., and a total sleep duration of 9:27 hours.

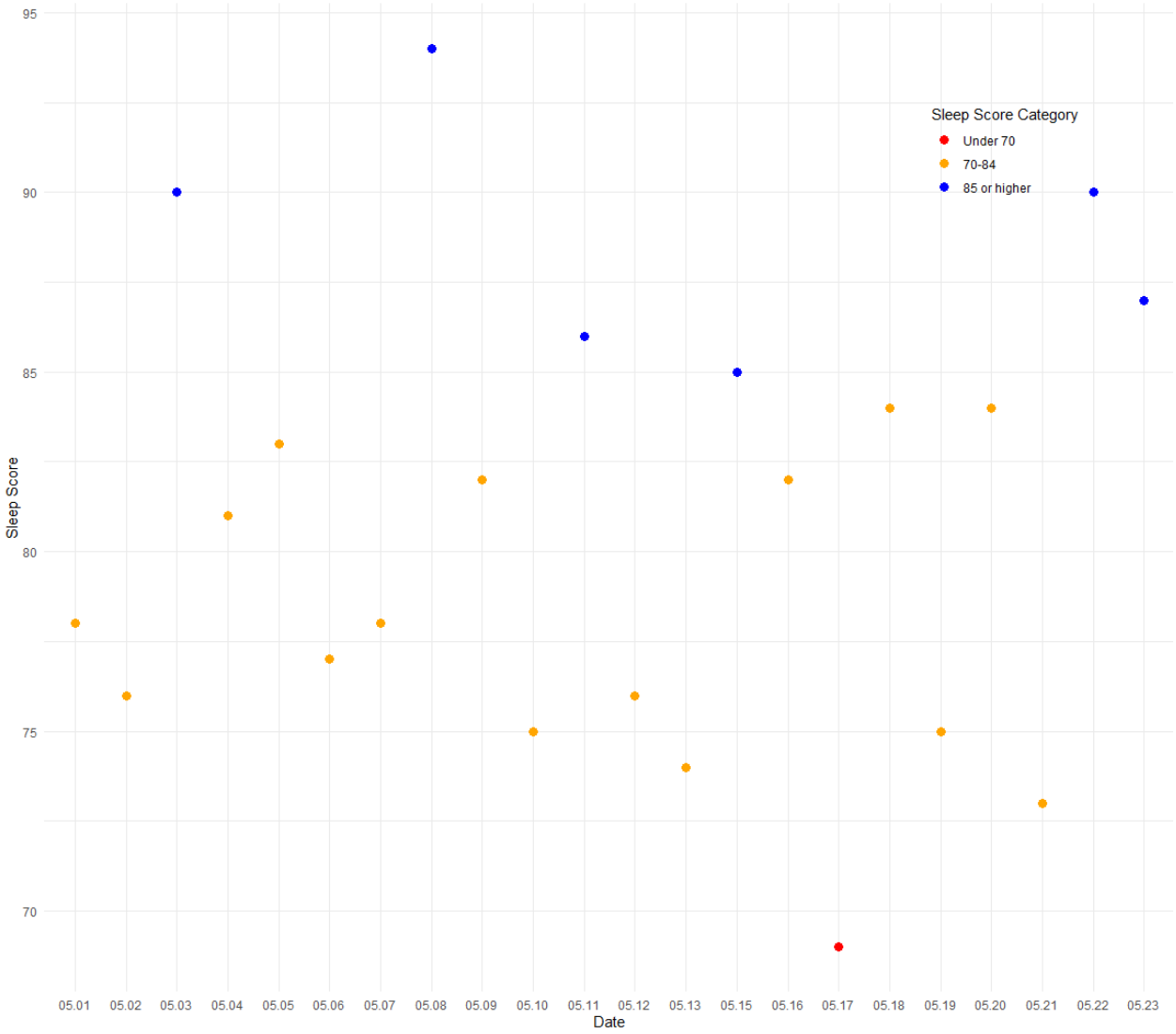
On this day, the participant spent 80 minutes on social media platform TikTok before bedtime, engaging in passive entertainment.

On the other hand, the lowest recorded OURA sleep score was 69, which was recorded on May 17th, 2023. On this day, the bedtime was at 1:14 a.m., 9 minutes to fall asleep, one instance of night-time awakening, a wake-up time at 7:40 a.m., and a total sleep duration of 5:51 hours. The participant spent 50 minutes on TikTok before bedtime, engaging in passive entertainment.

It is noteworthy that the highest sleep scores were associated with longer sleep duration, lower sleep onset latency, fewer night wakeups, and longer REM and deep sleep stages. Lower sleep scores were associated with shorter sleep duration, longer sleep onset latency, more night wakeups, and shorter REM and deep sleep stages.

Figure 4

OURA Sleep Score over the Course of the Study



Note. The figure illustrates the quality of sleep on a scale from 0 to 100 based on the OURA algorithm. Scores of 85 or higher denote optimal sleep quality. Scores in the range of 70-84 reflect a satisfactory level of sleep quality. A score below 70 might suggest suboptimal sleep.

Discussion

Summary

The case study aimed to analyse the potential impact of social media use before bedtime on sleep parameters and psychological states. The study utilized a dataset with 22 observations per variable and 18 variables.

The results of this study illustrated a variety of significant correlations between variables. Specifically, a strong positive correlation of .57 was observed between night wakeups and the lowest resting heart rate, indicating that frequent awakenings during the night were linked to a

higher resting heart rate. Surprisingly, a strong negative correlation of -.50 was found between sleep onset latency and social media usage before bedtime. Furthermore, social media use before bedtime revealed a moderate negative association with the lowest resting heart rate and time to fall asleep but correlated positively with the duration of deep sleep. This indicates that while late-night social media use may potentially disturb sleep initiation, it also seems to be associated with longer deep sleep durations.

Notably, none of the psychological variables, including irritability, attention, concentration, and feeling, showed any significant correlations with the sleep parameters. The predominant social media platform used by the participant was TikTok, and the primary purpose of usage was entertainment. The highest OURA sleep scores were generally associated with higher total sleep durations, lower sleep onset latencies, fewer night awakenings, and longer times spent in both REM and deep sleep stages. Conversely, the lower sleep scores were linked with less total sleep duration, longer sleep onset latency, more night awakenings, and shorter times spent in REM and deep sleep stages.

The first research question concerned the impact of short-form video content before bedtime on sleep parameters. The literature suggests that exposure to screens before bedtime can disrupt sleep hygiene by suppressing melatonin production and causing emotional, cognitive, and physiological arousal. In contrast to traditional beliefs, the results from this particular case study convey an unconventional understanding. The results of this study revealed a significant negative association between social media use before bed and sleep onset latency. Essentially, spending more time on social media meant falling asleep faster for the participant. This contradicts the assumption that screen time before bedtime delays sleep onset latency. Several studies have reported a link between increased media use before bed and higher sleep onset latency (Arora et al., 2014; Bartel et al., 2015; Hale, 2018; Leonard et al., 2021). In contrast, research from Combertaldi et al. (2021) and Scott et al. (2019) found that extensive social media usage did not influence sleep onset latency. The discrepancy in these findings could result from multiple factors, such as age, the type of content viewed, individual variations in screen time response, or other undetermined factors.

The secondary research question focused on the influence of pre-bedtime uses short-form video platforms on psychological states, including irritability, attention, concentration, and overall feeling. Moreover, the findings did not identify significant correlations between these

psychological variables and sleep parameters, indicating that pre-bedtime TikTok use might not directly impact these psychological states. This outcome could seem to deviate from existing literature suggesting that the content consumed on social media can trigger emotional and cognitive arousal, thereby affecting psychological states.

Although the study did not reveal a direct correlation between pre-bedtime social media use and psychological states, it noted other moderately strong relationships worth examining. A thorough analysis of the case study reveals insightful nuances. The participant, on days of achieving optimal sleep, marked by an OURA sleep score of 85 or higher (such as on May 3rd, 8th, 11th, 15th, 22nd, and 23rd), exhibited consistent social media use before bedtime, with usage spanning 60 to 90 minutes. On May 8th, for instance, which had one of the highest sleep scores at 94, the participant engaged in 80 minutes of pre-bedtime social media usage. This day saw improved sleep quality, reflected in an extended total sleep duration and increased REM and deep sleep minutes, potentially indicating restful sleep. In contrast, on May 17th, when the lowest sleep score of 69 was recorded, the participant had only 50 minutes of pre-bedtime social media use, which was less compared to the days of optimal sleep. The total sleep hours, REM sleep minutes, and deep sleep minutes also dropped compared to the optimal sleep score days.

The theoretical framework of this study was grounded in the cognitive arousal theory, the displacement theory, and the concept of Technostress, offering a foundation for exploring the complex relationships between pre-bedtime short-form video usage, sleep parameters, and psychological states.

The cognitive arousal theory suggests that cognitive hyperarousal can result in sleep disturbances (Harvey, 2002). This study found an unexpected negative correlation between pre-bedtime social media usage and sleep onset latency, contradicting the typical assumption that increased arousal from screen time delays sleep onset. However, the cognitive arousal theory primarily focuses on the impact of worry and rumination. It could be argued that entertainment focused TikTok usage, rather than eliciting worry, might serve as a distraction from stressors, contributing to faster sleep onset. This is demonstrated by the research conducted by Daniels et al. (2022) which implies that using social media platforms for entertainment purposes can effectively serve as a distraction mechanism from daily stressors, potentially facilitating faster sleep onset. This claim gains particular relevance when the platform is utilized in the evening hours as a form of relaxation and entertainment, thereby assisting individuals to unwind form the

day. The study emphasizes that engagement with such platforms can contribute to a reduction in pre-sleep cognitive arousal, a primary reason often causing sleep issues (Daniels et al., 2022). Consequently, it is suggested that entertainment use of social media platforms may in fact be beneficial in promoting a healthier sleep onset by providing a diversion from stressors and inducing relaxation before bedtime. This potential explanation aligns with the cognitive arousal theory and emphasizes the role of content type in social media's impact on sleep.

The displacement theory posits that media activities can displace time that would otherwise be spent on other activities, including sleep (Hill & Zheng, 2017; Kraut et al., 1998). While the displacement theory would predict reduced total sleep duration due to extended TikTok usage, this study found that higher pre-bedtime TikTok usage coincided with more optimal sleep on certain days. This may suggest that the entertainment value or stress-relief provided by TikTok could in some cases outweigh the potential displacement of sleep time, resulting in better overall sleep quality.

The concept of Technostress underscores the potential stress-related outcomes due to constant connectivity (Riedl, 2013). This study, however, found no significant correlations between pre-bedtime TikTok usage and psychological states, which could seem to diverge from the Technostress concept. However, it is possible that the specific nature of TikTok as an entertainment-focused platform might have helped to mitigate some of the stress and psychological impacts associated with constant connectivity.

In summary, this case study reveals nuanced associations between pre-bedtime social media use, sleep parameters, and psychological states, contradicting existing interpretations. While significant correlations were identified between some sleep parameters and social media usage, these diverged from literature expectations. Further, the study did not establish substantial connections between social media use and psychological states. These results suggest an intricate relationship that could be influenced by numerous uncaptured factors and invite further research into the influences of specific social media platforms and usage patterns. The findings, despite their complexity, emphasize the need to investigate the potential impact of pre-bedtime social media usage on sleep quality beyond the initial psychological parameters. The observed relationships challenge traditional theories such as cognitive arousal theory, displacement theory, and Technostress, suggesting entertainment focused TikTok usage may serve as a stress distraction rather than a source of cognitive arousal or displacement of sleep time. Despite the

lack of association between TikTok usage and psychological states, the specific nature of TikTok as an entertainment platform could potentially mitigate the stress and psychological impacts associated with constant connectivity.

Possible Explanations

The findings of the case study present a complex and somewhat counterintuitive picture of the relationship between social media usage before bedtime, sleep parameters and psychological states. There are several possible reasons that can help to understand and explain the observed phenomena.

In relation to the first research question on the impact of social media usage before bedtime on sleep parameters, the findings revealed a negative correlation between sleep onset latency and social media usage before bedtime. While literature suggests that screen time before bed generally disrupts sleep hygiene, the specifics of social media usage might play a crucial role in this context. For instance, the type of content accessed on social media could be a key determinant. If users are engaging with calming or relaxing content, it might facilitate faster sleep onset. Such as, sleep-aiding music videos, like white noise can help to relax and fall asleep quicker (Eke et al., 2020; Taranto-Montemurro et al., 2017). Moreover, individual differences, such as the user's resilience to screen light, attention span, or stress levels, could also be contributing factors.

For the second research question about the effect of social media usage before bedtime on psychological states, the findings showed no significant correlations between these psychological variables and sleep parameters. One possible explanation is that the impact of social media on psychological states may be more transient or immediate, and not necessarily sustained until the time of sleep, especially if there is a gap between social media usage and bedtime. Alternatively, the psychological variables measured in this study (irritability, attention, concentration, and feeling) may not be the most sensitive or relevant indicators of the psychological impacts for social media usage. The baseline of the participant for the psychological variables was two for irritability (slightly), three for attention and concentration (neutral), and four for feeling (very positive). This suggests that the participant started the study in a generally positive psychological state. However, whether this baseline state influenced the subsequent lack of significant findings is unclear.

Limitations

While the case study methodology offers invaluable perspectives, interpreting its findings requires acknowledging inherent limitations.

Firstly, the study depended on participant self-reporting for social media usage, sleep parameters, and psychological states. Such methods may be vulnerable to different bias types, including recall bias and social desirability bias, which could potentially distort data accuracy (Hassan, 2006; Taranto-Montemurro et al., 2017). The participant, for example, might have inaccurately reported their social media engagement or sleep metrics due to memory lapses or the desire to portray themselves in a certain light.

Secondly, the study did not adjust for potential confounding factors that might influence both social media engagement and sleep or psychological conditions. Variables such as stress levels, physical activity, dietary habits, or other lifestyle aspects could have contributed to the observed relationships. Without accounting for these variables, determining a direct causal link between pre-bedtime social media usage and sleep or psychological states becomes challenging.

Thirdly, it's critical to consider the nature of the research approach. This research was structured as a case study, focusing on a single individual. While this aligns with the expected methodology for a case study, it comes with inherent limitations characteristic of this research approach. The findings, while insightful, are inherently bound by the specific characteristics of the individual under study and thus may not be broadly generalizable to a larger, more diverse population (Yin, 2018). The reason behind this is that the case or cases under study do not serve as sampling units. Moreover, their limited number makes them inadequate to function as a representative sample for any larger population (Janosky, 2005; Lobo et al., 2017). Also, as case studies often focus on in-depth understanding, there might be complexities and variables at play that are unique to the case, and hence the results might not be reproducible in other contexts. Therefore, while the case study approach offers rich and detailed insights, its limitations in terms of external validity and reproducibility should be kept in mind (Yin, 2018).

In terms of the research questions and literature review, there might have been an overemphasis on specific psychological states such as irritability, attention, concentration, and feeling. Other potentially relevant psychological states, like arousal, information overload and emotional reactivity were not included in the study. This is a limitation because the focus lies on specific psychological states and the exclusion of others. Each psychological state can uniquely contribute to the understanding of how pre-bedtime social media use impacts sleep and mental

well-being. Therefore, a comprehensive examination should ideally cover a broad spectrum of states. By not considering potentially relevant psychological states, the study may have missed out on important dimensions of how social media usage before bedtime affects sleep and psychological well-being.

Lastly, the case study did not delve into the specifics of social media usage, such as the nature of the content viewed or the emotional reactions to the content. As suggested by the findings, these factors might play a crucial role in the relationship between social media usage before bedtime and sleep or psychological states.

Future Research

Future research in this field could be significantly enriched by building upon the initial findings of this case study in several ways.

One key area for future investigation is the sample size. This case study was conducted with a single participant. It would be advantageous for future studies to include a larger and more diverse sample of participants, enhancing the generalizability of the findings. With a larger cohort, it may be possible to reveal differences in sleep patterns and social media usage across different demographics such as age, gender, and occupation.

Following on from this, the influence of different social media platforms is another promising avenue to explore. The participant in this study exclusively used TikTok, but it would be interesting to see if usage of other platforms, like Instagram, Facebook, Snapchat, or Twitter, has different impacts on sleep patterns and psychological states. Understanding the unique effects of each platform could provide a more nuanced view of the impact of social media usage on sleep.

Furthermore, given the limited scope of this case study, where the participant primarily consumed entertainment content on TikTok, future research should explore the consumption of a wider array of content types across various short-form video platforms and its potential impact on sleep and psychological well-being. Such an expanded scope would better illuminate the potential effects on sleep and psychological well-being. Existing knowledge gaps within this field include a lack of understanding surrounding the psychological mechanisms at play during the use of short-form video content. A clearer understanding of how active content creation and passive content consumption individually affect users would also be beneficial. Lastly, additional

research should address the health implications for individuals engaging with short-form video content.

As an example, researchers could investigate how varying content types could trigger different levels of cognitive arousal, following the cognitive arousal theory. This research avenue may provide valuable insights into the differing impacts of content types on sleep quality. Another research area could compare the effects of active and passive engagement with short-form video content. Such studies would give a clearer picture of how different interaction modes may affect sleep and overall well-being.

Further research could examine the responses of varied age groups to pre-bedtime social media use, considering physiological variations associated with different life stages. Additionally, the role of diverse content types on sleep parameters requires further investigation, as the cognitive or emotional arousal levels may vary with the nature of the content. Another potential avenue for research lies in studying the individual differences in screen time response; aspects such as personal habits, tolerance to screen light, or stress levels could be determining factors for the effect of screen exposure on sleep. For a holistic understanding, it's recommended that researchers delve into unexplored factors that may explain the observed variation in findings. Broadening the scope of research in this manner will yield a more comprehensive understanding of the dynamics between pre-bedtime social media use and sleep onset latency.

Given the rapid rise and widespread popularity of platforms offering short-form video content, there is a pressing need for comprehensive investigations into associated health implications, particularly with a focus on sleep and mental health. As short-form video content increasingly reshapes digital human interaction and communication, a clear understanding of its impacts on sleep and well-being becomes an issue of paramount importance.

Finally, the exploration of long-term effects of social media usage before bedtime on sleep and psychological states could be a vital area of future research. While this case study provided valuable insights over a period of 22 days, examining these relationships over a longer duration could offer a more comprehensive understanding of the long-term impacts of bedtime social media usage. By exploring these areas, future research can continue to build a more complete and nuanced understanding of the complex relationship between social media usage, sleep, and psychological well-being.

Significant Contributions of the Study

The presented project significantly enriches the continuous discourse concerning social media's influence on sleep and psychological well-being through numerous substantial avenues.

Firstly, the focus on TikTok, one of the rapidly expanding social media platforms, infuses fresh perspective into the established literature. Preceding this case study, a majority of research revolved around platforms such as Facebook and Instagram. Concentrating specifically on TikTok augments our comprehension of diverse social media platforms' impact on sleep cycles and psychological conditions.

Secondly, this project has underscored the value of individual case studies in understanding the complex relationships between social media usage, sleep, and psychological well-being. The comprehensive approach taken in this study allowed for the exploration of various sleep parameters and mood states over a 22-day period in relation to specific patterns of TikTok use. This rich, detailed data contributes to a nuanced understanding of the phenomena that large-scale studies often miss.

Finally, the study's novel use of technology, in the form of the OURA ring, has demonstrated the potential of these tools for research in this field. The use of technology allowed for the collection of objective, real-time data over an extended period, providing a more accurate picture of the participant's sleep patterns than traditional self-report methods.

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Appendix A
Sleep Diary

Welcome to the 3-week Sleep Diary! Your participation is crucial in helping me to understand the impact of social media use before bedtime on sleep quality and its relationship with insomnia symptoms in a single case study. I aim to investigate:

1. To what extent does the duration of short-form video content use, particularly before bedtime, correlate with specific sleep parameters such as sleep onset latency, total sleep duration, and sleep quality in an individual aged 28?
2. How do end-of-day psychological variables, such as irritability, attention, concentration, and affect, correlate with specific sleep parameters (i.e., sleep onset latency, total sleep duration, and sleep quality) in an individual aged 28 who uses short-form video platforms before bedtime?

Each day, after waking up, please take a few minutes to fill out the short sleep diary and wear the OURA ring during sleep. This will help me gather valuable insights into your sleep patterns and social media usage. Additionally, end-of-day diary with psychological questions (irritability, attention, concentration, affect) throughout the day will be included to understand the correlation between sleep parameters and psychological end-of-day variables. Your participation will remain confidential and contribute to a better understanding of the relationship between social media and sleep quality. Thank you for your participation!

1. What time did you go to bed last night? (Please use 24h format and only numbers, e.g. 23:15)
2. How long did it take you to fall asleep (sleep onset latency in minutes, e.g. 15)?
3. How many times did you wake up during the night (wake after sleep onset, e.g 2)?
4. What time did you wake up in the morning? (Please use 24h format and only numbers, e.g. 08:45)
5. How many hours did you sleep in total? (e.g. 8)
6. What was your sleep score from the OURA app? (e.g 75)
7. How much REM sleep did you got? (Please use only minutes, e.g. 120)
8. How much deep sleep did you got? (Please use only minutes, e.g. 90)

9. What was your lowest resting heart rate? (62)
10. How long did you use social media before bedtime? (in minutes, e.g. 30)
11. Which social media platforms did you use before bedtime? (e.g., Facebook, Twitter, Instagram, TikTok, etc.) (Multiple answers possible)
    a. Facebook
    b. Twitter
    c. Instagram
    d. TikTok
    e. Reddit
    f. etc.
12. What type of content did you primarily consume on social media before bedtime? (e.g., news, personal updates, entertainment, educational, etc.)
    a. News
    b. Personal updates
    c. Entertainment
    d. Educational
    e. etc.
13. What type of social media usage best describes your habits before bedtime? Please select one option. Active usage (e.g., posting, commenting, messaging). Passive usage (e.g., scrolling, reading, watching videos). No usage (i.e., not using any social media platforms before bedtime).
    a. Active
    b. Passive
    c. None

Appendix B

End-of-Day Questionnaire

Welcome to the 3-week End-of-Day Diary! Each evening, before going to bed, please take a few minutes to fill out the short end-of-day diary with psychological questions. Additionally, wear the OURA ring during sleep to provide physiological data on sleep quality. This will help me gather valuable insights into your daily experiences with social media and sleep, and their impact on your psychological well-being. Your responses will remain confidential and contribute to a better understanding of the relationship between social media and sleep quality. Thank you for your participation!

1. How irritable were you today?
    a. Not at all (1)
    b. Slightly (2)
    c. Moderately (3)
    d. Very (4)
    e. Extremely (5)
2. How was your attention span today?
    a. Very poor (1)
    b. Poor (2)
    c. Neutral (3)
    d. Good (4)
    e. Very good (5)
3. How was your concentration today?
    a. Very poor (1)
    b. Poor (2)
    c. Neutral (3)
    d. Good (4)
    e. Very good (5)
4. How did you feel overall today?
    a. Very negative (1)

b. Negative (2)
c. Neutral (3)
d. Positive (4)
e. Very positive (5)