

**The Effect of Online Vigilance on Stress, Sleep Quality, and Overall Well-Being: A
Cross-Sectional Study**

Michele Petkovski

Department of Psychology, University of Twente

202000381: Positive Clinical Psychology & Technology

First Supervisor: Dr. Alejandro Domínguez Rodríguez

Second Supervisor: Maria Luisa Rispa Hoyos, MSc

July 1, 2023

APA 7th Edition

Word Count: 8031

Abstract

Introduction. The emergence of mobile internet technologies has greatly improved communication worldwide, but with this, the problem of online vigilance has arisen. Research on the relationship between online vigilance and mental health is scarce, particularly regarding factors such as stress, sleep quality, and overall well-being. Additionally, previous studies generally have only focused on adolescents and young adults. **Objective.** Therefore, this study aimed to investigate how online vigilance influences stress, sleep quality, and overall well-being. Furthermore, potential differences in online vigilance between young adults and middle-aged adults were explored. **Methods.** A cross-sectional study was conducted through an online questionnaire, in which participants' scores on the Online Vigilance Scale, Perceived Stress Scale, Pittsburgh Sleep Quality Index, and Mental Health Continuum Short Form were assessed. Moreover, items regarding digital and social media use were included. The data were analyzed using linear regression, Spearman's rank correlation, and Wilcoxon's Rank-Sum test. **Results.** Outcomes ($n = 167$) showed a positive association between online vigilance and stress ($\beta = .238, p < .001$), and a negative relationship between online vigilance and overall well-being ($r = -.23, p = .002$). No significant correlation was found between online vigilance and sleep quality ($r = .12, p = .121$). Additionally, stress ($\beta = .019, p = .067$) and sleep quality ($\beta = -.016, p = .210$) were no moderators of the relationship between online vigilance and overall well-being. Furthermore, young adults scored significantly higher on online vigilance than middle-aged adults ($W = 27889, p < .001$). Lastly, young adults spent more time per day using digital and social media than middle-aged adults. **Conclusion.** This study has expanded existing literature regarding the relationships between online vigilance, stress, sleep quality, and well-being, particularly by considering age differences. The findings can be utilized to further research and deepen the knowledge on these topics.

Keywords: online vigilance, mental health, well-being, stress, sleep quality, age

Contents

Introduction.....	4
Online Media Use and Mental Health	5
The Current Study.....	7
Methods.....	7
Participants.....	7
Design	8
Materials	9
Procedure	10
Data Analysis	11
Results.....	12
Descriptive Statistics.....	12
Inferential Statistics	15
Discussion	19
Study Outcomes and Comparison to Previous Literature.....	20
Study Limitations.....	22
Study Strengths	23
Future Directions	24
Practical Applications	26
Conclusion	26
References.....	27
Appendix A.....	31
Appendix B.....	33
Appendix C	35
Appendix D.....	46
Appendix E	47
Appendix F.....	48
Appendix G.....	49

Introduction

Mobile internet technologies allow people all over the world to easily connect to one another over devices such as smartphones and laptops. Users can easily access all different sorts of media through the internet, both for entertainment as well as for enquiring information (Vorderer et al., 2016). The rapid increase in online media use over the past years has led users to believe that accessing online content and communicating with others through it are helpful means to satisfaction, which can be accomplished anywhere and at any moment (Reinecke et al., 2018). However, instead of using digital media for entertainment and information purposes only at specific moments, as originally intended, it has become normal for a large number of people to be online and connect with others almost permanently. Many individuals feel the need to stay in contact with others as much as possible, even while doing other, offline activities, for instance, at work or school (Klimmt et al., 2018). This has become particularly apparent since the COVID-19 pandemic, as it has led many people to increase their daily screen time and social media usage (Marciano et al., 2022).

Especially adolescents and young adults appear to be affected, as they are growing or have grown up in this digital environment (Reinecke et al., 2018). For instance, Marino et al. (2018) state that 2-10% of adolescents and young adults have been found to problematically use Facebook, and that this has been associated with several negative health outcomes, such as psychological distress and decreased well-being. When offline activities require high attention, split attention between this activity and the digital world often leads to weakened performance of the physical task (Vorderer et al., 2016). On the contrary, if the individual is alone and performing a low-attention task, such as waiting, the chance that they will reach for their smartphone or another device highly increases (Vorderer et al., 2016). Additionally, even in social environments, people appear to switch their attention from the physically present to online connections. This could potentially lead to compromises being made in the communication with persons in the physical social environment (Klimmt et al., 2018).

The previously described state is often referred to with the term *permanently online and permanently connected* (POPC). It can be expressed in two ways: 1) as apparent and extensive use of digital media, and 2) as a psychological connection towards online media in the form of vigilance. These types of connections can exist in a person simultaneously or separately (Vorderer et al., 2016). The POPC mindset can be defined as *online vigilance*, which is derived from the psychological term *vigilance* (“the ability to sustain attention to a task”, Reinecke et al., 2018, p. 2). Online vigilance consists of three sub-dimensions: salience, reactivity, and monitoring. Salience means that individuals think extensively and often about

their online environments, even when engaging in offline activities. Reactibility refers to the willingness to react to cues on their devices instantly, even if one would have to interfere with another task they are conducting. Lastly, monitoring concerns the tendency to intently pay attention to one's digital media environment, also during other offline activities. Persons with high online vigilance will score high on all three elements (Reinecke et al., 2018).

Another important concept that is related to POPC is the *fear of missing out* (FoMO). FoMO refers to the fear that one may miss information and occurrences that are deemed to be meaningful, necessary, or rewarding to them (Elhai et al., 2021). Several research outcomes suggest that people who exhibit FoMO oftentimes use online media more actively and intensely. Being online is seen as a form of self-regulation to make sure that they do not miss out on social activities (Beyens et al., 2016). Elhai et al. (2021) describe that individuals who experience FoMO regularly monitor their online networks and media to counteract or avoid their fear of missing out. However, this form of self-regulation has been associated with negative consequences such as decreased attention in daily life activities, which could lead to reduced productivity (Elhai et al., 2021).

Online Media Use and Mental Health

The effects of digital media use on mental health have been researched frequently. Johannes et al. (2021) mention that studies demonstrate that online media use only has a small impact on well-being. However, it is highlighted that most of these studies have solely investigated the behavioral component of digital media use rather than psychological connectedness towards online media (Johannes et al., 2021). Le Roux & Parry (2022) confirm this by stating that there is limited literature available that considers the effects of POPC on well-being. This is an important point because this indicates a lack of knowledge about whether online vigilance and mental health are related, and if they are, in which ways (Johannes et al., 2021). As digital media use continues to grow, it is highly relevant to examine what the effects of experiencing high online vigilance could be on mental health.

Mental health is a broad term and consists of many elements (Hall et al., 2021). Concerning existing literature, multiple studies have found a positive relationship between online media use and psychological distress, specifically among young adults and adolescents (Wolfers & Utz, 2022; Hall et al., 2021; Marino et al., 2018). In some cases, individuals can even experience symptoms of depression or anxiety because of excessive digital media use (Marino et al., 2018). Wolfers & Utz (2022) describe that social media can induce approval anxiety, which is a fear of appearing unattractive or unpopular to other online media users. Especially adolescents have been found to experience stress because of this, as many

individuals in this age group are insecure about their self-presentation (Wolfers & Utz, 2022). Furthermore, online media use has also been positively correlated to FoMO in multiple studies (Le Roux & Parry, 2022). As many users share positive experiences from their lives on social media platforms, people can perceive this as more enjoyable and interesting than their own experiences, leading to feelings of missing out on such events (Wolfers & Utz, 2022). Consequently, individuals with FoMO may experience stress when they feel like they are missing out, and therefore, they tend to spend more time online to stay connected with, e.g., their friends (Beyens et al., 2016). Although high stress levels have been linked to affected well-being, no studies have yet been found to directly investigate if online vigilance and stress are related, and in turn, how this potential relationship could affect overall mental health (Hall et al., 2021).

Furthermore, sleep quality is also a factor of mental health that has been studied numerous times, especially in relation to electronic media use before sleep (e.g., Exelmans & Van den Bulck, 2016; Fossum et al., 2014). Diverse studies repeatedly have shown that electronic media use at night has a negative effect on sleep (e.g., Shochat et al., 2010; Brautsch et al., 2023); it is consistently associated with sleep disturbances such as shorter sleep duration, insomnia symptoms, irregular sleep-wake patterns, daytime sleepiness, and fatigue (Exelmans & Van den Bulck, 2016; Fossum et al., 2014; Shochat et al., 2010; Brautsch et al., 2023). However, most available research has investigated the relationship between sleep quality and digital media use at night. There is still relatively little known about how sleep is impacted by online media use throughout the day, especially regarding online vigilance. One study found that poor sleep quality and high levels of smartphone use were related, but only behavioral aspects such as duration and frequency were considered (Demirci et al., 2015), and online vigilance was not. Moreover, poor sleep quality has been negatively associated with overall well-being (Shochat et al., 2010). For instance, Scott et al. (2021) indicate that the chance that people with sleep problems such as insomnia develop depression or anxiety is at least twice as big compared to persons without insomnia. As electronic media use at night has been found to impact sleep quality, it is relevant for this study to investigate if sleep quality and online vigilance are related, and how this could impact well-being.

Moreover, well-being in general is a component of mental health that has been researched often with regard to online media use. For instance, Marino et al. (2018) indicate that problematic Facebook use has frequently been negatively correlated with factors such as life satisfaction and overall well-being, especially with prolonged use. According to Johannes et al. (2021), several studies have shown similar associations between social media use and

mental health. Although such associations appear to be small, these results generally seem to be consistent (Johannes et al., 2021). Furthermore, the relationship between online vigilance specifically and well-being is being researched more often recently. However, there appear to be no studies yet that have investigated the relationship between these variables with stress and sleep quality as moderating variables. Therefore, it is still unclear if stress and affected sleep quality, induced by online media use, could lead to lowered overall well-being.

The Current Study

This paper aims to investigate the relationship between online media use and mental health, specifically focusing on online vigilance as a measure for online media use. Most studies so far have focused on examining how online vigilance affects adolescents and young adults. However, it seems that there are no studies yet that explicitly investigated other age groups, for instance, middle-aged adults. This is relevant to note, as this indicates that there is limited knowledge on how online vigilance affects such groups. Therefore, this study will consider both young adults (ages 18-30) and middle-aged adults (ages 31-65). This way, insight will be gained on whether there are significant differences in the outcomes of the two groups. Furthermore, as described above, there is still limited research available on how online vigilance is related to stress, sleep quality, and overall well-being. Literature regarding these topics is particularly scarce in The Netherlands and Germany. Thus, this paper will be centered around the following research question: “To what extent are online vigilance and stress, sleep quality, and overall well-being related among Dutch and German individuals aged 18 to 65?”

The hypotheses corresponding with the research question are: 1) online vigilance is positively associated with stress, 2) online vigilance is negatively associated with sleep quality, 3) online vigilance is negatively associated with overall well-being, 4) stress and sleep quality are moderators of the relationship between online vigilance and overall well-being, and 5) young adults score higher on online vigilance than middle-aged adults.

Methods

Participants

In total, 297 participants were recruited. After sample filtering, according to the exclusion criteria below, 167 individuals remained. Regarding gender, 124 participants identified as female, 42 as male, and 1 as a third gender. Their ages ranged between 18 and 64 years old ($M = 29.89$, $SD = 13.09$); 117 of them were considered young adults (aged 18-30), and 50 of them were considered middle-aged adults (aged 31-65). Additionally, 112 participants were German, 47 were Dutch, 6 were from another European country, and 2 were

from a non-European country. Furthermore, 97 participants indicated they were in a relationship, and 70 were not. The most common highest attained degrees of education were *High School* (76), *Graduate University Degree (master's or equivalent)* (33), and *University of Applied Sciences* (22); 36 participants obtained another degree.

Inclusion Criteria

To take part in this study, participants were required to be between the ages of 18 and 65. Additionally, they had to live in either The Netherlands or Germany, have sufficient English proficiency, and they had to use any form of digital media at least once per week.

Exclusion Criteria

Individuals that did not provide informed consent to participate, either at the start or at the end of the study, as well as participants that filled in an age below 18 or above 65, were excluded from this study.

Recruitment

Participants were recruited through convenience sampling. The research team shared a link to an online questionnaire with family members, friends, and fellow students who complied with the requirements for participation. Such individuals also shared the link to the survey with their acquaintances; therefore, snowball sampling was also utilized.

Furthermore, advertisements were designed to distribute the questionnaire to a broader audience. The advertisements included general information about the study: the research topic, requirements for and duration of participation, and the link or QR code to the survey (see Appendix A). The advertisements were distributed by the research team on public pages on social media platforms, for instance, LinkedIn and Instagram.

Lastly, the questionnaire was uploaded to SONA, which is a Psychology Test Subject Pool of the BMS faculty at the University of Twente. Via SONA, undergraduate Psychology students could access the survey and gain 0.25 SONA credits upon successful completion.

Design

This study had a cross-sectional design, which is an observational study type in which data from a sample is collected at one particular moment in time (Wang & Cheng, 2020). For H1-H3, the independent variable was online vigilance, and the dependent variables were stress, sleep quality, and overall well-being. Additionally, for H4, stress and sleep quality were potential moderators of the relationship between online vigilance and overall well-being. Lastly, for H5, age was identified as the independent variable and online vigilance was the dependent variable.

Materials

This study was conducted through an online questionnaire via Qualtrics. Participants filled in the questionnaire on their own desktop, laptop, or mobile device. The survey consisted of several types of questions: demographics, media habits, and questions regarding online vigilance, overall mental health, sleep quality, and stress. Additionally, questions about FoMO, generalized anxiety disorder, loneliness, and personality were incorporated. However, these variables were excluded from the analysis for the purpose of this paper.

Demographics and Media Habits

Demographic questions included information regarding participants' gender, age, nationality, relationship status, and education level. Media habits concerned the following three questions: "How many hours a day do you spend using *digital media* on average (e.g., your smartphone, laptop/PC, TV, tablet, etc.)?", "How many hours a day do you spend on any *social media platform* on average (e.g., Facebook, Instagram, TikTok, WhatsApp, Snapchat, YouTube, etc.)?", and "Which social media platform(s) do you use most frequently?". The answers to these questions were provided in a multiple-choice interval format. For the first two questions, participants could choose between "0-3 hours", "3-5 hours", "5-7 hours", etcetera, and for the last question, they could select multiple answers from different social media platforms, e.g., Instagram, TikTok, and YouTube.

Psychological Measures

Online Vigilance Scale (OVS). Online vigilance was assessed with the OVS. The OVS consists of 12 items measuring the sub-dimensions of online vigilance: salience, monitoring, and reactivity, which are all assessed with 4 items each. The items were answered on a 5-point Likert scale, ranging from 1 = "Does not apply at all" to 5 = "Fully applies". Total scores were obtained by summing the points of all items (ranging between 12 and 60). The subscales all have shown high internal consistencies (salience: $\alpha = .91$; reactivity $\alpha = .83$; monitoring: $\alpha = .91$), and there were also significant correlations between each of the sub-dimensions (ranging between $r = .52$ and $r = .66$, with $p < .01$). This indicates that persons high in online vigilance will score high on all three dimensions. Furthermore, the OVS showed acceptable convergent and discriminant validity (Reinecke et al., 2018).

Mental Health Continuum Short Form (MHC-SF). Overall well-being was examined with the MHC-SF, which consists of 14 items that measure diverse feelings of well-being. Items were answered on a 6-point Likert scale, ranging from 0 = "Never" to 5 = "Every day". This questionnaire contains three sub-dimensions of well-being, namely emotional well-being (3 items), psychological well-being (6 items), and social well-being (5 items); however,

for this study, only the total score was considered, which could be obtained by calculating the mean scores of all items (ranging between 0 and 5). The higher participants scored, the higher their well-being. Internal reliability for the total score is found to be high ($\alpha = .89$), and the questionnaire demonstrated convergent and discriminant validity (Lamers et al., 2010).

Pittsburgh Sleep Quality Index (PSQI). Sleep quality was measured through the PSQI. The PSQI is a self-report scale that consists of 19 items that evaluate sleep quality and sleep disturbances that participants experienced in the past month. The items are categorized into 7 components, namely: sleep latency, sleep duration, subjective sleep quality, habitual sleep efficiency, sleep disturbances, daytime dysfunction, and use of sleeping medication. Scores on each component were indicated on a 0 (no difficulty) to 3 (severe difficulty) scale; the sum of all components (ranging between 0 and 21) led to a global score that demonstrated overall sleep quality. A total score of 5 or higher was considered poor sleep quality. Good levels of internal homogeneity ($\alpha = .83$) and test-retest reliability ($r = .85$), as well as discriminant and concurrent validity, were identified for this scale (Buysse et al., 1989).

Perceived Stress Scale (PSS). Stress was evaluated with the PSS. This instrument consists of 10 items regarding feelings and thoughts in different situations that could lead to stress. Each item was to be answered on a 5-point Likert scale, ranging from 0 = “Never” to 4 = “Very often”. Total scores were calculated by summing the points of all items (ranging between 0 and 40). The higher the sum score, the more stress a person experienced; $PSS \geq 14$ indicated moderate stress, and $PSS \geq 27$ indicated high stress. The PSS has shown high internal reliability ($\alpha = .85$; Cohen et al., 1983) and factorial validity (Eun-Hyun Lee, 2012).

Procedure

After clicking on the link to the questionnaire, participants first viewed a “welcome” page with the title of the study. Then, on the next page, they were informed about the background and purpose of the research, as well as the requirements for participation. It was described that all information provided would be anonymized, participation was voluntary, withdrawal from the study would be possible at any moment without having to provide a reason, and all data would be removed in case of withdrawal. Additionally, contact details of the research team were provided in case of questions or remarks. After reading all the information, participants were asked to provide their informed consent to take part in the study (see Appendix B). If consent was not provided, participants were automatically redirected to the end of the study.

If consent was granted, demographic questions were inquired, including gender, age, nationality, relationship status, and education level. Then, three general questions about online

media use were asked. For instance, one of the questions was: “How many hours a day do you spend using *digital media* on average (e.g., your smartphone, laptop/PC, TV, tablet, etc.)?”. Subsequently, questions regarding the independent and dependent variables were presented in the following order: online vigilance (OVS), fear of missing out (FoMOs), overall well-being (MHC-SF), personality (BFI-10), sleep quality (PSQI), stress (PSS), loneliness (UCLA LS), and generalized anxiety disorder (GAD-7). Afterwards, participants were debriefed. A phone number and website for free online counselling were provided, in case participants experienced any discomfort as a result of taking part in the study. Additionally, the contact details of the researchers were stated, which could be utilized if there were questions or remarks about the study. After debriefing, participants were asked if they still provided consent to the researchers to use their provided data. Lastly, participants were given the opportunity to leave their email address in case they were interested in the results. It was also mentioned here that participants’ contact details would be stored separately from their previously administered data. The complete questionnaire can be found in Appendix C.

Participants filled in the questionnaire between April 9 and April 27, 2023. This study was approved by the Ethics Committee of the Faculty of Behavioral, Management, and Social Sciences at the University of Twente (approval number: 230333).

Data Analysis

For data analysis, the statistical program RStudio was used (version 2023.03.0+386). After importing the dataset, it was first cleaned: participants that did not provide consent to use their data and responses that did not fit with the requirements for participation were removed. Additionally, the variables that were irrelevant to this paper were deleted. All remaining variables appeared as character variables; therefore, they were converted into numeric or factor variables, depending on which variable it was.

Next, descriptive statistics were assessed. For age, online vigilance, stress, sleep quality, and overall well-being, mean scores and standard deviations were computed. The data regarding gender, nationality, relationship status, education level, and the three questions related to media habits were analyzed.

Furthermore, the outcomes of all main variables were reported as raw scores, with each question answered separately. Raw scores, such as “Does not apply at all”, were converted into numeric scores, each into their assigned number (e.g., “Does not apply at all” corresponds to a value of 1). For the PSS, the scores from negatively formulated items were reversed. Then, items that corresponded to the same questionnaire were grouped into a new variable by calculating a sum score or mean score, depending on the questionnaire.

Before hypothesis testing, four linear models were created to check the variables for normality, linearity, and homoscedasticity. For H1, H2, and H3, simple linear models were plotted, and for H4, a multiple linear model was created. Scatterplots were generated to visualize the models; H2 and H3 turned out not to meet all assumptions of linear regression, therefore, they were tested utilizing Spearman's rank correlation coefficient. H1 and H4 were tested by analyzing the linear regression models, as those met each assumption.

Lastly, to test H5, it was planned to conduct an independent t-test. Beforehand, participants were divided into two age groups: young adults (18-30) and middle-aged adults (31-65). Then, the assumption of normality was checked with the Shapiro-Wilk test and turned out to be violated. Thus, Wilcoxon's Rank-Sum test was conducted in which the mean online vigilance of young adults was compared to the mean of middle-aged adults. For H5, a boxplot was created to visualize the results.

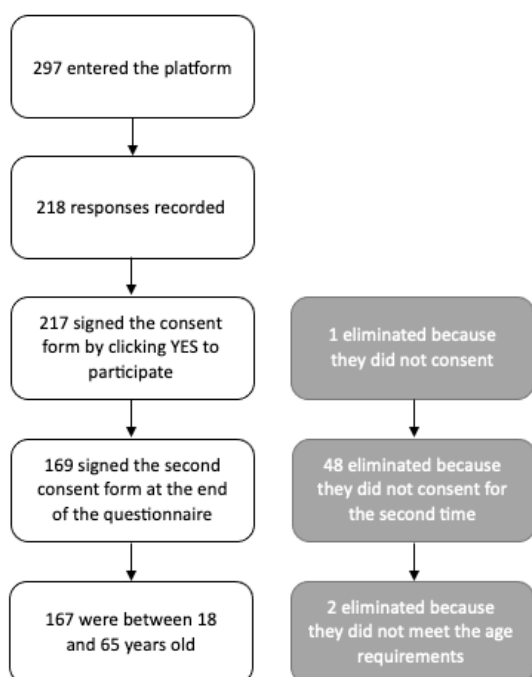
Results

Descriptive Statistics

From the sample of 297 individuals, 130 participants were excluded because they did not answer the survey, provide consent to participate, or meet the requirements for participation. A visualization of the sample filtering process is shown in Figure 1.

Figure 1

Sample Filtering Flow Chart



Note. Each number stands for the number of participants.

After sample filtering, first, the total scores of all numeric variables were calculated to plot them against each other to test for associations. Additionally, mean scores between young adults and middle-aged adults were to be compared. In Table 1, an overview of the mean scores (M) and standard deviations (SD) can be found per variable.

Table 1

Descriptive Statistics Numerical Variables

Variable	Age group	M	SD
Age	All participants	29.87	13.09
	Ages 18-30	22.09	2.57
	Ages 31-65	48.06	9.09
Online vigilance	All participants	28.65	9.09
	Ages 18-30	30.77	8.70
	Ages 31-65	23.68	8.06
Overall well-being	All participants	2.69	.79
	Ages 18-30	2.56	.78
	Ages 31-65	3.01	.73
Stress	All participants	17.66	7.19
	Ages 18-30	18.38	7.38
	Ages 31-65	16.00	6.49
Sleep quality	All participants	5.60	2.89
	Ages 18-30	5.55	2.74
	Ages 31-65	5.74	3.24

Note. Total scores of online vigilance (range 12-60), stress (range 0-40), and sleep quality (range 0-21) are sum scores, and the total score of overall well-being (range 0-5) is a mean score. For online vigilance, stress, and sleep quality, the higher the scores, the more affected participants were. For overall well-being, the lower the scores, the more affected participants were. All values are rounded off to two decimals.

Secondly, participants were also asked questions regarding media usage, namely the number of hours they spend using digital media and social media per day, and which social media platforms they use most frequently. The number of hours spent are reported in Table 2 and the responses regarding social media platforms are presented in Table 3.

Table 2*Hours Spent on Digital and Social Media*

Variable	Time	Number of responses		
		All participants	Ages 18-30	Ages 31-65
Hours spent on digital media per day	0-3 hours	33	13	20
	3-6 hours	60	42	18
	6-9 hours	50	42	8
	9-12 hours	20	17	3
	12-15 hours	3	3	0
	> 15 hours	1	0	1
Hours spent on social media per day	0-1 hour	34	8	26
	1-3 hours	92	72	20
	3-5 hours	28	24	4
	5-7 hours	11	11	0
	> 7 hours	2	2	0

Table 3*Most Frequently Used Social Media Platforms*

Social media platform	Number of responses		
	All participants	Ages 18-30	Ages 31-65
Instagram	102	67	35
WhatsApp	149	103	46
TikTok	34	24	10
Facebook	23	13	10
Snapchat	31	17	14
YouTube	92	64	28
Reddit	9	5	4
Twitter	9	6	3
Other	14	10	4

Note. Participants could select more than one answer for this question.

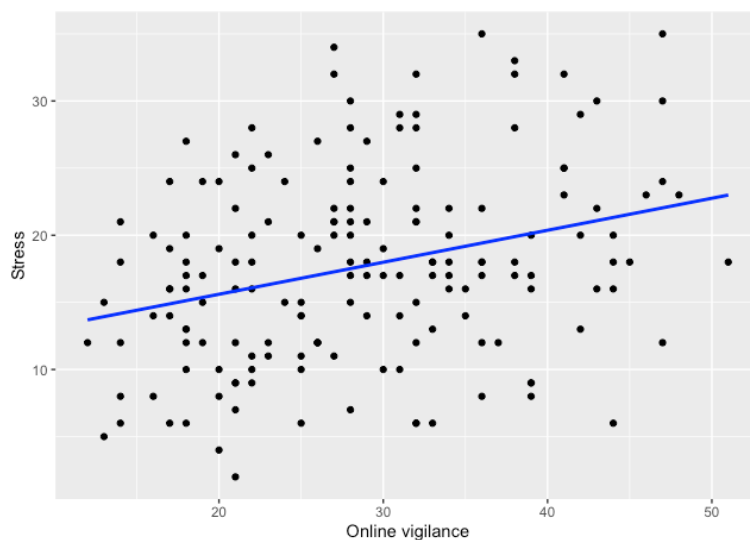
Inferential Statistics

For hypothesis testing, several types of tests were used. For H1, H2, H3, and H4, it was planned to conduct linear regression, and for H5, it was planned to conduct an independent t-test. Therefore, for the first four hypotheses, the assumptions of linear regression were tested: normality, linearity, and homoscedasticity. Normality was checked with Q-Q plots as well as histograms and the Shapiro-Wilk test, linearity was checked with Residuals vs Fitted Values plots, and homoscedasticity was checked with Scale-Location plots. The assumption of independence was not tested due to the cross-sectional nature of this study. For H5, the normality of the data was checked with the Shapiro-Wilk test before analysis.

For H1, online vigilance is positively associated with stress, none of the assumptions were violated (see Appendix D). Therefore, simple linear regression was conducted with an α of .05. The model was significant, $R^2 = .09$, $F(1, 165) = 16.49$, $p < .001$. This indicates that a significant positive relationship between online vigilance and stress was found, $\beta = .238$, $SE = .059$, $p < .001$, see Figure 2.

Figure 2

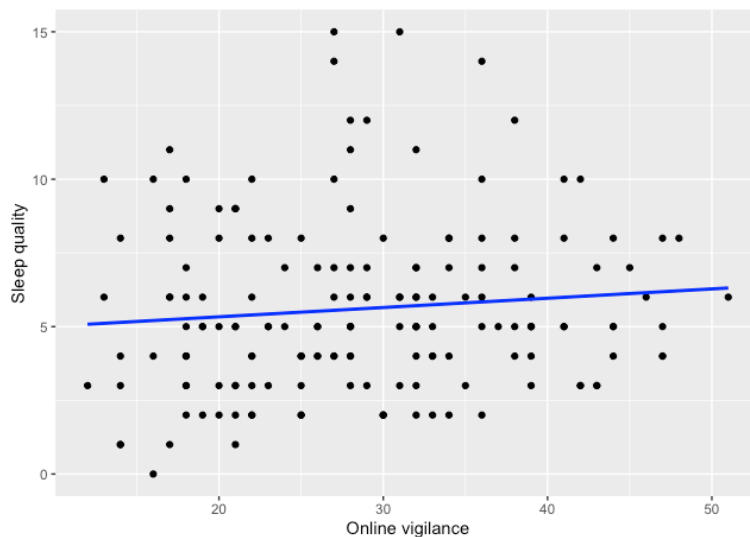
Relationship Between Total Scores of Online Vigilance (OVS) and Stress (PSS)



For H2, online vigilance is negatively associated with sleep quality, the assumption of normality was violated (see Appendix E). Therefore, non-parametric testing was required. Spearman's rank correlation coefficient was chosen, as this test fit the data the best. As high scoring on the PSQI indicates poor sleep quality, a positive correlation between OVS and PSQI scores was expected. Nevertheless, no significant association between online vigilance and affected sleep quality was found, $r(165) = .12, p = .121$, see Figure 3 for a visualization of the relationship.

Figure 3

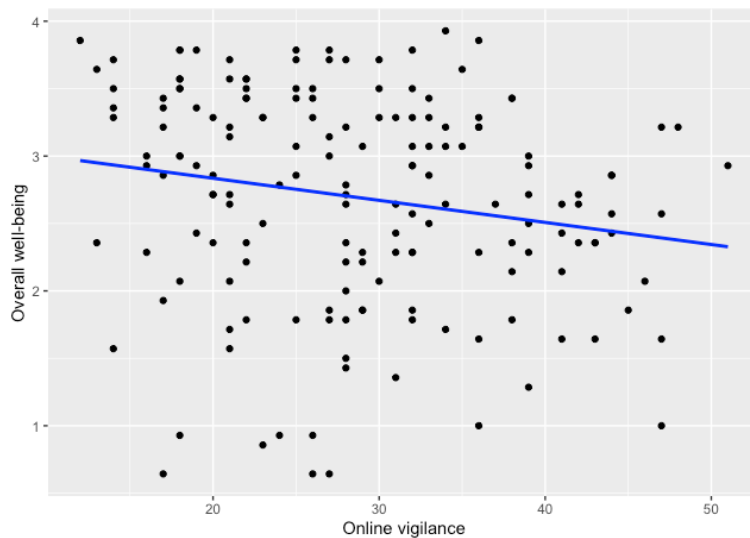
Relationship Between Total Scores of Online Vigilance (OVS) and Affected Sleep Quality (PSQI)



For H3, online vigilance is negatively associated with overall well-being, the assumption of homoscedasticity was slightly violated, and the assumption of normality was violated (see Appendix F). To test the relationship between online vigilance and overall well-being, Spearman's rank correlation coefficient was used. A significant negative relationship was found between these variables, $r(165) = -.23, p = .002$, see Figure 4.

Figure 4

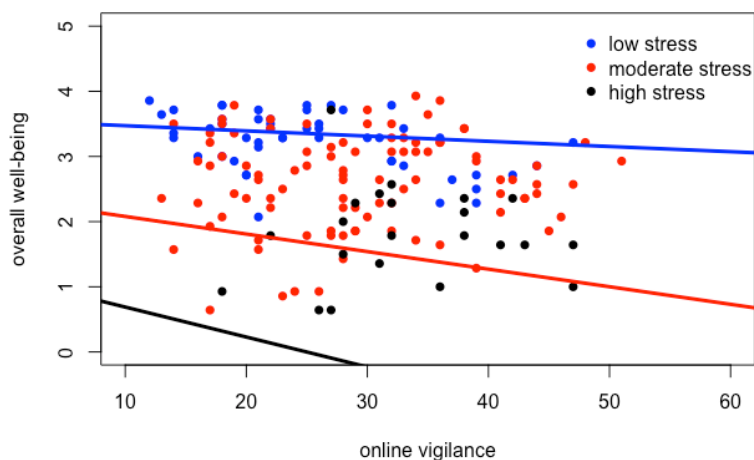
Relationship Between Total Scores of Online Vigilance (OVS) and Mean Scores of Overall Well-Being (MHC-SF)



For H4, stress and sleep quality are moderators of the relationship between online vigilance and overall well-being, a linear model was created in which both sleep quality and stress were included as potential moderators of the relationship between online vigilance and overall well-being. The moderator variables were converted into dummy variables, based on the cut-off scores that were previously identified. Then, the assumptions were tested, and none of them were violated (see Appendix G); thus, a multiple linear regression analysis was performed with an α of .05. The model was significant, $R^2 = .34$, $F(5, 161) = 16.73$, $p < .001$. However, neither stress nor sleep quality were significant moderators. For stress, $\beta = .019$, $SE = .010$, $p = .067$; for sleep quality, $\beta = -.016$, $SE = .013$, $p = .210$. See Figures 5 and 6 for visualizations of the results.

Figure 5

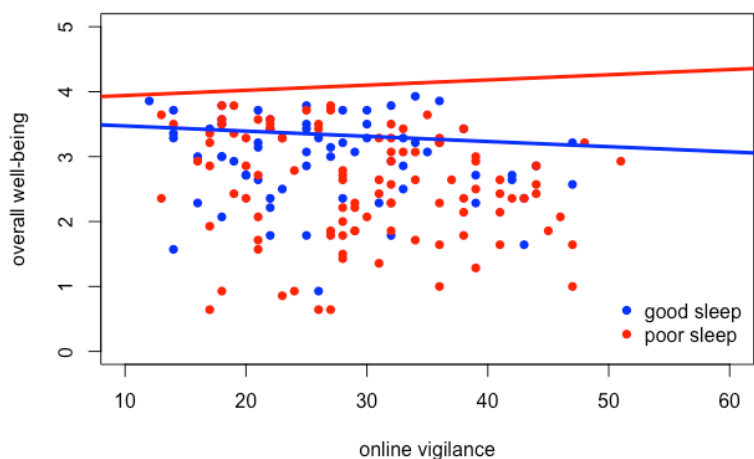
Relationship Between Total Scores of Online Vigilance (OVS) and Mean Scores of Overall Well-Being (MHC-SF), With Stress (PSS) as a Moderator



Note. The regression lines were plotted based on each category of stress (see legend). As the lines do not seem to be corresponding to the scores, this can be seen as additional confirmation that stress is not a significant moderator.

Figure 6

Relationship Between Total Scores of Online Vigilance (OVS) and Mean Scores of Overall Well-Being (MHC-SF), With Sleep Quality (PSQI) as a Moderator

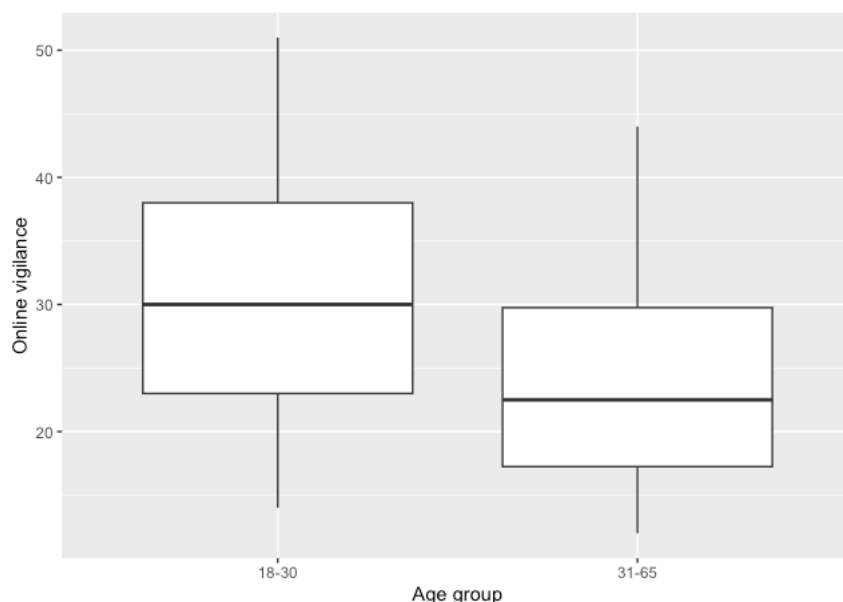


Note. The regression lines were plotted based on each category of sleep quality (see legend). As the lines do not seem to be corresponding to the scores, this can be seen as additional confirmation that sleep quality is not a significant moderator.

For H5, young adults score higher on online vigilance than middle-aged adults, the normality of the variables was checked with the Shapiro-Wilk test before conducting the independent t-test. For online vigilance, $p = .003$, and for age, $p < .001$, i.e., the normality assumption was violated for both variables. Consequently, the non-parametric alternative Wilcoxon's Rank-Sum test was selected for analysis. Age was converted into a dummy variable, as two groups were to be compared. The outcome showed a significant difference in mean online vigilance between young adults and middle-aged adults, $W = 27889$, $p < .001$, see Figure 7.

Figure 7

Relationship Between Total Scores of Online Vigilance (OVS) and Age Group



Note. The age group 18-30 is considered young adults, and the age group 31-65 is considered middle-aged adults.

Discussion

The purpose of this study was to investigate how online vigilance influences stress, sleep quality, and overall well-being. Furthermore, potential differences in online vigilance between young adults and middle-aged adults were explored. Consequently, the research question that this paper was centered around is: “To what extent are online vigilance and stress, sleep quality, and overall well-being related, among Dutch and German individuals aged 18 to 65?”. This question was to be answered through the following hypotheses: 1) online vigilance is positively associated with stress, 2) online vigilance is negatively associated with sleep quality, 3) online vigilance is negatively associated with overall well-

being, 4) stress and sleep quality are moderators of the relationship between online vigilance and overall well-being, and 5) young adults score higher on online vigilance than middle-aged adults. Results indicate that three of the five hypotheses could be accepted.

Study Outcomes and Comparison to Previous Literature

Descriptive Findings

Participants aged 18-30 (young adults) were more affected than participants aged 31-65 (middle-aged adults) regarding online vigilance, overall well-being, and stress. These findings replicate a study by Brailovskaia et al. (2022), which demonstrated that adults younger than 29 experienced higher stress, more excessive media use, and lower mental health than adults aged 29 or older. In contrast, for sleep quality, middle-aged adults were most affected; this finding is also consistent with previous studies (e.g., Madrid-Valero et al., 2017; Ohayon et al., 2004). Additionally, there were clear differences between the age groups when comparing the hours spent on digital media per day: most 18-30-year-old respondents selected “3-6 hours” or more, whereas most 31-65-year-olds reported spending at least 0-3 hours on digital media per day. Unsurprisingly, the total hours spent on social media per day showed similar results: young adults disclosed that they spent at least 1-3 hours per day on it, whereas middle-aged adults indicated their average time spent started at 0-1 hour per day. Moreover, there were no differences between the age groups regarding the most frequently used social media: the most used platforms in each age group were WhatsApp, Instagram, and YouTube. Based on these statistics, it can be concluded that young adults from this sample generally spend more time per day using digital and social media than middle-aged adults.

Main Findings

Firstly, it was found that individuals who exhibit higher levels of online vigilance also experience higher levels of stress. Therefore, H1 was accepted. Prior studies also found that online media use can lead to psychological distress (e.g., Wolfers & Utz, 2022). Thus, it can be stated that the current results are a replication of previous research outcomes. However, none of such studies directly examined the relationship between online vigilance and stress (Hall et al., 2021). Therefore, it can be concluded that the newly identified correlation is an expansion of existing literature and can be utilized as a starting point for future studies.

Secondly, no substantial relationship was found between online vigilance and poor sleep quality; H2 was rejected. A small correlation between the two variables was identified, but it was not strong enough to be significant. Although no previous studies regarding this relationship were found, this outcome contradicts a considerable amount of research that has shown that digital media use at night negatively affects sleep quality (e.g., Exelmans & Van

den Bulck, 2016). Possibly, this contrast is caused due to POPC being expressed in different ways: POPC is characterized either 1) as apparent and extensive use of digital media, or 2) as a psychological connection towards online media in the form of vigilance. These types of connections can exist in a person simultaneously or separately (Vorderer et al., 2016). In this study, POPC was measured through online vigilance, which only refers to the second definition of POPC. However, as online vigilance is still a relatively new construct, older studies likely only took behavioral aspects of media usage into account, such as screen time (Johannes et al., 2021). Since the current study is one of the first to consider psychological connectedness towards online media in relation to sleep quality, there remains a lack of knowledge as well as a need for more research on the topic.

Thirdly, it was found that, as predicted in H3, people high in online vigilance experience lower levels of overall well-being. This complements a large body of research, which has consistently proven that prolonged digital media use is linked to decreased well-being (e.g., Reinecke et al., 2017). However, such studies generally focus on behavioral aspects of online media use and do not consider online vigilance (Johannes et al., 2021). Although the findings from the current study are an addition to previous literature, this is relevant to note, as it indicates that more research must be conducted to confirm the relationship between online vigilance and decreased well-being.

Fourthly, outcomes indicated that neither stress nor sleep quality affected the relationship between online vigilance and overall well-being; H4 was rejected. No previous studies have been found regarding whether stress and lower sleep quality induced by online media use could lead to lowered overall well-being. However, based on previously found correlations between stress and well-being (e.g., Wolfers & Utz, 2022; Hall et al., 2021; Marino et al., 2018), and sleep quality and well-being (e.g., Brautsch et al., 2023; Demirci et al., 2015), it was expected that stress and sleep quality were moderators. Nevertheless, H4 was mostly exploratory, and for this sample, it was proven incorrect.

Lastly, study results demonstrate that young adults significantly score higher on online vigilance than middle-aged adults. Therefore, H5 was accepted. This outcome is critical, as most studies so far have only focused on examining how online vigilance affects adolescents and young adults (e.g., Marino et al., 2018; Wolfers & Utz, 2022). In other words, this is one of the first studies that explicitly investigated another age group's relation to online vigilance and additionally compared its outcomes to young adults. This can be seen as an interesting starting point for future studies, as it shows a distinction between the mean online vigilance of the two groups. Furthermore, results from H5 also indicate that young adults have a higher

sense of psychological connectedness to online media use. This could be related to the fact that this age group is the first to be growing up in a digital era (Reinecke et al., 2018), presumably leading individuals aged 18-30 to find extensive digital media use normal (Marino et al., 2018). However, evidence on this statement is limited, therefore, reasons for such differences could be explored more in future studies.

Study Limitations

Firstly, the sample of this study was very specific. It consisted of individuals living in The Netherlands and Germany, and one of the prerequisites was that they understand English. However, this prerequisite caused a large number of potential participants to be unable to participate, as individuals who do not have sufficient English proficiency, automatically got excluded. This led to the sample size being narrowed down significantly. Nevertheless, the study was conducted in English, as most of the questionnaires that were used were not available or validated in Dutch or German.

Secondly, the sample was relatively small for a cross-sectional study. Beforehand, a G*Power analysis was conducted with an α of .05, which indicated that a sample size of 185 participants would be suitable for the purpose of this study. However, the final sample consisted of only 167 individuals. The smaller sample size may have caused an over- or underestimation of outcomes, leading to possibly inaccurate results (Hackshaw, 2008).

In addition, the study was conducted with inhabitants of only two countries. Therefore, there was not controlled for cultural differences. Possibly, participants' cultural background might be a moderating variable; for instance, Cheng et al. (2021) found that social media addiction was twice as prevalent in collectivist countries as in individualist countries. Thus, the current study's outcomes may have been different if the sample consisted of people from a wider, more diverse range of countries.

Furthermore, there was an unequal division of male and female participants: approximately three-fourths of participants was female, and one-fourth was male. This study did not account for sex differences; however, internet addiction has been found to be significantly more prevalent among men compared to women (Shaw & Black, 2008). Therefore, it could be that male participants scored higher on online vigilance on average than female participants. Nevertheless, men were the minority in this study, which potentially may have led to an underestimation of the mean online vigilance score of the entire sample. Thus, it could be relevant to investigate if sex was a moderator or to find a way to recruit more male participants to even out the ratio between men and women. Moreover, slightly over two-thirds of the participants were young adults, and one-third were middle-aged adults. Although this

distribution was acceptable, it would be preferable to have an equal number of participants in each age group. This could be accomplished by creating new advertisements for participant recruitment in which a need for middle-aged adults is explicitly mentioned.

Lastly, almost half of the respondents that clicked on the link of the questionnaire did not finish the questionnaire until the end; 130 participants were removed during sample filtering. The most evident possible reason for this is that the questionnaire was too long. On average, it took participants 20-25 minutes to fill in, and for those less fluent in English, it likely took even longer. Sinkowitz-Cochran (2013) states that the response rate can significantly be affected if participants perceive the survey as lengthy; this is important to consider, as many potential or partial respondents eliminated themselves and consequently, additional, valuable data is missing.

Study Strengths

The study outcomes have contributed to the existing literature in several ways. Firstly, only a few previous studies have directly investigated the relationship between online vigilance and stress (e.g., Reinecke et al., 2018). Secondly, the effects of online vigilance on sleep quality had not been examined before. Therefore, the outcomes are a valuable addition to prior studies and can be utilized to further research and deepen the knowledge on these topics. Furthermore, this paper was also one of the first that considered online vigilance in an age group other than adolescents or young adults. This is relevant to note since remarkably little is known about the effects of online vigilance on such groups.

Additionally, literature regarding the relationships between digital media use and mental health factors, since the COVID-19 pandemic restrictions have been removed, is limited. Although several studies have examined the influence of the pandemic on behavioral components of online media use (e.g., Marciano et al., 2022; Kerekes et al., 2021; Munasinghe et al., 2020), its consequences on psychological connectedness to digital media are still scarcely researched. Thus, little is known about the effects of the pandemic on online vigilance levels, and in turn, how this impacts stress, sleep quality, and overall well-being. Moreover, this study's outcomes can be compared to findings from before the pandemic to examine the extent to which the pandemic has influenced the established relationships.

Furthermore, all questionnaires that were included in this study have good psychometric properties. Firstly, each of the surveys had an α ranging between .83 and .91, which indicates high internal reliability (Mohajan, 2017). Secondly, the applied questionnaires have extensively been validated (Reinecke et al., 2018; Lamers et al., 2010;

Buysse et al., 1989; Eun-Hyun Lee, 2012). Therefore, it can be concluded that this study's outcomes are a reliable and valid representation of the sample.

Moreover, the cross-sectional nature of this study also has several advantages. Firstly, this study was conducted in a relatively short time frame, without high expenses (Levin, 2006). The recruitment period was shorter than one month, which was enough to yield a satisfactory, somewhat large number of participants, considering the time that was spent on gathering them. Since the aim was to obtain information from participants at one specific moment in time, using a questionnaire to collect data was the most efficient approach, particularly because multiple variables were to be assessed (Wang & Cheng, 2020; Levin, 2006). This method also contributed to the inexpensiveness of this study, as conducting interviews would have been a more costly as well as more time-consuming alternative (Wang & Cheng, 2020).

Future Directions

Firstly, this study should be replicated on a larger scale and in different cultures to determine whether the outcomes can be generalized or if they are only sample-specific. Due to the issue with translated questionnaires, it may be best to gather data from more countries than only The Netherlands or Germany. For instance, one could start including other countries in Western Europe to broaden the scope, as there likely are no major cultural differences in such countries. Although this approach would not solve the current study's limitation regarding language barriers, more participants will be recruited, which decreases the importance of that limitation. Subsequently, another replication could expand the study to other continents as well to control for cultural differences. This could be accomplished by including nationality as a moderating variable. Nevertheless, it is also recommended to examine the extent to which the utilized surveys can be translated and validated. If the questionnaires are also validated in languages other than English, an even broader range of participants can be included in future replications of this study.

Furthermore, study outcomes showed that young adults spent more time per day using digital and social media than middle-aged adults. This could be related to the mean differences in online vigilance between the two groups; however, this was not analyzed in this paper. Existing literature regarding the relationships between online vigilance and media habits is scarce. For instance, Le Roux & Parry (2022) found that social media use significantly impacted online vigilance levels among university students, specifically for platforms where one can interact with others. Nevertheless, this was one of the first studies to investigate such a relationship, thus, in-depth knowledge on this topic is limited (Le Roux &

Parry, 2022). Therefore, it may be relevant for future studies to investigate whether and to what extent time spent on digital and social media impacts online vigilance, and whether age could be a moderator for this potential relationship. Moreover, since young adults showed higher psychological connectedness to online media than middle-aged adults, it might be of interest to also explore possible reasons for this difference.

In addition, although the mean scores of each measured variable were administered for both young adults and middle-aged adults, hypothesis testing was conducted only with the mean scores of the entire sample. Consequently, when comparing young adults to middle-aged adults, it is unclear whether there are significant differences in the strengths of each relationship. For instance, it could be that the correlation between online vigilance and stress is stronger for young adults than for middle-aged adults. To illustrate, a study by Reinecke et al. (2017) found that age was a moderator for the relationship between internet use and perceived stress. Since internet use is closely related to online vigilance (e.g., Klimmt et al., 2018), this is highly relevant to consider. The mean online vigilance in the current study was significantly higher for young adults, thus, this may have affected its relationships with stress, sleep quality, and overall well-being in a different way compared to middle-aged adults. Therefore, it is suggested to replicate this study while controlling for age as a moderator.

Future research could also investigate the impact of FoMO on online vigilance. Several studies have indicated that individuals high in FoMO increase their online media usage to counteract their fear of missing out (e.g., Beyens et al., 2016; Elhai et al., 2021; Le Roux & Parry, 2022). Although the behavioral effects of FoMO have been widely researched, there is limited knowledge about whether FoMO leads to higher psychological connectedness to digital media. Furthermore, FoMO has been positively related to stress (e.g., Beyens et al., 2016; Wolfers & Utz, 2022) and affected psychological well-being (Przybylski et al., 2013). Thus, it could also be interesting to examine the relationships between online vigilance, stress, and overall well-being with FoMO as a moderator.

Another factor that could possibly affect online vigilance levels is self-esteem. A study by Zhao et al. (2022) found that individuals with lower self-esteem were more likely to develop social media addiction. This is important to note, as extensive media use and online vigilance are associated; reduced self-esteem may therefore be a risk factor for developing high online vigilance. Additionally, low self-esteem has been linked to increased stress levels (Hubbs et al., 2012). Consequently, self-esteem could presumably affect the relationship between online vigilance and stress; thus, this is a potentially relevant variable to consider in future studies.

Lastly, since this was a cross-sectional study, no conclusions can be drawn about how online vigilance levels develop over time. Therefore, future research could conduct longitudinal studies to examine how this concept changes, for young adults as well as middle-aged adults. Additionally, if this study were to be replicated in, for instance, 10 years, it would be interesting to observe whether the outcomes are similar, or more/less extreme, since technology proceeds to be integrated into daily life to a greater extent as time continues.

Practical Applications

The most relevant outcome of this study that can be applied in practice is that young adults were most affected by online vigilance. One could provide psychoeducation to adolescents and young adults about media habits and their influence on well-being. Presumably, it would be preferable to provide this in high schools, as adolescents are most susceptible to developing unhealthy media usage patterns (Marin et al., 2021). By targeting this age group, one could prevent or at least limit such individuals from establishing high psychological connectedness towards digital media. However, although information provision is a beginning, it is unclear to what extent it will be successful in limiting the development of high online vigilance. Therefore, this psychoeducation would first have to be implemented in practice and researched before a claim about its effectiveness can be made.

Conclusion

This was one of the first studies that directly investigated the influence of online vigilance on stress, sleep quality, and overall well-being. A positive relationship was found between online vigilance and stress, and a negative relationship was found between online vigilance and overall well-being; additionally, a significant association between online vigilance levels and age was established. Furthermore, young adults were more affected than middle-aged adults regarding online vigilance, overall well-being, and stress. However, regarding sleep quality, middle-aged adults were most affected. Lastly, young adults spent more time per day using digital and social media than middle-aged adults. The study outcomes expand previous research about the effects of living in a POPC environment, and the findings initiate new opportunities to investigate the topic in more detail.

References

- Beyens I., Frison, E., & Eggermont, S. (2016). “I don’t want to miss a thing”: Adolescents’ fear of missing out and its relationship to adolescents’ social needs, Facebook use, and Facebook related stress. *Computers in Human Behavior*, 64, 1-8.
<https://doi.org/10.1016/j.chb.2016.05.083>
- Brailovskaia, J., Krasavtseva, Y., Kochetkov, Y., Tour, P., & Margraf, J. (2022). Social media use, mental health, and suicide-related outcomes in Russian women: A cross-sectional comparison between two age groups. *Women’s Health (London, England)*, 18.
<https://doi.org/10.1177/17455057221141292>
- Brautsch, L. A. S., Lund, L., Andersen, M. M., Jennum, P. J., Folker, A. P., & Andersen, S. (2023). Digital media use and sleep in late adolescence and young adulthood: A systematic review. *Sleep Medicine Reviews*, 68, Article 101742.
<https://doi.org/10.1016/j.smr.2022.101742>
- Buyse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Research*, 28(2), 193–213. [https://doi.org/10.1016/0165-1781\(89\)90047-4](https://doi.org/10.1016/0165-1781(89)90047-4)
- Cheng, C., Lau, Y., Chan, L., & Luk, J. W. (2021). Prevalence of social media addiction across 32 nations: Meta-analysis with subgroup analysis of classification schemes and cultural values. *Addictive Behaviors*, 117, Article 106845.
<https://doi.org/10.1016/j.addbeh.2021.106845>
- Cohen S., Kamarck T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, 24, 385–396.
<https://doi.org/10.2307/2136404>
- Demirci K., Akgönül, M., & Akpınar, A. (2015). *Journal of Behavioral Addictions*, 4(2), 85-92. <https://doi.org/10.1556/2006.4.2015.010>
- Elhai, J. D., Yang, H., & Montag, C. (2021). Fear of missing out (FOMO): overview, theoretical underpinnings, and literature review on relations with severity of negative affectivity and problematic technology use. *Brazilian Journal of Psychiatry*, 43(2), 203-209. <https://doi.org/10.1590/1516-4446-2020-0870>
- Eun-Hyun Lee, R. N. (2012). Review of the Psychometric Evidence of the Perceived Stress Scale. *Asian Nursing Research*, 6(4), 121-127. <https://doi.org/wj3>
- Exelmans, L., & Van den Bulck, J. (2016). Bedtime mobile phone use and sleep in adults. *Social Science & Medicine*, 148, 93-101. <https://doi.org/gdgzkg>

- Fossum, I. N., Nordnes, L. T., Storemark, S. S., Bjorvatn, B., & Pallesen, S. (2014). The association between use of electronic media in bed before going to sleep and insomnia symptoms, daytime sleepiness, morningness, and chronotype. *Behavioral Sleep Medicine, 12*(5), 343–357. <https://doi.org/10.1080/15402002.2013.819468>
- Hackshaw, A. (2008). Small studies: strengths and limitations. *Eur Respir J, 32*, 1141–1143. <https://doi.org/10.1183/09031936.00136408>
- Hall, J. A., Steele, R. G., Christofferson, J. L., & Mihailova, T. (2021). Development and initial evaluation of a multidimensional digital stress scale. *Psychological Assessment, 33*(3), 230–242. <https://doi.org/10.1037/pas0000979>
- Hubbs, A., Doyle, E. I., Bowden, R. G., & Doyle, R. D. (2012). Relationships among self-esteem, stress, and physical activity in college students. *Psychological Reports, 110*(2), 469–474. <https://doi.org/10.2466/02.07.09.PR0.110.2.469-474>
- Johannes, N., Meier, A., Reinecke, L., Ehlert, S., Nuranissa Setiawan, D., Walasek, N., Dienlin, T., Buijzen, M., & Veling, H. (2021). The relationship between online vigilance and affective well-being in everyday life: Combining smartphone logging with experience sampling. *Media Psychology, 24*(5), 581-605. <https://doi.org/10.1080/15213269.2020.1768122>
- Kerekes, N., Bador, K., Sfindla, A., Belaatar, M., Mzadi, A. E., Jovic, V., Damjanovic, R., Erlandsson, M., Nguyen, H. T. M., Nguyen, N. T. A., Ulberg, S. F., Kuch-Cecconi, R. H., Szombathyne Meszaros, Z., Stevanovic, D., Senhaji, M., Hedman Ahlström, B., & Zouini, B. (2021). Changes in Adolescents' Psychosocial Functioning and Well-Being as a Consequence of Long-Term COVID-19 Restrictions. *International Journal of Environmental Research and Public Health, 18*(16), Article 8755. <https://doi.org/10.3390/ijerph18168755>
- Klimmt, C., Hefner, D., Reinecke, L., Rieger, D., & Vorderer, P. (2018). The permanently online and permanently connected mind. Mapping the cognitive structures behind mobile Internet use. In P. Vorderer, D. Hefner, L. Reinecke & C. Klimmt (Eds.), *Permanently online, permanently connected. Living and communication in a POPC world* (pp. 18-28). New York: Routledge
- Lamers, S. M. A., Westerhof, G. J., Bohlmeijer, E. T., Ten Klooster, P. M., & Keyes, C. L. M. (2010). Evaluating the psychometric properties of the mental health Continuum-Short Form (MHC-SF). *Journal of Clinical Psychology, 67*(1), 99-110. <https://doi.org/10.1002/jclp.20741>

- Levin, K. A. (2006). Study design III: Cross-sectional studies. *Evidence-Based Dentistry*, 7, 24–25. <https://doi.org/10.1038/sj.ebd.6400375>
- Le Roux, D. B. & Parry, D. A. (2022). Investigating predictors of online vigilance among university students. *Information Technology & People*, 35(1), 27-45. <https://doi.org/10.1108/ITP-04-2020-0226>
- Madrid-Valero, J. J., Martínez-Selva, J. M., Ribeiro do Couto, B., Sánchez-Romera, J. F., & Ordoñana, J. R. (2017). Age and gender effects on the prevalence of poor sleep quality in the adult population. *Gaceta Sanitaria*, 31(1), 18-22. <https://doi.org/10.1016/j.gaceta.2016.05.013>
- Marciano L, Ostroumova M, Schulz P. J., & Camerini A-L. (2022). Digital Media Use and Adolescents' Mental Health During the Covid-19 Pandemic: A Systematic Review and Meta-Analysis. *Frontiers in Public Health*, 9, Article 793868. <https://doi.org/10.3389/fpubh.2021.793868>
- Marin, M. G., Nuñez, X., & de Almeida, R. M. M. (2021). Internet Addiction and Attention in Adolescents: A Systematic Review. *Cyberpsychology, behavior and social networking*, 24(4), 237–249. <https://doi.org/10.1089/cyber.2019.0698>
- Marino, C., Gini, G., Vieno, A., & Spada, M. M. (2018). The associations between problematic Facebook use, psychological distress and well-being among adolescents and young adults: A systematic review and meta-analysis. *Journal of Affective Disorders*, 226, 274-281. <https://doi.org/10.1016/j.jad.2017.10.007>
- Mohajan, H. K. (2017). Two Criteria for Good Measurements in Research: Validity and Reliability. *Annals of Spiru Haret University Economic Series*, 17(3), 58-82.
- Munasinghe, S., Sperandei, S., Freebairn, L., Conroy, E., Jani, H., Marjanovic, S., & Page, A. (2020). The Impact of Physical Distancing Policies During the COVID-19 Pandemic on Health and Well-Being Among Australian Adolescents. *The Journal of Adolescent Health*, 67(5), 653–661. <https://doi.org/10.1016/j.jadohealth.2020.08.008>
- Ohayon, M. M., Carskadon, M. A., Guilleminault, C., & Vitiello, M. V. (2004). Meta-analysis of quantitative sleep parameters from childhood to old age in healthy individuals: developing normative sleep values across the human lifespan. *Sleep*, 27(7), 1255–1273. <https://doi.org/10.1093/sleep/27.7.1255>
- Przybylski, A. K., Murayama, K., DeHaan C. R., Gladwell, V. (2013). Motivational, emotional, and behavioral correlates of fear of missing out. *Computers in Human Behavior*, 29(4), 1841-1848. <https://doi.org/10.1016/j.chb.2013.02.014>

- Reinecke, L., Aufenanger, S., Beutel, M. E., Dreier, M., Quiring, O., Stark, B., Wölfling, K., & Müller, K. W. (2017). Digital Stress over the Life Span: The Effects of Communication Load and Internet Multitasking on Perceived Stress and Psychological Health Impairments in a German Probability Sample. *Media Psychology*, 20(1), 90-115. <https://doi.org/10.1080/15213269.2015.1121832>
- Reinecke L., Klimmt C., Meier A., Reich S., Hefner D., Knop-Huelss K., Rieger D., & Vorderer P. (2018). Permanently online and permanently connected: Development and validation of the Online Vigilance Scale. *PLoS One*, 13(10), Article 0205384. <https://doi.org/10.1371/journal.pone.0205384>
- Scott, A. J., Webb, T. L., Martyn-St James, M., Rowse, G., & Weich, S. (2021). Improving sleep quality leads to better mental health: A meta-analysis of randomised controlled trials. *Sleep Medicine Reviews*, 60, Article 101556. <https://doi.org/gnft2m>
- Shaw, M., & Black, D. W. (2008). Internet addiction: definition, assessment, epidemiology and clinical management. *CNS drugs*, 22(5), 353–365. <https://doi.org/b8ts77>
- Shochat, T., Flint-Bretler, O., & Tzischinsky, O. (2010). Sleep patterns, electronic media exposure and daytime sleep-related behaviours among Israeli adolescents. *Acta Paediatrica*, 99(9), 1396-1400. <https://doi.org/10.1111/j.1651-2227.2010.01821.x>
- Sinkowitz-Cochran, R. L. (2013). Survey Design: To Ask or Not to Ask? That is the Question... *Clinical Infectious Diseases*, 56(8), 1159–1164. <https://doi.org/10.1093/cid/cit005>
- Vorderer, P., Krömer, N., & Schneider, F. M. (2016). Permanently online—Permanently connected: Explorations into university students' use of social media and mobile smart devices. *Computers in Human Behavior*, 63, 694-703. <https://doi.org/f82v7n>
- Wang, X., & Cheng, Z. (2020). Cross-Sectional Studies: Strengths, Weaknesses, and Recommendations. *Chest Journal*, 158(1), S65-S71. <https://doi.org/10.1016/j.chest.2020.03.012>
- Wolfers, L. N., & Utz, S. (2022). Social media use, stress and coping. *Current Opinion in Psychology*, 45, Article 101305. <https://doi.org/10.1016/j.copsyc.2022.101305>
- Zhao, J., Jia, T., Wang, X., Xiao, Y., & Wu, X. (2022). Risk Factors Associated With Social Media Addiction: An Exploratory Study. *Frontiers in Psychology*, 13, Article 837766. <https://doi.org/10.3389/fpsyg.2022.837766>

Appendix A

Advertisements for Participant Recruitment

Figure A1

Advertisement Design 1



**DO YOU HAVE PROBLEMS TO DISCONNECT?
DO YOU FEEL THE NEED TO ALWAYS BE ONLINE AND AVAILABLE?**

Then please help us in our research!

REQUIREMENTS

- 18-65 years old
- Living in Germany or the Netherlands
- Understanding English
- Using digital media at least once a week

TAKE PART NOW!
(20-25 MINUTES) 

https://utwentebs.eu.qualtrics.com/jfe/form/SV_cHcyqMkwNyxzrVvk

Figure A2

Advertisement Design 2



**Do you have problemes to disconnect?
Do you feel the need to always be online and available?**

Then please help us in our research!

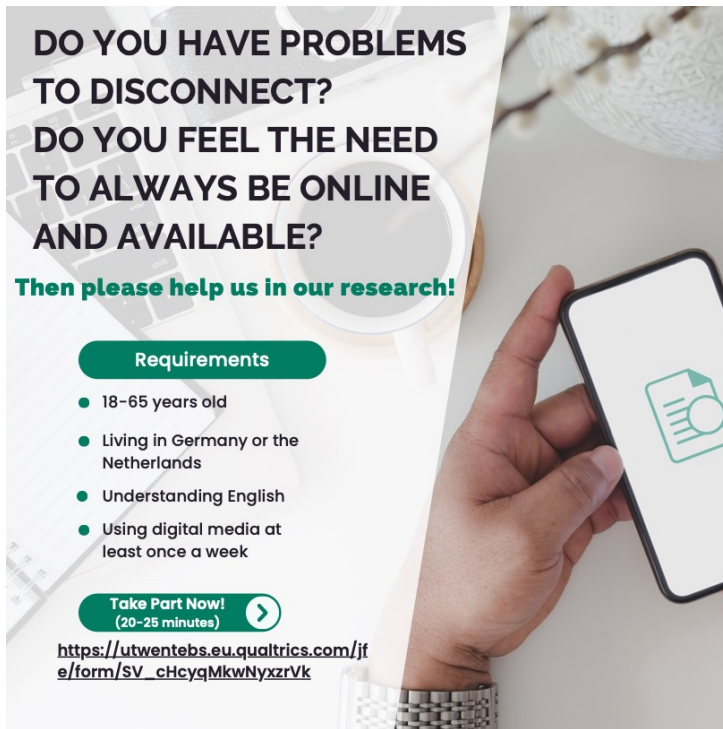
Requirements

- 18-65 years old
- Living in Germany or the Netherlands
- Understanding English
- Using digital media at least once a week

Take part in our online questionnaire (20-25 minutes)!



SCAN ME

Figure A3*Advertisement Design 3*


DO YOU HAVE PROBLEMS TO DISCONNECT? DO YOU FEEL THE NEED TO ALWAYS BE ONLINE AND AVAILABLE?

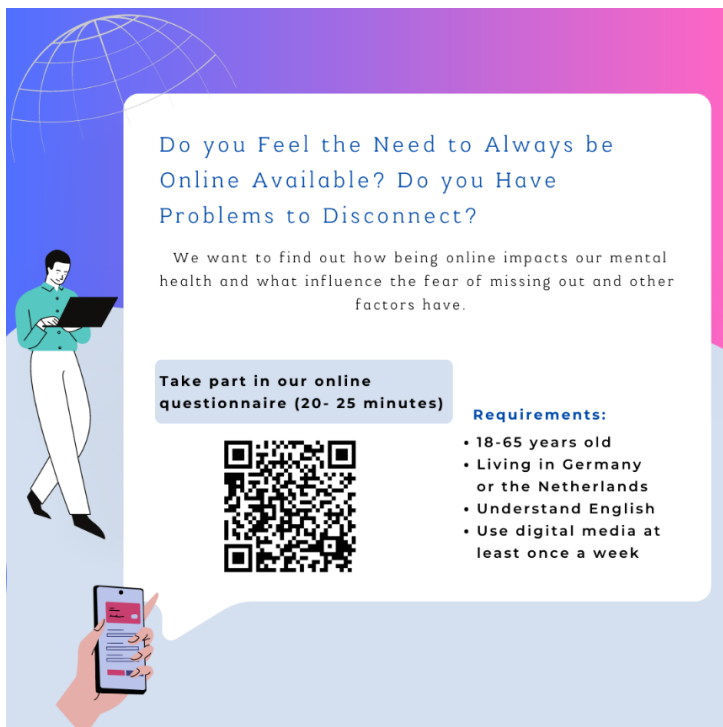
Then please help us in our research!

Requirements

- 18-65 years old
- Living in Germany or the Netherlands
- Understanding English
- Using digital media at least once a week

Take Part Now!
(20-25 minutes)

https://utwentebbs.eu.qualtrics.com/jfe/form/SV_cHcyqMkwNyxzrvk

Figure A4*Advertisement Design 4*


Do you Feel the Need to Always be Online Available? Do you Have Problems to Disconnect?

We want to find out how being online impacts our mental health and what influence the fear of missing out and other factors have.

Take part in our online questionnaire (20- 25 minutes)

Requirements:

- 18-65 years old
- Living in Germany or the Netherlands
- Understand English
- Use digital media at least once a week

Appendix B

Welcome and Informed Consent Form of Questionnaire

Welcome!

Thank you for participating in our study about the topic "Permanently Online - Permanently Connected and the Fear of Missing Out and its Impact on Mental Health".

Nowadays, many people are constantly online and available for digital media use. Social media apps are an important part of many people's everyday life. But what are the effects of constantly being online and why do we feel the psychological need to be connected?

This phenomenon of being permanently online and permanently connected (POPC) has different underlying reasons, the most common one being the fear of missing out. In this study, we request your support to answer the following questionnaires, for example regarding online vigilance, which is a term for psychological connectedness that people feel towards digital media use. The main purpose of this study is to investigate the effects of online vigilance (OVS) on overall mental well-being (MHC-SF), sleep quality (PSQI), loneliness (UCLA Loneliness scale), stress (PSS), personality (BFI10) and generalised anxiety disorder (GAD-7). This will be done with this online questionnaire. During this questionnaire general questions will be asked regarding different related topics, like your social media habits, your frequency of use or similar.

The study should take you around 20-25 minutes to complete. In order to take part in this study, you should be between 18 and 65 years old and live either in Germany or the Netherlands. Additionally, being able to answer this questionnaire in English is required and you should use online media apps (e.g., WhatsApp, Facebook, Instagram, online news, etc.) at least once a week.

Your participation in this research is voluntary and you have the right to withdraw at any point during the survey. If you choose to withdraw, by not answering the complete questionnaire, your data will be removed. All information you provide will be anonymized and therefore cannot be traced back to you. At the end of the questionnaire, you will once again be asked if you consent to your data being used or get the possibility to withdraw from the questionnaire, which will result in all your data being deleted.

This study has been reviewed and approved by the BMS Ethics Committee from the University of Twente (Approval Number 230333).

In case of any remarks or questions please contact:

Celine Rosen (E-Mail)

Lilli Baune (E-Mail)

Ninja Lehmann (E-Mail)

Michele Petkovski (E-Mail)

Supervisor: Alejandro Dominguez Rodriguez (E-Mail)

Informed consent

By clicking "Yes" below, I agree to the following:

- I have read the introduction of the study fully and I am aware of the purpose of this study.
 - I understand that information I provide will be used for study purposes only and will be anonymized.
 - I consent that my participation in this study is voluntary and I can withdraw from it at any time, without giving reasons.
 - I understand that in order to take part in this study, I am between 18 and 65 years old and I live either in Germany or the Netherlands. Additionally, I use online media applications or communication applications (like Instagram, WhatsApp, Tik Tok, online news, etc.) in my daily life at least once a week.
-
- Yes, I agree to participate in the study.
 - No, I do not agree (you will be directed to the end of the study).

Appendix C

Complete Questionnaire (Welcome and Informed Consent Excluded)

What is your gender?

- ☐ Male
- ☐ Female
- ☐ Non-binary / third gender

How old are you?

What is your nationality?

- ☐ Dutch
- ☐ German
- ☐ Other European country
- ☐ Non-European country

Are you in a relationship at the moment?

- ☐ Yes
- ☐ No

If yes, for how long?

- ☐ Less than a year
- ☐ Between 1 and 2 years
- ☐ Between 2 and 5 years
- ☐ More than 5 years

Please indicate your highest attained degree of education.

- ☐ Secondary school / high school / Weiterführende Schule
- ☐ MBO / Secondary vocational or technical school or college / Ausbildung
- ☐ HBO / University of Applied Sciences / Fachhochschule (e.g., Bachelor of Science/ Arts or equivalent)
- ☐ College / University / Universität - Undergraduate degree (e.g. Bachelor of Science/Arts or equivalent)
- ☐ College / University / Universität - Graduate degree (e.g. Master of Science/Arts or equivalent)

- Doctoral degree / PhD
- Other:

We will start with a few questions regarding your media habits. Please try to answer as accurately as possible. All answers will remain anonymous.

How many hours a day do you spend using *digital media* on average (e.g. your smartphone, laptop/PC, TV, tablet, etc.)?

- 0-3 hours
- 3-6 hours
- 6-9 hours
- 9-12 hours
- 12-15 hours
- More than 15 hours

How many hours a day do you spend on any *social media platform* on average (e.g. Facebook, Instagram, TikTok, WhatsApp, Snapchat, YouTube, etc.)?

- 0-1 hour
- 1-3 hours
- 3-5 hours
- 5-7 hours
- More than 7 hours

Which social media platform(s) do you use most frequently?

- ☐ Instagram
- ☐ WhatsApp
- ☐ TikTok
- ☐ Facebook
- ☐ Snapchat
- ☐ YouTube
- ☐ Reddit
- ☐ Twitter
- ☐ Other, please indicate:

The following questions are about how you personally handle online content. Here you will find statements that describe various forms of dealing with the Internet. When we say “online” or “the Internet”, we don’t refer to the Internet as a whole, but the content that you make use of on a regular basis (e.g., your WhatsApp or Snapchat contacts, your favorite websites, online communities, or social media). Please indicate how the following statements apply to you personally.

	1. Does not apply at all	2.	3.	4.	5. Fully applies
My thoughts often drift to online content.	☐	☐	☐	☐	☐
I have a hard time disengaging mentally from online content.	☐	☐	☐	☐	☐
Even when I am in a conversation with other people, I often think about what is happening online.	☐	☐	☐	☐	☐
Often online content occupies my thoughts, even as I am dealing with other things.	☐	☐	☐	☐	☐
I constantly monitor what is happening online.	☐	☐	☐	☐	☐
I often feel the urge to make sure I know what is happening online.	☐	☐	☐	☐	☐
I often start certain online applications so I don't miss out on any news.	☐	☐	☐	☐	☐
I always keep an eye on what is happening online at the moment.	☐	☐	☐	☐	☐

The following questions pertain to your personal reactions when you receive online messages (e.g., on your smartphone, laptop, or PC). When we say "online message" we refer to messages you receive on WhatsApp, Snapchat, Facebook, Twitter, or via E-Mails, as well as to push messages you receive from different applications (e.g., news apps, fitness apps, games, and learning apps). Please indicate how the following statements apply to you personally.

When I receive an online message...

	1. Does not apply at all	2.	3.	4.	5. Fully applies
My thoughts drift there immediately.	☐	☐	☐	☐	☐
It triggers an impulse in me to check it right away.	☐	☐	☐	☐	☐
I immediately attend to it, even if I am engaged in other things at that moment.	☐	☐	☐	☐	☐
I immediately give it my full attention.	☐	☐	☐	☐	☐

In the following, a collection of statements about your everyday experiences is presented. Using the scale provided, please indicate how true each statement is of your general experiences.

Please answer according to what really reflects your experiences, rather than what you think your experiences should be. Please treat each item separately from every other item.

	Not at all true	Slightly true	Moderately true	Very true of me	Extremely true
I fear others have more rewarding experiences than me.	☐	☐	☐	☐	☐
I fear my friends have more rewarding experiences than me.	☐	☐	☐	☐	☐
I get worried when I find out my friends are having fun without me.	☐	☐	☐	☐	☐
I get anxious when I don't know what my friends are up to.	☐	☐	☐	☐	☐
It is important that I understand my friends "in jokes".	☐	☐	☐	☐	☐
Sometimes, I wonder if I spend too much time keeping up with what is going on.	☐	☐	☐	☐	☐
It bothers me when I miss an opportunity to meet up with friends.	☐	☐	☐	☐	☐

That you had warm and trusting relationship with others	☐	☐	☐	☐	☐	☐
That you had experiences that challenge you to grow and become a better person	☐	☐	☐	☐	☐	☐
Confident to think or express your own ideas and opinions	☐	☐	☐	☐	☐	☐
That your life has a sense of direction or meaning to it	☐	☐	☐	☐	☐	☐

I see myself as someone who...

	Disagree strongly	Disagree a little	Neither agree nor disagree	Agree a little	Agree strongly
Is reserved	☐	☐	☐	☐	☐
Is generally trusting	☐	☐	☐	☐	☐
Tends to be lazy	☐	☐	☐	☐	☐
Is relaxed, handles stress well	☐	☐	☐	☐	☐
Has few artistic interests	☐	☐	☐	☐	☐
Is outgoing, sociable	☐	☐	☐	☐	☐
Tends to find fault with others	☐	☐	☐	☐	☐
Does a thorough job	☐	☐	☐	☐	☐
Gets nervous easily	☐	☐	☐	☐	☐
Has an active imagination	☐	☐	☐	☐	☐

The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month.

During the past month, what time have you usually gone to bed at night? Please round off to whole or half hours.

During the past month, how long (in minutes) has it usually taken you to fall asleep at night? Please round off to whole numbers.

During the past month, what time have you usually gotten up in the morning? Please round off to whole or half hours.

During the past month, how many hours of actual sleep did you get at night? This may be different than the number of hours you spent in bed. Please round off to whole or half hours.

During the past month, how often have you had trouble sleeping because you...

	not during the past month	less than once a week	once or twice a week	three or more times a week
Cannot get to sleep within 30 minutes	☐	☐	☐	☐
Wake up in the middle of the night or early morning	☐	☐	☐	☐
Have to get up to use the bathroom	☐	☐	☐	☐
Cannot breathe comfortably	☐	☐	☐	☐
Cough or snore loudly	☐	☐	☐	☐
Feel too cold	☐	☐	☐	☐
Feel too hot	☐	☐	☐	☐
Had bad dreams	☐	☐	☐	☐
Have pain	☐	☐	☐	☐

If you had trouble sleeping during the past month for other reasons than described above, please indicate here:

How often did you have trouble sleeping because of this reason during the past month?

- ☐ Not during the past month
- ☐ Less than once a week
- ☐ Once or twice a week
- ☐ Three or more times a week

During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?

- Not during the past month
- Less than once a week
- Once or twice a week
- Three or more times a week

During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

- No problem at all
- Only a very slight problem
- Somewhat of a problem
- A very big problem

During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?

- No problem at all
- Only a very slight problem
- Somewhat of a problem
- A very big problem

During the past month, how would you rate your sleep quality overall?

- Very good
- Fairly good
- Fairly bad
- Very bad

In the last month, how often have you...

	never	almost never	sometimes	fairly often	very often
Been upset because of something that happened unexpectedly?	☐	☐	☐	☐	☐
Felt that you were unable to control the important things in your life?	☐	☐	☐	☐	☐
Felt nervous and stressed?	☐	☐	☐	☐	☐
Felt confident about your ability to handle your personal problems?	☐	☐	☐	☐	☐
Felt that things were going your way?	☐	☐	☐	☐	☐
Found that you could not cope with all the things that you had to do?	☐	☐	☐	☒	☐
Been able to control irritations in your life?	☐	☐	☐	☐	☐
Felt that you were on top of things?	☐	☐	☐	☐	☐
Been angered because of things that happened that were outside of your control?	☐	☐	☐	☐	☐
Felt difficulties were piling up so high that you could not overcome them?	☐	☐	☐	☐	☐

Please indicate, how often those statements are descriptive of you.

	Never	Rarely	Sometimes	Often
I feel in tune with the people around me.	☐	☐	☐	☐
I lack companionship.	☐	☐	☐	☐
There is no one I can turn to.	☐	☐	☐	☐
I do not feel alone.	☐	☐	☐	☐
I feel part of a group of friends.	☐	☐	☐	☐
I have a lot in common with the people around me.	☐	☐	☐	☐
I am no longer close to anyone.	☐	☐	☐	☐

My interest and ideas are not shared by those around me.	☐	☐	☐	☐
I am an outgoing person.	☐	☐	☐	☐
There are people I feel close to.	☐	☐	☐	☐
I feel left out.	☐	☐	☐	☐
My social relationships are superficial.	☐	☐	☐	☐
No one really knows me well.	☐	☐	☐	☐
I feel isolated from others.	☐	☐	☐	☐
I can find companionship when I want it.	☐	☐	☐	☐
There are people who really understand me.	☐	☐	☐	☐
I am unhappy being so withdrawn.	☐	☐	☐	☐
People are around me, but not with me.	☐	☐	☐	☐
There are people I can talk to.	☐	☐	☐	☐
There are people I can turn to.	☐	☐	☐	☐

Over the last 2 weeks, how often have you been bothered by the following problems?

	Not at all	Several days	More than half the days	Nearly every day
Feeling nervous, anxious or on edge	☐	☐	☐	☐
Not being able to stop or control worrying	☐	☐	☐	☐
Worrying too much about different things	☐	☐	☐	☐
Trouble relaxing	☐	☐	☐	☐
Being so restless that it is hard to sit still	☐	☐	☐	☐
Becoming easily annoyed or irritable	☐	☐	☐	☐
Feeling afraid as if something awful might happen	☐	☐	☐	☐

You have reached the end of the survey, thank you for your participation!

If you felt any discomfort as a result of taking part in this survey after reviewing your social media habits, or one of the discussed factors, you can contact De Luisterlijn (+31(0)88 0767 000), which offers a free telephone counselling service, as well as an online chat function, in both English and Dutch (<https://www.deluisterlijn.nl/>).

For German speaking participants it is also possible to contact the "TelefonSeelsorge", both online (<https://online.telefonseelsorge.de/>), or via phone (+49 0800/111 0 111)

Students of the University of Twente can also contact the student psychologist at the University of Twente (phone number).

In case of questions or remarks please contact:

Celine Rosen (E-Mail)

Lilli Baune (E-Mail)

Ninja Lehmann (E-Mail)

Michele Petkovski (E-Mail)

Supervisor: Alejandro Dominguez Rodriguez (E-Mail)

All information leading back to you will be anonymized. All data entered will only be available for members of the research team and will be stored for two years. After you finish this questionnaire, your data will be analyzed and it is not possible to withdraw from the study.

By clicking yes, you consent again and allow us to analyze your anonymized data.

- ☐ Yes
- ☐ No

Research outcomes will be reported in an academic thesis, and also may be used for journal articles and/or scientific congress presentations. However, all data and information will remain anonymous!

Are you interested in a summary of the results? Feel free to leave your email address!
(Contact details will be stored separately for anonymization.)

Appendix D

Linear Regression Assumption Check, Hypothesis 1

Figure D1

Assumption of Linearity

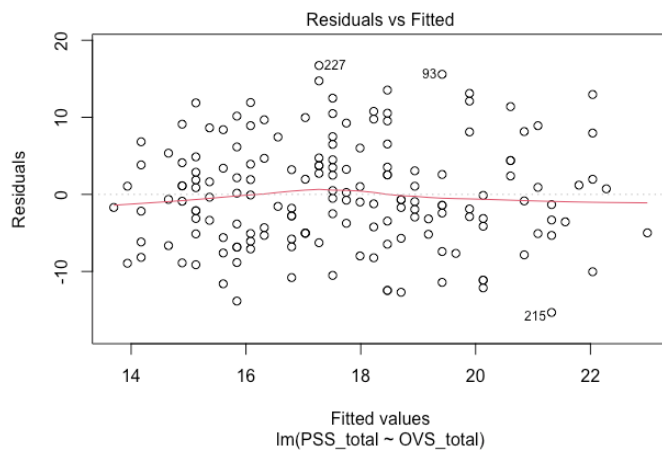


Figure D2

Assumption of Homoscedasticity

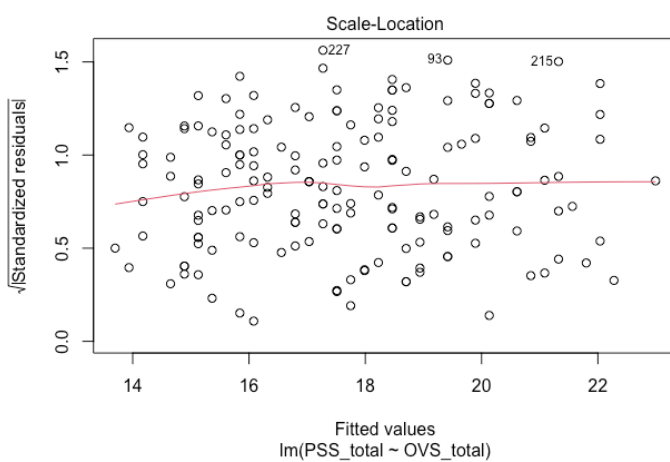
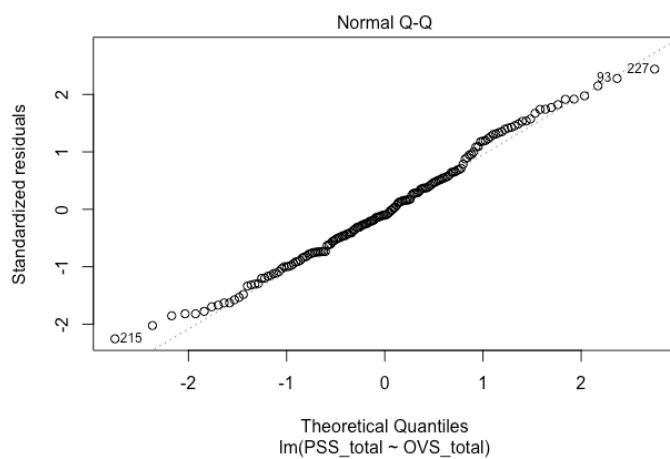


Figure D3

Assumption of Normality



Appendix E

Linear Regression Assumption Check, Hypothesis 2

Figure E1

Assumption of Linearity

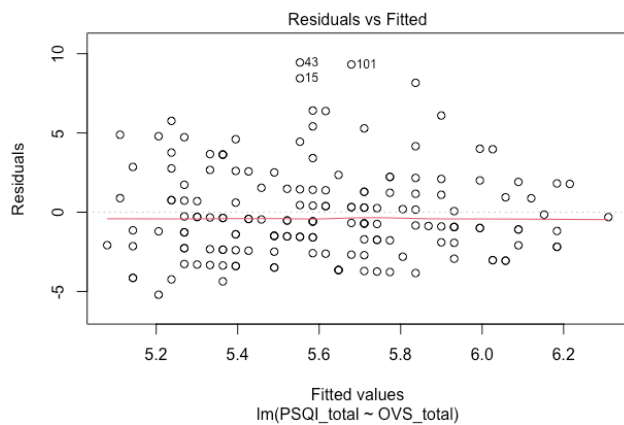


Figure E2

Assumption of Homoscedasticity

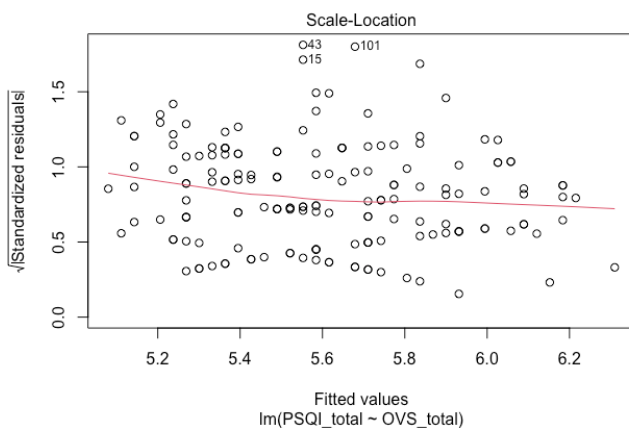
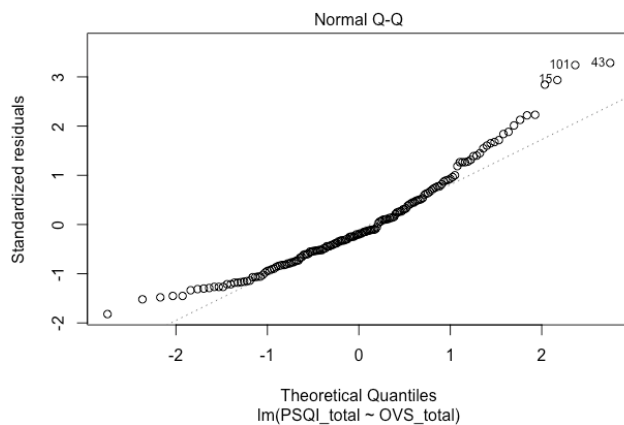


Figure E3

Assumption of Normality



Appendix F

Linear Regression Assumption Check, Hypothesis 3

Figure F1

Assumption of Linearity

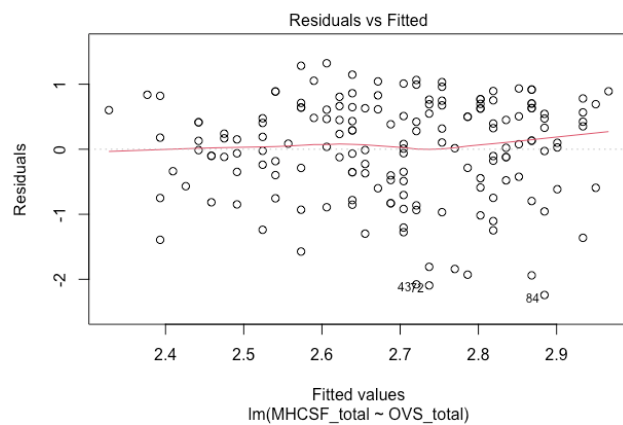


Figure F2

Assumption of Homoscedasticity

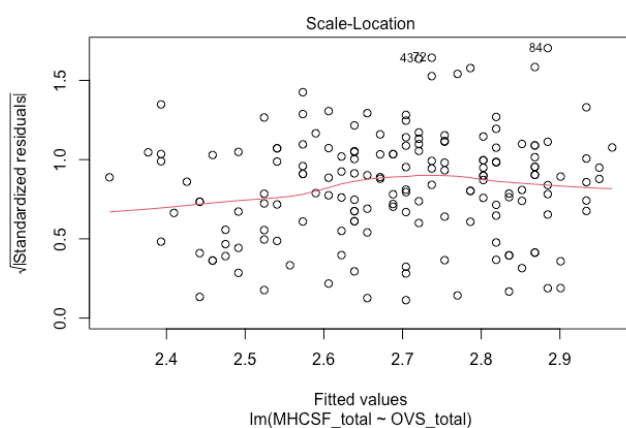
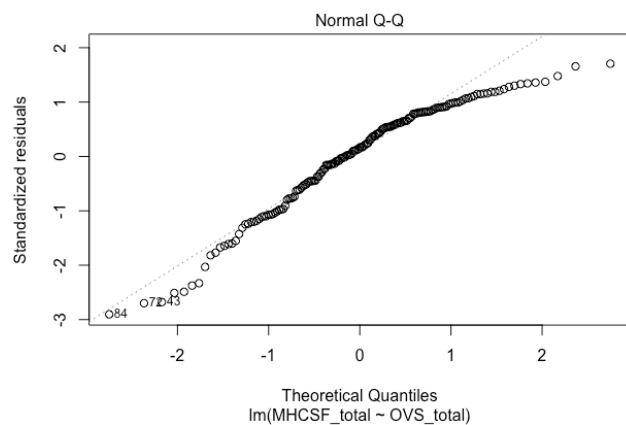


Figure F3

Assumption of Normality



Appendix G

Linear Regression Assumption Check, Hypothesis 4

Figure G1

Assumption of Linearity

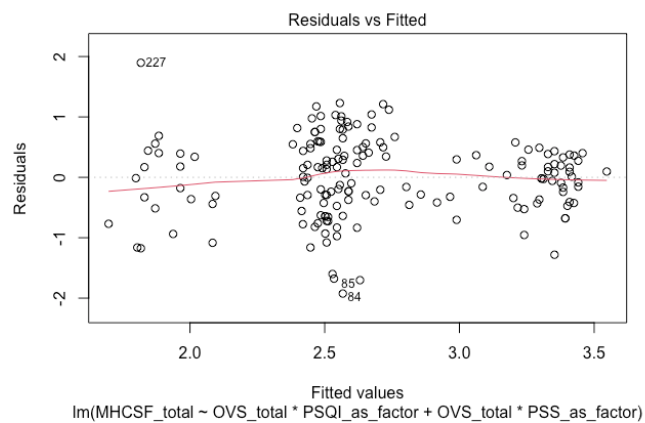


Figure G2

Assumption of Homoscedasticity

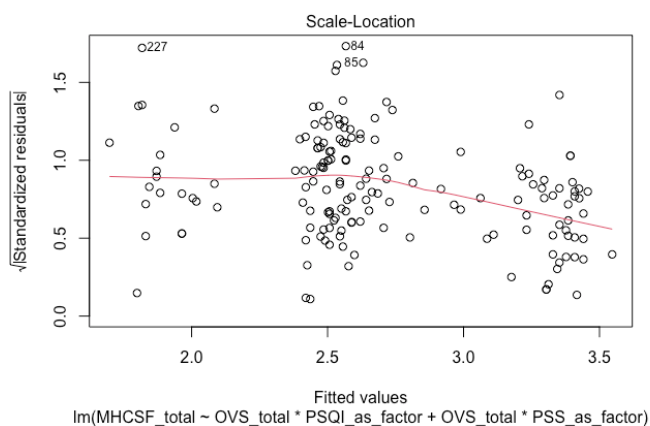


Figure G3

Assumption of Normality

