Does Reducing Social Media Use Have an Effect on Loneliness and Social Comparisons?

by

Wardah Mahboob

M.A. Psychology, Carleton University, 2022

A thesis submitted to

the Faculty of Graduate and Postdoctoral Affairs in

partial fulfillment of the requirements for the degree of

Master of Arts

in

Psychology

Carleton University

Ottawa, Canada

© 2022

Wardah Mahboob
Abstract

Social media and mental health issues have become increasingly prevalent in recent years raising questions about the psychological effects of excessive social media use (SMU), especially amongst transitional-aged youth (TAY). The present study experimentally investigated the effects of voluntarily reducing SMU to 1 hour/day on loneliness and social comparisons in TAY with pre-existing symptoms of anxiety and/or depression. After completing a baseline survey and providing daily screenshots of SMU for one week, 220 participants were randomly assigned to an intervention or control group for the next three weeks. Participants completed an online follow-up survey at 4-weeks post randomization to assess changes in loneliness and social comparisons. A repeated measures analysis of variance indicated that the intervention group showed significantly greater reductions in loneliness but not in social comparisons. The findings suggest that reducing SMU may represent a feasible, affordable and effective strategy in reducing loneliness for TAY with emotional distress.

Keywords: Social Media Use (SMU), Loneliness, Social Comparisons, Mental Health, Transitional-aged youth (TAY)
Acknowledgements

First and foremost, I would like to thank and express gratitude to my mentor and guide – my thesis supervisor, Dr. Gary Goldfield, for his continuous support and guidance which has enabled me to complete my thesis. I would also like to thank my thesis co-supervisor Dr. Katie Gunnell for her insight, encouragement and feedback.

I would also like to thank the committee members, Dr. Nassim Tabri, Dr. Karen Sewell, and Dr. Rachel Burns for all their support and advice – this project would not have been the same without you!

Last but not least, I am greatly indebted to my family for their constant encouragement, love, and support. Their belief in me brought me here and kept my spirits high throughout this journey!
# Table of Contents

Abstract........................................................................................................................................ ii

Acknowledgements........................................................................................................................ iii

Table of Contents............................................................................................................................ iv

List of Figures..................................................................................................................................... vii

List of Appendices........................................................................................................................... viii

Does Reducing Social Media Use Have an Effect on Loneliness and Social Comparisons? ........ 1

Social Media Use & Mental Health................................................................................................. 2

Loneliness.......................................................................................................................................... 5

Definition and Prevalence............................................................................................................... 5

Social Media Use & Loneliness: Cross-sectional Findings.......................................................... 6

Social Media Use & Loneliness: Quasi-experimental & Longitudinal Findings....................... 7

Possible Mechanisms Linking Social Media Use, Mental Health, and Loneliness.................. 10

Social Comparison Theory ........................................................................................................... 11

Social Comparisons & Mental Health .......................................................................................... 12

Social Comparisons & SMU .......................................................................................................... 13

Social Comparisons and Loneliness ............................................................................................. 14

Limitations in the Current Literature............................................................................................ 14

Objectives and Hypotheses........................................................................................................... 15

Methods ......................................................................................................................................... 16

Participants ...................................................................................................................................... 16
List of Figures

Figure 1. Participant flow per Consolidated Standards of Reporting Trials .......................... 20

Figure 2. Social comparisons as a mediator between SMU and Loneliness ............................ 26

Figure 3. Total daily social media use over time by group graph ........................................ 34
List of Appendices

Appendix A: Recruitment Notice.................................................................72
Appendix B: Informed Consent Form..........................................................74
Appendix C: Identifying Information..........................................................78
Appendix D: Revised UCLA Loneliness Scale...........................................79
Appendix E: Technology-Based Social Comparison and Feedback-Seeking (SCFS)...............80
Appendix F: Electronic Debriefing Form....................................................81
Appendix G: Email Reminders.........................................................................82
Appendix H: Certification of Institutional Ethics Clearance........................................87
Does Reducing Social Media Use Have an Effect on Loneliness and Social Comparisons?

Social media are online forums where people can share and exchange various content with one another including news, photos, and ideas. Some of the most popular social media platforms include Facebook, Instagram, Twitter, and Snapchat; with both Facebook and Instagram having billions of users worldwide (Eghtesadi & Florea, 2020; Saunders & Eaton, 2018). Among transitional aged-youth (TAY; 17-25 year olds) (Wilens & Rosenbaum, 2013) social media also increasingly plays a key role in how people interact with each other, as well as how they stay up to date on what is happening around them (Lau, 2017). According to the Pew Research Center (2015), social media use (SMU) by American TAY has increased from 12% in 2005 to 90% in 2015. Furthermore, 45% of American TAY are online almost constantly and 97% use a social media platform, such as YouTube, Facebook, Instagram, or Snapchat (Pew Research Center survey, 2018). Excessive use of social media is also common (Lerma et al., 2021; Marttila et al., 2029; Meshi et al., 2019). A study involving TAY ($n = 10,076$) in Canada found that SMU is also prevalent with 81.3% of TAY reporting moderate to heavy SMU daily before the COVID-19 pandemic (Sampasa-Kanyinga et al., 2019). It is important to note, excessive or heavy SMU is considered two hours or more of SMU as previous research demonstrates that TAY with less than two hours of SMU had a healthier mental health profile than those with greater than two hours of SMU (Sampasa-Kanyinga et al., 2019). Research conducted by Twenge (2019) also demonstrates that SMU greater than 1 hour/day is associated with poorer mental health. Heavy use of social media has also further increased as a result of the COVID-19 pandemic (Zhong et al., 2021).
Social Media Use & Mental Health

Several studies have examined whether excessive use of social media is associated with mental health problems. To date, there is consistent evidence of a relationship between SMU and anxiety/depression but less evidence for positive indicators of wellbeing and life satisfaction. Drawing from an epidemiological sample of American TAY, Twenge (2017) reported that those who spent more time on in-person social interaction, sports/exercise, homework, or attending religious services (essentially non-SMU activities) were less likely to report mental health issues compared to TAY who had higher SMU.

Woods and Scott (2016) examined the extent to which the heavy use of social media is related to sleep quality, self-esteem, anxiety, and depression in Scottish TAY. They found that in line with previous findings (Banjanin et al., 2015, Farahani et al., 2011, Pantic et al., 2012), heavier SMU was associated with higher levels of anxiety and depression, poor sleep, and low self-esteem. To be more specific, they report that anxious TAY had higher SMU compared to non-anxious TAY. Similarly, depressed TAY also had higher SMU than non-depressed TAY. However, as this study was cross-sectional the authors were unable to assess the direction of the relationship.

Additionally, a systematic review consisting of 16 studies (comprising of both cross-sectional and longitudinal studies) reported that heavy SMU is associated with poor mental health (Karim et al., 2020). For instance, research by Feder et al. (2019) found that participants with heavier SMU reported more symptoms of psychopathology than participants with lower SMU. Moreover, Rasmussen et al. (2020) found that SMU may be a threat leading to mental health struggles among TAY and that SMU may be a pastime that TAY turn to when dealing with difficult emotions. Orben and Przybylski (2019) also found that there is a small negative association between SMU and TAY well-being. Keles et al. (2019) found through a systematic
review of 13 studies (12 were cross-sectional and only one was longitudinal) that time spent on social media, type of activity (the quality and quantity of users’ engagement), levels of investment (i.e., the amount of effort and time one puts into social media), and addiction to social media all correlate with more severe symptoms of depression, anxiety, and psychological distress. Similar findings have also been reported in other epidemiological studies (Sampasa-Kanyinga et al., 2015; Zhao & Zhou, 2020).

On the other hand, there is also research to suggest there may be no negative associations between extended SMU and mental health. An 8-year longitudinal study by Coyne et al. (2020) found that high amounts of SMU were not associated with increased mental health issues across development. Similarly, Fardouly et al. (2020) found through cross-sectional research that although participants that used YouTube, Instagram, and Snapchat reported more body image concerns and eating pathology than participants who did not use these platforms, there were no differences between these participants on depressive symptoms or anxiety, highlighting that the effects of SMU may differ based on the health outcome studied. Similarly, Blomfield and Barber (2014) found no relationship between the duration of SMU and depressed mood. Likewise, Datu et al. (2012) found that there was no significant association between the use of Facebook ($r = 0.04, p = 0.70$) and depression levels in TAY in the Philippines.

A recent meta-analysis of 44 studies examining the association between heavy SMU and symptoms of depression indicated that depressive symptoms were significantly, but weakly, associated with heavy SMU ($r = 0.11$) for adults but not for TAY ($r = 0.02$) (Cunningham et al., 2021). Hence, the effect size in the case of adults suggested that the association from the meta-analysis was small but statistically significant.

It is important to note that the participants recruited could have led to the null or weak associations between heavy SMU and mental health. For instance, since the aforementioned
studies did not specifically recruit those with pre-existing symptoms of depression/anxiety, there could be greater variability in symptoms of anxiety/depression, leading to weaker associations. Some research also suggests that heavy SMU may not be a problem for those who are well-adjusted (Nereim et al., 2020; Shensa et al., 2018). Hence, if greater SMU is particularly harmful for those with pre-existing mental health issues, it may explain why studies that are made up mostly of well-adjusted TAY find only weak or non-significant correlations. Thus, the present study will focus on TAY with pre-existing symptoms of anxiety/depression as the aim is to recruit TAY with these symptoms.

There could also be several other reasons behind the findings of null or weak associations between heavy SMU and mental health. There may be issues of inaccurate measurement (e.g., self-reported screen-time versus actual screen-time) along with major methodological differences between the studies included in the meta-analysis (e.g., some studies analyzing data by gender or age group whereas others are not; some studies reporting only on one social media platform - such as Facebook - whereas others reporting on several). Moreover, epidemiological surveys on mental health often do not use validated assessment tools and are often based on brief or single-item indicators, which are less reliable than more comprehensive assessment instruments. Although these may be some of the reasons behind the null or weak associations, these criticisms may also apply to studies that have found significant effects. Given the preponderance of cross-sectional studies, limiting the causal inferences, experimental studies investigating the effects of reducing SMU are needed to better understand the relationship between SMU and mental health among TAY.

The present study focused on TAY with pre-existing symptoms of anxiety/depression since the aim was to recruit TAY with pre-existing symptoms of anxiety/depression on the assumption that heavy SMU may not be a problem for those in community-based samples who
are, on average, well-adjusted (Nereim et al., 2020; Shensa et al., 2018). It is important to study TAY with emotional distress as they are at risk for life-long mental illness (Xie et al., 2014). Additionally, part of the reason for the weak associations between SMU and mental health might be because most studies were in healthy samples, but there is reason to believe that this relationship is stronger in those with elevated baseline distress.

**Loneliness**

**Definition and Prevalence**

Loneliness is the subjective distressing feeling of being alone and constitutes a prolonged period of time as opposed to a momentary feeling (Hawkley & Cacioppo, 2010). In contrast, social isolation is a state in which an individual lacks a sense of social belonging, true engagement with others, and fulfilling relationships (Holt-Lunstad et al., 2015). It is important to make a distinction between loneliness and social isolation as one can live alone and not feel lonely; on the other hand, one can feel lonely even while being/living amongst other people. Based on a survey conducted by the Mental Health Foundation (2010), a greater proportion of younger people (aged 18–34 years) compared to older adults reported often feeling lonely, worry about feeling lonely, and seek help for loneliness. More specifically, compared to one-third of older respondents more than half of the young adults indicated that they often felt lonely (as opposed to sometimes, rarely, or never). In a more recent survey conducted by Statistics Canada (2021), TAY (17-25 year olds; Wilens & Rosenbaum, 2013) experience loneliness more frequently than older adults with nearly 1 in 4 (23%) TAY reported they always or often felt lonely. Research by Lee and Goldstein (2016) suggests that transitioning to young adulthood and moving away from family to university could represent a higher susceptibility to loneliness. Consistent with the literature (Cacioppo et al., 2010; Vanhalst et al., 2012) loneliness has also been found to invoke feelings of depression in TAY.
Loneliness is a significant human emotion that can have a wide range of adverse effects on human psychology, behavior, health and functioning. According to previous research (Crick & Ladd 1993; Heinrich & Gullone 2006; Koenig & Abrams 1999) TAY who are lonely tend to report higher rates of anxiety, social withdrawal, and suicidal ideation and attempts compared to TAY who are not lonely. Besides an increased risk of depression, loneliness is also a risk factor for other forms of psychopathology (Lasgaard et al., 2011). Lonelier individuals also tend to have more maladaptive strategies for coping with stress as opposed to non-lonely individuals; and also report lower global satisfaction with their lives (Matthews et al., 2019).

**Social Media Use & Loneliness: Cross-sectional Findings**

To date, the majority of the cross-sectional findings show evidence for the link between heavy SMU and loneliness. For instance, research conducted by Barry et al. (2017) found that heavy SMU in TAY is associated with greater loneliness (Barry et al., 2017). To provide context, this study consisted of 226 participants and found that SMU was moderately and positively associated with loneliness. SMU was measured through the use of a survey developed for this study asking participants questions about the basic parameters of their SMU such as the number of social media accounts, frequency of checking social media, connectedness/lack of connectedness to their parents on social media, etc. Furthermore, using participants representative of TAY (n = 1,787) in the United States (U.S.), Primack et al. (2017) found that both the duration and frequency of SMU were strongly associated with higher loneliness. SMU was assessed using both time and frequency by self-report.

While several studies have reported associations of heavy SMU with greater loneliness, not all studies have. For instance, a cross-sectional study by Yavich et al. (2019) did not find a statistically significant association between SMU and loneliness. The null finding could be due to many reasons. It is important to note that SMU was measured only through time spent on
Facebook, which is not the most accurate way to evaluate SMU as many young adults have various social media accounts (e.g., Instagram, TikTok, Snapchat, etc.) (Pew Research Center, 2018). Moreover, participants were also required to study in groups at least several times a week; these group study practices may have reduced loneliness for TAY.

Currently, the vast majority of research conducted in the area of SMU and loneliness are cross-sectional in nature, with inconsistencies as well, thus, highlighting the need for prospective and experimental studies in this area to provide a greater understanding of the relationship between SMU and loneliness.

**Social Media Use & Loneliness: Quasi-experimental & Longitudinal Findings**

A quasi-experimental study examining the association between the effects of different SMU platforms on loneliness among university students in Japan ($n = 155$) divided students into four different groups based on their usage of social media platforms: Twitter only, Twitter and Facebook, Twitter and Instagram, or users of all three social media platforms. They found that there were no effects of loneliness for participants who used only Twitter or both Twitter and Instagram (Ye et al., 2021). However, loneliness reduced for participants that used both Twitter and Facebook. Furthermore, users of all three social media platforms decreased in loneliness, when they used Facebook through their smartphones.

A longitudinal study conducted in Norway examining the implications of SMU found that users of social media reported more loneliness than nonusers (Brandtzaeg, 2012). This study had a total of 2,000 participants and collected data from 2008-2010. It is important to consider data was collected from 2008-2010 when social media wasn’t used like it is today (Pew Research Center, 2015). Additionally, this study used the revised UCLA loneliness scale to measure for loneliness and differentiated between users of social media and non-users by simply asking them
if they are using any social networking sites, so the amount or frequency of SMU was not quantified.

**Social Media Use & Loneliness: Experimental Findings**

Very few experimental studies exist, and the few that have been conducted have yielded mixed results. For instance, Hunt et al. (2018) conducted an experimental study examining how reducing SMU to 30 minutes/day for 3-weeks or less impacted loneliness in a population of TAY \((n = 143)\). Hunt et al. (2018) used the revised UCLA Loneliness Scale and also used screen shots to objectively measure time spent in SMU. These researchers found that the participants in the intervention group reported a significantly greater reduction in loneliness over three weeks compared to the control group who monitored their SMU but had no restriction on their SMU. Their findings strongly suggested that reducing SMU may lead to significant reductions in loneliness, at least in a healthy population of TAY.

In contrast, another experimental study conducted in TAY investigating the effects of SMU on loneliness found no significant effects (Agadullina et al., 2020). In this study, participants in the intervention group \((n = 40)\) were instructed to stop using SMU for four weeks, while the control group \((n = 37)\) were instructed to use SMU as per their usual. They found no significant differences in loneliness as a function of the intervention. There are several possible reasons why these researchers may have found no significant results. Firstly, Agadullina et al. (2020) had limited power to detect small to medium effect sizes due to small sample size. Second the study’s procedure to verify intervention group adherence appeared to be weak. SMU was evaluated via self-report for just a total of 3 times during the 4-week study. Third, to ensure that participants in the intervention group complied, the researchers checked the participants’ social media accounts on a daily basis for activity, which would only detect if any posts were made, and not if participants only browsed others’ posts. Hence, given the noteworthy implications of
loneliness along with the inconsistent findings reported in previous literature, it is important to study loneliness and its association with SMU, as well as identify interventions that may reduce loneliness in a high-risk population of TAY.

Moreover, another experimental study examining the effects of abstinence from SMU on loneliness found that those who abstained from SMU compared to the control group had an increase in loneliness (Vally, & D’Souza, 2019). This study used a randomized, controlled design and consisted of 68 participants. This study used one of the subscales of the Social and Emotional Loneliness Scale for Adults—Short Form (SELSA) DiTommaso et al. (2004) to measure loneliness; SMU was measured by self-report by a questionnaire. Participants in the intervention group were required to abstain from SMU for seven days, while controls were instructed to continue using social media as per their usual. In order to verify abstinence, participants were asked to delete all social media applications from their mobile devices since mobile devices tend to be the most frequently used means for accessing social media for TAY, deleting the applications would help to prevent logging-in behavior. Participants in the intervention group were also asked post-intervention about the number of times they logged into their accounts during the experimental period. The findings of this study do not align with previous research (Agadullina et al., 2020; Hunt et al., 2018) as it found evidence for abstinence increasing loneliness, the opposite of Hunt et al. (2018). Specifically, this study’s duration was shorter (seven days), hence, it’s possible loneliness could increase with abstinence in the short term, whereas Hunt et al. (2018) just reduced but not eliminated SMU so that could be the reason for the reduction in loneliness among their experimental participants.
Possible Mechanisms Linking Social Media Use, Mental Health, and Loneliness

Researchers have suggested a few possible explanations to explain why greater SMU might be associated with mental health issues. For example, Abi-Jaoude et al. (2020) found that the effects of heavy SMU on the psychosocial behaviours of TAY (e.g., social support, loneliness) are mediated by cyberbullying and the normalization of self-harm and suicidality among youth. In other words, the effect of excessive SMU on social support and loneliness depends on whether one has been cyberbullied and/or has normalized self-harm or suicidality. Besides cyberbullying and the normalization of self-harm and suicidality, negative experiences can also moderate the relationship between heavy SMU and loneliness due to the concept of negativity bias, people tend to give greater importance to negative things over positive things (e.g., negative experiences over positive experiences (Primack et al., 2019). Additionally, reduced and delayed sleep due to the use of digital media near bedtime may also explain the relationship between SMU and poor mental health such as depression and anxiety (Woods & Scott, 2016) since sleep disruption is associated with increased activity of the sympathetic nervous system and hypothalamic–pituitary–adrenal axis system noted to be important in emotion regulation (Medic et al., 2017). Additionally, the displacement hypothesis may also be useful for explaining a possible link between heavy SMU and mental health. The displacement hypothesis (Lees et al., 2020; Przybylski & Weinstein, 2017) suggests that heavy SMU may contribute to loneliness if time on social media replaces in-person social activities that are beneficial to TAY’s health and emotional development (such as sports or other hobbies). Previous research also suggests that social comparisons regarding perceived contact with others are also linked to loneliness given the tendency for people to only present themselves online in the most favourable light and positive contexts (e.g., flattering photos, vacations, parties,
restaurants) (Richey et al., 2018). Although, researchers have suggested several possible explanations to why heavy SMU might be associated with mental health issues, no experimental studies have considered social comparisons as a mechanism. Therefore, the present study is the first experimental study to explore social comparison as a mechanism between SMU and loneliness. This mechanism will be discussed in greater detail in the following section.

**Social Comparison Theory**

According to social comparison theory, people have an innate drive to evaluate their own attitudes, abilities, and traits, in comparison to others (Festinger, 1954). Engaging in social comparison is especially common among TAY (Chan & Prendergast, 2007). Unfavourable social comparisons involve comparing oneself to worse-off others and may enhance mood, along with reducing loneliness (by perceiving one’s own contact with others as better than compared to other people’s contact). On the other hand, a favourable comparison involves comparing one’s self to individuals who are deemed to be superior to the self. Such comparisons may make one feel worse and may contribute to anxiety, depression, and loneliness (Arnold et al., 2021; Stewart et al., 2013). Social comparison processes have also been implicated as a link between SMU and poor mental health given the tendency for people to only present themselves online in the most favourable light and positive contexts (e.g., vacations, parties, restaurants) (Richey et al., 2018). This often leads to feelings of inferiority about yourself (Collins, 1996) as social comparisons regarding perceived contact with others are linked to loneliness. Research also shows that continuous negative evaluation of oneself against others has the potential to have adverse impacts on one’s self-esteem, self-image along with emotional well-being (Burleson et al., 2005; Wang et al., 2017). Overall, these findings signify the importance of understanding loneliness from a social comparison perspective in order to reduce the public health problem of loneliness.
**Social Comparisons & Mental Health**

Higher frequency of social comparisons are associated with poorer mental health. Previous research demonstrates social comparisons are likely to have an important role in the onset of depressive symptoms with reductions in social comparisons leading to improvements in depression (Kelly et al., 2007). Furthermore, Wetherall et al. (2019) examined the association of depressive symptoms and suicide risk with evaluation in social comparisons in the form of social rank. Wetherall et al. (2019) found that there is an increase in depressive symptoms and self-harm, particularly in clinical populations when there is lower perceived social rank, suggesting that individuals with depressive symptoms are more likely to judge themselves negatively in comparison to others. Studies evaluating negative self-evaluation in relation to others found that in both mixed clinical and nonclinical populations there was a significant correlation between frequency of social comparisons and depression (Gilbert et al., 2010; Sturman & Mongrain, 2005; Thwaites & Dagnan, 2004). An intervention study found that using group compassion-focused therapy, led to improvements in self-evaluation ratings, depression and anxiety (Judge et al., 2012). Research investigating the effects of specific comparisons found that those with depression rated positive and negative comparisons as equally important, whereas the controls rated positive comparisons as more important, implying that the importance of information on social comparisons may be related to depressive symptoms (Thwaites & Dagnan, 2004).

Although, there has been less research conducted on the role of social comparisons in anxiety disorders; diary reports suggest that patients with anxiety are more likely to engage in unfavourable social comparisons and compare on several dimensions at a time, and are more vulnerable to affective reactions than patients without anxiety (Antony et al., 2005). Moreover, studies found that the correlations between frequency of social comparisons with anxiety in adult
(Gilbert et al., 2010) and TAY (Cunha et al., 2008) are statistically significant when assessing negative self-evaluation in comparison to others.

**Social Comparisons & SMU**

The application of social comparison theory is extremely relevant when studying social media platforms, as one can easily portray themselves unrealistically and positively by cherry-picking their most desirable moments and experiences, selectively uploading edited photos (Chae, 2017), whereas the more normal or challenging real-life situations and experiences are not posted (Herring & Kapidzic, 2015). Individuals with anxiety and depression often report feeling lonely, are typically less engaged in community hobbies, and spend more time alone and potentially on social media, in part to feel connected to peers (Pittman & Reich, 2016; Primack et al., 2019). As a result, for many young people, especially those with anxiety and depression, viewing other people’s SMU-related pictures of travel, and attending events, activities, and parties could be situations in which they may not be able to readily participate, could lead to loneliness, envy, guilt, regret, self-judgement, anxiety, and depression (Li, 2019; Van de Ven, 2017; Vogel et al., 2015). It is possible that this may be due to the fact that constant exposure to SMU fosters unfavourable social comparisons and exacerbates emotional distress and loneliness in this vulnerable population.

SMU provides the potential of making countless number of social comparisons since online friends/followers vastly exceed in person friends, thus increasing the frequency of social comparisons (Hampton et al., 2011; Reich et al., 2012). A cross-sectional study conducted by Kim et al. (2021) found that heavy SMU is associated with greater amounts of social comparisons, and it also mediates the relationship between social comparisons and stress. Moreover, research by de Vries et al. (2018) found that participants that had viewed positive posts made by others on social media tended to report more social comparisons. An experimental study that manipulated social
comparisons on mental health found that TAY in the U.S. who scored high in social comparison tended to have poorer self-perception, lower self-esteem, and felt more negative about themselves after browsing an acquaintance’s Facebook profile; however, this was not the case for TAY who made fewer social comparisons (Vogel et al., 2015). It is important to note, these studies discussed (Vogel et al., 2015; Vries et al., 2018) are lab studies as opposed to real world interventions like the present study.

Social Comparisons and Loneliness

Very little research has examined social comparisons and loneliness. Dibb and Foster (2021) found that social comparisons were significantly positively associated with loneliness among 214 Facebook users who completed an online questionnaire. Although this study was cross-sectional, it suggests that the relationship between social comparisons and loneliness can be bidirectional – SMU can lead to increased social comparisons which may lead to greater loneliness and loneliness can lead to greater SMU and social comparisons.

Limitations in the Current Literature

As demonstrated by the review of the previous literature on the effects and the association between heavy SMU and mental health, findings are both inconsistent and inconclusive in this area. Cross-sectional research conducted by Barry et al. (2017) on SMU and its relation to loneliness among TAY found that SMU was moderately and positively related to loneliness. However, although considered weak, another cross-sectional study investigating the relationship between SMU and loneliness did not find a significant association between SMU and loneliness (Yavich et al., 2019). This study is considered “weak” due to its assessment of SMU. SMU was only measured through time spent on Facebook, which is not the most reliable way to evaluate SMU as many TAY have various social media accounts (e.g., Instagram,
TikTok, Snapchat, etc.) (Pew Research Center, 2018). Moreover, most cross-sectional studies do not have an objective measure of SMU, this is a limitation as a subjective measure of SMU (i.e., self-report) is subject to recall bias and usually under-reported. Very few experimental studies have examined SMU reduction on loneliness in TAY, and those that exist show mixed findings (Hunt et al., 2018; Agadullina et al) and were conducted among healthy TAY.

The present study builds on past research by focusing on TAY with pre-existing symptoms of anxiety/depression since the aim was to recruit these participants given that they may be more susceptible to the psychologically harmful effects of SMU; whereas, SMU may not be as problematic for those in community-based samples who are, on average, well-adjusted (Nereim et al, 2020; Shensa et al., 2018). Additionally, the present research recruited regular social media users (defined as ≥2hrs/day) as they represent those with problematic use, hence, they would benefit the most from SMU reduction.

**Objectives and Hypotheses**

The primary purpose of this study was to determine if reducing SMU to 1-hour/day in TAY experiencing anxiety and/or depressive symptoms led to a decrease in loneliness at 4weeks compared to control participants who were required to self-monitor their SMU but had no constraints on their SMU. Additionally, the current study examined whether reducing SMU led to reduced social comparisons as a secondary objective. It was predicted that individuals in the intervention group who were asked to restrict their SMU to 1-hour/day would report a greater reduction in loneliness and social comparisons when assessed at post-intervention in comparison to the control group. As an exploratory objective, this study explored whether changes in social comparisons would mediate the intervention effects on reduced loneliness. It was predicted that reduced social comparisons would mediate the intervention effects on reduced loneliness.
Methods

Participants

Participants had to meet the following five requirements in order to participate in this experiment: 1) between the ages of 17-25 years old; 2) undergraduate students enrolled in Carleton University’s first or second-year Psychology courses (PSYC 1001/1002/2001/2002); 3) be regular users of SMU (at least 2 hours/day on average based on self-report at screening); 4) have elevated symptoms of depression or anxiety (via self-assessment); 5) have an iPhone running on iOS 12 or a more recent software or an Android running on 9 pie or a more recent software due to its internal app-tracking system, as this was determined to be the most reliable means of measuring screen-time. Participants were recruited for this study via SONA (Carleton University’s Psychology Experiment Sign-up System). Participants received grade-raising credits for participating in this study. This study was approved by the Carleton University and the Children’s Hospital of Eastern Ontario Research Ethics Boards.

Study Design

The present study used a parallel group randomized control trial (RCT) design, whereby participants were assigned to either intervention or control groups via a computer-generated randomization scheme. All participants were required to monitor their SMU on their smartphones using the Screen-time function and send in daily screenshots of their SMU for the duration of the study (i.e., four weeks). After the first week (baseline period), participants in the intervention group were asked to reduce their SMU to 60 min/day for the next three weeks, whereas participants in the control group had to monitor their SMU via sending screenshots daily but had no restrictions on their SMU and were instructed to continue using social media as per their usual. The control group controls for self-monitoring and increased awareness of SMU and thus can be considered an “active control” given that self-monitoring has been shown to
influence behaviour and mental health outcomes, thus providing a more stringent evaluation of efficacy than a waitlist control (Kim et al., 2017). The SMU reduction goal of 1 hour/day for participants in the intervention group was selected based on research by Twenge (2019) who found that those who do not use SMU at all or who use greater than 1 hour/day are at increased risk of poorer mental health. The present study also used behavioural modification techniques to promote compliance. For example, participants in the experimental group self-monitored their SMU via screenshots and used goal setting based on previous research (Jones et al., 2021; Weintraub et al., 2021) that demonstrated this technique to be effective in producing changes in SMU behaviour. Feedback and positive reinforcement on behaviour through emails was also sent as they are also effective in behaviour change techniques (Crommelinck, & Anseel, 2013; Wei & Yazdanifard, 2014). Prompts for change were also sent through email in order to encourage participants to adhere to the 60 minutes restriction on SMU.

The major social media platforms the current study targeted for reduction included Facebook, Instagram, TikTok, Snapchat, Pinterest, and Tumblr. Messaging apps including Facebook Messenger, WhatsApp, Reddit and texts were not targeted for reduction as research has shown these to be distinct realms of social media (Figueroa Jacinto & Arndt 2018; Kuss & Griffiths 2017). All participants were required to complete an online survey at baseline and at follow-up 4 weeks later. Participants received daily emails for the duration of the study reminding them to send their SMU screenshots the next morning upon wakening.
**Procedure**

Participants signed-up for the Social Media Study online through SONA. A poster was created and posted on the SONA website providing its description, eligibility, duration, and compensation. The study was named: Limiting Social Media Screen-time on Personal Devices. Once interested participants signed up for the study, a research assistant met with the participants via Zoom to describe the study, review the informed consent form, and answer any questions. Also, the research assistant verified if the participants met the eligibility criteria. Figure 1 illustrates the flow of participants throughout the study as per the consort guidelines (Falci & Marques, 2015).

In the initial meeting with the research assistant, participants were informed that they would be required to send daily screenshots by email, displaying the amount of time they have been using social media on their phone to the study’s secured inbox. Participants were shown how to objectively monitor their SMU through the built-in screen time tracker and were provided with instructions on how to take a screenshot of their SMU to send it to the study’s secure inbox. The research assistant also explained to the participants that they will receive 0.5% credits per week for sending their daily screenshots and that they have a 50-50 chance that they will be asked to reduce their SMU to 60 min/day. The research assistant then listed the major social media platforms that the study targeted and clarified that screen-time on messaging platforms (e.g., Facebook Messenger, WhatsApp, or text messages) would not be tracked along with SMU on other popular platforms (e.g., YouTube, Reddit, or Netflix). In both groups, if a participant forgot to send a screenshot for a particular day, they received a reminder email. Moreover, reminder emails were also sent to participants in the intervention group if they exceeded the 1 hour limit in an attempt to promote better intervention adherence.
Seven days after the meeting with the research assistant, participants randomized to the intervention group received an email asking them to reduce SMU to 1 hour per day. On Day 28, all participants received an email reminding them to send in their final screenshot. This email also contained a link to the set of post-intervention questionnaires located on Qualtrics (a secure platform that is commonly used for research at Carleton University). Upon completing this final survey participants earned an additional 0.5% credit.
Figure 1.

**Participant flow per Consolidated Standards of Reporting Trials**

- Participants assessed for eligibility \( (n = 286) \)
- Excluded \( (n = 52) \)
  - Age
  - Missing Screenshots
  - Failing Attention checks
- Participants Randomly assigned \( (n = 234) \)
- Allocated to intervention \( (n = 123) \)
  - Lost to follow-up \( (n = 6) \)
  - Analyzed \( (n = 117) \)
- Allocated to control \( (n = 111) \)
  - Lost to follow-up \( (n = 8) \)
  - Analyzed \( (n = 103) \)
Measures

At baseline, participants provided the following demographic information: name, age, gender (male/female/other), student number, and email address in order to link their data. Additionally, participants at baseline and at follow-up were asked questions on their lifestyle, mental health, non-targeted screen time, SMU on smartphones and SMU on other devices.

Social Media Use (SMU)

SMU (min/day) was measured at baseline based on the average daily SMU from days 1 to 7; whereas, SMU during the intervention was measured based on the average daily SMU from days 8 to 28. Once a daily screenshot of SMU was received a research assistant calculated the total SMU for that day in minutes for each participant and tracked it in an Excel spreadsheet. This method of objective monitoring provides more accurate measurement than self-report which tends to be unreliable and subject to cognitive bias (Gower, & Moreno, 2018; Lee et al., 2017). SMU on other devices was measured via self-report; participants were asked to input time spent on social media on other devices during the baseline and intervention surveys. As SMU on other devices is likely to be more intentional and less than smartphone SMU, research shows that it is more accurately remembered (Alfawareh, & Jusoh, 2014; Kuru et al., 2017). Participants’ screenshot had to display screen time for each application within the past 24 hours.

Loneliness

The revised UCLA Loneliness Scale (Russell et al., 1980) measures perceived social isolation. This scale has a high internal consistency (α = 0.94), good construct validity (Russell et al. 1980), and good test-retest reliability (r = .73) (Russell, 1996). The revised version of this scale includes 20 items, each scored on a scale of 1 (never) to 4 (often) and includes reverse-scored items. Sample items include statements such as “No one really knows me well,” “My
Social Media Use, Loneliness and Social Comparisons

interests and ideas are not shared by those around me,” and “I feel in tune with the people around me” (reverse scored). Higher mean scores indicate greater loneliness and social isolation. Previous studies which also used this scale demonstrated good sensitivity to change in loneliness among TAY (Hunt et al., 2018; Verduyn et al., 2015).

**Social Comparisons**

The Technology-Based Social Comparison and Feedback-Seeking subscale (SCFS) measures social comparison as a subscale of the Motivations for Electronic Interaction Scale (MEIS) by Nesi and Prinstein (2015). The subscale was devised to evaluate attitudes and behaviours of TAY on texting, and using various social media platforms; in other words, it was designed to get a sense of TAY’s electronic interaction. The subscale consists of 10 items (e.g. “I use electronic interaction to compare my life with other people's lives and “I use electronic interaction to compare the way I look with other people’s looks”). A 5-point Likert scale was used to rate each item to personal relevance on a scale of 1 (Not at all true) to 5 (Extremely true). Based on the average of the 10 items, higher scores indicated higher levels of technology-based social comparisons. This scale has strong internal consistency among TAY (α = .92; Nesi & Prinstein, 2015). Please note that although various other outcome measures were measured in this study they are not described here as they are not relevant to the current thesis.

**Power Analysis**

GLIMMPSE 3.0.0, a software designed to assess power in longitudinal designs was used to calculate statistical power (Kreidler et al., 2013). Power was estimated based on a hypothesized group x time interaction using a repeated measures analysis of variance (ANOVA). Those in the intervention group were expected to decline 1/3 of a standard deviation (SD) in loneliness and social comparisons; hence, a small effect size was inputted into the power
analysis. Controls were predicted to maintain their prior level of SMU. Using a 2 (group) x 2 (time) ANOVA, 200 participants were required to achieve a power of .80, assuming a criterion for significance of $p < .05$.

**Analytical Plan**

**Preliminary Analyses**

Variables were assessed to determine the percent of missing data. The Shapiro-Wilk test was assessed to determine if the distributions of all variables of interest were normally distributed. Homogeneity of variance was assessed by Levene’s Test. Sphericity was not assessed as only two time points were used. Finally, variables were screened for outliers by examining standardized residuals ($z > 3.00$).

**Demographic and Descriptive Statistics**

Independent t-tests were used to compare groups at baseline for continuous data and Pearson chi-square tests were used for categorical data. Independent t-tests were also conducted to compare groups on compliance with submitting daily screenshots of SMU. For $t$-tests, Cohen’s $d$ (Cohen 1988) was used to examine effect sizes: small ($d = 0.2$), medium ($d = 0.5$), and large ($d = 0.8$).

**Main Analyses**

To test the primary hypothesis (i.e., participants in the intervention group would report a significant decrease in loneliness compared to controls) a 2 x 2 repeated measures ANOVA consisting of a between-subjects factor of Group (intervention versus control) and a repeated- measures factor of time (baseline and 4-week postintervention) was conducted. Similarly, to evaluate the second objective (i.e., participants in the intervention group will report a significant decrease in social
comparisons compared to controls) a 2 x 2 repeated measures ANOVA was conducted, with the between-subjects factor of group (control versus intervention) as well as a repeated-measures factor of time (baseline and post-intervention). For each repeated measures ANOVA effect size was interpreted based on partial eta-square value with the following ranges to indicate small, medium and large effect sizes, respectively: small (0.01 – 0.05), medium (0.06 – 0.13), and large (0.14 – 1) (SPSS Tutorials, 2022).

Exploratory Analysis

The purpose of this mediation analysis was to estimate the pathway that operates through a mediator M, along with the pathways of influence from the causal variable (X) on outcome variable (Y). The series of causal steps involve the indirect pathway a and b, in which X affects the mediator M, which in turn causally influences Y, and the direct pathway c in which X affects Y. Figure 2 provides a visual representation of the mediation relationship.

Currently there is a lack of adequate methodology and software to run a mediation analysis for prospective experimental studies; hence, to test the exploratory objective that social comparisons mediate the relationship between reduced SMU and loneliness, a stepwise procedure was used similar to the steps described by Baron and Kenny (1986) with modifications to accommodate the nature of the data herein. In this analysis to explore mediation, each step relied on the preceding step to meet a statistical significance threshold of $p < .05$. If one step led to a statistically nonsignificant result ($p > .05$), model testing stopped and it was concluded that based on these exploratory analyses, social comparison may not be a mediator.
The first step in this model was to analyze whether SMU reduction leads to a reduction in the dependent variable (i.e., loneliness) using a 2 x 2 repeated measures ANOVA, which represents pathway c. The second step consisted of analyzing whether SMU reduction led to a reduction in social comparisons using a 2 x 2 repeated measures ANOVA, which represents pathway a. The final step was to investigate whether change in social comparisons controlling for the intervention effect affected loneliness which represents path b. This step was tested using a 2 x 2 repeated measures ANOVA, with a covariate. Finally, mediation is assumed if the effect of the intervention on loneliness controlling for social comparisons is zero, representing pathway c’.
Figure 2. Social comparison as a possible mediator between SMU and Loneliness
Results

Preliminary Analyses

Missing data was present on age (5%), SMU on smartphones (1.8%), and loneliness (0.4%). There was no missing data for gender, monitoring compliance (screenshots), and social comparisons. Because missing data was ≤ 5%, pairwise deletion was used. According to the Shapiro-Wilk test, there were violations of normality for the outcome variables loneliness (Shapiro-Wilk = .97, p < .001) and social comparisons (Shapiro-Wilk = .96, p < .001). Given that ANOVA with large samples is robust, no transformations were deemed necessary. Levene’s test revealed that the assumption of homogeneity of variance was not violated at baseline for loneliness ($F(1,214) = .61, p = .44$) or social comparisons ($F(1,214) = .174, p = .19$). Inspection of z-scores indicated the presence of no outliers for loneliness and three outliers for social comparisons.\(^1\)

Demographic and Descriptive Statistics

Demographic and baseline measurements of the participants are reported in Table 1. On average, the participants were 17-19 years of age (77% females, 23% males). The overall mean SMU at baseline was 174.89 minutes (SD = 76.35). There were no group differences at baseline in SMU ($t(218) = 1.24, p = .22, d = 0.17$). During the 3-week intervention phase, participants in the control group had an average of 189.41 min/day on SMU whereas participants in the intervention group had an average of 78.25 min/day. There were no group differences at baseline in loneliness, ($t(217) = -.34, p = 0.74, d = 0.05$) or social comparisons, ($t(214) = .99, p = 0.32$).

---

\(^1\) A sensitivity analysis was conducted without the outliers; however, the conclusions remained the same.
d = 0.13. The Chi-square tests of independence showed no group differences at baseline on gender: $X^2 (2, N = 220) = 2.64, p = .55$; or age: $X^2 (2, N = 209) = 1.87, p = .39$. No group differences were evident for compliance on submitting screenshots at baseline, $t(218) = .37, p = .71, d = 0.04$ or at intervention, $t(209) = .79, p = .43, d = 0.11$. Participant compliance to submitting screenshot data is reported in Table 2.

The repeated measures ANOVA on compliance showed the group x time interaction was non-significant, $F(1, 274) = .027, p = .87, \eta_{p}^2 = .01$, indicating that there were no significant group changes for compliance on submitting screenshots.

The repeated measures ANOVA on other SMU devices showed the group x time interaction was significant $F(1, 217) = 5.63, p < .05, \eta_{p}^2 = .025$, indicating there were group differences from baseline through the intervention for SMU on other devices such that the intervention group reduced SMU on other devices and controls increased SMU on other devices (see Table 2). However there was no main effect of time $F(1, 217) = .007, p = .94, \eta_{p}^2 = .001$ or main effect of group $F(1, 217) = 2.95, p = .08, \eta_{p}^2 = .01$.

**Manipulation Check: Social Media Use on Smartphone**

As indicated in Table 2 and Figure 1 the repeated measures ANOVA on SMU showed the group x time interaction was significant, $F(1, 214) = 117.85, p < .001, \eta_{p}^2 = .36$, indicating that intervention participants reported significantly greater reductions in SMU than controls from baseline through the intervention period. Simple main effects showed that intervention participants showed a significant reduction at week 2, $t(145.24) = 9.93, p < .001, d = 1.37$, week 3, $t(165.25) = 11.66, p < .001, d = 1.59$, and week 4, $t(162.07) = 10.07, p < .001, d = 1.38$ with an average of 78.25 min/day (reducing their daily SMU by approximately 50%) during the
3-week intervention period. However, as expected the control group showed no change in SMU with an average of 188.7 min/day during the intervention $t(218) = .37, p = .72, d = 0.17$.

Main Analyses

**Effects of Reducing SMU on Loneliness**

The repeated measures ANOVA analysis on loneliness revealed a significant interaction effect between group and time and a small effect size on loneliness, $F(1, 217) = 4.2, p = .04, \eta_p^2 = .02$. The simple main effects showed that levels of loneliness decreased significantly from baseline to post-intervention for the experimental group, $F(1, 123) = 5.87, p = .02, \eta_p^2 = .05$, but not for the control groups $F(1, 119) = .82, p = .37, \eta_p^2 = .007$. There was also a nonsignificant main effect of group and a small effect size, $F(1, 217) = .12, p = .73, \eta_p^2 = .001$. The main effect of time on loneliness was also non-significant with a small effect size, $F(1, 217) = 1.64, p = .2, \eta_p^2 = .008$.

**Effects of Reducing SMU on Social Comparisons**

The repeated measures ANOVA on social comparisons revealed a non-significant interaction effect between group and time and a small effect size on social comparisons $F(1, 218) = .25, p = .62, \eta_p^2 = .001$, as well as a non-significant main effect of group and a small effect size, $F(1, 218) = 1.58, p = .21, \eta_p^2 = .007$. However, there was a significant main effect of time on social comparison with a large effect size, $F(1, 218) = 28.27, p < .001, \eta_p^2 = .12$. The simple main effects showed that social comparisons decreased significantly from baseline to post-intervention for the experimental group, $F(1, 123) = 15.54, p < .001, \eta_p^2 = .112$ and unexpectedly, significantly decreased for the control groups as well, $F(1, 119) = 10.05, p = .002, \eta_p^2 = .078$. (see Table 3).
Social Comparisons Mediating the Relationship Between SMU and Loneliness

The stepwise mediation analysis revealed that social comparisons did not mediate the relationship between SMU and loneliness. Specifically, Step 1 to test if loneliness significantly reduced for participants in the experimental condition relative to controls was significant (p < .05). Hence, step 2 to determine if social comparisons significantly reduced for participants in the experimental condition compared to controls was undertaken. However, the 2 x 2 repeated measures ANOVA showed that the condition by time interaction was not significant, indicating reductions in SMU did not have a significant impact on social comparisons, thus social comparisons likely did not play a mediating role. Hence, there was no need to pursue the remaining steps of the mediation model.
Table 1.

Demographic and Baseline Descriptive Statistics by Group

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intervention</th>
<th>Control</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>117</td>
<td>103</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td>.55</td>
</tr>
<tr>
<td>Male</td>
<td>25</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>92</td>
<td>76</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td>.39</td>
</tr>
<tr>
<td>17-19</td>
<td>84</td>
<td>77</td>
<td></td>
</tr>
<tr>
<td>20-22</td>
<td>22</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>23-25</td>
<td>4</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Baseline Variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loneliness</td>
<td>2.18 (.65)</td>
<td>2.15 (.61)</td>
<td>.74</td>
</tr>
<tr>
<td>Social Comparisons</td>
<td>2.14 (.84)</td>
<td>2.25 (.84)</td>
<td>.32</td>
</tr>
<tr>
<td>Monitoring Compliance</td>
<td>6.94 (.24)</td>
<td>6.95 (.22)</td>
<td>.71</td>
</tr>
<tr>
<td>(screenshots/week)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SMU Smartphones (min/day)</td>
<td>168.04 (73.01)</td>
<td>180.8 (79.74)</td>
<td>.22</td>
</tr>
<tr>
<td>SMU Other Devices (min/day)</td>
<td>84 (110.4)</td>
<td>99 (117)</td>
<td>.39</td>
</tr>
</tbody>
</table>

Note. Data are mean (SD) unless otherwise specified. *Group differences in gender and age were determined by \( \chi^2 \), differences in other variables were determined by independent \( t \) tests.
Table 2.

Compliance to SMU Monitoring and SMU Restriction (by Device and Group)

<table>
<thead>
<tr>
<th>Variable &amp; Assessment Period</th>
<th>Intervention N = 117</th>
<th>Control N = 103</th>
<th>p, Group X Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring Compliance (screenshots)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline (Days 1-7)</td>
<td>6.94 (.24)</td>
<td>6.95 (.22)</td>
<td></td>
</tr>
<tr>
<td>Intervention (Days 8-28)</td>
<td>20.64 (.78)</td>
<td>20.73 (.84)</td>
<td></td>
</tr>
<tr>
<td>SMU Smartphones (min/day)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 1 (Baseline)</td>
<td>168.04 (73.01)</td>
<td>180.81 (79.94)</td>
<td>.22</td>
</tr>
<tr>
<td>Week 2</td>
<td>81.65 (48.05)</td>
<td>185.89 (96.58)</td>
<td>&lt;.001***</td>
</tr>
<tr>
<td>Week 3</td>
<td>75.57 (52.71)</td>
<td>188.38 (84.81)</td>
<td>&lt;.001***</td>
</tr>
<tr>
<td>Week 4</td>
<td>77.54 (57.78)</td>
<td>187.56 (96.76)</td>
<td>&lt;.001***</td>
</tr>
<tr>
<td>SMU Other Devices</td>
<td></td>
<td></td>
<td>&lt;.05*</td>
</tr>
<tr>
<td>Baseline (Days 1-7)</td>
<td>84 (110.4)</td>
<td>99 (117)</td>
<td></td>
</tr>
<tr>
<td>Intervention (Days 8-28)</td>
<td>63.26 (83.86)</td>
<td>109.81 (143.13)</td>
<td></td>
</tr>
</tbody>
</table>

Note. Data are mean (SD);
*p < .05
***p < .001
### Table 3.

**Loneliness, Social Comparison by Group and Time**

<table>
<thead>
<tr>
<th>Variable &amp; Assessment Period</th>
<th>Intervention N =117</th>
<th>Control N =103</th>
<th>p, Main Effect of Group</th>
<th>p, Main Effect of Time</th>
<th>p, Group X Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loneliness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline (Days 1-7)</td>
<td>2.18 (.65)</td>
<td>2.15 (.61)</td>
<td>.73</td>
<td>.201</td>
<td>.04*</td>
</tr>
<tr>
<td>Intervention (Days 8-28)</td>
<td>2.09 (.65)</td>
<td>2.17 (.65)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Comparisons</td>
<td></td>
<td></td>
<td>.21</td>
<td>&lt;.001***</td>
<td>.62</td>
</tr>
<tr>
<td>Baseline (Days 1-7)</td>
<td>2.14 (.84)</td>
<td>2.25 (.84)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intervention (Days 8-28)</td>
<td>1.92 (.80)</td>
<td>2.07 (.81)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Data are mean (SD);

* *p <.05

***p <.001
Figure 3. Total daily social media use over time by group. Error bars represent standard errors.
Discussion

There has been much debate around SMU and mental health. Despite the rapid growth of research in this area, the association between SMU and mental health continues to remain debated. To gain further insight into this area of research, the present study experimentally investigated the effects of reducing SMU on loneliness and social comparison, and whether social comparison could be a possible mediator in how social media impacts loneliness amongst a sample of Canadian TAY with emotional distress. It is important to examine loneliness because if left untreated, loneliness can have significant consequences for mental and physical health, including sleep problems (Matthews et al., 2017), impaired cognitive performance (Badcock et al., 2015), along with anxiety and depression (Ebesutani et al., 2015). Hence, intervention at an earlier stage is essential in order to prevent long-term loneliness and its mental health consequences for TAY.

Findings indicated that limiting SMU to approximately 1-hour/day (a 50% reduction from baseline) produced a significant reduction in loneliness relative to a control group that had unrestricted access to SMU and who showed no change in SMU. However, the SMU reduction intervention did not produce a significant change in social comparisons relative to controls. Instead, both groups showed a decrease. Thus, social comparisons did not mediate the effects of the SMU intervention on reduced loneliness.

Effects of SMU on Loneliness

Ironically, SMU can impact loneliness despite it intending to do the opposite. Few experimental field trials have been conducted to examine this relationship. Similar to Hunt et al. (2018), the present study found a significant reduction in loneliness for the participants in the intervention group who were asked to reduce SMU. Although the present study built off Hunt et al. (2018), it only recruited participants with heavy SMU (two hours or more) and had a
1 hour/day limit on SMU for those in the intervention group. These differences are important since they make the present study distinct from previous experimental studies. The present study also recruited TAY with high anxiety/depression as it was expected that the relationship between SMU reduction and loneliness would be stronger for those with elevated baseline distress.

Vally, & D’Souza (2019) also conducted an experimental study examining the effects of abstinence from SMU on loneliness. These researchers found that the intervention group (those who abstained from SMU) compared to the control group had an increase in loneliness. This is in contrast to the findings of the present study where the intervention group reduced in loneliness. It is possible loneliness could increase with abstinence in the short term as the Vally, & D’Souza (2019) study’s duration was shorter (seven days); whereas, the present study asked intervention participants to reduce but not eliminate SMU (for 21 days) which could explain the reason for the reduction in loneliness among the experimental participants. Additionally, complete abstinence of SMU could increase loneliness because it may remove all connections between others; whereas, the present study still permitted some SMU to retain connections.

Similarly, Agadullina et al. (2020) also conducted an experimental study examining the effects of SMU abstinence on loneliness. These researchers conducted a 4-weeks experiment on first-year college students in the U.S. and found that there was no difference between loneliness for the participants in the intervention group compared to the controls. The intervention group (n = 40) was asked to completely stop using SMU whereas the control participants had no restraints on SMU. It is possible that the present study found significant effects of SMU reduction on loneliness while Agadullina et al. (2020) found null effects due to a weak measure of SMU in their study. Notably, SMU was measured by self-report only for a total of 3 times during the 4-week study; researchers also checked daily participants’ social media accounts for activity to see if any posts were made, but were not able to see if participants browsed others’ posts. In contrast,
the current study used more objective measures of SMU through screen shots of time spent on SMU.

The present study is among the first to use experimental evidence to provide a more causal link between SMU and loneliness, which extends previous research simply showing associations primarily based on cross-sectional or observational studies. For example, similar to the research conducted by Barry et al. (2017) who found that heavy SMU in TAY is associated with greater loneliness, the present study was able to validate this through an experimental research design. Both the present study and Barry et al. (2017) used the same scale to measure loneliness (UCLA revised loneliness scale) and had similar sample sizes ($n = 220; n = 226$, respectively). However, the present study measured SMU via screenshots; while, Barry et al. (2017) relied on self-report via surveys to measure SMU. Furthermore, Primack et al. (2017) found that both the duration and frequency of SMU (number of times checked per day) were associated with higher loneliness in young adults. Therefore, results from this experimental study support observational findings that reductions in SMU are linked to lower loneliness.

Effects of SMU on Social Comparisons

Contrary to previous research, the present study found that SMU does not significantly impact social comparisons. Despite the null findings in the present study, it is important to continue to examine SMU and social comparisons because social comparison is strongly related to emotional distress, such as depression and anxiety (Antony et al., 2005; Pera, 2018). Social comparisons may also play a key role in the development of anxiety and depression (McCarthy & Mornina, 2020), making it important to study approaches for reduction. In addition, previous research also shows that negative self-evaluation has the potential to have adverse impacts on one’s self-esteem, self-image, and emotional well-being (Burleson et al., 2005; Wang et al.,
As people’s online networks tend to be larger than in-person networks (Hampton et al., 2011; Reich et al., 2012) it is easy to understand that excessive social comparisons may become a problem in an online context such as social media which the present study examined. However, it was unable to find that reducing SMU reduced social comparisons despite previous research which demonstrated this. Indeed, higher frequency of social comparisons are associated with poorer mental health. For instance, correlations between social comparisons with anxiety were found to be statistically significant when assessing negative self-evaluation in relation to others (Cunha et al., 2008; Gilbert et al., 2010). In essence, social media provides a platform for users to show positive life styles, events, and success stories (Lin & Utz, 2015) in order to make positive impressions about themselves to peers, colleagues, friends, and other socially connected acquaintances (Ellison et al., 2007; Hew, 2011). However, due to such pervasive ideals in social media, engaging in social comparisons might elicit stronger negative than positive consequences for TAY. Hence, it is important to further study the relationship between SMU and social comparisons as suggested by these findings to alleviate the public health issue of social comparisons.

The present study found that reducing SMU did not have a measurable impact on social comparisons. Although, there was a null intervention effect in social comparisons, interestingly, both groups reduced social comparisons. Although participants in the intervention group reduced social comparisons significantly in response to reduced SMU, unexpectedly, control participants also reduced in social comparisons, which could have mitigated the intervention effect. As part of the study, all participants were required to submit daily screenshots of SMU. Thus, it is possible that daily self-monitoring of SMU that was also required for controls led to a reduction in social comparisons by making them more aware of their SMU, which in turn, may have
reduced their social comparisons. Previous research also demonstrates that increased self-monitoring can lead to behaviour changes and motivational changes as one of the main strengths of self-monitoring is that it increases awareness, curiosity and consciousness within the user (Burgard, & Gallagher, 2006; Chen et al., 2017). An alternative explanation is that it is also possible that social comparisons may have decreased naturally over time for all participants, regardless of monitoring. It is also very likely that social desirability bias may also have played a role in the reductions in social comparisons observed in the control group as the present study had an active control rather than a wait list control group, which would have been less credible.

Finally, the findings did not support the exploratory objective that social comparisons would mediate the intervention effect on loneliness. Previous research demonstrates that TAY with emotional distress are a vulnerable population for life-long mental illness (Xie et al., 2014), thus may disproportionately benefit from lifestyle interventions such as social media reduction aimed at improving mental health. However, our findings were not able to support social comparisons as an explanatory mechanism. Although no comparable experimental studies exist, the study conducted by Dibb & Foster (2021) found that social comparison was significantly associated with loneliness. Specifically, they found that participants who were involved in more frequent social comparison were more likely to feel lonely. Additionally, the study conducted by Yang (2016) found that people who were less motivated to make social comparisons also had lower loneliness while interacting with others on Instagram. The primary difference between the present study and Yang (2016) lies in its design. The present study is an intervention study, however, Yang (2016) conducted a cross-sectional study. Besides this, Yang (2016) also did not have a robust measure of SMU as they were only considering usage on Instagram as part of SMU.
Our findings are also inconsistent with previous meta-analyses examining the effects of SMU on social comparisons. Yang and colleagues (2019) studied 22 effects from 13 different studies and had a total of 11,199 participants. These researchers found that social comparisons made on Facebook and well-being (e.g., affect, self-esteem, life satisfaction) showed a small to moderate negative association ($r = -.20$, 95% CI $[-.29, -.11]$). Moreover, Yoon et al. 2019 conducted another meta-analysis investigating social comparisons made on Facebook and depressive symptoms, studying eight effects from different studies ($n = 1715$) found that social comparisons showed a small ($r = .23$, 95% CI $[.12, .34]$) to moderate ($r = .33$, 95% CI $[.20, .47]$) positive association.

In explaining the null intervention effect, it is possible that it may have been due to the measure chosen, the Technology-Based Social Comparison and Feedback-Seeking subscale (Nesi & Prinstein, 2015). For instance, in the meta-analysis conducted by Yang and colleagues (2019), studies used various measures for social comparisons, such as the social comparison orientation scale (Gibbons & Buunk, 1999), the 11-item Social Comparison Rating Scale (Feinstein et al., 2013), or the Iowa-Netherlands Comparison Orientation Measure (INCOM), also developed by Gibbons & Buunk (1999). Although the present study’s questionnaire detected both groups significantly reducing in social comparisons, the validity of the INCOM scale has been tested in 22 different questionnaires and has demonstrated to be more sensitive to change and is also able to assess favourable versus unfavourable social comparisons which may be a potential explanation for the null finding (Gibbons & Buunk, 1999).
Mediators Influencing the Relationship between SMU and Loneliness

A reduction in SMU reduced loneliness but not via social comparisons as demonstrated by the stepwise mediation analysis. Thus, this relationship had to be mediated by other variables besides social comparison. The displacement hypothesis is an alternative theory that could help explain why a reduction in SMU reduced loneliness. The displacement hypothesis suggests that SMU reduces TAY well-being because it replaces time spent with existing friends, thus reducing the quality of these friendships (Valkenburg, & Peter, 2007). Participants in the intervention group that were required to reduce SMU to 1 hr/day perhaps reallocated increased time during in-person contact with friends and family, thereby, potentially explaining the reduction in loneliness (Fujii et al., 2021).

Additionally, reducing SMU to 1 hour of SMU/day could have also led to participants having limited exposure to the elements of the “dark side” of SMU which in turn, reduced loneliness. The “dark side” of SMU includes cyberbullying, addictive use, trolling, online witch-hunts, fake news, and privacy abuse (Baccarella et al., 2018; Kwan & Skoric, 2013). Kowalski et al. (2014) estimates that 10-40% of TAY are victims of cyberbullying. In their article, Baccarella and colleagues established the social media honeycomb framework to explain the dark side implications of each of the seven functional building blocks: conversations, sharing, presence, relationships, reputation, groups, and identity. Excessive, aggressive, and inaccurate engagement can occur while interacting with others on SMU. Negative experiences such as frequency of online arguments or being “de-friended” can also shape the relationship between heavy SMU and loneliness due to the concept of negativity bias, people tend to give greater importance to negative things over positive things e.g., negative experiences over positive experiences.
Although social media platforms have guidelines and moderating resources to intervene in harassment, it is still possible for users to be exposed to threats and bullying. Participants that were in the intervention group likely had less time to share vast amount of content, hence, leading to less chances of their content being inappropriately shared with others on social media. Furthermore, presence also comprises the dark side of SMU as the location and availability of users are known and can easily be tracked without users awareness or consent. Through limited SMU, participants location was less tracked, protecting their privacy. Since intervention participants spent less time on SMU, it is likely that they spent time forming and developing relationships outside of social media. There is also a threat of “ingroup-outgroup bias” as people tend to define themselves in terms of social groupings (Tajfel & Turner, 2004).

As participants in the intervention group had less time on social media it is likely that that they had to form groups in the outside world, saving them from facing exclusion from online groups. Lastly, another characteristic of the dark side of social media is related to displaying one’s identity online. Posting on social media risks the control of users identity leading to all sorts of privacy and safety risks. Due to the various elements of the dark side of SMU as discussed above, it is possible that social comparisons may not be a mediator between SMU and loneliness and there may be other factors coming into play. It is possible that reducing SMU limits exposure to the negative effects of social media, thereby reducing negative emotions such as loneliness.

It is also possible that participants maybe had less damaging contact in the 1 hour of SMU/day, leaving them to perhaps respond to the most important messages as opposed to browsing on social media, which has been shown to be more strongly related to mental distress than active, purposeful use (Escobar-Viera et al., 2018; Thorisdottir et al., 2019; Verduyn et al., 2019).
A cross-sectional study conducted by Yang (2016) on young American adults demonstrated that heavy SMU was related to both higher and lower levels of loneliness, contingent on how the platform was used and that this relationship was further moderated by users' tendency for social comparison. To be more specific, Yang (2016) found that interacting (considered to be interactive use) and browsing (considered to be passive use) on Instagram were both related to lower loneliness, whereas broadcasting (considered to be an active but noninteractive type of activity) on Instagram was associated with higher levels of loneliness. Furthermore, Yang (2016) also found that Instagram interaction was related to lower levels of loneliness only for TAY who scored lower on social comparison orientation, as measured by the INCOM scale. Hence, it can be deduced that social comparisons moderated the relationship between type of Instagram use and loneliness.

Furthermore, Tromholt (2016) conducted a 1-week experimental study examining active versus passive SMU as a predictor of intervention on well-being. Tromholt (2016) found that the intervention group participants (abstained from using Facebook) compared to the controls (continued to use Facebook) benefitted more than the latter in this abstinence study. Specifically, abstaining from Facebook was found to have positive effects on two dimensions of well-being: an increase in life satisfaction along with greater positive emotions. These effects were significantly greater for heavy Facebook users along with passive Facebook users. Hence, it is evident based on previous research that the type of SMU (active versus passive) also affects loneliness.

Similarly, there is also research to suggest a difference between the type of platform used for engaging in social media and its association with loneliness. For example, cross-sectional research demonstrates that users of some platforms such as Snapchat and Instagram self-reported lower levels of loneliness and higher levels of happiness and satisfaction with life (Pittman &
Reich, 2016). Whereas, for Facebook users, a higher number of friends on the platform was associated with lower levels of loneliness but more persistent usage was associated with higher levels of loneliness (Phu & Gow, 2019). Similarly, research by Lemieux, et al. (2013) found that the number of close friends on Facebook has a negative correlation with loneliness in college students, where close friends was self-identified by participants. Therefore, a reduction in SMU may reduce loneliness depending on which social media platform is used.
Strengths and Limitations

There are several strengths of the present study. One strength of the study was its design as a randomized controlled trial. An RCT reduces bias and provides a rigorous methodology that allows for the strongest causal inferences to be made. This study also had a novel research question with very few experimental studies examining SMU, loneliness, and social comparisons. Also, all of the measures in the present study were validated including the UCLA Loneliness Scale (Russell et al., 1980) along with the Social Comparisons and Feedback Seeking subscale (Nesi & Prinstein, 2015). Another strength of this study was that it objectively tracked SMU through an internal tracker on smartphones and also evaluated SMU on other devices as recommended, but not frequently implemented in previous studies (Orben & Przybylski, 2019; Kaye et al., 2020). Objectively tracking SMU is better than self-reported SMU as screenshots are more reliable than self-report – in which participants estimate how much time they spent on social media, and these estimates may be lower than actual usage. There was also excellent compliance with submission of screenshots provided by all participants (94%) along with adherence to SMU restriction as participants in the experimental group reduced their SMU by approximately 50%. Participant adherence is essential for the success of outcome studies in order to assess the improved health outcomes for participants in the intervention group. Additionally, this study recruited an at-risk population. By recruiting TAY with pre-existing symptoms of anxiety and/or depressive symptomology we were able to focus on individual differences that may be at greater risk to the adverse effects of SMU, and although the results may not be more generalizable to all university students, they are more clinically impactful.
The current study also has several limitations. Notably, this study had narrow age restrictions, relying on only a subset of university students within the ages 17-25 who were willing to participate in a SMU reduction study, thus somewhat limiting the generalizability of the findings. This study also used a convenience sample as only interested participants would have volunteered to participate in the present study. It is possible that these participants were strongly considering changes to their SMU and wanted to take some action to reduce it, hence, they signed up for the study, limiting generalizability of the findings. The present study was also designed as a proof of concept and perhaps the short period of intervention (i.e. 3 weeks of reduced SMU) may have not been long enough to show an effect on loneliness or social comparisons, although, similar research has shown an effect on depression and loneliness in a comparable population who were not emotionally distressed (Hunt et al., 2018).

Another limitation was the method used to test the exploratory objective of mediation. The causal steps approach similar to by Baron and Kenny’s (1986) approach was selected because the objective was exploratory and the study was a proof of principal study, but it is acknowledged that more advanced statistical techniques would be required to test mediation using experimental data. It is important to highlight the limitations of the causal steps approach as it is outdated for many reasons. First, the causal steps approach is low on statistical power for detecting mediation compared to other methods of assessing mediation (Hayes, 2009). Second, the causal steps approach does not directly test the indirect path (i.e., a x b), rather it uses a logical inference approach to infer mediation (Hayes, 2009). Finally, the causal steps approach relies of statistical significance and testing numerous paths which comes at the cost of increased decision error (Hayes, 2009).
Furthermore, another limitation was that the revised UCLA Loneliness scale measured a total score of loneliness that included indicators of social isolation. However, since loneliness and social isolation are conceptually distinct from one another (de Jong Gierveld, & Havens, 2004) it is not feasible to assess how the intervention may have impacted these constructs differently.

It is also important to note, the scale used to measure social comparisons, MEIS may have lacked sensitivity and it was also not well-aligned with the social comparison theory since it did not capture the directionality of comparisons (i.e., upward and downward social comparisons), which could have resulted in different emotional reactions from intervention.

There were also a few possible minimal risks involved for the participants in the present study. One possible risk in this study could have been a concern for privacy regarding screenshots capturing SMU. This was mitigated by storing the incoming screenshots in Carleton’s secure email inbox and Qualtrics. Participants may have also felt some distress trying to reduce SMU for the first few days. This risk was mitigated by reminding participants that their participation in this study is voluntarily, so if they feel that they would not be interested to continue, they were able to withdraw from the study without penalty. Moreover, the lack of adherence to SMU restrictions (as per the present study) may have also been a risk. This was mitigated by sending the daily reminder emails to participants in order to integrate behavioural principles of reinforcement and self-monitoring to promote adherence.
Implications

Distressed TAY may be at a greater risk to the adverse effects of heavy SMU, and this is concerning since previous research demonstrates that 81.3% of Canadian TAY are reporting moderate to heavy daily SMU (Sampasa-Kanyinga et al., 2019). Loneliness is an important mental health outcome to study as TAY that are lonely tend to report higher rates of anxiety, social withdrawal, and suicidal ideation and attempts (Crick & Ladd 1993; Heinrich & Gullone 2006; Koenig & Abrams 1999). Furthermore, previous literature demonstrates that social comparisons are strongly related to other mental health constructs such as depression, anxiety, and well-being. Hence, intervention studies are needed for targeting heavy SMU and improving the mental well-being of TAY. After reducing SMU to 1 hour/day, the present study found a reduction in loneliness for participants in the intervention group suggesting that reducing SMU may represent a feasible, affordable, and effective strategy in reducing loneliness. However, the present study did not find that social comparisons significantly decreased as a result of reducing SMU. An implication of this finding would be that the measure used for social comparisons in the present study, the Technology-Based Social Comparison and Feedback-Seeking subscale may have been not been sensitive enough to detect changes in social comparisons. The present study also found that social comparisons were not a mediator between SMU and loneliness, implying that there may other factors coming into play. The present study also looked at SMU on other devices implying that there is also a need to educate TAY regarding the proper use of SMU via different devices.
Future Research Directions

The present study found that limiting SMU led to significantly greater reductions in loneliness but not in social comparisons for intervention participants compared to control participants. Thus, future research should use more current and rigorous methods to test mediation such as structural equation modelling, path analysis and other approaches that can account for the randomized controlled prospective design. Alternatively, experimental research is needed to also examine other potential mediators influencing the relationship between SMU and loneliness. Future research should also experimentally investigate the effects of SMU from various platforms e.g., LinkedIn and Reddit versus Facebook and Instagram on loneliness and social comparison. Future studies may also want to lengthen the intervention period from three weeks to a longer period to determine how enduring study effects are. Furthermore, in the future, research should examine loneliness versus social isolation separately as they may differentially relate to SMU or its reduction. Although the present study focused on examining the effects of limiting SMU on TAY with pre-existing symptoms of depression and anxiety – it would also be interesting to examine the effects of limiting SMU across various age groups, nationalities, and genders as previous research found that age, gender, and culture also interact to predict loneliness (Barreto et al., 2021; Cheng et al., 2021). Besides this, future research should further look into personality factors that are often associated with social comparisons and assess how they affect SMU (Gerber, 2018). Future research should also investigate the effects of reducing SMU on social comparisons perhaps using a more sensitive social comparison scale such as the INCOM scale (Gibbons & Buunk, 1999) which is able to assess for upward and downward social comparisons. Future research is also needed to determine if the intervention effects can be sustained over longer periods of time and extend to other mental health indicators in this high-risk population.
Conclusion

The majority of the literature examining the associations between heavy SMU, mental health and by extension loneliness and social comparisons are cross-sectional and therefore inadequate for assessing the psychological effects of excessive SMU. Literature shows that both loneliness and social comparisons are important constructs and can have impacts on well-being. The present study is one of the first research studies to experimentally investigate if reducing SMU can reduce loneliness and unfavourable social comparisons. The results showed that reducing SMU may represent a feasible and effective strategy in reducing loneliness. Surprisingly, social comparisons reduced for participants in the experimental and control groups suggesting that self-monitoring may be valuable in reducing social comparisons. Future research is needed to better understand the underlying mechanisms of the association between SMU and loneliness, perhaps using different scales to measure social comparisons. Overall, the findings provide evidence for public health messaging around the safe use of social media among TAY experiencing distress. This may provide evidence for future cost-effective, scalable public health interventions.
References


[https://doi.org/10.3390/ijerph14030311](https://doi.org/10.3390/ijerph14030311)


[https://doi.org/10.1016/j.jrp.2010.12.005](https://doi.org/10.1016/j.jrp.2010.12.005)


[https://doi.org/10.1016/j.chb.2016.11.043](https://doi.org/10.1016/j.chb.2016.11.043)


[https://doi.org/10.1089/cyber.2020.0498](https://doi.org/10.1089/cyber.2020.0498)


[https://doi.org/10.2466/07.PR0.112.2.545-552](https://doi.org/10.2466/07.PR0.112.2.545-552)


Social Media Use, Loneliness and Social Comparisons


Twenge, J. M. (2017). *iGen: Why today's super-connected kids are growing up less rebellious, more tolerant, less happy--and completely unprepared for adulthood--and what that means for the rest of us*. Simon and Schuster.


Appendix A

SONA Recruitment Notice

Study Name: Limiting Social Media Screen-time on iPhones and Androids

Description: For this study, you have a 50-50 chance of being asked to limit your social media screen-time (e.g., Facebook, Snapchat, Instagram). Participants will be asked to email daily screenshots of their screen-time usage for a period of 4 weeks. Participants will also be asked to complete questionnaires and attend an initial Zoom session where instructions will be provided.

Eligibility Requirements: We are looking for individuals who meet all of the following conditions:
1) be a regular (daily) social media user (i.e., greater than 2 hours per day on average) 2) have an iPhone running on iOS 12 or more recent or an Android running on 9 Pie or more recent;
3) answer ‘Yes’ to at least two of the following four statements:
   • Over the past two weeks, I have not been able to stop worrying
   • Over the past two weeks, I have been worrying too much
   • Over the past two weeks, I felt depressed
   • Over the past two weeks, I had trouble keeping my mind on what I was doing

and 4) be between the ages of 17 and 25.

Risks: We realize that limiting social media screen-time is hard for many people to do. In the first few days of limiting your screen-time, you may feel some distress. You are participating in this study voluntarily, so if you feel that you do not wish to continue, you may quit the study without penalty.

Duration and Locale: 30 min on a Zoom conference, 30 minutes completing an initial online survey, 2-5 min daily for 4 weeks via email, and one 30 min online questionnaire at the end of the 4 weeks.

Compensation: You will receive up to 3.5% towards your course (PSYC 1001, 1002, 2001, 2002) for your time, based on the following:

Attending (on Zoom) the initial meeting where the study is described, consent form reviewed, followed by completion of an initial online survey will be compensated with 1% grade-raising credit. Sending in daily screen-shots of social media usage will be compensated with a further 0.5% per week (4 x 0.5% =2%). Completing a survey 4 weeks after you began the study that will be compensated with .5% credit, totalling 3.5%. Note: Participants completing the final survey
after the last day of classes (when we must submit your credit), we will issue a $5 Amazon gift card instead of the final .5% credit.

Researchers:
Professor Chris Davis
(Principal Investigator, Professor of Psychology, Carleton U.) chris.davis@carleton.ca;
Wardah Mahboob, grad student, wardahmahboob@cmail.carleton.ca;
Niall Stewart, niallstewart@cmail.carleton.ca;
Helen Thai, helenthai@cmail.carleton.ca;
Dr. Gary Goldfield, CHEO Research Institute, ggoldfield@cheo.on.ca,
Mohcène Abdessemed, mabdessemed@cheo.on.ca
Sabrina Perry, SabrinaPerry@cmail.carleton.ca
Alex Adams, alexadams@cmail.carleton.ca
This study has received clearance by the Carleton University Research Ethics Board-B (Clearance # 111107).

If you have any ethical concerns with the study, please contact the REB Chair, Carleton University Research Ethics Board-B at ethics@carleton.ca.
Appendix B

Informed Consent Form

Name and Contact Information of Researchers: Dr. Chris Davis, Professor, Dept of Psychology, Carleton U. email: chris.davis@carleton.ca; Niall Stewart, niallstewart@cmail.carleton.ca; and Helen Thai, helenthai@cmail.carleton.ca; Dr. Gary Goldfield, CHEO Research Institute ggoldfield@cheo.on.ca, WardahMahboob,wardahmahboob@cmail.carleton.ca; Mohcene Abdessemed, mabdessemed@cheo.on.ca, Sabrina Perry, sabrinaperry@cmail.carleton.ca; Alex Adams, alexadams@cmail.carleton.ca

Project Title

Limiting Social Media Screen-time on iPhones and Androids

Project Sponsor and Funder (if any)

Unfunded

Carleton University Project Clearance

Clearance #: 111107 Date of Clearance: Nov 27, 2020

Invitation

You are invited to take part in a research project because you 1) tend to feel stressed or distressed at least occasionally; 2) use an iPhone running on iOS 12 or later, or an Android running on 9 Pie or later; 3) are a regular social media user; and 4) are between the ages of 17 and 25. The information in this form is intended to help you understand what we are asking of you so that you can decide whether you agree to participate in this study. Your participation in this study is voluntary, and a decision not to participate will not be used against you in any way. As you read this form, and decide whether to participate, please ask all the questions you might have, take whatever time you need, and consult with others as you wish.

What is the purpose of the study?

The purpose of the study is to assess the effect that limiting social media screen-time has on one’s level of emotional health.

What will I be asked to do?
If you agree to take part in the study, we will ask you to: 1) send us daily (by email) screen-shots showing the amount of time you have been using social media on your iPhone or Android every day for four weeks; 2) complete some questionnaires at an initial meeting and after 4-weeks; and 3) for a random half of participants, you will be asked to limit your social media screen-time for a period of three weeks. There is a 50-50 chance that you will be asked to limit your screen time.

**Risks and Inconveniences**

We realize that limiting social media screen-time is hard for many people to do. In the first few days of limiting your screen-time, you may feel some distress. You are participating in this study voluntarily, so if you feel that you do not wish to continue, you may quit the study without penalty.

**Possible Benefits**

You may find that by limiting your social media screen-time, you have more time for other activities that you enjoy or for school assignments.

**Compensation/Incentives**

You will receive course credit based on the extent of your participation. Attending the initial meeting (on Zoom) where the study is described, consent form reviewed, and completing an initial survey online will be compensated with 1% grade-raising credit for PSYC 1001/1002/2001/2002. Sending in daily screen-shots of social media usage will be compensated with a further 0.5% per week (4 x 0.5% = 2%). Completing a follow-up survey after a few weeks of trying to cut-back on social media screen-time will be compensated with .5% credit, totalling 3.5%.

Note: Participants completing the final survey after the last day of classes (when we must submit your credit), we will issue a $5 Amazon gift card instead of the final .5% credit.

**No waiver of your rights**

By signing this form, you are not waiving any rights or releasing the researchers from any liability.

**Withdrawing from the study**

If you withdraw your consent during the course of the study, all information collected from you before your withdrawal will still be used, unless you request that it be removed from the study.
data. Once data have been rendered anonymous at the end of the study, it will not be possible to withdraw your data.

**Confidentiality**

We will remove all identifying information from the study data as soon as possible, which will be after you have submitted the follow-up survey 4 weeks after you started the study.

We will treat your personal information as confidential, although absolute privacy cannot be guaranteed. No information that discloses your identity will be released or published. Research records may be accessed by the Carleton University Research Ethics Board in order to ensure continuing ethics compliance.

The results of this study may be published or presented at an academic conference or meeting, but the data will be presented so that it will not be possible to identify any participants unless you give your express consent.

You will be assigned a code [or pseudonym] so that your identity will not be directly associated with the data you have provided. All data, including coded information, will be kept in a password-protected file on a secure computer and/or on a secure cloud. Data, with all identifiers removed, will be maintained for five years after publication of findings, as required by the American Psychological Association.

Because you will be granted course credit for taking part in the study, identifying information will be retained using a code until the course credit is granted.

**Data Retention**

After the study is completed, your de-identified data will be retained and used in aggregate (with other participants’ data) for research and teaching purposes. Screen-shots of your social media usage will be destroyed (deleted) within 24-hours of each submission.

**New information during the study**

In the event that any changes could affect your decision to continue participating in this study, you will be promptly informed.

**Ethics review**

This project was reviewed and cleared by the Carleton University Research Ethics Board–B. If you have any ethical concerns with the study, please contact the REB Chair, Carleton University Research Ethics Board (at ethics@carleton.ca).
By Clicking the “I agree” button on this consent form at the beginning of the online survey, you consent to participating in the study and to submitting my daily screen-shots showing my social media usage.
Appendix C

Identifying Information

Please provide the following information so that we can link your data.
All identifying information will be deleted once you have been credited:
Name:

Age:

Gender:

Student Number:

Email that we should use to communicate with you:
### Revised UCLA Loneliness Scale

Indicate how often each of the statements below is descriptive of you.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I feel in tune with the people around me</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. I lack companionship</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. There is no one I can turn to</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. I do not feel alone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I feel part of a group of friends</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. I have a lot in common with the people around me</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. I am no longer close to anyone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. My interests and ideas are not shared by those around me</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. I am an outgoing person</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. There are people I feel close to</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. I feel left out</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. My social relationships are superficial</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. No one really knows me well</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. I feel isolated from others</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. I can find companionship when I want it</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. There are people who really understand me</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. I am unhappy being so withdrawn</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. People are around me but not with me</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. There are people I can talk to</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. There are people I can turn to</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Scoring:**

Items 1, 5, 6, 9, 10, 15, 16, 19, 20 are all reverse scored. Keep scoring continuous.
Appendix E

Technology-Based Social Comparison and Feedback-Seeking (SCFS)

I use Electronic Interaction (texts, Facebook, etc.):

<table>
<thead>
<tr>
<th></th>
<th>1 Not at all True</th>
<th>2 A Little Bit True</th>
<th>3 Somewhat True</th>
<th>4 Very True</th>
<th>5 Extremely True</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To check out the way others look.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. To compare the way I look with other people’s looks.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3. To get feedback from others on the things I send/post.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>4. To see what others think about how I look.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>5. To compare my body/shape with other people’s bodies/shapes.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>6. To see what others think about the things I send/post.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>7. To see if others think I am cool, funny, or popular.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>8. To see what others think about my photos.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>9. To see what the “popular” people think about me.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>10. To compare my life with other people’s lives.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
Appendix F

Electronic Debriefing Form

What are we trying to learn in this research?

Social media has revolutionized how people interact with one another, and how they stay up to date on current happenings. However, there is some debate in the scientific literature about whether too much social media can affect a person’s mental health. Our study was designed to test whether limiting a person’s social media results in improved mental health. If it does improve mental health, we are interested in understanding why. Does cutting down on social media result in an increase in face-to-face interactions? Does it change how you think of yourself? These are some of the possible mechanisms that we are investigating.

Why is this important to scientists or to the general public?

Almost all of the scientific evidence for the effect of social media on mental health has been based on surveys asking people how often they use social media. This study is an advance over these past studies because it allows for a comparison of mental health status before and after reducing social media screen-time. This will provide a better test of whether social media use affects mental health.

Where can I learn more?

If you are interested in this area of research, you may wish to read the following articles:


Contact Information:

If you have any complaints, concerns, or questions about this research, please feel free to contact, the primary research investigator, Dr. Chris Davis at chris.davis@carleton.ca. Any ethical concerns about the study may be directed to the REB Chair, Carleton University Research Ethics Board – B (613-520-2600x4085; ethics@carleton.ca).

This study has received clearance by the Carleton University Research Ethics Board -B (CUREB–B) (# 111107, expiry: June 30, 2022)
Appendix G

Email Reminders

**Days 1-6**
Subject Line: Social Media Screen-time (Day X)

*Hi,*

*Just a quick reminder to take a screenshot of your social media use for today. Please send it in by midnight tonight, or first thing tomorrow morning. If you have any questions or concerns, please reply to this email with your question.*

*Thanks,*

*Social Media Research Team*

*Participants randomly assigned to the control group continue to receive the same message.*

**Day 7**
Subject Line: Limiting your Social Media Screen-time! (Day 7)

*Hi,*

*Starting tomorrow morning, we want you to limit your social media screen-time to 60 minutes per day. We recognize that this may be hard for some people to do, especially the first few days, but we think you can do it. If you exceed this limit, that is ok. We realize that some days will be harder than other days to stick within this limit. Try your best, but don’t get upset with yourself if you exceed this limit.*

*Remember to send in your screenshot tonight!*

*If you have any questions or concerns, feel free to reply to this email. Thanks,*

*Social Media Research Team*

**Day 8**
Subject Line: Limiting your Social Media Screen-time (Day 8)

*Hi,*
Congratulations for successfully limiting your screen-time! We hope it wasn’t as hard as you thought it would be. Please remember to send in your screenshot tonight. If you have any questions or concerns, please reply to this email with your question.

Thanks,

Social Media Research Team

Hi,

We noticed you have exceeded your social media smartphone time limit on one or more days. We would like to remind you to try your best to meet the 60 minute per day limit. Thank you for trying so hard to comply with our study requirements.

Thanks,

Social Media Research Team

**Days 9-13**
Subject Line: Limiting your Social Media Screen-time (Day X)

Hi,

Please remember to send in your screenshot tonight. If you have any questions or concerns, please reply to this email with your question.

Thanks,

Social Media Research Team

**Day 14**
Subject line: Limiting your Social Media Screen-time – 1 week in! (Day 14)

Hi,

Congratulations on getting through the first week limiting your screen-time. Please remember to send in your screenshot tonight. If you have any questions or concerns, please reply to this email with your question.

Thanks,

Social Media Research Team
**Days 15-25**  
Subject line: Limiting your Social Media Screen-time (Day X)

*Hi,*

*Please remember to send in your screenshot tonight. If you have any questions or concerns, please reply to this email with your question.*

*Thanks,*

*Social Media Research Team*

**Day 26**  
Subject line: Limiting your Social Media Screen-time – almost done! (Day 26) *Hi,*

*Only two days left of limiting your screen-time. Hang in there!* 

*Please remember to send in your screenshot tonight. If you have any questions or concerns, please reply to this email with your question.*

*Thanks,*

*Social Media Research Team*

**Day 27**  
Subject line: Limiting your Social Media Screen-time – almost done! (Day 27) 

*Hi,*

*Only one day left of limiting your screen-time!*

*Please remember to send in your screenshot tonight. If you have any questions or concerns, please reply to this email with your question.*

*Thanks,*

*Social Media Research Team*
Day 28 (Experimental)
Subject line: You Made it! Last Night Limiting your Social Media Screen-time! (Day 28)

Hi,

Today is the last time we will ask you send in your screenshot! Please send your screenshot by the end of the night.

The study is almost done. When you get the chance in the next day or so, could you please complete this online survey?

https://carletonpsych.co1.qualtrics.com/jfe/form/SV_3EtVDuWPqd0IirQ

As a reminder, your participation is voluntary, and you may quit the study at any time without penalty. If you withdraw your consent during the course of the study, all information collected from you before your withdrawal will still be used, unless you request that it be removed from the study data. Once data have been rendered anonymous at the end of the study, it will not be possible to withdraw your data.

We will remove all identifying information from the study data as soon as possible, which will be after you have submitted the follow-up survey. We will treat your personal information as confidential, although absolute privacy cannot be guaranteed. No information that discloses your identity will be released or published. Research records may be accessed by the Carleton University Research Ethics Board in order to ensure continuing ethics compliance. All data, including coded information, will be kept in a password-protected file on a secure computer and/or on a secure cloud. Data, with all identifiers removed, will be maintained for five years after publication of findings, as required by the American Psychological Association.

By completing and submitting this survey, you will receive a .5% grade raising credit towards your PSYC 1001/1002/2001/2002 final grade, which is part of the 3.5% grade raising credit promised for completing all parts of the study.

If you have any questions or concerns, please reply to this email with your question. Thanks,

Social Media Research Team
**Day 28 (Control)**
Subject Line: You Made it! Last Night Monitoring Social Media Screen-time (Day 28)

_The same email can be sent to the control group; only the subject line should change._
Appendix H

Certification of Institutional Ethics Clearance

The Carleton University Research Ethics Board-B (CUREB-B) at Carleton University has renewed ethics clearance for the research project detailed below. CUREB-B is constituted and operates in compliance with the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS2).

**Title:** Limiting Social Media screen time on iPhones and Androids

**Protocol #:** 111107

**Principal Investigator:** Dr. Christopher Davis

**Department and Institution:** Faculty of Arts and Social Sciences\Psychology (Department of), Carleton University

**Project Team (and Roles):** Dr. Christopher Davis (Primary Investigator)
Gary Goldfield (Co-Investigator (External))
Niall Stewart (Student - MA student)
Helen Thai (Research Assistant)
Wardah Mahboob (Research Assistant)
Brandon Heidinger (Research Assistant)
Mohcène Abdessemed (Research Assistant)
Sabrina Perry (Research Assistant)
Alex Adams (Research Assistant)

**Funding Source** (If applicable):

Effective: **June 17, 2021**  Expires: **June 30, 2022**.

Please ensure the study clearance number is prominently placed in all recruitment and consent materials: CUREB-B Clearance # 111107.

In light of the COVID-19 outbreak, the REB has developed guidance for human participants' research at [https://carleton.ca/researchethics/](https://carleton.ca/researchethics/). However, the situation is evolving rapidly so please check back regularly to keep up with any ongoing changes to this guidance.

**Restrictions:**

This certification is subject to the following conditions:
1. Clearance is granted only for the research and purposes described in the application.

2. Any modification to the approved research must be submitted to CUREB-B. All changes must be approved prior to the continuance of the research.

3. An Annual Application for the renewal of ethics clearance must be submitted and cleared by the above date. Failure to submit the Annual Status Report will result in the closure of the file. If funding is associated, funds will be frozen.

4. During the course of the study, if you encounter an adverse event, material incidental finding, protocol deviation or other unanticipated problem, you must complete and submit a Report of Adverse Events and Unanticipated Problems Form, found here: https://carleton.ca/researchethics/forms-and-templates/

5. It is the responsibility of the student to notify their supervisor of any adverse events, changes to their application, or requests to renew/close the protocol.

6. Failure to conduct the research in accordance with the principles of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans 2nd edition and the Carleton University Policies and Procedures for the Ethical Conduct of Research may result in the suspension or termination of the research project.

**Special requirements for COVID-19:**

If this study involves in-person research interactions with human participants, whether on- or off-campus, the following rules apply:

1. Upon receiving clearance from CUREB, please seek the approval of the relevant Dean for your research. Provide a copy of your CUREB clearance to the Dean for their records. See Principles and Procedures for On-campus Research at Carleton University and note that this document applies both to on- and off-campus research that involves human participants. Please contact your Dean's Office for more information about obtaining their approval.

2. Provide a copy of the Dean's approval to the Office of Research Ethics prior to starting any in-person research activities.

3. If the Dean’s approval requires any significant change(s) to any element of the study, you must notify the Office of Research Ethics of such change(s).
Upon reasonable request, it is the policy of CUREB, for cleared protocols, to release the name of the PI, the title of the project, and the date of clearance and any renewal(s).

Please email the Research Compliance Coordinators at ethics@carleton.ca if you have any questions.

**CLEARED BY:**

Janet Mantler, PhD, Chair, CUREB-B

Natasha Artemeva, PhD, Chair, CUREB-B

**Date:** June 17, 2021