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BIDIRECTIONAL RELATIONSHIPS BETWEEN USE OF POPULAR SOCIAL MEDIA PLATFORMS AND ANXIETY, DEPRESSION, AND SOCIAL SUPPORT

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ABSTRACT

BIDIRECTIONAL RELATIONSHIPS BETWEEN USE OF POPULAR SOCIAL MEDIA PLATFORMS AND ANXIETY, DEPRESSION, AND SOCIAL SUPPORT

The relationship between social media use and mental health outcomes among young populations has been a cause for increasing concern in research. However, the directionality of these relationships remains ambiguous due to existing literature being largely cross-sectional and having limited focus on individual platforms. This study aimed to explore the bidirectional relationship between social media use across prominent platforms and various mental health-related outcomes among young adults. A sample of 203 young adults, ages 18-29, completed baseline and 6-month follow-up assessments measuring social media use across Instagram, TikTok, and Snapchat, as well as measures of depression, anxiety, and perceived friend support. Cross-lagged panel models were used to examine bidirectional associations between social media use and mental health variables over time. No significant cross-lagged effects were observed, indicating that social media use across the examined platforms did not predict changes in anxiety, depression, or perceived friend support over time, or vice versa. These findings are consistent with existing longitudinal literature, suggesting lack of associations between social media use and mental health outcomes when examined longitudinally. The results challenge prevalent narratives linking social media use to adverse mental health outcomes contributing to the evolving understanding of the relationship between social media use and mental health outcomes among young adults. These results emphasize the need for nuanced research approaches and policy development to promote positive mental well-being in the digital age.

Keywords: Instagram, Snapchat, TikTok, depression, anxiety, social support

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Introduction

Over the past decade, social media platforms have been on the rise, presenting a new frontier for the internet by providing users the ability to interact with individuals outside of their usual social sphere, as well as engaging in online content that may not be present in other forms of traditional media. Social media platforms vary broadly in their nature, from short form videos to text-based virtual blogs and private interpersonal chats. While their content is varied, these platforms tend to have a few basic structures in common. Boyd and Ellison (2007) state an early conceptualization of social media as:

> Web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection (follows, mutuals, etc.), and (3) view and traverse their list of connections and those made by others within the system (p.211).

This is reflective of the essence of present platforms, their primary emphasis being the creation of individual, autonomous profiles that can be used to connect with the profiles of others, to create their own content, and in turn consume content shared and created by other users.

Over time, use of these platforms has significantly increased. Since Facebook became publicly available, social media use by U.S. adults between ages 18-29 increased from 7% to 84% by 2021 (Auxier & Anderson, 2021). Several studies indicate approximately 97% of their young adult samples used social media regularly, with 81% frequenting these platforms daily (Auxier & Anderson, 2021; Knight-McCord et al., 2016; Perrin, 2015; Rideout & Fox, 2018). This significant rise in engagement could be a result of these platforms expanding beyond virtual social engagement outlets and into resources of information, virtual entertainment, representation of varied experiences, formation of online support groups, mediums for company marketing

strategies, and more (Cheung et al., 2020; Javed et al., 2020; Taylor et al., 2011). Another consideration is the increased quantity of social media platforms available; while initial research on the topic focused primarily on early sites like Facebook and Myspace, the recent uptick in social media use could be partially attributed to the development of newer platforms such as Instagram, TikTok, Snapchat, BeReal, and many more. Recent studies surveying U.S. adults found that for 18–29-year-olds, YouTube, Facebook, Instagram, Snapchat, and TikTok were the most frequently used (Auxier & Anderson, 2021; Vogels et al., 2022). They also stated that as of April 2023, BeReal was the fastest-growing media platform in the United States, and YouTube was the most popular with 95% of teens and young adults, followed by TikTok at 67%, Instagram at 62%, Snapchat at 59%, and Facebook at 32% (Auxier & Anderson, 2021; Vogels et al., 2022).

Relative to the increased implementation of social media in our society, researchers have become more invested in how these sites may affect mental health outcomes, particularly given increased rates of mental health issues in young people (Twenge, 2020; Swist et al., 2015). Between 2012 and 2020, one analysis indicated that across several studies, there appears to have been a significant increase in depression, self-harm, and suicide rates among US adolescents since 2012 (Twenge, 2020). A similar study, examining data from two national samples of college students, revealed a significant rise in the prevalence of negative mental health symptoms among students between 2007 and 2018; specifically, the percentage of students reporting symptoms related to depression increased by 34%, anxiety by 24%, suicidal ideation by 76%, suicide attempts by 58%, and self-injury by 47% (Duffy et al., 2019). Symptoms of depression among US students aged 13–18 years were shown to increase significantly from 2012 to 2018 according to another study using cross-sectional self-report data (Keyes et al., 2019).

Additionally, there was significant concern during the COVID-19 pandemic regarding the effects of social isolation and other effects of the pandemic on individual's mental wellbeing, especially with regards to children and adolescents, and how their development may be impacted (Di Cara et al., 2022; Lee et al., 2022). One study using a prospective-longitudinal cohort design found several mental health issues significantly increased during the pandemic, such as feelings of hopelessness, distrust, loneliness, and poor self-reported health (Shanahan et al., 2022). A similar study found that compared to lowered self-injury rates at the beginning of the pandemic, reported behaviors had returned to more severe, pre-pandemic rates by September of 2020, accompanied by a moderate increase in depressive symptoms (Ford et al., 2020). These results exacerbated the trend of worsening mental health for adolescents over the past few decades. Considering the recent impact of the COVID-19 pandemic, in conjunction with increased rates of social media use, there may be additional concern regarding adolescent wellbeing.

A primary emphasis in digital media focuses on young people's use and associated effects. Adolescence and young adulthood are developmentally critical periods for social engagement and peer relationships (Crone & Dahl, 2012; Somerville, 2013). Social and emotional elements play a significant role in shaping aspects of adolescent media engagement. Adolescents have been shown to have increased neural flexibility and adaptability traits, particularly within social contexts (Crone & Dahl, 2012). Adolescents and young adults often display quick adjustment to changes in society, which can encompass embracing emerging "trends" within culture (e.g., language, music, fashion, etc.; Nesi et. al., 2018). Adolescence and young adulthood are also periods that emphasize the influence of peer relationships and increased social priority and engagement (Somerville, 2013). Given increased social prioritization in conjunction with increased media use among adolescents and young adults

(Auxier & Anderson, 2021; Vogels et al., 2022), it is reasonable that use of these platforms would be popular among teens and young adults. This may lead young people to be especially prone to adverse reactions to social media. When engaged online, younger adults are more driven by information-seeking and self-expression, and therefore exhibit greater self-disclosure and a higher frequency of public communication than older adults and are exposed to a higher variety of content than reported by older adults (Chang et al., 2015; Swist et al., 2015). These patterns can lead to increased exposure to negative online content and interactions; while social media may serve as a venue for connection, it also can expose users to a plethora of issues like cyberbullying, sensitive or harmful content (e.g. self-harming, body shaming, promotion of disordered eating, etc.), and create an environment that promotes social comparison, which in turn can negatively influence mental wellbeing (Swist et al., 2015; Valkenburg et al., 2022b). The intersection of these ideas, teens increased motivations for social engagement and peer relationships accompanied by increased media use, creates a specific need to examine the associations between adolescent mental health and social media use and identify protective and risk factors.

Notably, social media use has been linked with several mental health-related issues. One meta-analysis found that there was a significant association between social media use and increased levels of depression, anxiety, and psychological distress in adolescents (Keles et al., 2020). Similarly, another meta-analysis found a small association between adolescent social media use and depression (Ivie et al., 2020). A similar study reflected these results when looking at Instagram use, suggesting that excessive use of platforms that emphasize social comparison led to higher levels of depression and anxiety in adolescents (Hwang, 2019). Additionally, a 2017 study identified a significant positive correlation between social media use and anxiety in

emerging adults: the more time individuals spent on social media platforms, the higher their reported levels of anxiety (Vannucci et al., 2017). They also found that specifically, frequent checking of social media and the fear of missing out (FOMO) on social events and experiences were associated with increased anxiety. Another element highlighted by researchers is the relationship between social media use and suicidality and self-injury. Nesi and colleagues (2021) conducted a comprehensive review investigating the association between social media use and self-injurious thoughts, self-harm, and suicide ideation. The results of the review indicated a significant positive association between social media use and each suicide-related outcome, showing individuals who engage in higher levels of social media use are more likely to experience self-harm and suicidal ideation. Furthermore, a similar study indicated that social media content itself may encourage maladaptive behaviors, finding increased online social networking led to increased exposure and engagement in self-harm behavior (Memon et al., 2018). This was attributed to user exposure to negative online content, such as receiving negative messages promoting self-harm, emulating self-injurious behavior of others, and adopting self-harm practices from shared videos.

The recent effects of the COVID-19 pandemic may be additional cause for concern regarding well-being and increased use of social media (Daly et al., 2022; Di Cara et al., 2022; Lee et al., 2022). Several studies have demonstrated a positive relation between media exposure related to COVID-19 and symptoms of depression and anxiety in samples obtained in China and Spain (Fullana et al., 2020; Gao et al., 2022; Wang et al., 2020). Additionally, a meta-analysis that collected and analyzed data from 14 cross-sectional studies indicated a significant association between social media use and mental health in young adults during the COVID-19 pandemic (Lee et al., 2022). Specifically, excessive social media use was linked to higher levels

of depression, anxiety, and stress. The study also found that exposure to COVID-19-related information and misinformation on social media platforms was associated with increased mental health problems. These results illustrate how the effects of social media on mental health have been significantly impacted by the events of COVID-19, presenting unique perspectives of these effects that may have been otherwise overlooked. Combined, this literature illustrates potential links between social media use and an array of psychological problems.

However, in contrast to this literature, there have also been many studies that fail to identify a significant relationship between worse mental health and greater social media use. In an empirical reply to Twenge et al., (2018), Heffer and colleagues (2019) conducted a longitudinal study with a large sample of adolescents and young adults, measuring social media use and depressive symptoms for two cohorts surveyed annually; one group was surveyed over two years and the other across six years. Their findings indicated non-significant associations between social media use and depressive symptoms among adolescents and young adults across time. Beyens and colleagues (2020) measured potential effects of social media use on affective wellbeing in adolescents by taking reports of well-being and minutes of social media use six times a day over a one-week period. They found 44% felt neutral after use, 46% felt better after use, and 10% felt worse. Overall social media use was not associated with well-being. Similarly, an eight-year longitudinal study failed to find a relationship between social media use and increased depression or anxiety symptoms (Coyne et al., 2020). Another study using ecological momentary assessment found that on days when participants used social media more than they typically did, individuals did not experience worsened depression, anxiety, or social isolation (Sewall et al., 2022). Valkenburg and colleagues (2022a) reported that that the relationship between social media use and well-being is multifaceted and may not be solely negative or

positive. This may partly explain the inconclusive findings in the literature. These articles show the mixed nature of literature on this topic, indicating a need for additional research to elucidate these relationships.

In line with the points noted above, use of social media may also have positive outcomes. One element to consider in this literature is that given the social nature of these platforms, one source of appeal may be access to virtual social networks as a potential venue of social support. Significant amounts of literature indicate the protective capacities of perceived social support when protecting mental wellbeing, recovering from stressors, and buffering numerous negative mental health outcomes (Arató et al., 2022; Brinker & Cheruvu, 2017; Bukhari & Afzal, 2017; Rueger et al., 2016). Many researchers have attributed this link to the stress-buffering theory of social support, which asserts that social support protects against or moderates the detrimental effects of life stress on mental health (Cohen, 2004; Thoits, 2011). With increased use of social media platforms, this may indicate a new method of seeking support via virtual social connections or media content; some researchers see the appeal of social media being its opportunities for social connection, self-expression, and emotional support, contributing to positive well-being outcomes that may impact the negative effects associated with media use (Bekalu et al., 2019; Caplan, 2006; Valkenburg et al., 2022a). One meta-analysis identified several benefits of online social media engagement for adolescents, including the motivation to connect with others, in turn reaping the benefits of perceived social support through these venues (Swist et al., 2015). Additionally, a study by Wolfer and Schneider (2021) indicated that individuals that actively engage in social media indicated higher perceived social support, accompanied by more benefits like reduced stress and loneliness. This is reflected by Pouwels and colleagues (2021), where both “socially rich” adolescents (those that are high in perceived

friend support and low in loneliness) as well as “socially poor” adolescents (low friend support and high loneliness), reported social support benefits such as “feeling closer to their friends” after engaging with them via social media. However, other studies have suggested that these benefits of support are not as salient for individuals who reported lower perceived social support via their social media involvement (Meng et al., 2016; Nabi et al., 2013; Pouwels et al., 2021). Considering its protective nature, social support can prove to be a beneficial and protective factor for users as social media platforms and their applications continue to develop. Given the underlying connections between social support and the social orientations of social media, it is important to include social support in examination of both positive and negative outcomes of media use.

One key limitation of this literature is that the direction of these relationships is frequently unclear, creating dubious conclusions as to whether social media and mental health outcomes are causally related. This is due to the largely cross-sectional nature of literature in this domain; without observing these relationships longitudinally, one cannot adequately gauge the direction of their relationships. It is reasonable to consider that the relationship between these factors may indeed be bidirectional. There is general evidence that internet-use behaviors and habits may stem from existing mental health issues, as well as those issues being influenced by internet behaviors. A longitudinal study using cross-lagged panel modeling found that initial reports of ADHD symptoms were significantly associated with problematic internet use later, and vice versa (Morita et al., 2022). Similar results were found between reported depression symptoms and later problematic internet use. One study examining national data in the UK from 2011-2018, found that early higher levels of social media use were linked to reduced life satisfaction later (Orben et al., 2022), and initial low life satisfaction was also related to later

increases in social media usage. Similarly, another study found within-person effects indicating higher depression reports led to later increased online engagement across 4 time points, as well as increased internet use relating to later depression scores (Marciano et al., 2022). A similar study examining loneliness, poor social skills, and social media engagement found that individuals with high loneliness or poor social skills develop problematic internet use to compensate and meet their social needs (Kim et al., 2009). While the majority of this research does not specifically examine time spent on social media platforms, it presents a case for the mutual relationship between internet engagement and mental health factors. This illustrates the need for more research regarding bidirectional effects of social media use and mental health.

An additional notable limitation is that much of the literature on this topic has overemphasized examination of only one platform and its effects rather than evaluating multiple social media outlets. In several other studies, social media use is assessed globally, thus obscuring the effects of individual platforms (Coyne, et al., 2020; Jenkins et al., 2020; Sewall et al., 2022). Given that users tend to engage in multiple platforms at once, this inhibits researchers from observing unique effects that may arise from different platforms, and it is dubious to assume that all social media platforms have similar dynamics with mental health. Considering the new advancements and additions to social media over the years, it is imperative that research expand its focus to gain a more cohesive understanding of the effects of social media on mental wellbeing across platforms. One way of moving this literature forward is by examining bi-directional relationships between social media and mental health via examination of multiple social media platforms.

The purpose of this study is to investigate the bidirectional relationship between the amount of time spent on various social media platforms and multiple mental health-related

outcomes in young adults, including depression, anxiety, and perceived social support. The current study included popular media platforms of TikTok, Instagram, and Snapchat to have a broader understanding of the effects across different media, especially examining young adults as they are the most frequent users of social media platforms and are consequently more likely to seek out and be affected by them (Di Cara et al., 2022; Twenge et al., 2020; Vanucci et al., 2017). These platforms were chosen because they are especially popular among young adults and have been found to be particularly relevant in associations between social media use and mental health in prior work we have conducted (Woodward et al., under review).

Hypotheses

The current study hypothesized the presence of bidirectional relationships between social media use and mental health-related outcomes.

1. Specifically, we predicted that the use of TikTok and Instagram would be positively associated with anxiety and depression and negatively associated with social support.
2. Additionally, we hypothesized that Snapchat would be negatively associated with anxiety and depression and positively associated with social support.

These hypotheses are based upon findings from a recent cross-sectional study we completed previously demonstrating divergent associations found between Snapchat and well-being compared to other social media platforms (Woodward et al., under review).

Method

Participants

The sample consisted of 203 young adults aged 18-29 (M = 23.21, SD = 3.15) who completed baseline and follow-up assessments. The sample was predominantly female (53.9%) and Caucasian (47.3%), followed by Hispanic (12.3%), Asian American (13.5%), African

American (9.6%), and those who identified as Other/Multiethnic (15.3%). A majority identified as straight or heterosexual (59.6%), followed by non-heterosexual (38.7%). All sample demographic data can be found below in *Table 1*.

Participants read the informed consent documents presented on Prolific Academic. Only participant data from U.S. adults between the ages of 18 and 29 were used. Participants were recruited via Prolific Academic, a research platform utilizing populations from the United States and United Kingdom. Participants create an account with the Prolific system, complete initial screener questionnaires, and then select studies to participate in, and proceed to the survey measures after providing consent. Participants were financially compensated for survey completion via Prolific.

Measures

Demographics

Participants completed a brief demographics measure assessing age, ethnicity, gender, sexual orientation, highest level of education, employment status, college enrollment status, and Greek life involvement.

Social Media Use

Participants were asked to self-report their average social media use in a typical day across a variety of social media platforms. The platforms assessed included Facebook, Instagram, Reddit, Twitter, TikTok, Snapchat, and YouTube. They were also given the option to name and list their use of an unlisted platform. Response options for amount of time used were given in half-hour increments.

Depression and Anxiety

The Depression, Anxiety and Stress Scale (DASS-21; Lovibond & Lovibond, 1995) is a 21-item self-report measure that consists of three subscales assessing symptoms of stress, anxiety, and depression, respectively. For the current study, anxiety and depression were the subscales examined, given that anxiety and depression are two of the most prominent mental health issues studied in this literature. Each subscale contains 7 items where participants indicate how much each item has applied to them over the past week on a 4-point Likert scale, from 0 ("Did not apply to me at all") to 3 ("Applied to me very much, or most of the time"). Sample items include, "I found it hard to wind down," "I felt scared without any good reason," and "I felt I wasn't worth much as a person." Each subscale is calculated by adding the scores of each item and then multiplying the sum by 2, with higher scores representing greater symptoms. Cronbach's alphas for the depression subscale showed reliability at both timepoints (α_{T1} = .93; α_{T2} = .92). The anxiety subscale similarly showed good reliability across timepoints (α_{T1} = .84; α_{T2} = .81).

Friend Social Support

The Multidimensional Scale of Perceived Social Support (MSPSS; Wilcox, 2010; Zimet et al., 1988) was used to examine perceived social support. This self-report measure consists of 12-items divided into three subscales assessing different domains of support: friends, family, and a special person. Some example items include, "My family is willing to help me make decisions," "There is a special person who cares about my feeling," and "I can count on my friends when things go wrong." The items are scored on a 7-point Likert scale, from 1 ("Very Strongly Disagree") to 7 ("Very Strongly Agree"). Higher total scores indicate higher levels of perceived support. For this study's purpose, the Friend Support subscale was used, consisting of 4-items.

This subscale was found to be highly reliable at both baseline (α = .95) and the follow-up timepoint (α = .96).

Procedures

The data utilized were formerly collected as part of a larger study focusing on mental health and substance use in young adults. The initial survey procedures were approved by the Institutional Review Board of Western Kentucky University (IRB# 22-096) and were available from October of 2021 to December of 2022. The survey was administered at baseline and again 6 months afterward via the Prolific Academic system. Before participants began the study, they were presented with an informed consent document detailing the nature of the study, risks and benefits, confidentiality, and particularly that participants may withdraw from the study without penalty. The survey took around 30-45 minutes to complete.

After accepting, participants began survey completion, detailing demographic information, social media use, social support, mental health, and a variety of other measures. Once the survey was completed, participants received a debriefing form and were thanked for their participation. The survey was available online and did not require any in-person procedures.

Data Analysis

Before conducting analysis, the data were examined to identify any violations of normality, including checking for univariate and multivariate outliers, and addressing issues of skewness and kurtosis if needed using guidelines from Tabachnick and Fidell (2007). Associations were first examined via bivariate correlations for a preliminary examination of relationships among variables. For primary analyses, data across both waves were analyzed using cross-lagged panel modeling. Cross-lagged panel models are useful for examination and testing of bidirectional hypotheses in longitudinal analyses (e.g., Woodward et al., 2018). These models

account for autoregressive associations of each variable over time and associations between variables A and B at each individual timepoint.

Analyses were run as path models with social media use and mental health variables using Mplus software. Maximum likelihood estimation was used as the estimation method to find parameter values that maximized the probable observed data within the proposed model. Because cross-lagged panel modeling involves only two variables, separate models were run for each variation of the social media platform and outcome variable. Examples of the proposed cross-lagged models are shown in Figures 1 and 2. Paths of primary interest were the cross-lagged associations between two variables over time (e.g., Instagram use at time 1 → anxiety at time 2).

Model fit was assessed using a chi-square statistic and its associated p-value, the root-mean-square error of approximation (RMSEA), the standardized root-mean-square residual (SRMR), the comparative fit index (CFI), and the Tucker-Lewis index (TLI). To test acceptable model fit, the following criteria were applied based on previous research recommendations: a non-significant chi-square value for the model, RMSEA below .08, SRMR below .10, and CFI and TLI values exceeding .90 (Bentler 1990; Brown & Cudeck 1993; Kline 2005).

Results

Descriptive Statistics

Social media use data indicated varying levels of engagement across TikTok, Instagram, and Snapchat over the study period. Of the 3 platforms observed in this study, TikTok was the most frequently used among participants, with a mean of 2.48 hours per day (*SD* = 2.67), followed by Instagram (*M* = 1.45, *SD* = 1.66) and Snapchat (*M* = 0.98, *SD* = 1.58). On average, participants reported spending more time on social media platforms collectively at baseline (*M* =

7.78 hours per day, *SD* = 5.08) compared to six months later (*M* = 6.91 hours per day, *SD* = 4.29). A paired samples t-test revealed a statistically significant decrease in social media use from baseline to the six-month follow-up, t (201) = 3.69, $p < .001$, $d = .26$, with a mean difference of 0.91 hours per day, 95% CI [0.42, 1.4].

Similarly, mental health outcomes demonstrated fluctuations in anxiety, depression, and perceived friend support over time. At baseline, participants reported moderate levels of anxiety (*M* = 4.50, *SD* = 4.05) and depression (*M* = 7.39, *SD* = 6.07), along with moderate to high levels of perceived friend support (*M* = 4.90, *SD* = 1.74). However, at the second timepoint, anxiety levels decreased (*M* = 3.91, *SD* = 3.82), while depression scores increased (*M* = 8.29, *SD* = 4.79). Perceived friend support remained relatively stable at time 2 (*M* = 4.89, *SD* = 1.73), indicating consistent levels of perceived social support among participants across the study period. Paired samples t-tests revealed a slight, statistically significant decrease in anxiety from baseline to six months later, t (199) = 2.30, $p = .02$, $d = .16$, with a mean difference of 0.59 hours per day, 95% CI [0.08, 1.1]. Conversely, depression scores showed a slight, significant increase from baseline to six months later, t (199) = -2.87, $p = .005$, $d = -.20$, with a mean difference of -0.91 hours per day, 95% CI [-0.15, -0.28]. These findings suggest that participants experienced a slight reduction in anxiety but a slight increase in depression over the study period. There were no significant changes in perceived friend support scores, t (201) =.136, $p = .89$, $d = 0.1$.

Bivariate Correlations

Bivariate correlations, along with means and standard deviations for all social media platforms and mental health outcomes at both time points, are presented in Table 2. Examination of bivariate correlations showed significant, positive associations between all social media platforms cross-sectionally and across timepoints ($r \geq .30$). Similarly, associations between

mental health outcomes were all significant, with a few exceptions between friend social support and anxiety across both timepoints.

Investigating correlations between social media and mental health variables, 6 significant associations were found. Anxiety at Time 1 was significantly associated with TikTok at time 1 (r = .21, p <.001), and TikTok at time 2 (r = .21, p < .001). Anxiety at time 2 was significantly associated with TikTok at time 1 (r = .17, p <.05), as well as Snapchat at time 1 (r = .14, p < .05). Depression and TikTok were associated at baseline (r = .10, p < .05), and Friend Social Support and Instagram were also associated at the initial timepoint (r = .11, p < .05). All other associations between social media and mental health variables were nonsignificant.

Cross-Lagged Panel Models

Nine separate models were examined to investigate bidirectional relationships between TikTok, Instagram, and Snapchat with the mental health variables of anxiety, depression, and friend support. All cross-lagged panel models employed in this study were just-identified (i.e., had 0 degrees of freedom), and as such resulted in a 'perfect' reproduction of the observed variance-covariance matrix (Kline, 2011). Thus, model fit indices are not reported. Autoregressive associations for anxiety ($b \leq .52$, $\beta \leq .60$, p <.001), depression ($b \leq .55$, $\beta \leq .70$, p <.001), and perceived friend support ($b \leq .76$, $\beta \leq .76$, p <.001) were significant and persisted across all nine models. Examples of three of the nine total cross-lagged models are illustrated in Figures 1, 2, and 3.

TikTok

The first model examined the relationship between TikTok use and Anxiety levels over time. Results revealed no significant cross-lagged effects for TikTok at time 1 predicting anxiety at time 2 (b = .04, β = .02, p = .78) or anxiety at time 1 predicting TikTok use at time 2 (b = .005, β = .02, p = .79). Associations between TikTok use and anxiety were significant at time

point 1 (b = 1.77, β = .21, p <.001). However, at the follow-up time point, the association was non-significant (b = -.23, β = -.07, p = .36). Autoregressive associations for TikTok ($b \leq .67$, $\beta \leq .73$, p <.001) were significant and persisted across all three TikTok models.

Similarly, the second model investigated the association between TikTok use and depression across time. No significant cross-lagged effects were observed for paths from TikTok at time 1 to depression at time 2 (b = -0.21, β = -.08, p = 0.12), or for depression at time 1 to TikTok at time 2 (b = -.002, β = -.01, p = .875). Associations between TikTok and depression were significant at time point 1 (b = 1.11, β = .10, p = .049), however were not significant at the following timepoint (b = .32, β = .08, p = .25).

The third model focused on the relationship between TikTok use and perceived friend support. No significant cross-lagged effects were found from TikTok at time 1 to friend support at time 2 (b = .008, β = .01, p = .86) or between friend support at time 1 to TikTok at time 2 (b = -.04, β = -.04, p = .40) Associations between these variables were non-significant at both the first (b = -.18, β = -.06, p = .23) and second timepoint (b = .004, β = .003, p = .96).

Instagram

Examining the relationship between Instagram use and anxiety levels, the fourth model yielded non-significant cross-lagged effects from Instagram at time 1 to anxiety at time 2 (b = .32, β = .10, p = .10), or from anxiety at time 1 to Instagram at time 2 (b = .003, β = .01, p = .84). Associations between Instagram use and anxiety were significant at time point 1 (b = .54, β = .10, p = .047). However, the association was not significant at the subsequent time point (b = .02, β = .01, p = .91). Autoregressive associations for Instagram use ($b \leq .69$, $\beta \leq .76$, $p < .001$) remained significant and consistent across all three Instagram models.

The fifth model investigated the association between Instagram use and depression. No significant cross-lagged effects were observed Instagram at time 1 to depression at time 2 (b = .08, β = .02, p = .71), or from depression at time 1 to Instagram at time 2 (b = .002, β = .01, p =.79). Associations between Instagram use and depression indicated no significant relationship between the variables at either time point 1 (b = -.27, β = -.04, p = .07) or timepoint 2 (b = -.11, β = -.05, p = .52).

In the model focusing on Instagram use and perceived friend support, no significant cross-lagged effects were found for Instagram at time 1 to friend support at time 2 (b = .02, β = .01, p =.79), or from friend support at time 1 to Instagram at time 2 (b = .02, β = .03, p = .51). Associations between Instagram use and perceived friend support were significant at time point 1 (b = .22, β = .11, p = .03), indicating a positive relationship. However, the association between these two variables did not reach statistical significance at the follow-up time point (b = -.02, β = -.03, p = .70).

Snapchat

No significant cross-lagged effects emerged for Snapchat at time 1 predicting anxiety at time 2 (b = .39, β = .12, p = .06), or from anxiety at time 1 to Snapchat at time 2 (b = -.007, β = -.03, p = .63). No significant associations were found between Snapchat use and Anxiety at time 1 (b = .51, β = .09, p = .07) or time 2 (b = .17, β = .07, p = .32). Autoregressive associations for Snapchat ($b \leq .57$, $\beta \leq .67$, $p < .001$) were found to be significant and consistent across all three Snapchat models.

The eighth model assessed the association between Snapchat use and depression. Results revealed no significant cross-lagged effects for Snapchat at time 1 predicting depression at time 2 (b = -.15, β = -.04, p = .52), or from depression at time 1 to Snapchat at time 2 (b = -.01, β = -

.06, p = .25). Associations between Snapchat use and depression were non-significant at time point 1 (b = -.16, β = -.02, p = .67), as well as the subsequent time point (b = .03, β = .01, p = .89).

The final model investigated Snapchat use and perceived friend support, showing no significant cross-lagged effects from Snapchat at time 1 to friend support at time 2 (b = -.01, β = -.01, p = .85), or from friend support at time 1 to Snapchat at time 2 (b = .004, β = .006, p = .90). Associations between Snapchat use and perceived friend support were non-significant at the initial timepoint (b = .08, β = .04, p = .45) and at the follow-up timepoint (b = .04, β = .05, p = .48).

Discussion

This study aimed to investigate the bidirectional relationship between social media use and mental health outcomes among adolescents and young adults. Significant attention has been directed towards exploring the association between social media use and mental health outcomes. However, due to the literature's cross-sectional nature, the direction of these relationships has remained ambiguous, making it challenging to discern causality between social media engagement and mental health outcomes. Furthermore, the disproportionate focus on assessment of aggregate social media use rather than use of individual platforms presented a significant limitation, preventing observation of potential platform-specific effects on mental health.

The present study investigated the bidirectional relationship between social media use across prominent platforms—TikTok, Instagram, and Snapchat—and various mental health outcomes among young adults. We hypothesized the presence of bidirectional relationships, specifically anticipating positive associations between TikTok and Instagram use with anxiety

and depression, and negative associations with perceived social support. We also expected Snapchat use to have negative associations with anxiety and depression, and positive associations with perceived friend social support, based upon the presumption that Snapchat may have more beneficial effects compared to TikTok and Instagram.

Across all models, no significant cross-lagged effects were observed, indicating that the use of social media showed no significant longitudinal associations with anxiety, depression, or perceived friend support. The lack of statistically significant findings suggests that, in this sample, the examined social media platforms do not appear to be predictive of changes in mental health outcomes over time, or vice versa.

These results, while not supportive of our original hypotheses, are consistent with some existing longitudinal literature, which also indicate a lack of relationship between social media use and mental health outcomes when these factors are measured across multiple timepoints. For instance, Heffer et al., (2019) measured social media use and depressive symptoms across annual surveys and found non-significant associations over time. Similarly, Beyens et al., (2020) examined the potential effects of social media use on affective wellbeing in adolescents using reports of well-being and social media use collected six times a day over a one-week period. Their findings revealed that social media use was not significantly associated with overall wellbeing. Additionally, Coyne et al., (2020) conducted an eight-year longitudinal study and likewise failed to find a relationship between social media use and increased depression or anxiety symptoms.

Furthermore, studies examining the associations between social media use and mental health outcomes on a daily level also fail to find significant relationships. For instance, Jensen et al., (2019) conducted an ecological momentary assessment (EMA) study involving 388

adolescents, tracking their digital technology use and mental health symptoms over a 14-day period. They found no evidence to support the idea that adolescents' technology use predicted later mental health symptoms. Similarly, Sewall et al., (2022) utilized ecological momentary assessment to examine daily social media use and its impact on mental health. Their findings revealed that increased social media use on certain days did not worsen depression, anxiety, or social isolation. Although the current study examined associations across a more protracted period, these studies contribute to the growing body of evidence challenging the narrative that social media use is linked to adverse mental health outcomes. Our findings further support this, given that some significant correlations were observed between social media use and various mental health outcomes within our data, these associations were not detected within the cross-lagged paths. This furthers the notion that while there may be concurrent relationships between social media use and mental health at specific points in time, evidence for social media use as a causal factor in negative symptomology is limited.

It has also been speculated that the development of mental health problems may lead to increased social media use. Prior research has found that initial levels of depression or low life satisfaction can predict later increases in social media use, and vice versa (Orben et al., 2022; Marciano et al., 2022). Moreover, individuals experiencing high levels of loneliness or poor social skills may turn to social media platforms as a means of compensating for their social needs, leading to increased internet engagement (Kim et al., 2009). However, no evidence was found in the current study for this process when examining either anxiety or depressive symptoms.

Moreover, prior studies have examined the potential positive outcomes associated with social media use, particularly in terms of accessing virtual social networks as a source of social

support. The stress-buffering theory of social support posits that perceived social support can mitigate the detrimental effects of stress on mental health (Cohen, 2004; Thoits, 2011). As such, the appeal of social media platforms may lie in their capacity to provide opportunities for social connection, self-expression, and emotional support, thereby contributing to positive well-being outcomes (Bekalu et al., 2019; Caplan, 2006; Valkenburg et al., 2022a). Our findings are not reflective of this body of research and indicate a lack of consistent mutual relationships between these factors. These interpretations emphasize the complex relationship between social media and mental well-being; while initial correlations may indicate some level of association, the lack of longitudinal associations suggests that these links may not be indicative of causal relationships. Thus, while caution should be exercised in interpreting these correlations, the overarching findings of our study align with the broader literature, suggesting that the impact of social media on mental health may be more varied and context-dependent than previously assumed.

Greater Implications

The results observed in this study have significant implications for both greater social media research and policy development regarding the relationship between social media use and mental health outcomes. First, these findings suggest that other factors beyond social media use may play a more substantial part in shaping the mental health associations observed in young demographics. For instance, harmful content present on social media platforms could potentially contribute to short-term mental health issues. However, the lack of longitudinal associations found in this study indicates that exposure to such content may have limited long-term effects on young people's mental wellbeing. The design and features of social media platforms themselves may contribute more to shaping users' experiences and mental health outcomes than time spent

on these platforms alone. Platforms that incorporate and emphasize social connectivity and interaction over content promotion, may have beneficial results compared to other platforms, as seen in some areas of past literature (Bekalu et al., 2019; Caplan, 2006; Pouwels et al., 2021; Valkenburg et al., 2022a). Features such as built-in, automated reminders/timers (e.g., Apple's "Screen Time" feature), differences in algorithms and content adaptation/promotion across platforms, the type and frequency of content encountered, and the emphasis on monetization and ads could all also influence the impact of social media use on mental health. Some research similarly indicates that the way individuals engage with social media platforms appears to be important; passive use, seemingly constant scrolling without active interaction with content or others, has been linked with poorer mental health outcomes, whereas active engagement, involving direct interaction with others online, is associated with better mental health (Wolfer & Schneider, 2021). Thus, time spent on social media is but one indicator of social media use, and this factor may not be as salient as other aspects of social media use such as content consumed and styles of use, which have been less explored.

These findings call into question policy proposals that advocate for limiting the use of social media platforms for younger individuals solely based on concerns about their potential negative effects on mental health. While it is important to recognize that these platforms can contain potentially harmful content, including toxic or inappropriate material, our findings suggest that exposure to such content may have limited long-term effects on mental health. Instead, efforts may be better directed towards understanding and addressing other factors that may be more influential in shaping mental health outcomes, such as familial and peer relationships, school environments, and access to mental health resources. Additionally, policies aimed at promoting responsible and safe social media use, including content moderation,

sensitive content warnings, and parental controls, may prove more effective in mitigating any potential harms associated with social media use among young individuals rather than promoting limitations of time spent on these media altogether.

Strengths and Limitations

The current study has several strengths that contribute to the existing literature on the relationship between social media use and mental health outcomes. First, the longitudinal approach utilized in this study offers an advantage over cross-sectional designs by allowing for the examination of changes in social media use and mental health outcomes over time. By collecting data at multiple time points, longitudinal studies enable observation of temporal patterns and changes in variables. In contrast, cross-sectional studies, while useful for capturing associations at a single time point, are limited in their ability to establish causality and infer temporal sequences.

Related to this, the use of a bidirectional model, a cross-lagged panel model, is useful in observing the potential reciprocal influences over time between these variables. This approach is necessary in the context of social media and mental health, where the relationship between these factors in prior literature is dubious (Kim et al., 2009; Marciano et al., 2022; Morita et al., 2022; Orben et al., 2022). Bidirectional modeling provides a more comprehensive framework for capturing this relationship. While such associations were not observed within our study, testing this type of relationship can be useful in informing both research and interventions in this area.

Furthermore, the study's consideration of individual social media platforms is notable. Previous literature often assesses social media use globally, neglecting the distinct features and designs of specific platforms. The present study addresses this limitation by examining the effects of different platforms separately, specifically platforms that are most popular among

younger populations (Auxier & Anderson, 2021; Vogels et al., 2022; Woodward et al., 2023, under review). This approach allows for a more comprehensive understanding of how various social media platforms may influence mental health outcomes differently.

Despite its strengths, this study is not without limitations. One limitation is the reliance on self-report methodology for assessing social media use and mental health outcomes. Self-report measures are subject to biases, including misreporting of social media use due to human error or factors such as stigma or social desirability bias. Moreover, the multifaceted nature of social media use (in the presence of various platforms and types of content and engagement) can make it difficult for participants to accurately quantify their use. Use of more objective measures of time spent on social media, such as phone logs (Parry et al., 2021) and screen-time monitoring functions on various devices, may be more reliable quantifiers of time spent on social media. Additionally, mental health outcomes are inherently subjective and influenced by individual perceptions, introducing potential bias in self-report measures.

Another limitation of this study is the use of limited time points for data collection, which restricts the ability to comprehensively capture changes in social media use and mental health outcomes. This limitation makes it challenging to clearly establish the full relationship between social media use and mental health outcomes; the interval between the two time points may not be ideal for capturing meaningful changes, as shorter-term changes may be missed. However, it is worth noting that existing daily diary studies fail to find significant associations (Jensen et al., 2019; Sewall et al., 2022).

Future Research Directions

Moving forward, future research in the field should prioritize conducting longitudinal studies with multiple time points to observe the nature of social media use and its impact on

mental health outcomes more comprehensively. It is also necessary to explore potential mediators and moderators of this relationship, taking into consideration the role of specific features and functions of social media platforms and other contextual factors. Additionally, using more objective measures of social media use, such as smartphone app usage data or daily diaries, can complement self-report measures and improve the validity of findings. Moreover, investigating the bidirectional associations between social media use and mental health outcomes using extended points of data collection is needed for a better understanding of the relationships between these variables. By addressing these, future studies can contribute to a more nuanced understanding of the relationship between social media use and mental health and inform approaches and policies promoting positive mental well-being in the digital age and healthy social media practices.

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Table 1

Sample Demographic Data at Baseline

Gender (Female)	53.9%
Race	
Caucasian	47.3%
Asian American	13.5%
Hispanic/Latino	12.3%
African American	9.6%
Other/Multiethnic	15.3%
Sexual Orientation	
Straight/Heterosexual	59.6%
Non-heterosexual	38.7%
Social Media Use (avg. hours/day)	
Overall Use	7.59 (4.99)
TikTok	2.48 (2.67)
Instagram	1.45 (1.66)
Snapchat	0.98 (1.58)
Age (years)	23.21 (3.15)

Note: Demographic percentages do not sum to 100% due to missingness; Social media use means and standard deviations are shown, values were aggregated across both timepoints.

Table 2

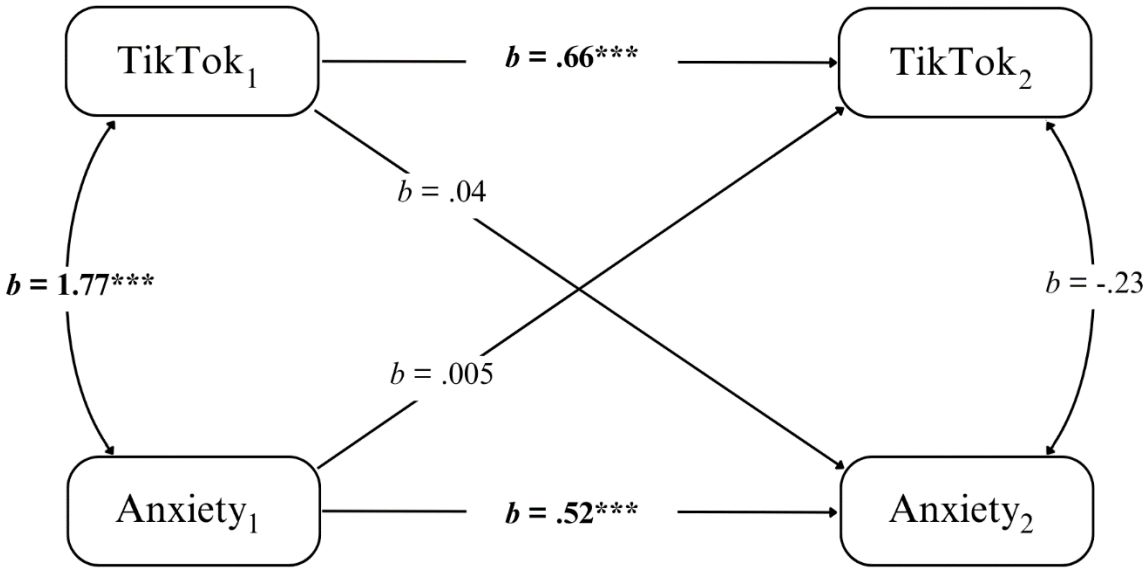
Correlations Between Social Media and Mental Health Outcomes at Each Timepoint

Measure	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***	***12***
1. **TikTok** *Time 1*	—											
2. **TikTok** *Time 2*	**.72*****	—										
3. **Instagram** *Time 1*	**.34*****	**.33*****	—									
4. **Instagram** *Time 2*	**.16***	**.35*****	**.72*****	—	.							
5. **Snapchat** *Time 1*	**.45*****	**.29*****	**.35***	**.28*****	—							
6. **Snapchat** *Time 2*	**.30*****	**.35*****	**.16***	**.42*****	**.58*****	—						
7. **Anxiety** *Time 1*	**.21*****	**.21****	.10	.07	.09	.02	—					
8. **Anxiety** *Time 2*	**.17***	.10	.14	.13	**.14***	.13	**.57*****	—				
9. **Depression** *Time 1*	**.10***	.09	-.03	-.03	-.02	-.10	**.64*****	**.41*****	—			
10. **Depression** *Time 2*	.09	.04	-.007	-.034	-.08	-.10	**.43*****	**.66*****	**.69*****	—		
11. **Friend SS** *Time 1*	-.06	-.07	**.11***	.10	.04	.09	-.05	-.10	**-.28*****	**-.24*****	—	
12. **Friend SS** *Time 2*	-.20	-.05	.08	.07	.09	.08	.01	-.06	**-.21****	**-.18****	**.78*****	—
M	1.73	1.53	1.05	.83	.72	.54	4.5	3.86	7.01	8.15	5.03	4.89
SD	1.84	1.64	1.17	1.06	1.21	1.0	4.5	3.8	6.1	4.77	1.64	1.71

Note. * $p < .05$, ** $p < .01$, *** $p < .001$; Friend SS: Friend Social Support (subscale of the Multidimensional Scale of Perceived Social Support)

Figure 1.

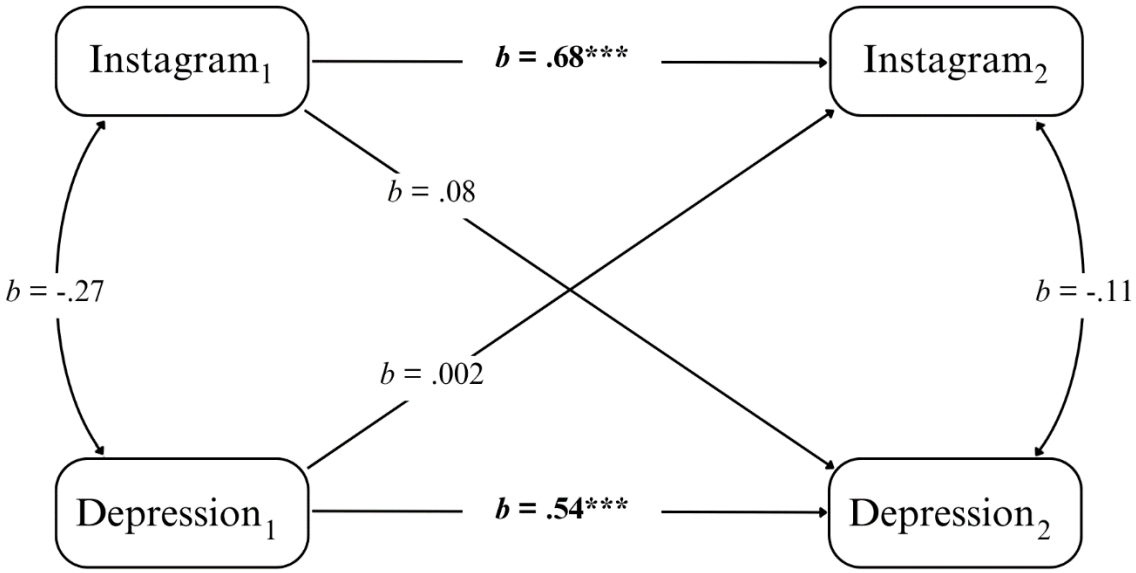
Cross-Lagged Panel Model: TikTok and Anxiety



Note: * $p < .05$, ** $p < .01$, *** $p < .001$

Figure 2.

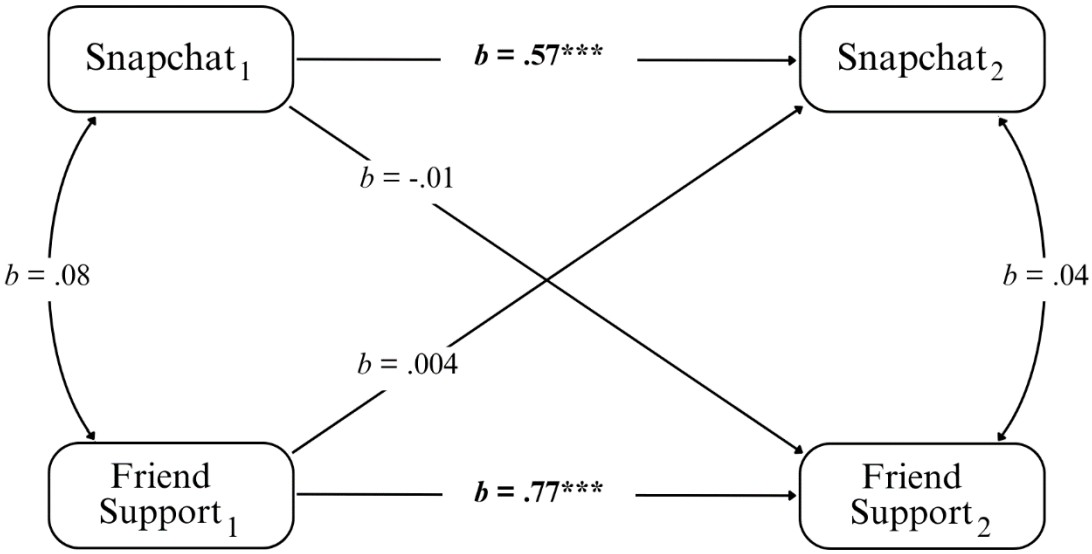
Cross-Lagged Panel Model: Instagram and Depression



Note: * $p < .05$, ** $p < .01$, *** $p < .001$

Figure 3.

Cross-Lagged Panel Model: Snapchat and Friend Social Support



Note: * $p < .05$, ** $p < .01$, *** $p < .001$

Appendix A: Measures

Measure of Social Media Use

Below please indicate how many HOURS you typically use the following social media platforms on an average day. If you do not use a particular platform, please select 0.

Facebook

Instagram

Reddit

Twitter

TikTok

Snapchat

Youtube

Another unlisted social media platform (specify below)

Depression, Anxiety, and Stress Scale (DASS-21)

INSTRUCTIONS: Please read each statement and choose the number which indicates how much the statement applied to you over the PAST WEEK. There are no right or wrong answers. Do not spend too much time on any statement.

	Did not apply to me at all	Applied to me to some degree, or some of the time	Applied to me to a considerable degree, or a good part of the time	Applied to me very much, or most of the time
I found it hard to wind down	○	○	○	○
I was aware of dryness of my mouth	○	○	○	○
I couldn't seem to experience any positive feeling at all	○	○	○	○
I experienced difficulty breathing	○	○	○	○
I found it difficult to work up the initiative to do things	○	○	○	○
I tended to over-react to situations	○	○	○	○

	Did not apply to me at all	Applied to me to some degree, or some of the time	Applied to me to a considerable degree, or a good part of the time	Applied to me very much, or most of the time
I experienced trembling in my hands	○	○	○	○
I felt that I was using a lot of nervous energy	○	○	○	○
I was worried about situations in which I might panic and make a fool of myself	○	○	○	○
I felt that I had nothing to look forward to	○	○	○	○
I found myself getting agitated	○	○	○	○
I found it difficult to relax	○	○	○	○

	Did not apply to me at all	Applied to me to some degree, or some of the time	Applied to me to a considerable degree, or a good part of the time	Applied to me very much, or **most** of the time
I felt down-hearted and blue	○	○	○	○
I was intolerant of anything that kept me from getting on with what I was doing	○	○	○	○
I felt I was close to panic	○	○	○	○
I was unable to become enthusiastic about anything	○	○	○	○
Select 'Applied to me very much, or most of the time' for your response to this statement	○	○	○	○
I felt I wasn't worth much as a person	○	○	○	○

	Did not apply to me at all	Applied to me to some degree, or some of the time	Applied to me to a considerable degree, or a good part of the time	Applied to me very much, or **most** of the time
I felt that I was rather touchy	○	○	○	○
I was aware of the action of my heart in the absence of physical exertion (e.g., rapid heart beat, heart missing a beat)	○	○	○	○
I felt scared without any good reason	○	○	○	○
I felt that life was meaningless	○	○	○	○

Multidimensional Scale of Perceived Social Support (MSPSS)

Instructions: We are interested in how you feel about the following statements. Read each statement carefully. Indicate how you feel about each statement.

	Very Strongly Disagree	Strongly Disagree	Mildly Disagree	Neutral	Mildly Agree	Strongly Agree	Very Strongly Agree
There is a special person who is around when I am in need.	○	○	○	○	○	○	○
There is a special person with whom I can share my joys and sorrows.	○	○	○	○	○	○	○
My family really tries to help me.	○	○	○	○	○	○	○
I get the emotional help and support I need from my family.	○	○	○	○	○	○	○
I have a special person who is a real source of comfort to me.	○	○	○	○	○	○	○
My friends really try to help me.	○	○	○	○	○	○	○
I can count on my friends when things go wrong.	○	○	○	○	○	○	○
I can talk about my problems with my family.	○	○	○	○	○	○	○
I have friends with whom I can share my joys and sorrows.	○	○	○	○	○	○	○
There is a special person in my life who cares about my feelings.	○	○	○	○	○	○	○
My family is willing to help me make decisions.	○	○	○	○	○	○	○
I can talk about my problems with my friends.	○	○	○	○	○	○	○

In the last series of questions, you were asked about a "special person." Please indicate below who the special person you were thinking of was (e.g., romantic partner, best friend, therapist, grandmother, etc.)

Appendix B: IRB Approval Form

INSTITUTIONAL REVIEW BOARD
OFFICE OF RESEARCH INTEGRITY

DATE:	October 25, 2021
TO:	Jenni Teeters
FROM:	Western Kentucky University (WKU) IRB
PROJECT TITLE:	[1828031-1] Exploring Health Behaviors and Related Experiences
REFERENCE #:	IRB# 22-096
SUBMISSION TYPE:	New Project
ACTION:	APPROVED
APPROVAL DATE:	October 25, 2021
EXPIRATION DATE:	October 25, 2022
REVIEW TYPE:	Expedited Review

Thank you for your submission of New Project materials for this project. The Western Kentucky University (WKU) IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a project design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulation.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding followed by an *implied* consent form. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Federal regulations require each participant receive a copy of the consent document.

Please note that any revision to previously approved materials must be approved by this office prior to initiation. Please use the appropriate revision forms for this procedure.

All UNANTICIPATED PROBLEMS involving risks to subjects or others and SERIOUS and UNEXPECTED adverse events must be reported promptly to this office. Please use the appropriate reporting forms for this procedure. All FDA and sponsor reporting requirements should also be followed.

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to this office.

This project has been determined to be a MINIMAL RISK project. Based on the risks, this project requires continuing review by this committee on an annual basis. Please use the appropriate forms for this procedure. Your documentation for continuing review must be received with sufficient time for review and continued approval before the expiration date of October 25, 2022.

Please note that all research records must be retained for a minimum of three years after the completion of the project.

If you have any questions, please contact Robin Pyles at (270) 745-3360 or irb@wku.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within Western Kentucky University (WKU) IRB's records.

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Name: Dick, Olivia G.

Email (to receive future readership statistics): olivia.dick910@topper.wku.edu

Type of document: ['Thesis']

Title: Bidirectional Relationships Between Use of Popular Social Media Platforms and Anxiety, Depression, and Social Support

Keywords (3-5 keywords not included in the title that uniquely describe content): Instagram, Snapchat, TikTok, mental wellbeing

Committee Chair: Dr. Matthew Woodward

Additional Committee Members: Dr. Andrew Mienaltowski Dr. Aaron Wichman

Select 3-5 TopSCHOLAR® disciplines for indexing your research topic in TopSCHOLAR®: clinical psychology, community psychology, other psychology