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The association between valence of social media experiences and depressive symptoms

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Abstract

Background: Social media (SM) may confer emotional benefits via connection with others. However, epidemiologic studies suggest that overall SM is paradoxically associated with increased depressive symptoms. To better understand these findings, we examined the association between positive and negative experiences on SM and depressive symptoms.

Methods: We conducted a cross-sectional survey of 1,179 full-time students at the University of West Virginia ages 18–30 in August of 2016. Independent variables were self-reported positive and negative experiences on SM. The dependent variable was depressive symptoms as measured using the Patient-Reported Outcomes Measures Information System. We used multivariable logistic regression to assess associations between SM experiences and depressive symptoms controlling for socio-demographic factors including age, sex, race/ethnicity, education, relationship status, and living situation.

Results: Of the 1,179 participants, 62% were female, 28% were non-White, and 51% were single. After controlling for covariates, each 10% increase in positive experiences on SM was associated with a 4% *decrease* in odds of depressive symptoms, but this was not statistically significant (AOR=0.96; 95% CI=0.91-1.002). However, each 10% increase in negative experiences was associated with a 20% *increase* in odds of depressive symptoms (AOR=1.20; 95% CI=1.11-1.31). When both independent variables were included in the same model, the

association between negative experiences and depressive symptoms remained significant (AOR=1.19, 95% CI=1.10-1.30).

Conclusion: Negative experiences online may have higher potency than positive ones because of negativity bias. Future research should examine temporality to determine if it is also possible that individuals with depressive symptomatology are inclined toward negative interactions.

Introduction

Depression is the leading cause of disability worldwide (World Health Organization, 2016). In the United States, the economic burden of depression is over \$210 billion (Greenberg, Fournier, Sisitsky, Pike, & Kessler, 2015). Moreover, many individuals with depression also experience physical or psychiatric comorbidities that contribute to the overall disease burden (Greenberg et al., 2015). Only about half of individuals experiencing major depression receive treatment in the United States and fewer than 10% receive treatment in many other countries (National Institute of Mental Health, 2016; SAMHSA, 2015; World Health Organization, 2016). Depression is associated with a combination of biological, psychological, and social factors (World Health Organization, 2016). Prior research has identified media exposures, such as video games, television, movies, and the Internet, to be associated with the depression among adolescents (Bickham, Hswen, & Rich, 2015; Primack et al., 2009).

However, social media (SM) use has presented a puzzle in terms of its relationship with depression. SM use is rapidly increasing worldwide. In the United States the percentage of young adults using SM skyrocketed from 12% in 2005 to 90% in 2015 (Perrin, 2015). Among online adults in 2016, Facebook remained the most popular SM platform (79%, a 7-percentage point increase from 2015), followed by Instagram (32%), Pinterest (31%), LinkedIn (29%), and Twitter (24%; Greenwood, Perrin, & Duggan, 2016). Of note, as of 2016, 62% of American adults reported getting their news from SM (Gottfried & Shearer, 2016).

Because the goal of SM is to connect individuals, it is not surprising that studies suggest its ability to enhance emotional support. For example, Facebook use among college students

may help maintain previously established relationships, and benefits appear particularly strong among users with low self-esteem and low life-satisfaction (Ellison, Vitak, Gray, & Lampe, 2014). SM also facilitates the formation of new connections, providing an alternative way to connect with others who share similar interests (Ellison, Heino, & Gibbs, 2006; Ellison, Steinfield, & Lampe, 2007). Furthermore, individuals with more SM connections report having greater social capital, which has also been associated with lower depression (Ellison, Steinfield, & Lampe, 2011; Ellison et al., 2014; Steinfield, Ellison, & Lampe, 2008). This may be because those with greater social capital are able to draw upon resources from members of their networks, leading to useful information, new personal relationships, and employment opportunities (Granovetter, 1973; Paxon, 1999). Consistent with all of this, having a larger Facebook audience has been associated with increased life satisfaction, perceived social support, and subjective well-being (Kim & Lee, 2011; Manago, Taylor, & Greenfield, 2012).

However, other studies suggest that increased SM exposure may counter-intuitively be associated with *increased* depression among both adolescents (Lou, Yan, Nickerson, & McMorris, 2012; Pantic et al., 2012) and adults (Kross et al., 2013; Lin et al., 2016; McDougall et al., 2016; Shensa, Sidani, Lin, Bowman, & Primack, 2016). This may be because SM facilitates engagement in social comparison, giving users the impression that others are happier and more meaningfully engaged (Acar, 2008; Chou & Edge, 2012; Lup, Trub, & Rosenthal, 2015).

Frequency of SM use may lead to media multitasking—either between SM platforms or SM and other tasks—which has been associated with depression, social anxiety, and declines in academic performance (Becker, Alzahabi, & Hopwood, 2013; Cain, Leonard, Gabrieli, & Finn, 2016; Xu, Wang, & David, 2016).

While prior studies have generally treated SM use as a unidimensional exposure variable (e.g., via “time” or “frequency”), all SM experiences are not the same in terms of positive or negative subjective experience. For example, an individual can spend two hours engaging in experiences which feel highly positive to the user—such as supporting close friends with positive messages and “likes”—while another user might spend those same two hours having highly negative experiences including vehement arguments on emotional topics such as politics. It would be valuable to determine if these distinct experiences are differently associated with depression; if they are, that might provide a direction for intervention.

Another literature gap that would be useful to fill would be to assess overall use of SM. Many previous studies have focused on one platform, such as Facebook (Kross et al., 2013) or Instagram (Lup et al., 2015). However, an increasing number of individuals are using a more diverse set of platforms (Greenwood et al., 2016; Perrin, 2015), with 56% of online adults using more than one of the five most common SM platforms (Greenwood et al., 2016).

Therefore, the purpose of this study was to examine, in a large cohort of university students, associations between positive and negative SM experiences on a variety of platforms and depressive symptoms. We hypothesized that reporting a greater proportion of positive experiences on SM would be associated with lower levels of depressive symptoms (H1). Second, we hypothesized that reporting a greater proportion of negative experiences on SM would be associated with greater levels of depressive symptoms (H2). Our third aim was to compare the effect sizes associated with positive and negative experiences on depressive symptoms in the same statistical model. For this more exploratory aim, we did not have a specific *a priori* hypothesis.

Methods

Design

We conducted a cross-sectional study of SM use and depressive symptoms among young adults from one large U.S. state university. In August 2016, participants were recruited via an email distributed to all registered students, including both undergraduate and graduate students. The email invited recipients to participate in an online survey designed to understand both the positive and negative associations between SM use and well-being. Enrollment continued until about 1,200 responses were received; this figure was based on power calculations that relied upon prior distributions and estimates for the independent and dependent variables.

Participants provided online informed consent. The median completion time for the survey was 16 minutes. As thanks for their time, participants were entered into a drawing for a \$50 Amazon gift card for every 25 participants enrolled. This study was approved by the University of West Virginia Institutional Review Board and the survey was administered via Qualtrics (Qualtrics, 2015).

Sample

To be eligible, participants had to be between 18 and 30 years of age and undergraduate or graduate students at the University of West Virginia in Morgantown, WV. There were 1,228 eligible participants, and of these, 1,179 had complete data for our primary dependent and independent variables.

Measures

Depressive symptoms (dependent variable). We assessed depressive symptoms using the 4-item Patient-Reported Outcomes Measurement Information System (PROMIS) scale. PROMIS is a National Institutes of Health Roadmap initiative whose aim is to provide precise, valid, reliable, and standardized questionnaires measuring patient-reported outcomes across the domains of physical, mental, and social health (Cella et al., 2010). The PROMIS depression scale has been validated against other commonly used depression instruments, including the Center for Epidemiological Studies Depression Scale (CES-D), the Beck Depression Inventory (BDI-II), and the Patient Health Questionnaire (PHQ-9; Choi, Schalet, Cook, & Cella, 2014; Pilkonis et al., 2014). The 4-item PROMIS depression scale asked participants how frequently in the past 7 days they had felt hopeless, worthless, helpless, or depressed (Pilkonis et al., 2011). Each item was scored on a 5-point Likert scale ranging from 1 to 5, corresponding to responses of *Never* (1), *Rarely* (2), *Sometimes* (3), *Often* (4), and *Always* (5). The resulting composite scale ranged from 4 to 20 and served as the dependent variable in our models. Because of the skewed and non-normal distribution of this variable, we could not use it as a continuous variable. Therefore, based on the distribution of our data and to improve interpretability of results, we operationalized this variable in two ways. First, we used the standard cutoff for depression of 11, which corresponds to the T-score of 60.5 (Cella, Gershon, Bass, & Rothrock, 2015), indicating moderate depressive symptoms based on the recommendation of the American Psychiatric Association. (American Psychiatric Association, 2013) Because the PROMIS scale is also designed to assess level of depressive symptoms, we also collapsed scores into

three roughly equal categories—Low (4); medium (5–8); and high (9–20)—to create an ordered categorical outcome. For our primary analyses, we used the depression cutoff of 11, and for our secondary analyses, we used the three-level variable.

Positive and negative experiences on social media (independent variables). We assessed positive and negative experiences on SM by directly asking participants to estimate what percentage of their SM experiences involved positive and negative experiences, respectively. Participants interpreted the meaning of positive and negative experiences, a decision made after focus groups suggested that offering interpretations would be counter-productive. We presented participants with sliders ranging from 0 to 100 as the response choice for each item. The resulting 2 scores served as independent variables. For logistic regression analyses, we transformed responses into a 10-point scale (1 point for every 10%), based on the natural distribution of responses around these anchors and to improve interpretability of results.

Socio-demographic factors (covariates). We asked participants to report their age, sex, race/ethnicity, highest level of education, relationship status, and living situation. We provided participants with open response formats for reporting age, sex, and race/ethnicity. We assessed age as a continuous variable in years (18 to 30) and collapsed race/ethnicity into two categories: (1) White, non-Hispanic; and (2) non-White. We used multiple choice items to assess relationship status (single, dating, in a committed relationship) and living situation (with parent/guardian, with significant other, with friends, alone, other). We collapsed categories with < 5% responses for model stability in analyses.

Analysis

For primary analyses, we only included individuals with complete data for our dependent variable (depressive symptoms) and independent variables (positive and negative experiences on SM). Of the 1,228 eligible participants, 49 (4%) were excluded because of missing data.

We performed chi-square tests for sex, race/ethnicity (categorical variables) and *t*-tests for age (continuous variable) to assess patterns of missing data and determine if there were any socio-demographic differences between those with complete and those with incomplete data. There were no significant differences by age ($P=.50$), race/ethnicity ($P=.27$), or sex ($P=.19$)

We described our sample by reporting counts and percentages. In order to make sure we had met appropriate assumptions for our analytic models, we also screened our data. We screened all six multivariable models for collinearity among covariates, and an average VIF of 1.34 indicated no issues of multicollinearity among each independent variable. All three models using ordered logistic regression met the proportional odds assumption, indicated by non-significant *p*-values ranging from 0.95 to 0.97.

We then assessed bivariable and multivariable associations between each independent and dependent variable using logistic regression and ordered logistic regression based upon both a dichotomous and 3-level ordered categorical scale of our dependent variable. We decided a priori to adjust for all socio-demographic covariates in our multivariable models regardless of significance level in bivariable analyses. We defined statistical significance with a 2-tailed alpha of 0.05 and analyzed all data using Stata 14 (StataCorp, 2016). Our primary multivariable model included both positive experiences and negative experiences in the same

model. However, we also conducted analyses with each of these independent variables in different models in order to triangulate findings.

We conducted three sets of sensitivity analyses to examine robustness of results. First, we conducted all analyses using continuous variables when they were available (e.g., for age). Second, we re-conducted all analyses using only covariates with a $P < 0.20$ association with the outcome in order to ensure that we were not overcontrolling. Third, we re-conducted all analyses using other depression cutoffs (i.e., 8, 9, 10, and 12) to ensure results were consistent with primary models. Because all of these additional analyses demonstrated similar results to primary models, only primary results are presented in the current manuscript.

Results

Our final sample consisted of 1,179 individuals. As shown in **Table 1**, the majority of our sample was female (62%); 37% identified as male and 1% identified as “other” gender. The majority of participants were White, non-Hispanic (72%), hereafter referred to as “White.” Our sample ranged in age from 18 to 30 years old, with a mean age of 20.9 (SD=2.9). Median age was 20 (IQR=19–22). About half of participants reported being single (51%) and about half reported living with friends (48%). Variables significantly associated with depression as a dichotomous variable in bivariable analyses included positive experiences, negative experiences, sex, and race/ethnicity (**Table 1**). When depression was operationalized in tertiles, variables significantly associated with depressive symptoms included positive experiences, negative experiences, sex, and living situation (**Table 2**).

Internal consistency of the four depressive symptom items was high ($\alpha=0.91$). Data were skewed to the right, with a mean of 7.6 (SD=3.7) and median of 7 (IQR=4–10) on the composite scale ranging from 4–20. About one-third of our sample (30%) was in the low depressive symptoms group and a similar percentage was in the high group (34%).

The distribution of each independent variable was skewed. Participants reported that about 71% (SD=31) of their SM experiences were positive. This corresponded with a median of 85% (IQR=50–96). However, participants reported that about 11% (SD=16) of their SM experiences were negative, and this corresponded with a median of 5% (IQR=1–14).

Our first set of multivariable models explored associations with depressive symptoms as a dichotomous variable. In the model only including positive experiences, each 10% increase in positive experiences on SM was associated with a 4% decrease in depressive symptoms

(AOR=0.96; 95% CI=0.91–1.002) (**Table 3, Model 1**). This was statistically insignificant, indicating that H1 was not upheld. In the model only including negative experiences, each 10% increase in negative experiences on SM was associated with a 20% increase in depressive symptoms (AOR=1.20; 95% CI=1.11–1.31) (**Table 3, Model 2**). This was statistically significant, indicating that H2 was upheld. When independent variables were in the same model, results were only slightly different (**Figure** and **Table 3, Model 3**). Each 10% increase in positive experiences was associated with a 2% decrease in odds of depressive symptoms (AOR=0.98; 95% CI=0.93–1.03), which was statistically insignificant. While each 10% increase in negative experiences was associated with a 19% increase in odds of depressive symptoms (AOR=1.19; 95% CI=1.10–1.30), which was statistically significant. In all three models, covariates significantly associated with depressive symptoms included negative experiences, sex (“Female” and “Other”), race/ethnicity (“Non-white”), and education (“Some college”; **Table 3**).

In the second set of multivariable models, which explored associations with depressive symptoms operationalized in tertiles, results were generally similar to those with depressive symptoms as a dichotomous variable. In the model only including positive experiences, each 10% increase in positive experiences was associated with a 6% decrease in depressive symptoms, and this was statistically significant (AOR=0.94; 95% CI=0.91–0.97; **Table 4, Model 1**). In the model only including negative experiences, each 10% increase in negative experiences was associated with a 16% increase in depressive symptoms (AOR=1.16; 95% CI=1.08–1.25; **Table 4, Model 2**). Model 3, which included both independent variables, demonstrated results that were similar in magnitude and significance to Model 1 and Model 2 (**Table 4, Model 3**). In all three models, female sex was significantly associated with depressive symptoms. For

example, being female was associated with an increase in the odds of depressive symptoms (e.g., AOR=1.68, 95% CI=1.34–2.12; **Table 4, Model 3**). In some models, relationship status and living situation were weakly associated with depressive symptoms (**Table 4**).

Discussion

This study of university students found that having positive experiences on SM was only weakly associated with lower depressive symptoms, while having negative experiences on SM was strongly associated with higher depressive symptoms. Because 83% of SM users are within the age range of our study population (Duggan & Brenner, 2013), it is valuable to know that the valence of online experiences may be associated with important outcomes such as depressive symptoms in this population. These findings may encourage individuals to pay closer attention to their online exchanges and experiences, and assist development of interventions.

It should be noted that one important caveat of our findings is that, because we used a cross-sectional methodology, we cannot determine whether negative interactions engender depressive symptoms, whether depressive symptoms draw individuals into negative interactions, or some combination of the two. Future longitudinal and/or qualitative research may help to elucidate directionality.

One potential explanation for the association between valence of SM experiences and depressive symptoms is that individuals use and experience SM in different ways, including social engagement, information seeking, passing time, relaxation, or entertainment (Whiting & Williams, 2013). In these various contexts, some users tend to have positive exchanges that bolster their feelings of connectedness and positivity, while others engage in negative exchanges and arguments that may leave them feeling disconnected or depressed.

Our findings are consistent with *social network theory* (Granovetter, 1973; Krackhardt, 1992), which suggests that “strong ties” based on trust and affection are more likely to manifest in positive experiences and greater levels of emotional support. On the other hand,

“weak ties” are helpful for finding new information, but they may provide low levels of intimacy and relationship intensity (Granovetter, 1973; Krackhardt, 1992). In the complex milieu of SM—where the average Facebook user has 217 “friends” (Acar, 2008) and the average size of a real-life social network is around 125 (Hill & Dunbar, 2003)—frequent engagement with weak ties may increase misunderstandings and negative experiences, leading to greater depressive symptoms. The additional “friends” that SM sites facilitate may actually foster disconnectedness rather than engender meaningful connections.

In our model including both independent variables, each 10% increase in positive experiences on SM was associated with a 2% decrease in depressive symptoms. While the result was not statistically significant, its direction is consistent with studies demonstrating the value of SM in developing and maintaining social capital and connectedness, entities that inversely correlate with depressive symptoms (Ellison et al., 2007; Steinfield et al., 2008). However, the magnitude of the finding was much stronger for negative experiences. Each 10% increase in *negative* experiences was associated with a 19% *increase* in odds of depressive symptoms. Additional analyses which operationalized depressive symptoms in tertiles demonstrated similar results. Because the effect size for negative experiences seems to be higher than that for positive experiences, one might conclude that negative SM experiences may be more “potent” than positive experiences. This reasoning is consistent with *negativity bias*, a concept which purports a tendency for humans to give greater emphasis to negative entities (e.g., events, objects, personal traits) compared with positive ones (Rozin & Royzman, 2001). This may be particularly relevant in the context of SM use. For example, while positive experiences may be associated with fleeting positive reinforcement, negative experiences such

as public SM arguments may rapidly escalate due to a need to shape or defend one's "digital identity"(Cover, 2015) and may in turn leave a lasting, potentially traumatic impression on the individual.

Because these data are cross-sectional, it may also be that individuals with depressive symptoms tend to subsequently have more negative and fewer positive experiences on SM. This explanation is plausible, because depressed and/or anhedonic individuals may seek out SM relationships due to their tendency to shun in-person social opportunities (Caplan, 2003). It may also be that the association between SM experiences and depressive symptoms is bi-directional in nature.

Aside from positive and negative SM experiences, one covariate—sex—was associated with depressive symptoms across all analytic models. When compared to those who identified as male, participants who identified as female demonstrated a 50% increase in odds of depressive symptoms. This is consistent with other research demonstrating that females have higher rates of depression than males (World Health Organization, 2016).

Three additional covariates were associated with depressive symptoms in our primary analysis. First, participants who identified as "other" when compared to those who identified as male had a nearly six-fold odds of increased depressive symptoms. This is consistent with research demonstrating that gender-fluid individuals tend to feel marginalized (Grubb, 2016). Second, participants who identified as "non-White" had a 45% odds of increased depressive symptoms when compared to those who identified as "White." While this is consistent with reportedly higher rates of depression among non-White individuals (Pratt & Brody, 2014), it could also be due to factors not assessed such as income or access to health care which may be

associated with depression in minorities. Third, compared to those with a high school diploma or less, participants with only some college—versus two-year/technical degree or Bachelor’s degree—had 78% odds of increased depressive symptoms. It may be that individuals in four-year degree programs are at increased risk of depressive symptoms due to high levels of stress. This is consistent with research showing that college students today, compared to 30 years ago, are more likely to report feeling overwhelmed and believe they are below average in mental and physical health (Twenge, 2015).

While these early findings need to be replicated, they may be useful to public health practitioners. For example, educating the general public to be more aware of the risks associated with engaging in negative encounters online may help interrupt a potential cycle of negative experiences and depressive symptoms. In a similar vein, cyberbullying occurs not only among adolescents but also among young adults and older adults (Cassidy, Faucher, & Jackson, 2017). Therefore, many possible venues—such as universities, workplaces, and community spaces—could be leveraged to increase awareness around positive and negative SM experiences.

These findings may also be useful for healthcare practitioners working with depressed individuals. Specific strategies to improve quality of online experiences include restricting time spent using SM, thereby reducing the time during which negative encounters could happen; removing one’s membership from groups that have previously enabled negative SM experiences; and “de-friending” people who are contributors to negative experiences. Although the association between positive experiences and lower depressive symptoms was not significant in our primary model—and only weakly significant in our secondary model—it

still may be valuable for individuals to have positive SM experiences. Engaging in various forms of SM has been shown to enhance communication, social connection and even technical skills amongst children and adolescents (O’Keeffe & Clarke-Pearson, 2011). Effective SM use—such as communication and knowledge transfer, maintenance of existing connections, and fellowship building—can also lend itself to positive experiences, which may in turn lead to lower depressive symptoms.

Limitations

The major limitation of this study is the cross-sectional nature of these data. Future studies utilizing longitudinal designs and/or more rigorous qualitative components would be useful to explore directionality of results. However, regardless of directionality, knowledge of this association suggests that interventions may be valuable to interrupt this potential cycle. Additionally, it is important to acknowledge that we focused on a convenience sample of young adult university students. Therefore, results cannot be generalized to a more diverse population, such as older or non-university adults. It is also possible participants may have under-reported depression due to the sensitive nature of this topic. We attempted to minimize this by assuring participants of confidentiality and having participants self-administer the survey. In addition, it should be noted that we assessed depressive symptoms using a self-report scale rather than the gold standard, which would have involved interview with a psychiatric professional. Finally, this study was purely observational; future work comparing negative and positive experiences in the online milieu to the real world may be useful.

Conclusions

Having positive experiences on SM is associated with lower depressive symptoms and having negative experiences is associated with higher depressive symptoms. However, the magnitude of effect seems to be more substantial and significant for negative encounters. Therefore, it may be useful to increase awareness of the importance of avoiding negative SM encounters to reduce the risk of depressive symptoms.

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Conflict of Interest Disclosure

The authors have no conflicts of interest to report. The authors confirm that the research presented in this article met the ethical guidelines, including adherence to the legal requirements, of the United States and received approval from the Institutional Review Board of the University of West Virginia.

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Table 1. Whole Sample Characteristics and Bivariable Associations Between Independent Variables, Covariates, and Depressive Symptoms as a Dichotomous Variable (N = 1179)

Independent Variable/Covariate	Whole Sample	Depressive Symptoms		P
		No	Yes	
Positive exp., mean (SD)	71 (31)	72 (31)	68 (31)	.046
Positive exp., median (IQR)	85 (50, 96)	85 (52, 97)	80 (46, 95)	.04
Negative exp., mean (SD)	11 (16)	10 (15)	15 (20)	<.001
Negative exp., median (IQR)	5 (1, 14)	5 (0, 11)	5 (1, 20)	<.001
Age, y, n (%)				.95
18	264 (22)	210 (23)	54 (22)	
19–20	394 (33)	311 (33)	83 (33)	
21–24	377 (32)	297 (32)	80 (32)	
25–30	144 (12)	111 (12)	33 (13)	
Sex, n (%) ^a				.001
Male	439 (37)	360 (39)	79 (32)	
Female	726 (62)	563 (61)	163 (65)	
Other	14 (1)	6 (1)	8 (3)	
Race/Ethnicity, n (%) ^a				.007

White, non-Hispanic	843 (72)	682 (74)	161 (65)	
Non-White ^c	331 (28)	244 (26)	87 (35)	
Education				.15
HS Diploma or less	268 (23)	224 (24)	44 (18)	
Some college	591 (50)	453 (49)	138 (55)	
Two-year/technical degree	193 (16)	153 (16)	40 (16)	
Bachelor's degree	127 (11)	99 (11)	28 (11)	
Relationship status, n (%) ^a				.34
Single	606 (51)	470 (51)	136 (54)	
Dating	322 (27)	253 (27)	69 (28)	
In a committed relationship ^d	251 (21)	206 (22)	45 (18)	
Living situation, n (%) ^a				.67
With a parent or guardian	172 (15)	139 (15)	33 (13)	
With a significant other	122 (10)	101 (11)	21 (8)	
With friends	564 (48)	436 (47)	128 (51)	
Alone	202 (17)	159 (17)	43 (17)	
Other	119 (10)	94 (10)	25 (10)	

^a Column percentages may not total 100 due to rounding.

^b Significance level determined using the non-parametric Kruskal-Wallis test for continuous independent variables and Chi-square tests for categorical socio-demographic variables.

^c Includes Black, Hispanic, Asian, Native American, and Multiracial.

^d Included being engaged, married, or in a domestic partnership.

Table 2. Whole Sample Characteristics and Bivariable Associations Between Independent Variables, Covariates, and Depressive Symptoms Operationalized in Tertiles (N = 1179)

Independent Variable/Covariate	Whole Sample	Depressive Symptoms			<i>p</i> ^b
		Low (4)	Medium (5-8)	High (9-20)	
Positive exp., mean (SD)	71 (31)	74 (31)	73 (30)	67 (31)	.004
Positive exp., median (IQR)	85 (50, 96)	90 (60, 99)	86 (52, 97)	80 (46, 95)	<.001
Negative exp., mean (SD)	11 (16)	10 (16)	9 (13)	14 (19)	<.001
Negative exp., median (IQR)	5 (1, 14)	4 (0, 10)	5 (0, 10)	5 (1, 20)	<.001
Age, y, n (%)					.37
18	264 (22)	87 (25)	94 (22)	83 (21)	
19–20	394 (33)	106 (31)	149 (35)	139 (35)	
21–24	377 (32)	120 (35)	130 (30)	127 (32)	
25–30	144 (12)	34 (10)	58 (13)	52 (13)	
Sex, n (%) ^a					<.001
Male	439 (37)	152 (44)	166 (38)	121 (30)	
Female	726 (62)	191 (55)	264 (61)	271 (68)	
Other	14 (1)	4 (1)	1 (0)	9 (2)	

Race/Ethnicity, n (%) ^a					.096
White, non-Hispanic	842 (72)	252 (73)	320 (74)	271 (68)	
Non-White ^c	331 (28)	93 (27)	110 (26)	128 (32)	
Education					.31
HS Diploma or less	268 (23)	95 (27)	92 (21)	81 (20)	
Some college	591 (50)	164 (47)	214 (50)	213 (53)	
Two-year/technical degree	193 (16)	54 (16)	75 (17)	64 (16)	
Bachelor's degree	127 (11)	34 (10)	50 (12)	43 (11)	
Relationship status, n (%) ^a					.43
Single	606 (51)	171 (49)	217 (50)	218 (54)	
Dating	322 (27)	102 (29)	113 (26)	107 (27)	
In a committed relationship ^d	251 (21)	74 (21)	101 (23)	76 (19)	
Living situation, n (%) ^a					.02
With a parent or guardian	172 (15)	58 (17)	59 (14)	55 (14)	
With a significant other	122 (10)	37 (11)	48 (11)	37 (9)	
With friends	564 (48)	177 (51)	183 (42)	204 (51)	
Alone	201 (17)	53 (15)	89 (21)	60 (15)	
Other	119 (10)	22 (6)	52 (12)	45 (11)	

^a Column percentages may not total 100 due to rounding.

^b Significance level determined using the non-parametric Kruskal-Wallis test for continuous independent variables and Chi-square tests for categorical socio-demographic variables.

^c Includes Black, Hispanic, Asian, Native American, and Multiracial.

^d Included being engaged, married, or in a domestic partnership.

Table 3. Multivariable Associations Between Independent Variables, Covariates, Socio-Demographic Characteristics, and Depressive Symptoms as a Dichotomous Variable (N = 1179)

Independent variable/covariate	Depressive Symptoms		
	Model 1 ^a AOR (95% CI) ^b	Model 2 ^a AOR (95% CI) ^b	Model 3 ^a AOR (95% CI) ^b
Positive experiences ^c	0.96 (0.91—1.002)	—	0.98 (0.93—1.03)
Negative experiences ^c	—	1.20 (1.11—1.31)	1.19 (1.10—1.30)
Age			
18	reference	reference	reference
19–20	0.77 (0.48—1.23)	0.78 (0.49—1.26)	0.78 (0.49—1.25)
21–24	0.84 (0.49—1.44)	0.87 (0.51—1.49)	0.86 (0.50—1.47)
25–30	1.01 (0.48—2.11)	1.10 (0.52—2.31)	1.07 (0.51—2.26)
Sex			
Male	reference	reference	reference
Female	1.41 (1.03—1.93)	1.49 (1.09—2.05)	1.50 (1.09—2.06)
Other	5.55 (1.79—17.17)	6.27 (2.00—19.63)	5.94 (1.88—18.74)
Race/Ethnicity			
White, non-Hispanic	reference	reference	reference
Non-White ^d	1.45 (1.06—1.98)	1.42 (1.04—1.94)	1.41 (1.03—1.93)

Education			
HS Diploma or less	reference	reference	reference
Some college	1.77 (1.11—2.82)	1.78 (1.11—2.84)	1.78 (1.12—2.85)
Two-year/technical degree	1.53 (0.79—2.97)	1.62 (0.83—3.16)	1.64 (0.84—3.20)
Bachelor's degree	1.53 (0.73—3.19)	1.43 (0.68—3.00)	1.47 (0.70—3.08)
Relationship status			
Single	reference	reference	reference
Dating	0.96 (0.68—1.34)	0.97 (0.69—1.36)	0.97 (0.68—1.36)
In a committed relationship ^e	0.71 (0.45—1.10)	0.70 (0.45—1.10)	0.70 (0.44—1.09)
Living situation			
With a parent or guardian	reference	reference	reference
With a significant other	0.94 (0.46—1.91)	0.87 (0.42—1.77)	0.86 (0.42—1.76)
With friends	1.19 (0.75—1.87)	1.17 (0.74—1.85)	1.16 (0.73—1.84)
Alone	1.05 (0.61—1.82)	0.99 (0.57—1.72)	0.99 (0.57—1.72)
Other	1.07 (0.59—1.95)	0.99 (0.54—1.84)	0.99 (0.54—1.83)

^a Model 1 includes positive experiences and all covariates included in the table. Model 2 includes negative experiences and all covariates included in the table. Model 3 includes both of these independent variables and all covariates included in the table.

^b AOR = adjusted odds ratio; CI = confidence interval; adjusted for age, sex, race/ethnicity, education, relationships status, and living

situation.

^c Each independent variable indicates the proportion of participants' SM experiences they perceive as being positive or negative. Associated odds represent the increase in depression for every 10% increase in the independent variable.

^d Includes Black, Multiracial, Hispanic, Asian, and Native American.

^e Included being engaged, married, or in a domestic partnership.

Table 4. Multivariable Associations Between Independent Variables, Covariates, Socio-Demographic Characteristics, and Depressive Symptoms Operationalized in Tertiles (N = 1179)

Independent variable/covariate	Depressive Symptoms		
	Model 1 ^a	Model 2 ^a	Model 3 ^a
	AOR (95% CI) ^b	AOR (95% CI) ^b	AOR (95% CI) ^b
Positive experiences ^c	0.94 (0.91—0.97)	—	0.95 (0.92—0.99)
Negative experiences ^c	—	1.16 (1.08—1.25)	1.14 (1.06—1.23)
Age			
18	reference	reference	reference
19–20	1.16 (0.82—1.66)	1.18 (0.83—1.68)	1.17 (0.82—1.67)
21–24	1.02 (0.68—1.54)	1.06 (0.70—1.59)	1.02 (0.68—1.54)
25–30	1.40 (0.80—2.45)	1.47 (0.83—2.58)	1.42 (0.81—2.49)
Sex			
Male	reference	reference	reference
Female	1.63 (1.30—2.05)	1.65 (1.31—2.07)	1.68 (1.34—2.12)
Other	2.61 (0.83—8.26)	3.13 (0.98—9.94)	2.74 (0.85—8.81)
Race/Ethnicity			
White, non-Hispanic	reference	reference	reference
Non-White ^d	1.18 (0.93—1.51)	1.19 (0.93—1.51)	1.16 (0.91—1.48)

Education			
HS Diploma or less	reference	reference	reference
Some college	1.32 (0.94—1.84)	1.32 (0.94—1.85)	1.32 (0.94—1.86)
Two-year/technical degree	1.26 (0.78—2.05)	1.31 (0.81—2.14)	1.33 (0.82—2.17)
Bachelor's degree	1.25 (0.72—2.14)	1.20 (0.70—2.08)	1.25 (0.72—2.15)
Relationship status			
Single	reference	reference	reference
Dating	0.86 (0.66—1.11)	0.86 (0.67—1.12)	0.86 (0.67—1.11)
In a committed relationship ^e	0.72 (0.52—0.99)	0.74 (0.54—1.02)	0.72 (0.53—0.9996)
Living situation			
With a parent or guardian	reference	reference	reference
With a significant other	1.02 (0.62—1.69)	0.98 (0.59—1.62)	0.96 (0.58—1.59)
With friends	1.10 (0.79—1.53)	1.09 (0.78—1.53)	1.08 (0.77—1.51)
Alone	1.02 (0.69—1.53)	0.997 (0.67—1.49)	0.98 (0.65—1.46)
Other	1.57 (1.02—2.43)	1.53 (0.99—2.36)	1.52 (0.98—2.34)

^a Model 1 includes positive experiences and all covariates included in the table. Model 2 includes negative experiences and all covariates included in the table. Model 3 includes both of these independent variables and all covariates included in the table.

^b AOR = adjusted odds ratio; CI = confidence interval; adjusted for age, sex, race/ethnicity, education, relationships status, and living

situation.

^c Each independent variable indicates the proportion of participants' SM experiences they perceive as being positive or negative. Associated odds represent the increase in depression for every 10% increase in the independent variable.

^d Includes Black, Multiracial, Hispanic, Asian, and Native American.

^e Included being engaged, married, or in a domestic partnership.

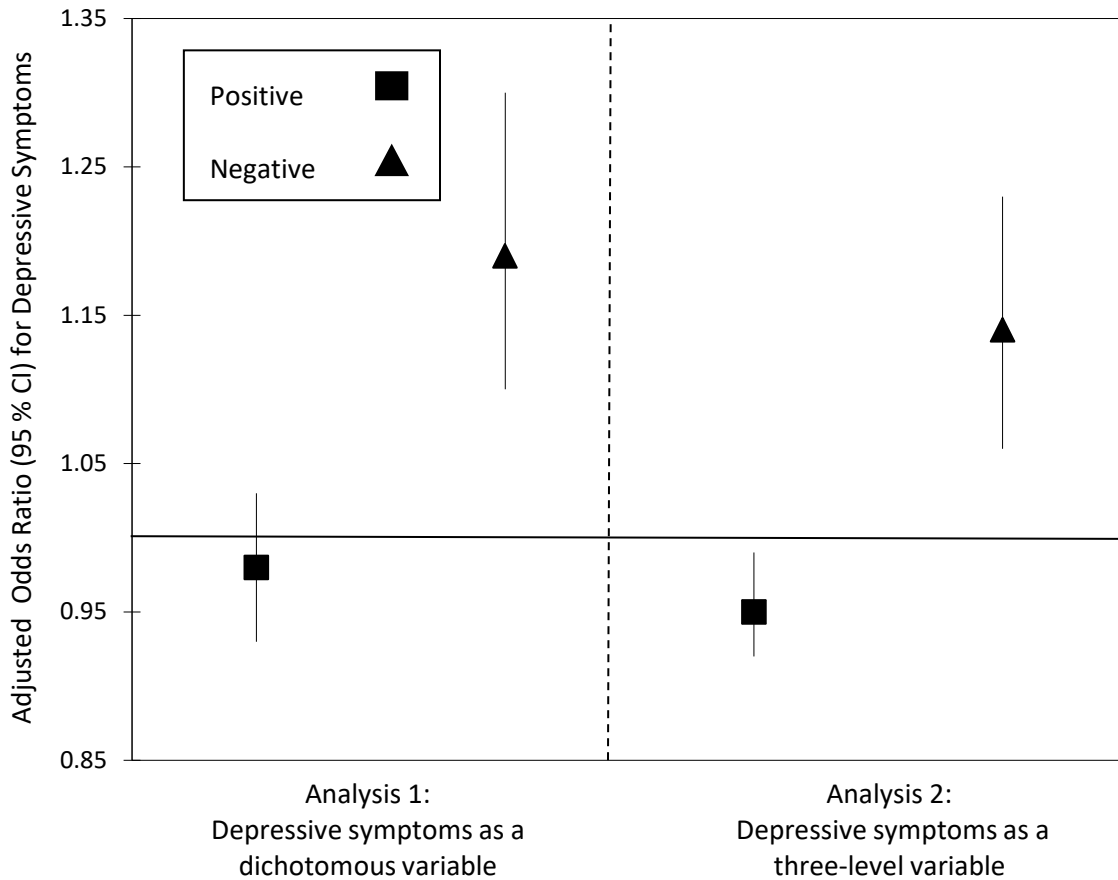


Figure. Adjusted odds ratios with 95% confidence intervals of the association between both positive and negative experiences of social media (SM) with depressive symptoms, measured in two separate ways: 1) as a dichotomous variable and 2) as a three-level ordered categorical variable. Overall, positive experiences on SM (“positive”) are associated with lower odds of depressive symptoms and negative experiences on SM (“negative”) are associated with higher odds of depressive symptoms. This association holds true when depressive symptoms was divided a dichotomous variable or a three-level variable. Depressive symptoms was assessed using a 4-item PROMIS scale and operationalized as a dichotomous variable using the standard cutoff for depression of 11, as well as a three-level categorical variable—Low (<4); medium (5–8); and high (9–20). Positive and negative experiences on social media were assessed by directly asking participants to estimate which percent of their SM experiences involved positive and negative experiences respectively. Responses were transformed into a 10-point scale (1 point for every 10%) based on the natural distribution of responses and to improve interpretability. Results are reported as an adjusted odds ratio, for which each 10% increase in positive and/or negative experiences is associated with odds of depressive symptoms. All analyses were adjusted for age, gender, and race/ethnicity.