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ORIGINAL RESEARCH

Longitudinal Problematic Social Media Use in Students and Its Association with Negative Mental Health Outcomes

Holly Shannon^{1,2}, Katie Bush^{2,3}, Cecelia Shvetz², Vincent Paquin^{4,5}, Juliette Morency^{2,6}, Kim GC Hellemans¹, Synthia Guimond^{1-3,6,7}

¹Department of Neuroscience, Carleton University, Ottawa, ON, Canada; ²The Royal's Institute of Mental Health Research, University of Ottawa, Ottawa, ON, Canada; ³Department of Psychology, Carleton University, Ottawa, ON, Canada; ⁴Department of Psychiatry, McGill University, Montreal, QC, Canada; ⁵McGill Group for Suicide Studies, Douglas Mental Health University Institute, Montreal, QC, Canada; ⁶Département de Psychoéducation et Psychologie, Université du Québec en Outaouais, Gatineau, QC, Canada; ⁷Department of Psychiatry, University of Ottawa, Ottawa, ON, Canada

Correspondence: Synthia Guimond, 1145 Carling Ave, Ottawa, ON, K1Z 7K4, Canada, Tel +1 (613) 722-6521 x6870, Email synthia.guimond@theroyal.ca

Purpose: Social media has become increasingly part of our everyday lives and is influential in shaping the habits, sociability, and mental health of individuals, particularly among students. This study aimed to examine the relationship between changes over time in problematic social media use and mental health outcomes in students. We also investigated whether resilience and loneliness moderated the relationship between social media use and mental health.

Patients and Methods: A total of 103 participants completed a baseline virtual study visit, and 78 participants completed a follow-up visit, 4-weeks later. Participants completed a comprehensive set of questionnaires measuring symptoms of depression and anxiety, perceived stress, loneliness, and resilience.

Results: Our results showed that problematic social media use at baseline was significantly negatively correlated with resilience and positively correlated with all other mental health outcomes. Furthermore, increases in problematic social media use were significantly associated with increased depressive symptoms and loneliness between visits. Resilience significantly moderated the relationship between increased problematic social media use and heightened perceived stress. Poor mental health at baseline did not predict increased problematic social media use over time. Contrarily to problematic use, frequency of social media use was not significantly correlated with any mental health measures at baseline.

Conclusion: This study offers a longitudinal perspective, providing valuable insights into the potential protective role of resilience against the detrimental mental health effects seen with increases in problematic social media use.

Keywords: depression, anxiety, loneliness, stress, resilience, social media

Introduction

Social media can have a major influence on the habits, sociability, and mental health of individuals. Since the beginning of the COVID-19 pandemic, levels of social media use in post-secondary students have continued to increase significantly.¹⁻³ In a recent study examining social media use in university students during the pandemic, 48.2% reported increased use since the beginning of the pandemic, by one to two hours, and 26.3% reported a substantial increase of 2 or more hours.⁴ These increases are concerning, particularly given that extensive social media use among these populations is occurring during a time of identity formation and personal growth.^{5,6} Post-secondary students use social media for a variety of reasons that can be positive (eg, maintaining social connectedness with peers and increasing personal knowledge⁷) or negative (eg, using it as an avoidant coping mechanism or for gratification reasons for social elevation)⁷⁻¹⁰ Therefore, the content that students engage in during this time can influence the development of their values, opinions, and social relationships.^{5,10} As a result of being in a key period of social development and spending higher amounts of time on social media, post-secondary students are particularly at risk for using social media problematically.^{11,12}

The term “problematic social media use” refers to an increased preoccupation with, and motivation to engage in social media; including withdrawal symptoms (eg, aversive psychological experiences when discontinuing use); salience; and tolerance.^{8,13,14} Although problematic social media use is not currently a formal diagnostic entity, its definition has been based upon traditional symptoms of substance use disorders.¹⁵ Previous research has found that the amount of time one spends using social media is significantly but weakly associated with depressive symptoms, while problematic social media use is significantly more predictive of negative mental health outcomes.¹⁶ Therefore, problematic social media use represents a maladaptive pattern of social media use that seems more detrimental to mental health than the mere frequency of social media use.¹⁵

More specifically, problematic social media use is moderately associated with increased depressive symptoms, anxiety, and stress in youth and post-secondary students.^{6,17–21} A variety of factors may contribute to this relationship. Using social media to relieve stress may be a coping mechanism used to mask or alleviate symptoms of depression and anxiety.²² Some students spend a significant amount of time passively scrolling on their devices, or monitoring the lives of others without directly engaging with them.²³ This has been linked to increased levels of social comparison between students, which may contribute to feelings of depression and low self-esteem.^{18,24} In addition, many students feel the need to constantly respond to notifications from their peers.²⁵ When they are unable to respond promptly, the fear of missing out on important or popular news may contribute to increased levels of anxiety.¹⁹

Loneliness has been highly correlated with negative mental health and increased engagement in unhealthy behaviours.^{3,26} This has been especially prominent in the COVID-19 pandemic, whereby individuals experiencing higher perceived loneliness have been driven to use social media more frequently, which may put them at risk for problematic use.^{3,4,27,28} Although problematic social media use has been correlated with increased loneliness, there is a lack of evidence investigating the interplay between mental health, problematic social media use and loneliness.^{29,30}

Comparatively, other studies have shown that social media use may have the potential to buffer stress, by providing people with social support.³¹ Social media can also be used as a source of social connection, which may help to decrease levels of loneliness and have a positive moderating effect on mental health outcomes.^{32,33} Individuals with more social support may be less likely to engage in problematic social media use.³⁴ Resilience has been proposed as a possible factor influencing the relationship between social support and problematic social media use.^{34,35} More specifically, resilience could protect against negative coping styles, such as problematic social media use.³⁴ Individuals who are more resilient may be less likely to experience problematic social media use.³⁵ This has been previously demonstrated in college students, where resilience moderated the relationship between problematic social media use and perceived stress.³⁵

Although the current literature supports the link between problematic social media use and decreased mental health, there is a lack of evidence on the influence of loneliness and resilience in this relationship. The longitudinal nature of the current study captures a more dynamic trajectory of the relationship. We aim to investigate the relationship between problematic social media use and mental health outcomes among post-secondary students over time, during the COVID-19 pandemic. It was hypothesized that problematic social media use would be associated with mental health outcomes at baseline and that increased problematic social media use would be positively associated with increases in depressive and anxiety symptoms, and self-reported stress over time. Secondly, we aimed to investigate whether resilience and loneliness moderate the relationship between problematic social media use and mental health. It was hypothesized that changes in resilience and loneliness over time would significantly moderate the relationship between changes in problematic social media use and depressive and anxiety symptoms, and self-reported stress over time.

Materials and Methods

Participants

Participants were recruited via social media advertisements and through SONA Systems, a student research recruitment platform at Carleton University (Ottawa, ON). All participants signed an informed consent form before completing any study procedures. The study was conducted in accordance with the declaration of Helsinki and approved by the University of Ottawa Institute of Mental Health Research Ethics Board (REB #2020009) and Carleton University Research Ethics Board (CUREB-B #113166). All participants who completed visit 1 were entered into a random draw to win one of five \$100 gift cards.

Eligible participants were post-secondary students above the age of 18, English speaking, owned a smartphone, and with no changes in medication in the month before enrollment. Recruitment and data collection was completed from June 2020 to March 2022.

Study Visits and Measures

Participants were invited to take part in two separate virtual study visits, where participants completed a series of questionnaires with a research assistant via Zoom Healthcare (see Figure 1). The Bergen Social Media Addiction Scale (BSMAS) was used to assess levels of problematic social media use ($\alpha_{\text{visit1}} = 0.88$, $\alpha_{\text{visit2}} = 0.88$).³⁶ This is an 18-item scale which addresses each of the six core elements of addiction and evaluates negative life situations attributed to social media use.³⁷

Symptoms of depression were assessed with the Hamilton Depression Rating Scale (HDRS), ($\alpha_{\text{visit1}} = 0.71$, $\alpha_{\text{visit2}} = 0.75$).³⁸ Generalized anxiety symptoms were measured using the General Anxiety Questionnaire 7 (GAD-7), ($\alpha_{\text{visit1}} = 0.88$, $\alpha_{\text{visit2}} = 0.89$).³⁹ Additional measures included the UCLA Loneliness Scale to assess participants' loneliness and isolation ($\alpha_{\text{visit1}} = 0.95$, $\alpha_{\text{visit2}} = 0.96$); the Perceived Stress Scale (PSS) to determine levels of self-reported perceived stress ($\alpha_{\text{visit1}} = 0.88$, $\alpha_{\text{visit2}} = 0.88$); the Brief Resilience Scale (BRS) to measure resilience ($\alpha_{\text{visit1}} = 0.83$, $\alpha_{\text{visit2}} = 0.79$).^{40–42} All questionnaires were completed in both visits. Demographics, medical history, and frequency of social media use (average hours per day) were also collected during the first visit. Visits 1 and 2 were separated by 4 weeks (28–31 days).

Statistical Analyses

All statistical analyses were performed in R (version 3.3.0+) for Mac. Pearson's correlations were first calculated in the total baseline sample ($N = 103$) to examine the relationship between both the frequency of and problematic social media use, and all mental health outcomes. One-way analysis of variance (ANOVA) and Chi-square tests were conducted to compare participant demographics, baseline mental health and social media use between the two participant groups (ie baseline group and longitudinal subgroup; see Table S2). Another one-way ANOVA was conducted to investigate if the association between frequency of social media use, problematic social media use and mental health differed between social media platforms. All correlation coefficients were calculated for each of the top three social media platforms, as three separate matrices, and then compared using ANOVA.

Linear regressions were performed in a subsample of participants who completed both study visits (longitudinal subgroup, $N=78$) to see if worse mental health at baseline predicted increased problematic social media use between the two visits. Mental health at baseline was entered into the model (independent variable) as the predictor variable, and change in problematic social media use (dependent variable) was included as the outcome variable. The change in scores for each variable was determined by calculating the differences between the two visits within each participant (score at visit 2 – score at visit 1). A positive change indicates an increase from the baseline assessment to visit 2. Next, we investigated the association between changes in problematic social media use scores between visits (independent

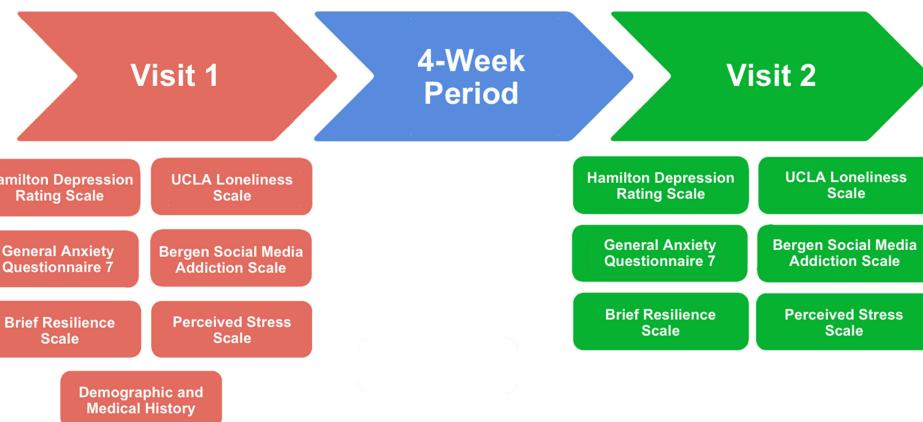


Figure 1 Outline of two virtual visits, separated by 4-week interval period. Total scores were obtained at each visit for all clinical assessments.

variable) and changes in mental health outcomes between visits (dependent variable). Interaction effects were examined between the changes in loneliness and the changes in problematic social media use with mental health outcomes between timepoints (dependent variable), as well as the changes in resilience and the changes in problematic social media use with mental health outcomes (dependent variable) between timepoints. Sex and age were used as covariates in all models. To visualize the interaction effects, participants were then split into three groups based on their level of change in resilience/loneliness scores between the two visits. Participants were categorized as either having an increase in resilience/loneliness over time, a decrease in resilience/loneliness over time, or zero change in resilience/loneliness between visits.

Results

Demographic Results

Demographic and clinical results are presented in [Table 1](#). A total of 104 participants were enrolled in the study. One participant was excluded from analyses for not completing the first visit, leaving a total of 103 participants who completed the baseline visit, and 78 participants who completed both visits 1 and 2 (ie. the longitudinal subgroup).

Social Media Use

The average frequency of social media use at baseline was 3.80 (± 1.85) hours per day. When participants were asked to select their most used social media platform, the top platforms were Instagram (38.8%), Snapchat (17.5%), and TikTok (15.5%) (see [Table S1](#)). Problematic social media use was significantly correlated with all mental health measures,

Table 1 Demographics for Total Participant Sample at Baseline and the Longitudinal Subgroup Who Completed Both Visits 1 and 2

	Baseline (N = 103)	Longitudinal subgroup (N = 78)	Group Comparison
Age (mean (SD))	20.67 (± 3.25)	20.77 (± 2.99)	p = 0.83
Sex = Female (%)	80 (77.67)	59 (75.64)	p = 0.75
Gender Identity (%)			p = 0.66
Woman	77 (74.75)	57 (73.08)	
Man	24 (23.30)	20 (25.64)	
Transgender	2 (1.94)	1 (1.28)	
Ethnicity (%)			p = 0.64
Caucasian	40 (38.83)	35 (44.87)	
Black	20 (19.41)	13 (16.67)	
South Asian	13 (12.62)	9 (11.54)	
Arab/West Asian	10 (9.71)	6 (7.69)	
Asian	7 (6.80)	6 (7.69)	
Latin American/Hispanic	6 (5.82)	5 (6.41)	
Southeast Asian	2 (1.94)	1 (1.28)	
Other	5 (4.85)	3 (2.91)	
Year in Post-Secondary Education			p = 0.90
1st Year	51 (49.5)	38 (48.7)	
2nd Year	16 (15.5)	12 (11.7)	
3rd Year	12 (11.7)	8 (7.8)	
4th Year	21 (20.4)	18 (17.5)	
Graduate	2 (1.9)	1 (1.3)	

however no significant correlations were observed between frequency of social media use and mental health (see **Table 2**). Problematic social media use did not significantly differ at visit 1 between the baseline group and longitudinal subgroup (see **Table S2**). The one-way ANOVA revealed there was no significant difference between the top three social media platforms used (ie. Instagram, Snapchat, and TikTok) on the correlation coefficients between the mental health measures, frequency of social media use, and problematic social media use ($F_{(2, 18)} = 3.40e^{-31}$, $p = 0.39$).

Baseline Mental Health and Changes in Problematic Social Media Use

Mental health at baseline was examined as a predictor of changes in problematic social media use between the two time points. Increased problematic social media use was not significantly predicted by depressive symptoms ($p = 0.11$, 95% CI $[-.50, 0.05]$, $R^2 = 0.04$), anxiety ($p = 0.50$, 95% CI $[-.21, 0.44]$, $R^2 = 0.02$), stress ($p = 0.19$, 95% CI $[-.37, 0.08]$, $R^2 = 0.03$), loneliness ($p = 0.83$, 95% CI $[-.14, 0.11]$, $R^2 = 0.01$), or resilience ($p = 0.85$, 95% CI $[-2.55, 2.10]$, $R^2 = 0.01$) at baseline.

Longitudinal Associations Between Problematic Social Media Use and Mental Health

An increase in problematic social media use scores between the two visits was significantly associated with an increase in depressive symptoms, $t(74) = 1.97$, $p = 0.05$, 95% CI $[-.01, 0.26]$, $R^2 = 0.09$ (see **Figure 2A**), and was trending towards a significant increase in perceived stress, $t(74) = 1.75$, $p = 0.08$, 95% CI $[-.02, 0.34]$, $R^2 = 0.06$ (see **Figure 2B**). Increased problematic social media use was not significantly associated with changes in anxiety, $t(74) = 0.73$, $p = 0.47$, 95% CI $[-.07, 0.15]$, $R^2 = 0.02$. No significant effects of age or sex were observed in any of the models.

The increase in problematic social media use scores between visits was significantly and positively associated with increased loneliness, $t(74) = 2.15$, $p = 0.04$, 95% CI $[0.01, 0.37]$, $R^2 = 0.10$; see **Figure 2C**), but not changes in resilience, $t(74) = 1.06$, $p = 0.29$, 95% CI $[-0.01, 0.03]$, $R^2 = 0.04$. Again, no significant effects of age or sex were observed in any of the models.

Loneliness and Resilience as Possible Moderators

Loneliness and resilience were also examined as moderators in the relationship between changes in problematic social media use, and changes in depressive and anxiety symptoms, and stress. When examining resilience as a moderator, there was a significant interaction with problematic social media use when predicting changes in stress $t(72) = -2.07$, $p = 0.04$, 95% CI $[-.64, -0.01]$, $R^2 = 0.11$, and trending significance when predicting changes in depressive symptoms $t(72) = -1.39$, $p = 0.11$, 95% CI $[-.39, 0.07]$, $R^2 = 0.12$ (see **Figure 3**). Resilience did not significantly moderate the relationship between changes in anxiety symptoms $t(72) = -0.43$, $p = 0.67$, 95% CI $[-.88, 0.60]$, $R^2 = 0.08$ and changes in problematic social media use (see **Figure 3**). From visit 1 to 2, 39.7% of participants had an increase in reported resilience (>0), 38.5% had a decrease in resilience (<0), and 21.8% did not have any change in resilience scores ($=0$).

Table 2 Pearson's Correlation Coefficients Between Mental Health Measures, Frequency of Social Media Use and Problematic Social Media Use at Baseline

Psychosocial Domains	1	2	3	4	5	6	7
1. Depression	–						
2. Anxiety	0.58**	–					
3. Stress	0.63**	0.60**	–				
4. Resilience	-0.43**	-0.41**	-0.53**	–			
5. Loneliness	0.54**	0.50**	0.63**	-0.49**	–		
6. Problematic Use	0.32**	0.30*	0.39**	-0.30*	0.28*	–	
7. Frequency of Use	-0.05	-0.05	-0.07	0.00	-0.05	0.03	–

Notes: * $p < 0.05$, ** $p < 0.01$. P-values are corrected for multiple comparisons using Bonferroni correction. Numbered columns on the top x-axis of the table correspond to the numbered psychosocial domains listed on the y-axis of the table. Correlations between domains are based on a total score from their respective questionnaire; depression symptoms from the HDRS, anxiety symptoms from the GAD-7, stress from the PSS, resilience from the BRS, loneliness from the UCLA, and problematic social media use from the BSMAS. Participants were asked how many hours a day they spend on social media on average in the demographic questionnaire as a measure of frequency of use.

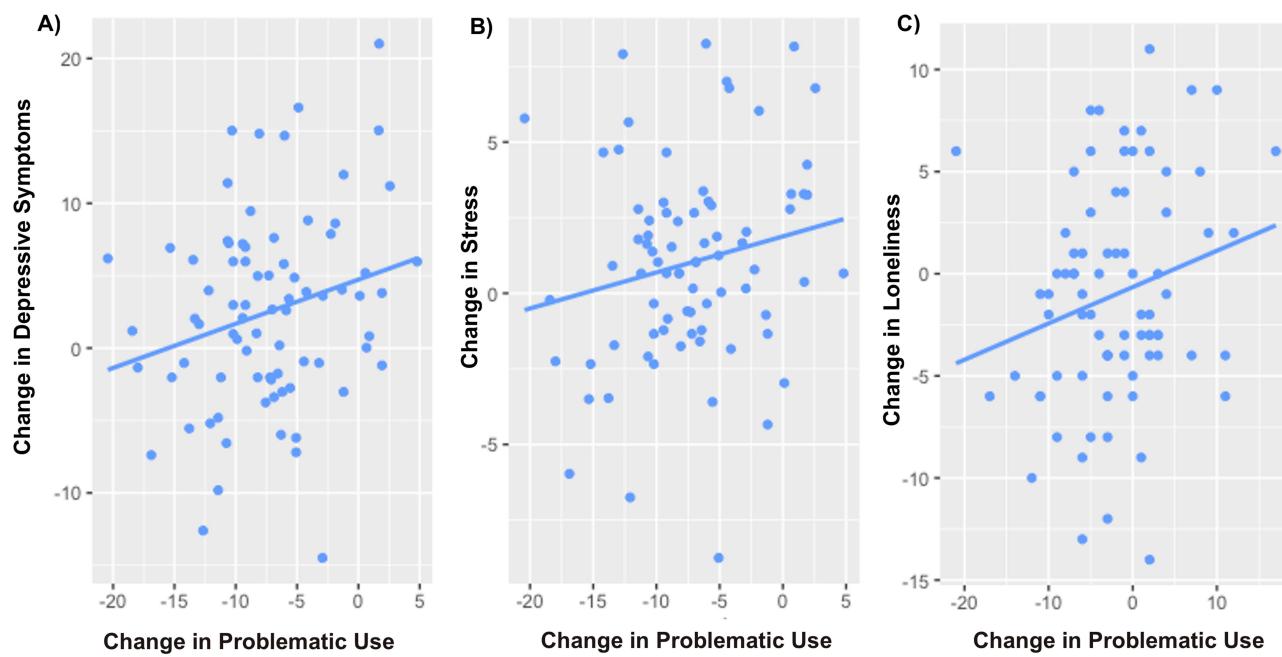


Figure 2 Changes in psychosocial domains between baseline and visit 2. All variables were adjusted for age and sex. **(A)** Change in the total score of the Hamilton Depression Rating Scale and problematic social media use, measured by the Bergen Social Media Addiction Scale. **(B)** Change in the total score of the General Anxiety Questionnaire and problematic social media use. **(C)** Change in the total score of the UCLA Loneliness Scale and problematic social media use.

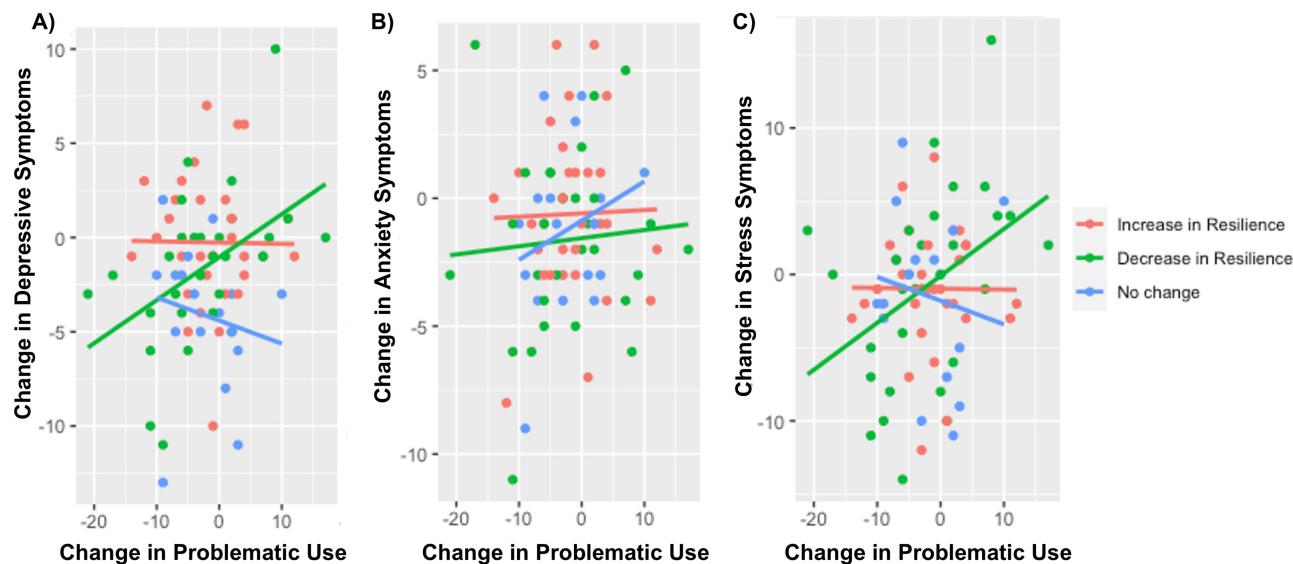


Figure 3 Resilience as a moderator in the relationship between changes in **(A)** depression symptoms; **(B)** anxiety symptoms; and **(C)** stress and changes in problematic social media use across the two study visits.

The interaction between loneliness and problematic social media use was trending in significance when predicting changes in depressive symptoms $t(72) = -0.60$, $p = 0.07$, 95% CI [-.08, 0.06], $R^2 = 0.10$. However, loneliness did not significantly interact with changes in problematic social media use to predict changes in anxiety $t(72) = -0.54$, $p = 0.59$, 95% CI [-.02, 0.02], $R^2 = 0.06$, or changes in stress $t(72) = 1.15$, $p = 0.88$, 95% CI [-.03, 0.03], $R^2 = 0.32$. Across the two visits, 35.9% of participants showed increased reported loneliness (>0), 55.1% showed decreased loneliness (<0), and 9.0% did not differ in their loneliness scores ($=0$). No significant age or sex differences were observed in either of the interaction models.

Discussion

Principal Findings

The current study aimed to investigate changes in problematic social media use and mental health in post-secondary students. At baseline, problematic social media was positively correlated with depressive and anxiety symptoms, perceived stress, and loneliness, and negatively correlated with resilience. However, worse mental health at baseline did not significantly predict an increase in problematic social media use between time points. Longitudinally, increases in problematic social media use were significantly associated with increases in depressive symptoms and loneliness. These results emphasize how changes in problematic use of social media over time are associated with negative changes to mental health (see [Figure 4](#)). Resilience had a moderating effect on the relationship between changes in problematic social media use and changes in stress, with trending significance toward moderating the relationship between changes in problematic social media use and changes in depressive symptoms.

Interestingly, the simple frequency of social media use was not associated with adverse mental health outcomes (ie. depressive and anxiety symptoms, stress, and loneliness) at baseline. In other words, spending a considerable amount of time on social media does not necessarily increase negative mental health symptoms. Concerns are often raised about younger generations spending too much time on their phones and on social media.⁴³ However, our findings suggest that problematic usage of social media use is a better indicator of risk for negative mental health, than frequency of use. This also suggests that motivation to use social media could influence the degree of mental health deterioration. In an era of technology, these results have important implications for identifying vulnerable individuals for negative mental health outcomes. Critically, therefore, it is important to investigate what other psychosocial variables may influence problematic social media use and mental health symptoms.

Our findings also support the well-established literature that problematic social media use is cross-sectionally moderately associated with negative mental health outcomes, such as depressive symptoms, anxiety, and stress.^{6,44} Interestingly, our current study did not find a significant association between mental health at baseline and changes in problematic social media use. These results indicate worse mental health does not predict increases in problematic social media use between visits, but they may instead increase in tandem. Increased problematic social media was significantly associated with increased depressive symptoms and loneliness over the 4-week time period. While very few longitudinal studies have explored this relationship, our findings are consistent with a previous study done in a sample of adolescent girls, in which they observed changes in problematic social media use were significantly associated with changes in depressive symptoms over a 2-year period.⁴⁵ A recent review by Course-Choi and Hammond (2021) did not find sufficient evidence to support any impact of frequency of social media use on adolescent well-being longitudinally.⁴⁶ The authors conclude that simply measuring frequency of social media use may not encompass the complexity of how

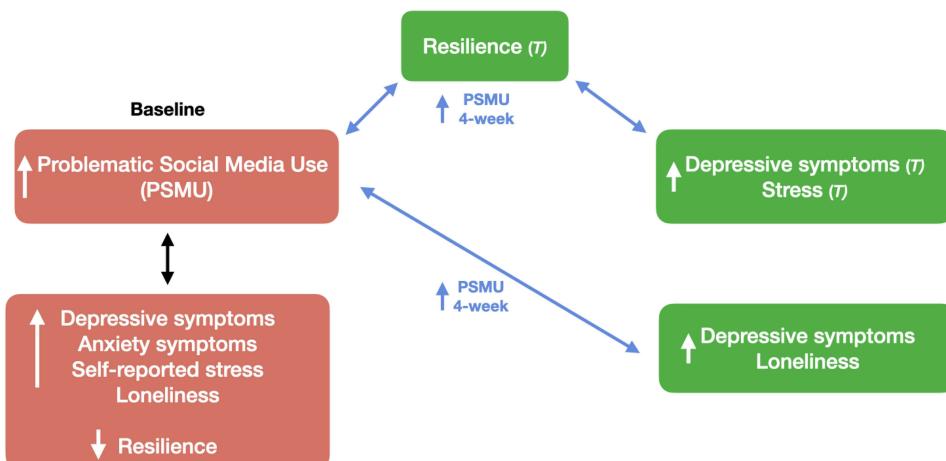


Figure 4 Significant principal findings of the current study at baseline and over the 4-week period. (T) indicates results that are trending towards significance.

individuals use social media. Our findings highlight the need for additional longitudinal studies to focus on maladaptive behaviors around social media, such as problematic use. Furthermore, future research should explore these associations over a longer period of time to capture long-term changes in mental health.

Our data demonstrate that resilience moderated the relationship between changes in problematic social media use and changes in stress, and was trending significant with changes in depressive symptoms over time. Specifically, participants had worsening depressive symptoms and stress over time, in tandem with worsening problematic social media use, but only when resilience scores decreased from baseline. Whereas an increase or no change in resilience did not have a large influence on the relationship between mental health and problematic social media use. Individuals who experience unsupportive relationships or environments tend to have lower resilience, which could in turn lead to an increased risk for engaging in maladaptive behaviors.³⁴ Zmavc et al found resilience scores did not directly affect problematic social media use in a sample of students. Instead, higher resilience was indirectly associated with reduced chance of developing problematic social media use by diminishing stress and depressive symptoms.⁴⁷ Therefore, resilience could act as a protective factor in not only the development of problematic use, but from the detrimental mental health consequences associated with problematic social media use.^{47,48} As our current study was limited by its sample size and statistical power, we call for future studies with larger sample sizes to further examine the role of resilience.

In our study, loneliness did not significantly moderate the relationship between changes in problematic social media use and changes in mental health over time. With loneliness often comes the need to connect, which in turn can cause individuals to turn to social media to maintain social connections or to develop new connections.³⁴ The relationship between problematic social media use and higher levels of loneliness in post-secondary students could be a result of using social media to cope.⁴⁹ It was recently found that the relationship between using social media to cope during the pandemic and problematic social media use was strongest in students who reported high levels of loneliness.⁴ Loneliness could act more as a risk factor for the development of problematic use, rather than a moderator in its association with mental health effects.⁴ Heightened loneliness could drive individuals to use social media as an avoidant or maladaptive coping strategy leading to problematic usage, however further research is needed to confirm this.

Limitations and Future Directions

The results of the current study must be interpreted considering some limitations. First, this study took place throughout the COVID-19 pandemic where participants were recruited at various levels of lockdown severity, which was challenging to control in our analyses. It was difficult to explore how changes in mental health and loneliness are attributed to the various levels of isolation inflicted by the pandemic, especially since over half of participants had a decrease in loneliness at visit 2. Second, this study explored the relationship between problematic social media use and mental health outcomes over time, but the directionality and mechanisms underlying these relationships remains to be investigated. Future studies with larger sample sizes should consider individual context and susceptibilities, as they likely influence this relationship.⁵⁰ In addition, it is recommended that future longitudinal studies use additional time points, over a long period of time, to capture a more accurate trajectory of the relationship. Third, there is a lack of research exploring the moderating effect of resilience in association with problematic social media use. Previous research has shown that some people are resilient and experience personal growth after disasters.⁵¹ Future research should further investigate the determinants of resilience and its association with problematic social media use in the context of environmental or populational stressors. Fourth, many students only completed the first visit, resulting in a smaller sample size for some of the results, which may have affected the statistical power of our longitudinal analyses. In addition, as we were mainly interested in investigating the relationship between problematic social media use and mental health outcomes overtime, frequency of social media use was only collected at baseline. Therefore, analysis exploring the impact of change in frequency of use on mental health outcomes was not possible. Lastly, our sample only includes primarily female post-secondary students which constrain the generalization of our findings to this specific population.

Conclusion

We found all mental health outcomes were associated with problematic social media use at baseline, but not frequency of social media use. However, worse mental health at baseline did not predict an increase in problematic social media use

over a 4-week period. Increased problematic social media use was associated with increased depressive symptoms and loneliness in post-secondary students between the study visits. Resilience moderated the relationship between increased problematic social media use and heightened perceived stress, as well as between increased problematic use and elevated depressive symptoms. Further research is needed to explore the mechanism underlying this relationship, as individual factors and context such as resilience and loneliness likely play a role in the susceptibility to problematic social media use and its mental health impacts.

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Disclosure

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