Title: Social media use and prospective suicidal thoughts and behaviors among adolescents at high-risk for suicide

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Abstract

Objective: To examine the relationship between social media use and suicidal thoughts and behaviors among adolescents in the first 30 days of an intensive outpatient program (IOP) for depression and suicidality.

Method: Participants included 100 adolescents who enrolled in an IOP for depression and suicidality and completed baseline measures of social media and weekly measures of depression and suicidal thoughts and behaviors at clinical visits over the next month.

Results: Lower levels of social media use (overall and messaging) were associated with a greater likelihood of having suicidal ideation with plan over the next 30 days. There was no effect on suicidal behavior. Multilevel modeling indicated no main effects of social media use on depression or average days of suicidal thoughts. However, individuals with lower levels of social media use maintained more depression symptoms and days with passive death wish across the first month of treatment.

Conclusions: Among adolescents at high risk for suicide, less engagement in social media may reflect social anhedonia or withdrawal, which may heighten risk for more severe suicidal ideation or impede initial treatment. Findings highlights the importance of considering social media as an additional context when assessing social dysfunction in treatment for depression and suicidality.

Keywords: social media, adolescence, suicidal thoughts, suicidal behaviors, depression

Social media use and prospective suicidal thoughts and behaviors among adolescents at high-risk for suicide

Suicide is the second leading cause of adolescent mortality in the United States. To date, many known risk factors are stable and/or unchangeable (e.g., history of past suicide attempt), and research remains limited in the ability to predict adolescent suicidal behavior on the basis of these risk factors. Given that adolescence is a developmental period of increased risk for suicidal ideation and behavior, it is critical to identify risk factors that are modifiable and that may be particularly salient in suicide risk for adolescents.

Social factors have long been implicated in suicide (Horton et al., 2016; Joiner et al., 2017; Joiner et al., 2009; King & Merchant, 2008a). However, social media (SM) use has transformed the adolescent environment by changing the frequency, immediacy, and quality of social experiences (Nesi et al., 2018a, 2018b). SM encompasses a broad range of social networking applications that allow for communication that is both active (e.g., commenting, messaging) and passive (e.g., scrolling, browsing) (Anderson & Jiang, 2018; Nesi et al., 2018a). Adolescents are uniquely sensitive to peer evaluation and feedback (Burnett et al., 2011; Schriber & Guyer, 2016; Silk et al., 2012), and these types of SM applications are rich in opportunity for social feedback (Moreno & Uhls, 2019; Nesi et al., 2018a). Whereas SM use can facilitate social connection (Hamilton et al., 2020), it also may confer risk for adolescents who use SM in a way that heightens negative internal or external consequences (e.g., social comparison, cyberbullying). Indeed, a systematic review of cross-sectional studies found that heavier SM or internet use was associated with increased likelihood of suicidal behavior among adolescents (Sedgwick et al., 2019).

To date, no studies have prospectively examined the association between SM use and suicidality. Cross-sectional designs limit conclusions regarding directionality, and the question

remains: does SM use predict suicidality, or are youth with suicidality simply more likely to use SM? Indeed, adolescents with depression and/or suicidality often use more SM and report that it exacerbates their mood and risk for suicide (John et al., 2018). Only one study has examined individual differences in SM use related to suicidality among high-risker adolescents, finding that adolescents with internalizing disorders and suicide attempt history reported more negative experiences on SM and viewed more suicide-related content on SM than those without (Nesi et al., 2019). Although there is a need to move beyond SM 'screentime' (Orben, 2020), duration of SM use and messaging activities may be readily-available metrics for understanding patterns of social activity among adolescents at risk for suicide. More active media use such as direct/text messaging may be indicative of greater social engagement and connection, which has been linked to lower depressive symptoms (Escobar-Viera et al., 2018) and may protect against suicide risk among more vulnerable adolescents. However, no study has examined individual differences in SM use as a predictor of near-term suicidality among adolescents at high-risk for suicide.

The current study examined whether SM use prospectively predicted the occurrence of suicidal ideation with and without a plan and suicidal behavior, and frequency of weekly suicidal ideation among adolescents in a specialized intensive outpatient program (IOP) for depressed and suicidal youth. To identify predictors of near-term suicidality (Ribiero et al., 2016), this study specifically focused on SM use (overall and direct messaging/texting—one form of active SM use) as predictors of prospective suicidal ideation and behavior that occurred in the first month after a baseline evaluation for entrance to the IOP. Given that adolescents varied in the number of sessions attended in the first month following the initial evaluation, and most adolescents were expected to improve over the course of treatment, we further examined whether SM use moderated the relationship between the number of IOP sessions attended and weekly suicidal ideation and

depression symptoms. Importantly, supplemental analyses were conducted with television/video watching and gaming as media use outcomes to identify the specificity of relationships to social media compared to other media.

Method

Participants and Procedure

Participants included 100 adolescents (12-18 years; mean age = 15.17 years; SD = 1.43) who enrolled and participated in a specialized IOP program for adolescent depression and suicidality during the period of data collection from March 2019- March 2020 (prior to COVID-19 shutdown). Following a baseline evaluation, patients begin the course of IOP treatment that included 9 hours of treatment per week (3 hours each/ 3 days per week) consisting of group, individual psychotherapy, and medication management. On average, participants started their course of IOP treatment within 9 days of baseline evaluation (range 1-28 days[1]) and completed between 2-12 sessions in the month following the IOP baseline evaluation (M = 4.39 sessions; SD = 1.58). IOP sessions may include a combination of IOP group with or without sessions for individual therapy and medication management. All patients completed questionnaires as part of standard clinical care, which included a longer intake and shorter weekly measures completed during the IOP sessions. Patients completed an informed consent for their data to be used for research purposes. The Institutional Review Board approved study procedures.

Measures

Media Use. At the intake assessment, participants completed four items measuring the average duration of media use on a typical day over the past month, including SM use (e.g., Instagram, Facebook, etc.), Messaging (e.g., text/direct messaging apps), Gaming (e.g., playing

[1] In the event that participants' treatment in IOP groups are delayed due to being at full capacity, participants will begin individual therapy and medication management in the interim and be closely monitored for safety.

video games on computer, game console, or cell phone), and Video watching (i.e., watching videos, shows, or movies on a cell phone, tablet, or computer—not TV). For all items, participants responded on a scale from 0-5: "Less than 30 minutes", "30 minutes to 1 hour", "more than 1 hour to 2 hours", "more than 2 hours to 3 hours", "more than 3 hours to 4 hours", and "more than 4 hours". Given limited endorsement of more than 3 hours for text/direct messaging (see results), responses of 4 and 5 were condensed as "more than 3 hours", with the scale ranging from 1 to 4.

Suicidal thoughts and behaviors. The Ask Suicide- Screening Questions (ASQ) is a 4-item screening tool used to assess the occurrence of suicidal thoughts and behaviors (Horowitz et al., 2012). Participants responded to four items measuring the occurrence of passive death wish (PDW; "wish you were dead?"), suicidal ideation (SI; "have thoughts of killing self?"), suicidal thoughts with a plan (SI with plan; "had a suicidal plan?"), and suicidal behavior (SB; "tried to kill self?"). If endorsed, participants reported the frequency of suicidal ideation or behaviors in the past month (baseline) and past week (weekly). In the current study, baseline suicidality was calculated as the number of endorsed past-month suicidal thoughts and behaviors (ranging from 0-4). Weekly measures of suicidal thoughts and behaviors were used to calculate primary study outcomes, including the occurrence of SB or SI with plan endorsed at any point over the first 30 days (dichotomized), and weekly days of PDW and SI endorsed.

Depressive Symptoms. The abbreviated version of the Mood and Feelings Questionnaire (MFQ-short) was used to examine depressive symptoms at baseline and weekly visits (Angold et al., 1987). Participants responded to each of the 13-items (e.g., 'I felt miserable or unhappy') on a scale of 0 ('not true') to 2 ('true'), with higher scores (0-26) reflecting more depressive symptoms.

Anxiety Symptoms. Participants completed the 41-item Screen for Child Anxiety-Related Emotional Disorders (SCARED; (Birmaher et al., 1999), responding to each item on a scale of 0

("Not True or Hardly Ever True") to 2 ("Very True or Often True"). Possible scores ranged from 0 to 82. The SCARED was completed at the baseline and weekly assessments.

Demographics. Participants reported their gender and race (by selecting categories). Sexual orientation was reported given that sexual minority youth are at risk for suicide (Liu et al., 2020). Participants selected the response that "best described them: 100% heterosexual, Mostly heterosexual, Bisexual, Mostly homosexual, 100% homosexual, Don't Know, Prefer Not to Answer." Based on prior procedures (Dermody et al., 2014), 100% heterosexual was coded as 'heterosexual' and other responses were coded as sexual minority, with the exception of 'don't know' or 'prefer not to answer'.

Analytic Plan

Distributions of suicidality and media use were assessed to inform analytic procedures. For all analyses, continuous variables were centered prior to analyses. Given the relatively rare occurrence of more severe suicidal thoughts (with plan) and suicidal behavior, dichotomous variables (yes [1]/no [0]) of whether suicidal thoughts with a plan or suicidal behavior occurred in the 30-day period were the primary outcomes of interest. In these analyses, binary logistic regressions were used to examine the relationship between media use and the occurrence of a suicidal plan or attempt over the next 30 days, covarying for age, gender, baseline depression, anxiety, and suicidality, and total number of IOP sessions attended over the month.

For analyses examining the frequency of depressive symptoms, passive death wish (PDW), and suicidal ideation (SI), we conducted multilevel modeling to examine whether SM use at baseline predicted the average number of days (in a week) that participants had PDW and SI over the next month. Given that not all participants had the same number of sessions, we were unable to calculate total number of days in past month with PDW or SI. Thus, the intercept (or average)

of weekly days of PDW or SI were the primary outcomes of interest. The Level 2 (between-person) predictor was SM use (overall and messaging). Level 2 (between-person) covariates included age, gender, and baseline suicidality. Level 1 (within-person variables) covariates included weekly depressive symptoms (when not outcome of interest), weekly anxiety symptoms, and IOP visit number. Random intercepts were included in these models to account for clustering effects at the individual level [ICCs = 52% (PDW) and 47% (SI)], and number of IOP sessions was included as random slope to allow for individual variations in the effect of time (i.e., IOP visits) on suicidality. Given that participants were in treatment over the 30-day period (and would therefore be expected to have decreases in suicidality over time), we conducted exploratory analyses to examine whether SM use moderated the effects of treatment (i.e., IOP visit number) on depression and suicidality. In these models, we included a cross-level interaction term between time (i.e., IOP visit number) and SM use (overall and messaging). Given prior research indicating that there might be curvilinear effects of SM on mental health outcomes (Przybylski & Weinstein, 2017), we also included a quadratic term in exploratory analyses to test whether the relationship between SM and suicidal ideation and behavior in the present study was curvilinear.

Results

Participants were 75% female (sex assigned at birth), and 83% identified as White, 8% Black/African American, 4% Asian American, and 1% biracial (4 participants did not answer). A total of 46% of participants identified as sexual minority, 44% as heterosexual, and 10% did not know or preferred not to answer. In the month prior to the baseline IOP assessment, 23 (out of 100) adolescents endorsed having a suicide attempt, 11 of which were in the past week, and 40 adolescents endorsed SI with plan in the past month, including 23 in the past week. A total of 90% of patients reported having PDW and 85% reported having active SI in the month before IOP

assessment. In the first month of IOP, 9 patients reported a suicide attempt (2 of whom reported more than 1 attempt) and 23% endorsed having SI with plan. Participants reported having 2.60 days (SD = 1.93; range: 0-7 days) of PDW and 1.74 days (SD = 1.70; range: 0-7 days) of active SI as a weekly average over the first month. In terms of media use, 55% of participants reported having more than 2 hours of SM use per day, with 27% reporting using SM more than 3 hours on average per day. In addition, 25% reported text/direct messaging, 32% reported gaming, and 47% reported watching shows/videos for more than 2 hours per day on average.

Table 1 presents descriptive statistics and bivariate correlations for study variables. Of primary study variables, media use was significantly correlated, with the exception of messaging and gaming. Although the sample was predominantly characterized by patients who identified as female and White, we conducted t-tests and chi square tests to better characterize the sample, including female vs. male, sexual minority vs. heterosexual, and White vs. Person of Color (POC; i.e., Black, Asian, and Biracial). There were no significant differences between females and males in SM use or watching shows/videos (*t's* < 1.50), but boys reported more time gaming than girls ($t = 4.28$, $p < .001$). There were no differences in mean days of PDW or SI (*t's* < .19) or in the likelihood of having SI with plan or suicidal behavior (chi squares < .19). There were no differences by race in media use (*t's* <1.77) or PDW ($t = .46$). There were racial differences in mean days of SI ($t = 2.45$, $p = .03$), and the likelihood of having SI with plan and suicidal behavior (chi square > 5.31, *p's* <.02), such that youth who identified as POC were more likely to endorse suicidality over the first month of treatment. There were no differences in media use or suicidality among those who identified as sexual minority and heterosexual (*t's* < 1.52, $p > .13$).

Social Media and Prospective Suicidal Behavior and SI with Plan

Table 2 presents logistic regression analyses predicting the occurrence of suicidal behavior and suicidal ideation with plan over the first 30 days of IOP. In contrast to hypotheses, there were no significant effects of social media or messaging on the occurrence of suicidal behavior. Of the covariates, only baseline depressive symptoms significantly predicted which youth had a suicide attempt, with more depressive symptoms predicting a subsequent attempt.

Logistic regression analyses for the occurrence of having SI with plan over the next 30 days indicated that greater duration of SM use significantly predicted having SI with plan (Table 3; Figure 1a), covarying for baseline symptoms of depression and anxiety, demographic characteristics (age, gender), and baseline suicidality. There was a significant relationship between the amount of direct messaging/texting and having future SI with plan (Table 3; Figure 1b). In contrast to hypotheses, individuals who spent *less* time on SM use and text/direct messaging had a greater likelihood of future SI with plan than those with more SM, with an odds ratio of 0.67 and 0.62 for SM use and text/direct messaging, respectively. Supplemental logistic analyses evaluating other media (Video and Gaming) and suicidality were not significant (*p*'s> .10), suggesting results are specific to SM and direct/text messaging (Supplemental Table 1). There were no quadratic effects of SM use on SI or SB (Supplemental Table 3).

Social Media and Prospective Depression Symptoms and Suicidal Thoughts: PDW and SI

Tables 4 and 5 present results of multilevel models predicting the intercept (average) numbers of days in a week that patients endorsed having passive death wish (PDW) and suicidal ideation (SI) without plan. For all analyses, there were no effects of SM use or text/direct messaging on the average number of days of weekly PDW or SI over the first month (*p*'s .24). Importantly, there was significant variability in the intercept of PDW and SI, as well as the effect

of time on suicidality. There also was no main effect of SM use on average depressive symptoms over the 30-day follow-up period.

For exploratory cross-level interaction analyses examining the effect of SM use (overall and text/direct messaging) on PDW and SI over the first month of treatment, there was a significant effect of SM use (β = -.08, SE = .03, p = .02) and text/direct messaging (β = -.10, SE = .04, p = .01) on the slope of PDW across IOP treatment visits. Specifically, patients who had less SM use and text/direct messaging at baseline demonstrated the least improvement across treatment and reported the most weekly days of PDW across study visits over the first month. In contrast, adolescents who had the most SM use (overall and active) demonstrated the greatest decrease in the number of days of PDW across the first month of IOP visits (Figures 2a and 2b). Similarly, there was a significant cross-level interaction on the effect of SM use (overall only) on depressive symptoms across treatment sessions following a similar pattern (Figure 2c; β = -.23, SE = .09, p = .01), but there was no effect of active text/direct messaging (β = -.09, SE = .11, p = .39). SM use (overall or active) did not moderate the weekly days of active SI over time (overall SM use: β = -.02, SE = .03, p = .49; Text/Direct Messaging: β = .002, SE = .04, p = .97). Supplemental analyses evaluating other media (Video and Gaming) and frequency of PDW and SI were not significant (p's > .46), suggesting these results are specific to SM and direct/text messaging (Supplemental Table 2). There were no quadratic effects of SM use on PDW, SI, or depressive symptoms (Supplemental Table 3).

Discussion

The current study is the first to examine SM use, including overall SM use and direct messaging/texting (one form of active SM use), as a predictor of prospective suicidal ideation and behavior among adolescents at high-risk for suicide in an intensive outpatient program

(IOP). Notably, over half of adolescents in the current study used SM more than 2 hours per day, and over 1 in 4 adolescents reported using SM for 3 hours or more per day in the past month. In contrast with prior cross-sectional studies (Twenge et al., 2018), results indicate that adolescents who spent *less* time on SM on a typical day, including engagement in active SM use (text/direct messaging), are at higher risk of having suicidal ideation with a plan over the next month than those with more daily SM use. Put simply, adolescents with higher levels of SM use may be at lower risk of SI with plan in the next month than those with less time on SM. However, there were no direct effects of SM use on prospective suicidal behavior, which may be due to lower power to detect suicidal behavior given its infrequent occurrence among adolescents in the IOP. In addition, there was no direct effect of SM use on frequency of passive death wish (PDW) or suicidal ideation (SI) without plan over the next month or average weekly depressive symptoms. There was, however, evidence that SM use moderated the effect of treatment on average days of PDW and depression symptoms, such that adolescents with lower levels of SM use were more likely to maintain similar frequency of PDW and depression symptoms across initial treatment period. In contrast, adolescents with more SM use at baseline reported declining weekly days of PDW across the first month in treatment.

While this study is preliminary, findings highlight the complexity of the relationship between SM use and suicidality. Unlike prior research (Przybylski & Weinstein, 2017), our study also did not find evidence of curvilinear relationships. Thus, among adolescents who are at high risk for suicide, SM use may be indicative of adaptive or healthy social engagement. Among these adolescents, the lack of SM engagement may suggest social anhedonia or withdrawal, which is associated with suicide risk (Calati et al., 2019). Given that adolescents report being "constantly connected" (Anderson & Jiang, 2018), the absence of SM use may indicate

loneliness, isolation, and thwarted belongingness among youth who are already more vulnerable to negative social factors (King & Merchant, 2008b; Stewart et al., 2019). Findings do not suggest that SM use is necessarily protective against suicidality for high-risk adolescents, but rather that it may be a proxy for social engagement or withdrawal that confers risk for more severe SI. In this sense, SM use may be a quantifiable metric for social factors that are associated with heightened risk for SI with plan, which is a more severe form of SI than SI without plan. It is also possible that youth who have disengaged from SM have had negative experiences on SM, such as cyberbullying, that contributed to their lack of engagement (Biernesser et al., 2019). Youth at high risk for suicide may have encountered these negative experiences and learned how to use SM to manage negative emotional states and enhance their support network (Biernesser et al., 2019). Our findings also suggest that more SM use reported at baseline is associated with improvements in depressive symptoms and PDW, but not SI, over the first 30 days of treatment. Thus, it is possible that SM use reflects ongoing social disengagement across the initial treatment period that confers risk for continued depressive symptoms and PDW. Disengagement from SM also may indicate social dysfunction in other domains such as peers and, family, which is associated with poorer treatment outcomes (Gunlicks-Stoessel et al., 2010). Our finding highlights the importance of considering social media as an additional context when assessing social dysfunction in treatment for depression and suicidality.

There are important considerations and limitations for interpreting the current findings and future directions of research. First, although the current study included both SM use and messaging, it did not examine the content or quality of SM use, which would be informative for understanding the nuanced experiences of SM (Nesi et al., 2019). While active SM use is typically considered to be adaptive (Escobar-Viera et al., 2018), high-risk adolescents who

engage with suicide-related content are more likely to report suicidal behavior (Biernesser et al., 2019; Liu et al., 2020; Nesi et al., 2019). Thus, it is important to examine the content and context of SM use, including objective measures of SM and experiences (Orben, 2020). The current study also did not assess other social experiences, including offline peer and familial relationships, which would inform the broader context of adolescents' lives. Importantly, our study tested these prospective relationships among higher-risk adolescents who are in treatment for depression and suicidality, and findings may not generalize to other samples of adolescents in other levels of care (e.g., inpatient, outpatient) or community samples. For instance, higher levels of SM use may prospectively contribute to maladaptive psychological processes that confer risk for the development of suicide risk among some adolescents, but these associations are different among youth already at higher risk for suicide.

The current study represents the first prospective examination of the associations between SM use and multiple domains of suicidality (i.e., PDW, SI with and without plan, and suicidal behavior) among adolescents. Our findings suggest that SM use and prospective suicidality is complex, and it highlights the need to further explore how self-reported SM use may be a quantifiable risk factor of known social risk factors for suicide, such as loneliness and thwarted belongingness. Future research using intensive, longitudinal designs and multimethod reports of SM use and suicidality is needed to build on these findings and examine SM use and quality as risk factors for the development and worsening of suicidal thoughts and behaviors among adolescents.

References

Anderson, M., & Jiang, J. (2018). *Teens, social media, and technology*. Pew Research Center. pewresearch.org

Angold, A., Weissman, M. M., John, K., Merikangas, K. R., Prusoff, B. A., Wickramaratne, P., Gammon, G. D., & Warner, V. (1987, Nov). Parent and child reports of depressive symptoms in children at low and high risk of depression. *J Child Psychol Psychiatry, 28*(6), 901-915. https://www.ncbi.nlm.nih.gov/pubmed/3436996

Biernesser, C., Bear, T., Mair, C., Brent, D., & J., T. (2019). *Social media and adolescent suicide: exploring risks, benefits, and opportunities for prevention*. University of Pittsburgh, PhD Dissertation

.

Birmaher, B., Brent, D. A., Chiappetta, L., Bridge, J., Monga, S., & Baugher, M. (1999, Oct). Psychometric properties of the Screen for Child Anxiety Related Emotional Disorders (SCARED): a replication study. *J Am Acad Child Adolesc Psychiatry, 38*(10), 1230-1236. https://doi.org/10.1097/00004583-199910000-00011

Burnett, S., Sebastian, C., Cohen Kadosh, K., & Blakemore, S. J. (2011, Aug). The social brain in adolescence: evidence from functional magnetic resonance imaging and behavioural studies. *Neurosci Biobehav Rev, 35*(8), 1654-1664. https://doi.org/10.1016/j.neubiorev.2010.10.011

Calati, R., Ferrari, C., Brittner, M., Oasi, O., Olie, E., Carvalho, A. F., & Courtet, P. (2019, Feb 15). Suicidal thoughts and behaviors and social isolation: A narrative review of the literature. *J Affect Disord, 245*, 653-667. https://doi.org/10.1016/j.jad.2018.11.022

Escobar-Viera, C. G., Shensa, A., Bowman, N. D., Sidani, J. E., Knight, J., James, A. E., & Primack, B. A. (2018, Jul). Passive and Active Social Media Use and Depressive Symptoms Among United States Adults. *Cyberpsychol Behav Soc Netw, 21*(7), 437-443. https://doi.org/10.1089/cyber.2017.0668

Gunlicks-Stoessel, M., Mufson, L., Jekal, A., & Turner, J. B. (2010, Apr). The impact of perceived interpersonal functioning on treatment for adolescent depression: IPT-A versus treatment as usual in school-based health clinics. *J Consult Clin Psychol, 78*(2), 260-267. https://doi.org/10.1037/a0018935

Hamilton, J. L., Coulter, R. A., & Radovic, A. (2020). Mental health benefits and opportunities. In M. A. Moreno & A. J. Hoopes (Eds.), *Technology and Adolescent Health: In Schools and Beyond* (pp. 305-345). Elsevier.

Horowitz, L. M., Bridge, J. A., Teach, S. J., Ballard, E., Klima, J., Rosenstein, D. L., Wharff, E. A., Ginnis, K., Cannon, E., Joshi, P., & Pao, M. (2012, Dec). Ask Suicide-Screening Questions (ASQ): a brief instrument for the pediatric emergency department. *Arch*

Pediatr Adolesc Med, 166(12), 1170-1176. https://doi.org/10.1001/archpediatrics.2012.1276

Horton, S. E., Hughes, J. L., King, J. D., Kennard, B. D., Westers, N. J., Mayes, T. L., & Stewart, S. M. (2016, Aug). Preliminary Examination of the Interpersonal Psychological Theory of Suicide in an Adolescent Clinical Sample. *J Abnorm Child Psychol, 44*(6), 1133-1144. https://doi.org/10.1007/s10802-015-0109-5

John, A., Glendenning, A. C., Marchant, A., Montgomery, P., Stewart, A., Wood, S., Lloyd, K., & Hawton, K. (2018, Apr 19). Self-Harm, Suicidal Behaviours, and Cyberbullying in Children and Young People: Systematic Review. *J Med Internet Res, 20*(4), e129. https://doi.org/10.2196/jmir.9044

Joiner, T. E., Buchman-Schmitt, J. M., Chu, C., & Hom, M. A. (2017, Mar). A Sociobiological Extension of the Interpersonal Theory of Suicide. *Crisis, 38*(2), 69-72. https://doi.org/10.1027/0227-5910/a000463

Joiner, T. E., Van Orden, K. A., Witte, T. K., Selby, E. A., Ribeiro, J. D., Lewis, R., & Rudd, M. D. (2009, Aug). Main predictions of the interpersonal-psychological theory of suicidal behavior: empirical tests in two samples of young adults. *J Abnorm Psychol, 118*(3), 634-646. https://doi.org/10.1037/a0016500

King, C. A., & Merchant, C. R. (2008a). Social and interpersonal factors relating to adolescent suicidality: a review of the literature. *Arch Suicide Res, 12*(3), 181-196. https://doi.org/10.1080/13811110802101203

King, C. A., & Merchant, C. R. (2008b). Social and interpersonal factors relating to adolescent suicidality: a review of the literature. *Archives of Suicide Research, 12*(3), 181-196. https://doi.org/10.1080/13811110802101203

Liu, X., Huang, J., Yu, N. X., Li, Q., & Zhu, T. (2020, Apr 28). Mediation Effect of Suicide-Related Social Media Use Behaviors on the Association Between Suicidal Ideation and Suicide Attempt: Cross-Sectional Questionnaire Study. *J Med Internet Res, 22*(4), e14940. https://doi.org/10.2196/14940

Moreno, M. A., & Uhls, Y. T. (2019, Jan-Dec). Applying an affordances approach and a developmental lens to approach adolescent social media use. *Digital Health, 5*, 2055207619826678. https://doi.org/10.1177/2055207619826678

Nesi, J., Choukas-Bradley, S., & Prinstein, M. J. (2018a, Sep). Transformation of adolescent peer relations in the social media context: Part 1-A Theoretical framework and application to dyadic peer relationships. *Clinical Child and Family Psychology Review, 21*(3), 267-294. https://doi.org/10.1007/s10567-018-0261-x

Nesi, J., Choukas-Bradley, S., & Prinstein, M. J. (2018b, Sep). Transformation of Adolescent Peer Relations in the Social Media Context: Part 2-Application to Peer Group Processes

and Future Directions for Research. *Clinical Child and Family Psychology Review, 21*(3), 295-319. https://doi.org/10.1007/s10567-018-0262-9

Nesi, J., Wolff, J. C., & Hunt, J. (2019, Jun). Patterns of social media use among adolescents who are psychiatrically hospitalized. *Journal of the American Academy of Child and Adolescent Psychiatry, 58*(6), 635-639 e631. https://doi.org/10.1016/j.jaac.2019.03.009

Orben, A. (2020, Apr). Teenagers, screens and social media: a narrative review of reviews and key studies. *Social Psychiatry and Psychiatric Epidemiology, 55*(4), 407-414. https://doi.org/10.1007/s00127-019-01825-4

Przybylski, A. K., & Weinstein, N. (2017, Feb). A Large-Scale Test of the Goldilocks Hypothesis. *Psychol Sci, 28*(2), 204-215. https://doi.org/10.1177/0956797616678438

Schriber, R. A., & Guyer, A. E. (2016, Jun). Adolescent neurobiological susceptibility to social context. *Developmental Cognitive Neuroscience, 19*, 1-18. https://doi.org/10.1016/j.dcn.2015.12.009

Sedgwick, R., Epstein, S., Dutta, R., & Ougrin, D. (2019, Nov). Social media, internet use and suicide attempts in adolescents. *Curr Opin Psychiatry, 32*(6), 534-541. https://doi.org/10.1097/YCO.0000000000000547

Silk, J. S., Stroud, L. R., Siegle, G. J., Dahl, R. E., Lee, K. H., & Nelson, E. E. (2012, Jan). Peer acceptance and rejection through the eyes of youth: pupillary, eyetracking and ecological data from the Chatroom Interact task. *Social Cognitive and Affective Neuroscience, 7*(1), 93-105. https://doi.org/10.1093/scan/nsr044

Stewart, J. G., Shields, G. S., Esposito, E. C., Cosby, E. A., Allen, N. B., Slavich, G. M., & Auerbach, R. P. (2019, Oct). Life Stress and Suicide in Adolescents. *J Abnorm Child Psychol, 47*(10), 1707-1722. https://doi.org/10.1007/s10802-019-00534-5

Twenge, J., Joiner, T. E., Rogers, A. E., & Martin, G. N. (2018). Increases in Depressive Symptoms, Suicide-Related Outcomes, and Suicide Rates Among U.S. Adolescents After 2010 and Links to Increased New Media Screen Time. *Clinical Psychological Science, 6*(1), 3-17.

Table 1. Descriptives and bivariate correlations among primary study variables

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9
1. SM Use	2.52	1.66									
2. Messaging	1.60	1.34	.53								
3. TV/Videos	1.70	1.81	.26	.02							
4. Gaming	2.39	1.64	.45	.32	.29						
5. PDW Days	2.60	1.93	-.09	.01	.03	-.01					
6. SI Days	1.74	1.70	-.13	-.10	.01	.01	.72				
7. MFQ	18.96	4.89	.02	.10	.01	.15	.39	.27			
8. SCARED	46.16	13.68	.01	.09	-.03	.25	.08	-.01	.48		
9. Age	15.17	1.43	.10	.12	-.06	.16	-.14	-.11	-.06	-.01	
10. IOP Visits	4.39	1.58	-.19	-.25	-.11	-.11	.12	-.03	-.03	.09	-.09

Note. M and *SD* are used to represent mean and standard deviation, respectively. Values greater than .25 in magnitude are significant. SM = Social media. Media use (SM, messaging, TV/Videos, and Gaming) = Amount of reported media use on a typical day (scored from 1 (less than 30 minutes) to 5 (more than 3 hours). PDW = Passive Death Wish (M = average weekly days with PDW); SI = Suicidal Ideation (M = average weekly days with SI); MFQ = Mood and Feelings Questionnaire; depressive symptoms; SCARED = Screen for Anxiety and Emotion-Related Disorders; anxiety symptoms. IOP Visits = Number of IOP visits in the first 30 days after the baseline evaluation.

Table 2. SM use and SM Messaging Use predicting occurrence of suicidal behavior in the next 30 days

	Suicidal Behavior			**Suicidal Behavior**		
Predictors	*OR*	*CI*	*p*	*OR*	*CI*	*p*
Intercept	.16	.00 – 5.92	.34	.06	.00 – 1.99	.13
Age	.65	.35 – 1.15	.16	.66	.35 – 1.18	.18
Gender	.56	.11 – 3.56	.51	.51	.10 – 3.04	.43
MFQ	1.31	1.05 – 1.77	**.04**	1.32	1.05 – 1.77	**.03**
SCARED	.97	.92 – 1.03	.36	.97	.92 – 1.03	.32
Time (IOP Visits)	.96	.58 – 1.48	.86	1.00	.59 – 1.57	.99
Baseline ASQ sum	.92	.38 – 2.24	.83	1.07	0.46 – 2.55	.87
Daily SM Use	.72	.43 – 1.14	.17			
Daily Messaging Use				.87	.45 – 1.57	.65
R^2	0.13			0.10		

Note: Gender coded as 0 = female; 1 = male. MFQ = Mood and Feelings Questionnaire; SCARED = Screen for Anxiety and Emotion-Related Disorders; Time = number of IOP visits in first 30 days, ASQ = Ask Suicide- Screening Questions (range 0-4); SM Use Total = Amount of reported SM use on a typical day (scored from 1 (less than 30 minutes) to 5 (more than 3 hours). Messaging Use Total = Amount of reported direct messaging/texting on a typical day (scored from 1 (less than 30 minutes) to 4 (3 or more hours).

Table 3. SM use and SM Messaging Use predicting occurrence of Suicidal Ideation with Plan in the next 30 days

	Suicidal Ideation with Plan			**Suicidal Ideation with Plan**		
Predictors	*Odds Ratios*	*CI*	*p*	*Odds Ratios*	*CI*	*p*
Intercept	.06	.00 – .84	**.05**	.04	.00 – .51	**.02**
Age	.81	.55 – 1.17	.28	.82	.55 – 1.21	.33
Gender	1.38	.41 – 5.42	.62	1.42	.43 – 5.30	.58
MFQ	1.15	1.00 – 1.34	.07	1.15	1.01 – 1.35	.05
SCARED	.98	.94 – 1.03	.49	.98	.94 – 1.03	.50
Time (IOP Visits)	.19	.86 – 1.71	.32	1.17	.84 – 1.68	.37
Baseline ASQ sum	1.50	.84 – 2.80	.18	1.65	.92 – 3.10	.10
Daily SM Use	.67	.47 – .94	**.02**			
Daily Messaging Use				.62	.38 – .96	**.04**
R^2	0.19			0.17		

Note: Gender coded as 0 = female; 1 = male. SM = Social Media; MFQ = Mood and Feelings Questionnaire; SCARED = Screen for Anxiety and Emotion-Related Disorders; Time = number of IOP visits in first 30 days, ASQ = Ask Suicide- Screening Questions (range 0-4); SM Use Total = Amount of reported SM use on a typical day (scored from 1 (less than 30 minutes) to 5 (more than 3 hours). Messaging Use Total = Amount of reported direct messaging/texting on a typical day (scored from 1 (less than 30 minutes) to 4 (3 or more hours).

Table 4. SM use and SM Messaging predicting average number of days with PDW over next 30 days

	Days of Passive Death Wish			**Days of Passive Death Wish**		
Predictors	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*
Intercept	2.85	1.61 – 4.10	**<.001**	2.63	1.49 – 3.76	**<.001**
Age	-.13	-.37 – .11	.28	-0.13	-.37 – .10	.27
Gender	-.31	-1.10 –.48	.44	-0.32	-1.13 – .48	.43
MFQ	.17	.14 – .21	**<.001**	0.17	.14 – .21	**<.001**
SCARED	<.00	-.02 – .02	.84	.<00	-.02 – .02	.87
Time (IOP Visit)	-.01	-.11 – .10	.92	<.00	-.11 – .10	.93
Baseline ASQ sum	.14	-.19 – .48	.39	.17	-.16 – .50	.31
Daily SM Use	-.09	-.30 – .12	.41			
Daily Messaging Use				-.03	-.29 – .23	.81
Random Effects						
Intercept	1.93	1.55 – 2.40		1.91	1.54 – 2.36	
Time (Slope)	.23	.11 – .47		.30	.18 – .49	

Note: Gender coded as 0 = female; 1 = male. SM = Social Media; MFQ = Mood and Feelings Questionnaire; SCARED = Screen for Anxiety and Emotion-Related Disorders; Time = IOP visit number (level 1 predictor), ASQ = Ask Suicide- Screening Questions (range 0-4); SM Use Total = Amount of reported SM use on a typical day (scored from 1 (less than 30 minutes) to 5 (more than 3 hours). Messaging Use Total = Amount of reported direct messaging/texting on a typical day (scored from 1 (less than 30 minutes) to 4 (3 or more hours).

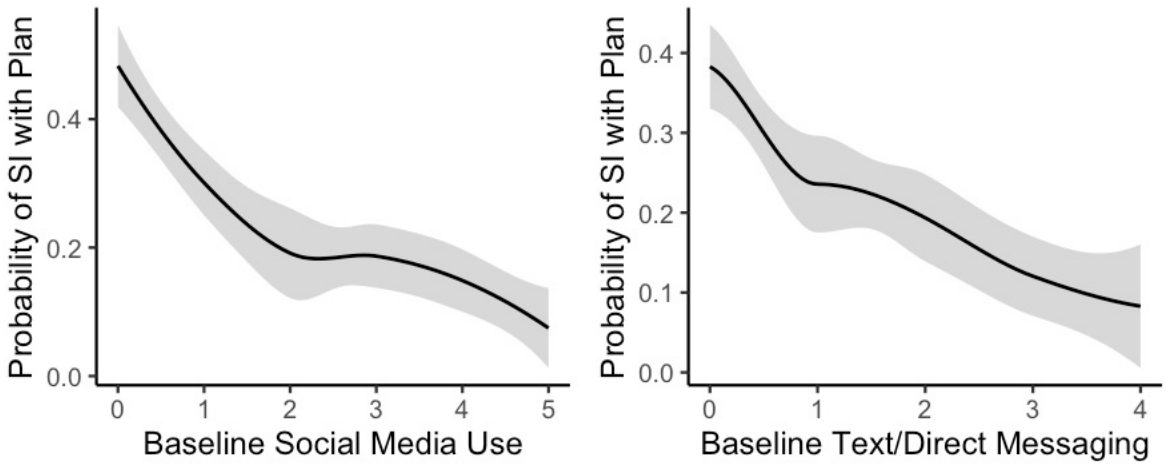
Table 5. SM use and SM Messaging predicting average number of days with suicidal ideation over next 30 days

	Days of Suicidal Ideation			**Days of Suicidal Ideation**		
Predictors	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*
Intercept	2.24	1.04 – 3.43	**<.001**	2.11	1.03 – 3.20	**<.001**
Age	-.08	-.30 – .15	.50	-.07	-.30 – .16	.55
Gender	-.18	-.93 – .57	.64	-.14	-.90 – .63	.73
MFQ	.12	.09 – .16	**<.001**	.12	.09 – .16	**<.001**
SCARED	<.001	-.02 – .02	.82	<.001	-.02 – .02	.82
Time (IOP Visit)	-.11	-.22 – .01	.07	-.11	-.22 – .01	.06
Baseline ASQ sum	.12	-.19 – .44	.45	.14	-.17 – .45	.37
Daily SM Use	-.11	-.31 – .09	.28			
Daily Messaging Use				-.15	-.40 – .10	.24
Random Effects						
Intercept	1.93	1.55 – 2.40		1.88	1.51 – 2.34	
Time (Slope)	.23	.11 – .47		.30	.19 – .49	

Note: Gender coded as 0 = female; 1 = male. SM = Social Media; MFQ = Mood and Feelings Questionnaire; SCARED = Screen for Anxiety and Emotion-Related Disorders; Time = IOP visit number (level 1 predictor), ASQ = Ask Suicide- Screening Questions (range 0-4); SM Use Total = Amount of reported SM use on a typical day (scored from 1 (less than 30 minutes) to 5 (more than 3 hours). Messaging Use Total = Amount of reported direct messaging/texting on a typical day (scored from 1 (less than 30 minutes) to 4 (3 or more hours).

Figures 1a and 1b. Baseline SM use and Text/Direct Messaging and the Predicted probability of SI with plan

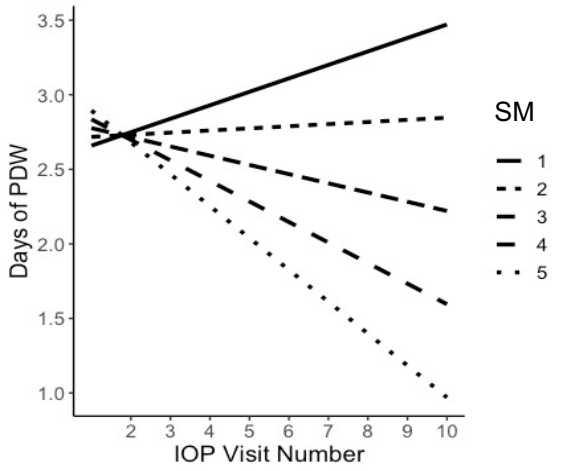
1a) Social Media Use 1b) Text/Direct Messaging



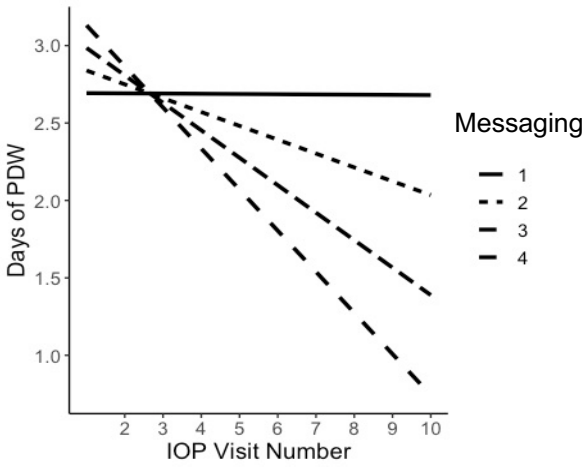
Note. The X-axis reflects the baseline scores on the media use items, with response options including (0) “Less than 30 minutes”, (1) “30 minutes to 1 hour”, (2) “more than 1 hour to 2 hours”, (3) “more than 2 hours to 3 hours”, (4) “more than 3 hours to 4 hours”, and (5) “more than 4 hours”. For text/direct messaging, responses of 4-5 were combined and reflect text/direct messaging use more than 3 hours.

Figures 2a-c. Baseline SM use and Text/Direct Messaging and PDW and Depression Symptoms across treatment

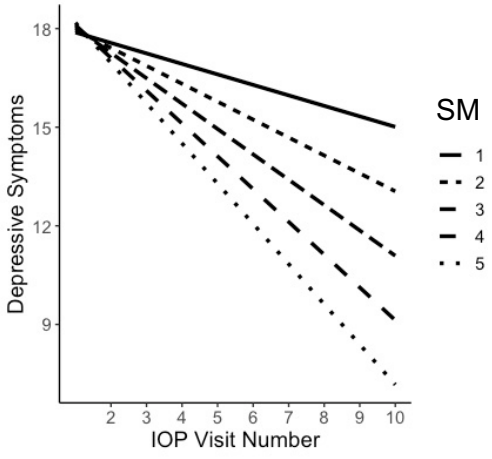
2a) SM use and PDW



2b) Messaging and PDW



2c. SM Use and Depressive Symptoms



Note. The moderator reflects baseline scores on media use, with response options including (0) "Less than 30 minutes", (1) "30 minutes to 1 hour", (2) "more than 1 hour to 2 hours", (3) "more than 2 hours to 3 hours", (4) "more than 3 hours to 4 hours", and (5) "more than 4 hours". For text/direct messaging, responses of 4-5 were combined and reflect text/direct messaging use more than 3 hours. The x-axis reflects IOP visit number in the first 30 days. The y-axis indicates the numbers of days in the past week with passive death wish (PDW) or depressive symptoms.