

Social Media and Cardiovascular Disease

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Personality subtypes and systolic blood pressure (SBP) at night are recognized predictors of cardiovascular disease among social media users. Healthy individuals (n=88, 77% female, 31% African American) were surveyed using the Media and Technology Usage and Attitudes Scale (MTUAS). Demographics, 24-hours SBP, and personality types (e.g., introvert, extrovert, and blended) were used. Personality (B= 5.37, t= 2.86, p=.005) significantly predicted elevated SBP in social media users (r²= .157, F(4, 72)=3.37, p=.014). There was a significant gradient increase in nighttime SBP by personality [introvert (M=100, SD=2.1), extrovert (M=102, SD=1.7), and blended (M=111, SD=4.4); all ps.<0.05]. Negative attitudes toward using technology (B= -5.093, t= -2.390, p= .019) also significantly predicted elevated overnight SBP. Higher anxiety/dependence with mobile phones (B=.400, t= 2.49, p=.019) significantly predicted elevated nighttime SBP [r² = 0.342 F(4, 27) = 3.505, p=.020]. Our findings indicate that a blended personality type and anxiety due to separation from or dependence on a mobile phone or internet use elevate SBP at night, increasing the risk of developing cardiovascular disease.

Keywords: personality, social media, cardiovascular disease, ambulatory blood pressure, cell phone

INTRODUCTION

Humans are undoubtedly social beings by nature, and this is evident in today's overreliance on technology use, in particular social media that creates "the awareness of being part of a social network" or extension of an in-person one, (Brailovskaia et al., 2019; Hampton et al., 2016). Human relations are able to serve as a strong predictor of health outcomes, such as the link between hypertension, burnout, and cardiovascular diseases. Excessive social media usage may induce chronic stress (Hampton et al., 2016; Lin et al., 2014; Uchino et al., 2016). For instance, Brailovskaia et al. (2019) looked at the relationship between daily stress, social support, and Facebook addiction disorder. With 309 Facebook users, they found that daily stress was positively related to the intensity of Facebook usage, which was negatively moderated by perceived offline social support. Therefore, with lower support, there was higher Facebook usage and increased stress. Life span relationship processes support this notion, seeing as age-associated risks for chronic conditions such as cardiovascular disease can be mediated by the use of social media networks (Uchino et al., 2016). Social media can be viewed as a vessel that human relations transcend through, creating a link between health outcomes and social media use, which may be mediated by personality (Hampton et al., 2016).

REVIEW OF LITERATURE

Having access to data from social media users all over the world allows social media to be a strong psychological assessor of well-being at the "(individual) and macro- (county) levels" (Guntuku et al., 2019). However, linguistic analysis of social media posts predicts that social media can also serve as a psychological or emotional stressor (Guntuku et al., 2019). For instance, "event-related stress has been predicted from social media posts about experiences such as travel and work" (Guntuku et al., 2019). Avoiding negativity is very difficult to attain, considering how much exposure we receive from social media daily. Generation Z youth are exposed to media more than any other activity besides sleeping, with 67 minutes per day up to 8 hours of media consumption daily (Turner, 2015). Research on social media does not account for the possibility of individual differences, such as disposition to chronic stress, or factors of personality traits, such as the tendency of upward/downward social comparison, which leads to emotional dependency on social media (Guntuku et al., 2019; Masood et al., 2020).

Younger individuals are shown to be more prone to enjoyment-seeking behaviors and social influence, which makes sense then why they are most at risk for stress-like symptoms from social media (Masood et al., 2020). Masood et al. (2020), examined the adverse consequences of excessive social networking site use on academic performance. They wanted to explain the underlying mechanisms for the stress perspective through theoretical methods: the transactional model of stress and the stressor-strain-outcome framework.

Results concluded that excessive use of social networking causes cognitive distraction, which therefore leads to lower academic performance.

Studies such as those by Andreassen & Pallesen (2014), Brailovskaia et al. (2019), Brailovskaia et al. (2017), and Marino et al. (2018) continue to support links between daily stress, social support social media use (Facebook) and addiction and have adopted the criteria and term created by Griffiths (2005) and Fenichel (2009) for Facebook Addictive Disorder (FAD). Accordingly, Brailovskaia et al. (2019) found that individuals who received low support offline were more likely to utilize Facebook, creating a higher dependency and, essentially, addiction. “Individuals who would often experience daily stress have been shown to use SNSs excessively to modify their mood” (Brailovskaia et al., 2019). This mood modification creates a bond that turns into a need to constantly stay online, as staying online creates a false sense of connection to others (Brailovskaia et al., 2019). Social media can also cause daily stress among low social media users due to lower technological competency, leading to chronic stress (Hampton et al., 2016). The pressure to keep in contact can be exhausting and becomes a chronic stressor (Hampton et al., 2016). Among heavy social media users, having this time spent online rather than in social situations or other settings of recreation can also lead to chronic stress (Hampton et al., 2016).

GEMEINSCHAFTSGEFÜHL THEORY IN PRACTICE

Social media use is closely tied to Alfred Adler’s most distinct concept of social interest (or Gemeinschaftsgefühl) (Turner, 2015). This theory supports the notion that social interest is a basic human need and necessary for individuals to develop and evolve (Adler, 1979, as cited in Turner, 2015). Social media is the bridge through which humans connect, thus confirming humans’ need for communication, a sense of community, and support. This sense of belonging accompanies online environment users through network communities. It is especially felt by Generation Z (Millennials) as they grew up with available information at the click of a button (i.e., individuals can look up information on any of their interests in the search bar) (Turner, 2015). For these individuals, technology is a primary means of relating to other human beings and, unfortunately, often a source of confirmation of self-worth through popularity on social media (i.e., likes on photos posted praising appearance). The social norm of constantly presenting public opinions promotes civic participation (Bers, 2010, as cited in Turner, 2015). These social media outlets allow individuals to meet new like-minded individuals, gather to discuss views, maintain touch with friends and family, find romantic partners, even organize civic protests, and receive education or therapy online (Xiaoging et al., 2013, as cited in Turner, 2015). If social media serves as a medium to promote social interest, how does it cause stress?

Generation Z, in particular, has formed a very close bond with social media, to the point of feeling “emotionally attached” to it. According to a study by Palley (2012), more than 90% of reporting participants stated that they would be upset to give up the internet as a punishment. They would be more upset to give up on cell phones or texting than punishments such as not receiving allowance money or not being allowed to buy new video games (Palley, 2012). This constant reliance on social media can support the Adlerian concept of social identity, as losing social media is a mirror to losing social presence and rewards for social presence. This is precisely the source of social media-related stress. Another reason is the comfort and self-esteem boost that social media provides today’s Generation Z, with the ease of speaking to individuals online in comparison to in-person (Turner, 2015). In fact, 60% of participants reported their social life begins online, 70% of participants reported that it is more convenient to talk to friends online than in real life, and 50% reported that they are more comfortable talking to strangers online than in real life (Palley, 2012). As a result, today’s social media includes information not only about occasional events in our life but also an expression of our identity and social interest. It fits our emotional voids and our need to belong by providing groups online who we interact with daily.

Studies show that “dopamine is released in the limbic system of the brains of video-game players, which may have the same effect on social media platforms comparable to levels released in amphetamine users” (Weinstein, 2010). However, not all individuals seek social interest via social media in the same manner. On the contrary, some individuals display immediate rewards by deviating from social interest

(social disinterest) through cyberbullying, shifting the paradigm of social media from a positive environment to a source of stress. The problem with social media-induced anxiety is that social media serves both as a perpetrator and a cure. But these are not healthy coping skills, as stated by Adler (1930), as cited in Turner (2015), “only such persons who are courageous, self-confident, and at home in the world can benefit both by the difficulties and by the advantages of life. They are never afraid. They know that there are difficulties, but they also know that they can overcome them”.

Social Media, Stress, and Cardiovascular Disease

The current study aimed to connect several facets (i.e., personality, attitudes, cell phone dependence, and other social factors) with social media usage and hypertension risk. In past studies, researchers also analyzed how factors such as the quality of social networks predicted age-related changes in cardiovascular reactivity to stress (i.e., Christenfeld & Gerin, 2000; Eichstaedt et al., 2015; Kreamsoulas & Anand, 2010; Uchino et al., 2016). For instance, Uchino et al. (2016) found older age to be tied to negative age-related changes in physiological flexibility. The number of ambivalent networks affects the increase in diastolic blood pressure reactivity (a supportive social network equated to higher reactivity). Indeed, social networking can create a sense of connection and more accessibility to online support. Yet, researchers found this false sense of connectedness can also elicit a sense of social isolation, where individuals have been shown to disengage from social connections, events, ties, and other social engagements. As a result, researchers explored the effects of perceived social isolation from social media and its links to deficits in the cardiovascular system, including but not limited to increased hypertension risk and coronary artery disease (i.e., Pantell et al., 2013; Valtorta et al., 2016). If replicated, these studies can demonstrate that negative social media interactions lead to increased social isolation, increasing the risk for deterioration of cardiovascular health. This study will show the impact technology, social media, cell phone dependence, and personality have on 24-hour ambulatory blood pressure.

METHODS

Procedure and Participants

Data was gathered from 88 healthy individuals (77% females; 31% African American), age range: 22-54, who were in general good health as indicated by self-report. Participants were recruited from three different age brackets to account for the variance in technology use across generations. Participants were recruited by flyers and word of mouth. Participation was fully voluntary. The study received full IRB approval and consent was collected during the visit. Anthropometric measurements were collected in an examination room and included height and weight, from which BMI was calculated.

MEASURES

Ambulatory Blood Pressure as an Indicator of Stress

In order to assess levels of daily stress with physiological outcomes, 24-hour blood pressure (BP) was measured with an ambulatory blood pressure monitor that was provided to each participant. This device took BP measures every 15 minutes during the day and every 30 minutes during the night. Instructions were given to each participant to wear the device for the full 24-hr period. This device was fitted to match the arm of each participant, the BP cuff was always placed on the non-dominant arm. Once the participant was wearing the device, the research associate would turn the device on and record the first measurement. The device would not be turned off until 24 hours have passed. The device would be returned to the lab the next day, and the data would be downloaded.

QUESTIONNAIRES

Several validated questionnaires were used and conducted using an iPad in a lab setting. SurveyMonkey was the survey tool used to collect this data. Participants were given an iPad to fill out the questionnaires.

This process ensured compliance. Rather than just sending the link to the survey to each participant, the participant completed the survey in the lab.

Fear of Missing Out Survey

The Fear of Missing Out Survey is conceptualized as the need to constantly be connected with or knowing what others are doing and having a persistent fear or worry that others have enjoyable experiences without them (Przybylski et al., 2012). The Fear of Missing out Scale (FoMOs) asks participants to indicate, using a Likert scale model (1-Not at all true of me, 2-Slightly true of me, 3-Moderately true of me, 4-Very true of me, 5-Extremely true of me) how true each of the 10 statements are. The statements are general everyday-type experiences, and participants are asked to reflect on each statement as separate entities from one another. This scale is meant to be personal and have the participants rate each statement based on their personal experiences. To calculate individual scores, average all responses from the ten items. A measure of reliability for this measure is between $\alpha = .87$ to $.90$ (Przybylski et al., 2012).

Need to Belong Survey

Leary et al. (2013) explain the need to belong as “a strong desire to form and maintain enduring interpersonal attachments.” The Need to Belong Scale uses a Likert scale model (1-Strongly disagree, 2-Moderately disagree, 3-Neither agree nor disagree, 4-Moderately agree, 5-Strongly agree) consisting of 10 statements. Participants were asked to indicate a number in which they agreed or disagreed with each of the 10 statements. In research conducted by Leary et al. (2013) with 15 adult samples, the NTBS possessed acceptable interitem reliability, with Cronbach’s alpha coefficients ranging from $.78$ -. 87 (median alpha = $.81$).

Social Media and Technology

To measure individual involvement and daily stress with media consumption, we used the *Media and Technology Usage and Attitude Scale (MTUAS)*, a non-experimental survey that measures the amount of social media exposure and use for each participant, as well as their perceived stress using cyber technology (Rosen et al., 2013). The design consists of two different Likert scales and five predictor variables, such as gender, age, SES, BMI, and attitudes. The usage portion had two parts with 44 questions on a 10-point Likert scale regarding the use of social media and technology (0=never, 10=all the time). The remaining 16 questions pertain to attitudes using technology on a five-point Likert scale (5=strongly agree, 1=strongly disagree). The survey was completed online. A score greater than 106 indicated low social media usage, a score from 159 to 279 indicated average social media usage, and a score greater than 280 showed high social media usage. Attitude ranged from negative to positive on a Likert scale. On the positive attitude scale, a score lower than 12 indicated a low positivity, a score from 13 to 23 indicated average positivity, and a score higher than 24 indicated high positivity. On the negative attitude scale, a score lower than 6 indicated low negativity, a score from 7 to 11 indicated average negativity, and a score higher than 12 indicated high negativity. The resultant 60-item measurement tool—the Media and Technology Usage and Attitudes Scale—includes 15 subscales, 11 measuring usage and four assessing attitudes with Cronbach’s alpha coefficients ranging from $.71$ to $.96$ (median alpha = $.85$) (Rosen et al., 2013).

Perceived Stress

We adapted the Perceived Stress Scale (PSS) by Cohen et al. (1983, 1988) to specifically measure stress regarding the use of technology. The adapted PSS scale had 10 questions on a five-point Likert scale regarding levels of stress experienced while using technology (0=never, 4=very often). The survey was completed online. A score less than 13 was an indicator of low stress perceived, a score between 13 and 19 was determined as average, and a score higher than 20 was considered an indicator of high stress perceived. Anxiety/dependence on technology was measured on the following score: a score lower than 6 indicated low anxiety/dependence, a score between 7 and 11 indicated a medium level of anxiety/dependence, and a score higher than 12 indicated a high level of anxiety/dependence. Task switching was marked on a scale where a score that was less 8 was considered low task-switching behavior, a score from 7 to 15 indicated

average task-switching behavior, and a score higher than 16 indicated high task-switching behavior. Internal consistency reliability for the PSS-10 total scores was adequate for the full sample ($\alpha = .82$) (Baik, 2019).

Personality and Blood Pressure

The association between personality and blood pressure was evaluated using an adaptive version of the Myers-Briggs Personality Assessment (MBTI). While this tool has many different variables, we only focused on extroversion, introversion, or ambivert (blended) personalities in this study. This variable was used as a predictor of social media stressors. The MBTI claims the assessment “has a 90% accuracy rating and a 90% average test-retest correlation, making it one of the most reliable and accurate personality assessments available. On retest, people come out with three to four type preferences the same 75% to 90% of the time. The reliabilities are quite good across most age and ethnic groups.” “The internal consistency has been measured by way of coefficient alphas, where scores for the continuous scales have been reported to range from 0.64 to 0.85 (Tzeng, 1984).

STATISTICAL ANALYSIS

Statistical analyses were conducted using a multivariate linear regression and logistic regression models to examine the predictive values of social media parameters to blood pressure. The models were adjusted for negative and positive attitudes, overall social media usage, and personality. Other factors, such as age, race, gender, technology usage, baseline systolic blood pressure, perceived stress, fear of missing out, and the need to belong, were also considered. All data analyses were performed using SPSS software version 24 (SPSS, IBM Corp.). A $p < 0.05$ was considered statistically significant.

Analytic Approach to Aim1

To identify the association between social media and mental stress, we used a G-power analysis using an F-test linear regression fixed model design, which determined the sample size ($N = 93$) with a medium effect size set at .15, an alpha of .05, and power at 80%, using a total of five predictors in an attempt to correctly identify risk factors. By identifying risk factors associated with elevated ambulatory blood pressure, we further elucidated the role of personality, attitudes about technology, and social media usage.

Analytic Approach to Aim 2

To identify the association between social media on cell phones, mental stress, and using the same power analysis above. A one-way ANOVA and correlations were used to examine the predictive values of social media parameters to blood pressure, and models were adjusted for age, race, gender, technology usage, baseline systolic blood pressure, and anxiety/ dependence.

RESULTS

Aim 1

Personality ($B = 5.37$, $t = 2.86$, $p = .005$) significantly predicted elevated overnight systolic blood pressure (SPB) in social media users after controlling for negative and positive attitudes and overall social media usage ($r^2 = .157$, $F(4, 72) = 3.37$, $p = .014$). Personality [introvert ($M = 100$, $SD = 2.1$), extrovert ($M = 102$, $SD = 1.7$), and blended ($M = 111$, $SD = 4.4$)] showed a significant gradient increase when compared to nighttime SPB; negative attitudes toward using technology ($B = -5.093$, $t = -2.390$, $p = .019$) also significantly predicted elevated overnight systolic blood pressure. Whereas positive attitudes toward using technology were not significant predictors ($B = -3.245$, $t = -1.220$, $p = .227$). “All technology usage” was not a predictor of overnight systolic blood pressure ($B = -4.909$, $t = -1.547$, $p = .126$) after controlling for personality and positive and negative attitudes.

Aim 2

Anxiety/Dependence on cell phone and internet use ($B=.400$, $t= 2.49$, $p=.019$) significantly predicts elevated overnight systolic blood pressure after controlling for task switching, negative attitudes, and perceived stress with the total model explaining 34% of the variance [$r^2 =.342$ $F(4, 27)= 3.505$, $p=.020$]. Using a one-way ANOVA, “The fear of missing out” [$F(1, 26)=8.726$, $p=.007$] significantly affects the amount of usage on social media.

FIGURE 1
NIGHT TIME BLOOD PRESSURE WITH HIGH AND LOW SOCIAL MEDIA USE

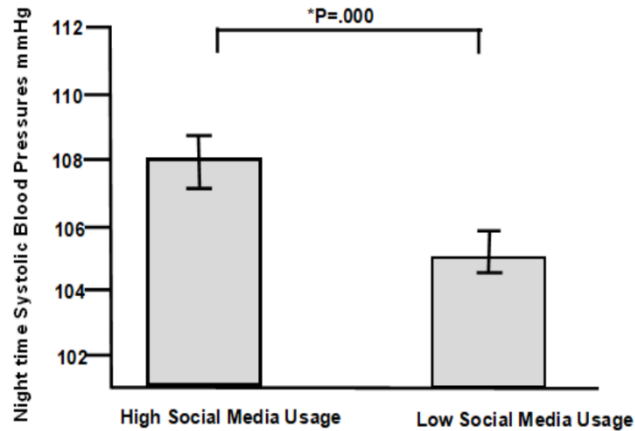
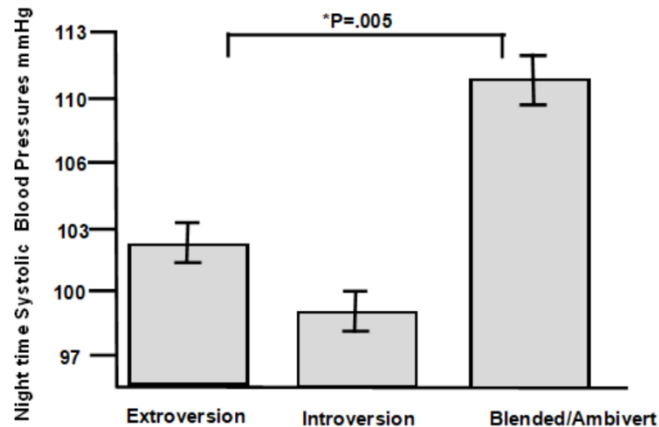


FIGURE 2
NIGHT TIME BLOOD PRESSURE WITH PERSONALITY



Participants who reported high social media use also showed higher nighttime blood pressure (Figure 1). In Figure 2, individuals with a blended personality type showed a significantly higher SBP at night compared to extroverted and introverted personality types. Younger participants reported experiencing more stress using social media than older participants (Figure 3).

FIGURE 3
SELF-REPORTED STRESS USING SOCIAL MEDIA

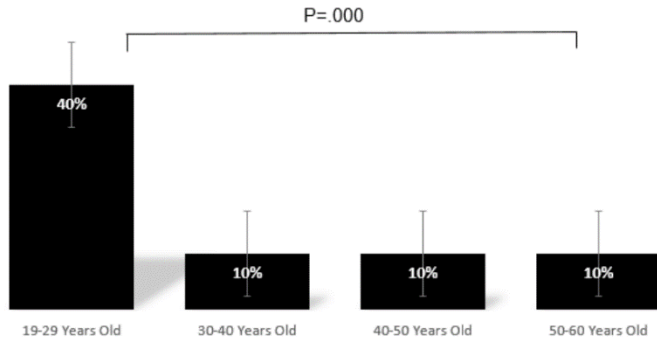


FIGURE 4
NIGHT TIME BLOOD PRESSURE WITH HIGH AND LOW ANXIETY AND DEPENDENCE ON CELL PHONE AND INTERNET USE

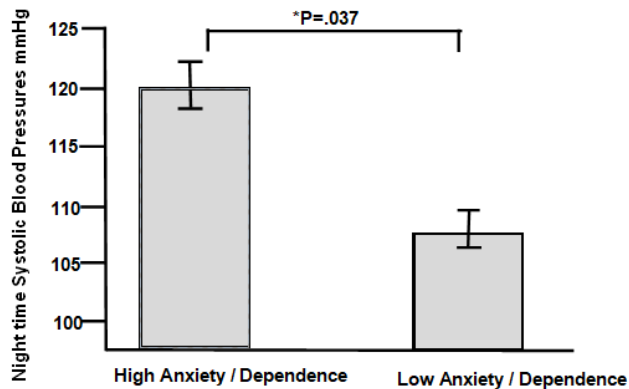


FIGURE 5
FEAR ON MISSING OUT ON SOCIAL MEDIA USAGE

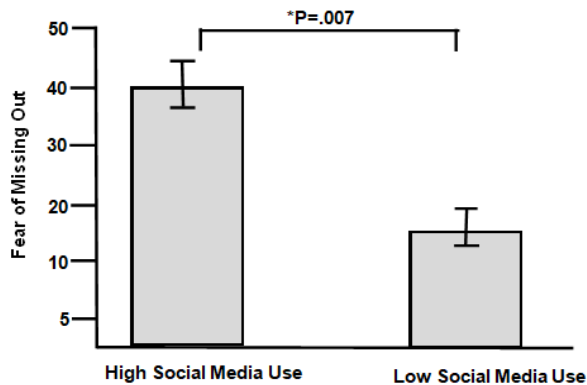


Figure 4 Shows high anxiety/dependence on mobile phones and the internet predicts increased SBP overnight. Figure 5 shows the Fear of Missing Out (FoMO) in relation to Social Media Usage. High social media usage is correlated with higher FoMO scores.

DISCUSSION

This research shows that those participants who engaged in social media activities throughout much of their day have an increased risk of cardiovascular disease (Figure 1). This risk is exacerbated by ambivert personality types, as shown in Figure 2. Individuals with extroverted and introverted traits (ambiverts) are usually skilled in “reading the room.” They are able to choose from one persona to another to fit the occasion, like a social chameleon. However, social media has changed the landscape for these individuals making it more difficult to react to the world around them (Özgülven & Mucan, 2013; Smith & Williams, 2020; van der Schuur et al., 2019). For example, someone with an ambivert personality type may post something on social media and then fret about how people may respond or accept it. This type of stress would not be an issue for an ambivert in a face-to-face conversation as they would already know what was appropriate. Social media has turned this into a guessing game for many. Figure 3 shows that the younger generation is more prone to stress over using social media. This may be because this kind of activity means more to this population than older cohorts.

Participants who reported higher anxiety and dependence on their mobile phones experienced increased overnight blood pressure, suggesting that being dependent on a smartphone or the internet can increase cardiovascular health deterioration. These findings align with other field studies reporting high anxiety among individuals who are absent from their mobile devices (Alt, 2015; Anderson, & Jiang, 2018; Beyens et al., 2016; Elhai et al., 2016; Primack et al., 2019). Participants who had a high Fear of Missing Out (FoMO) score also reported high social media usage, suggesting FoMO increases involvement with social media sites. Previous studies show that separating a person from their mobile phone increases heart rate (Cheever et al., 2014; Turel et al., 2018), possibly due to dependence on mobile phones. The association between FoMO and increased social media usage may also cause sleep disruption (Levenson et al., 2016), daily life activity disruption, or increased dependence on a mobile phone.

We chose the Gemeinschaftsgefühl Theory because it shows the importance of interconnectedness among populations. While on the surface, social media seems to connect people with each other globally; however, it does not meet that inherent need to belong and connect in a meaningful way. Instead, it is another source of anxiety and stress displayed throughout our lives. Over time this stress can become chronic and damage cardiovascular health.

Limitations

The population for this study was primarily made up of Generation Z and Generation X; therefore, it may not be generalized to the general population. The study took place in the stroke belt, where high blood pressure is particularly prevalent. Evidence suggests that this high prevalence of hypertension is linked to higher cardiovascular reactivity to stress (Treiber, 2003). We attempted to show social media stress in different age brackets; however, our study population was mostly made up of younger participants. We hope our findings will motivate the need for validation in a larger study across the lifespan.

Future Implications

Because most of our population consisted of young, healthy adults, the systolic blood pressures reported in our study do not show hypertension. However, high social media users show a significant elevation compared to those who do not regularly use social media. A longitudinal study with a time-series design is needed to show the chronic changes over time. Another approach for future studies would be to test various generations to assess age differences in anxiety/dependence on overnight blood pressure. A researcher could also expand the study to include individuals from various backgrounds (e.g., SES, education level, location) and assess mobile phone addiction through a survey and the relation to overnight blood pressure. Including social media as part of an individual’s subjective well-being and/or burnout may also have merit (Diener, Lucas, & Oishi, 2002; Halbert et al., 2020).

CONCLUSION

We found that increased social media usage combined with blended/ ambivert personality types were predictive of elevated nighttime systolic blood pressure. We also report that anxiety due to separation from or dependence on a mobile phone or internet use elevates ambulatory blood pressure overnight, while the fear of missing out causes increases social media usage. Therefore, these factors may be indicative of the future development of cardiovascular disease.

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