

Research Article

ASSOCIATION BETWEEN SOCIAL MEDIA USE AND DEPRESSION AMONG U.S. YOUNG ADULTS

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Background: *Social media (SM) use is increasing among U.S. young adults, and its association with mental well-being remains unclear. This study assessed the association between SM use and depression in a nationally representative sample of young adults. Methods:* We surveyed 1,787 adults ages 19 to 32 about SM use and depression. Participants were recruited via random digit dialing and address-based sampling. SM use was assessed by self-reported total time per day spent on SM, visits per week, and a global frequency score based on the Pew Internet Research Questionnaire. Depression was assessed using the Patient-Reported Outcomes Measurement Information System (PROMIS) Depression Scale Short Form. Chi-squared tests and ordered logistic regressions were performed with sample weights. **Results:** The weighted sample was 50.3% female and 57.5% White. Compared to those in the lowest quartile of total time per day spent on SM, participants in the highest quartile had significantly increased odds of depression (AOR = 1.66, 95% CI = 1.14–2.42) after controlling for all covariates. Compared with those in the lowest quartile, individuals in the highest quartile of SM site visits per week and those with a higher global frequency score had significantly increased odds of depression (AOR = 2.74, 95% CI = 1.86–4.04; AOR = 3.05, 95% CI = 2.03–4.59, respectively). All associations between independent variables and depression had strong, linear, dose-response trends. Results were robust to all sensitivity analyses. **Conclusions:** SM use was significantly associated with increased depression. Given the proliferation of SM, identifying the mechanisms and direction of this association is critical for informing interventions that address SM use and depression. *Depression and Anxiety 00:1–9, 2016.*

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Key words: *social media; internet; communications media; depression; young adult*

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INTRODUCTION

Depression is highly prevalent in the United States and the incidence is increasing.^[1,2] It accounts for more disability-adjusted life years (DALYs) than all other mental disorders,^[3] and it is projected to become the leading cause of disability in high-income countries by 2030.^[4] The economic burden of depression is estimated at 83 billion dollars annually from reduced worker productivity, increased medical expenses, and suicide.^[5] Recurrence is frequent, and comorbidity with other psychiatric illnesses such as anxiety and substance use disorder is common.^[1,6]

Depression often begins around young adulthood.^[7,8] Although multiple factors contribute to depression,^[9] there is growing interest in the potential influence of social media (SM) use on psychological well-being. SM, which can be defined as “a group of Internet-based applications that allow the creation and exchange of user-generated content,”^[10] has become an integral component of connecting with friends and family, sharing personal content, and obtaining news and entertainment.^[11,12] Use of SM sites such as Facebook and Twitter has particularly increased among young adults, who are at critical junctures surrounding developmental tasks such as identity development and establishment of social norms.^[13] As many as 90% of young adults in the United States use social media, and the majority of users visit these sites at least once a day.^[14] SM use accounts for about 20% of time online on personal computers and 30% of time online via mobile phones.^[15]

Published studies on the association between social media use and depression have yielded mixed results.^[16,17] Some studies suggest that SM users may experience decreased depression,^[18] possibly from an increase in social capital, perceived social support, and life satisfaction.^[19,20] Other studies, however, indicate that frequent use of social media may be associated with declines in subjective well-being, life satisfaction, and real-life community.^[17,21] All of these prior studies, however, have been limited by small and/or localized samples. Furthermore, they have tended to focus on one specific platform, Facebook,^[16,21] while real-life usage, especially among young adults, tends to incorporate a diverse array of social media sites such as Twitter, Google+, Instagram, Tumblr, Snapchat, and Vine.^[14,15] In this study, we aimed to examine a broader range of SM exposures and to determine the association between SM exposure and depression in a large, nationally representative sample of young adults. Understanding the relationship between SM use and depression could allow the development of interventions or preventative strategies for at-risk populations.

MATERIALS AND METHODS

DESIGN, PARTICIPANTS, AND SETTING

We surveyed a nationally representative sample of U.S. young adults aged 19 to 32 regarding their depression and social media use. We drew

our sample from a large-scale web-based research panel developed and maintained by a survey research company called Growth from Knowledge (GfK).^[22] Participants were recruited via random digit dialing and address-based sampling, reaching a sampling frame of over 97% of the U.S. population.^[22] GfK is continuously recruiting individuals to be a part of their survey panel. Individuals are also free to withdraw from the panel at any point. The GfK Knowledge Panel[®] model has been shown to be a statistically valid method for surveying and analyzing health indicators from a nationally representative sample.^[23,24]

From October 2014 to November 2014, our web-based survey was sent via email to a random sample of 3,048 noninstitutionalized adults between the ages of 19 to 32 who had consented to participate in a previous study wave. Participation for this initial wave was 54%, a strong response rate for the use of Internet panels in the recruitment of study subjects.^[25,26] The current data were collected during the 18-month follow-up of this study, which assessed multiple health behaviors among individuals ages 18 to 30 at baseline. We used only the 18-month follow-up data for the current analysis because the social media items were not asked at baseline. Thus, although the overall survey was part of a longitudinal study, the data specific to social media use and depression were only asked at one-time point. Responses were received from 1,787 participants (59%).

The survey research company (GfK) instituted multiple strategies to improve data quality. For example, they screened all data sets for patterns suggestive of lack of effort. GfK also instituted procedures such as minimizing survey length whenever possible, reducing the need for scrolling, and avoiding the use of long grids. Furthermore, if individuals did not answer a question they were prompted once to answer with the statement “your answer is important to us. Please put your best guess.”

The median time for survey completion was 15 min and participants received \$15 for their participation. This study was approved by the University of Pittsburgh Institutional Review Board and was granted a Certificate of Confidentiality from the National Institutes of Health.

MEASURES

Participants completed online survey items including depression (dependent variable), social media use (independent variable), and covariates.

Depression. We assessed depression using a 4-item scale developed by the Patient-Reported Outcomes Measurement Information System (PROMIS). 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.^[27] The PROMIS depression scale was developed using item response theory to promote greater precision and decrease respondent burden.^[28] Specifically, the PROMIS depression scale has been correlated and validated with 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).^[29,30] The 4-item PROMIS depression scale asked participants how frequently in the past 7 days they had experienced depression, including feeling hopeless, worthless, helpless, or depressed.^[31] These items were scored on a 5-point Likert scale ranging from 1 to 5, corresponding to responses of “Never,” “Rarely,” “Sometimes,” “Often,” and “Always.” Thus, the total possible raw score was between 4 and 20. Based upon the nonnormal distribution of data, the raw scores were collapsed into tertiles of “low,” “medium,” and “high” for primary analysis. This was appropriate because one of the specific aims of the PROMIS depression scale is to grade the severity of depression, instead of merely providing a dichotomous cutoff for clinical depression. We classified those who did not endorse any depression as those in the “low” group (raw score = 4), which represented 44.5% of the

population. We then classified a “high” group based on both the distribution of the data and the clinical cutoff for depression recommended by the American Psychiatry Association (APA).^[32] This cutoff corresponded to a raw score of 9 or more (out of 20), which corresponds to a T-score of 57.3. Because the APA uses 55 as a cutoff for diagnosing clinical depression, individuals in the “high” group have a high likelihood of experiencing some depression.^[32] This group represented 26.3% of the population. Those with raw scores between 5 and 8 were classified as “medium” and comprised 29.2% of the population.

Social Media Use. We assessed participants’ social media use in three complementary ways. First, participants were asked to estimate *total time per day* on social media for personal use. This item specifically instructed participants to not count any time spent on social media for work. Participants provided estimates in numerical fields for hours and minutes on an average day. Second, participants were asked to report their use of each of 11 widely used social media platforms, including Facebook, Twitter, Google+, YouTube, LinkedIn, Instagram, Pinterest, Tumblr, Vine, Snapchat, and Reddit.^[14,15] Seven response choices ranged from “I do not use this platform” to “I use this platform 5 or more times a day.” We based these items on the measures used by Pew Internet Research.^[14] Using weighted averages based on the frequency responses, we computed social media site *visits per week*. Finally, we summed responses across platforms to obtain a total score without weighting values for frequency. Because there were seven response choices for each item, which we coded as 0 to 6, the resulting *global frequency score* ranged from 0 to 66. In order to improve interpretability of results, we collapsed all independent variables into quartiles for primary analyses. To ensure robustness of results, we also conducted all analyses with independent variables as continuous.

Covariates. For analysis, we divided the sample into three age groups (19–23; 24–26; 27–32) and race/ethnicity into five mutually exclusive groups (White, non-Hispanic; Black, non-Hispanic; Hispanic; Bi-racial, multiracial; or other non-Hispanic). We also assessed other environmental and personal factors that may affect depression and social media use.^[1,14] These included relationship status (single or in a committed relationship), living situation (with a parent or guardian; with a significant other; or other situation), household income (under \$30,000; \$30,000–\$74,999; or \$75,000 or more) and education level (high school or less; some college; or bachelor’s degree or higher).

DATA ANALYSIS

We included all participants who had complete data on the PROMIS depression scale and the social media items. Because only ~1% of participants had missing data for these variables, this did not affect our results. To describe our sample, we computed percentages of the dependent variable, each of the three independent variables, and the seven covariates. Next, we used chi-square tests to determine bivariable associations between each of the independent variables and covariates and the PROMIS depression scale score. After confirming that the proportional odds assumption was met, we used ordered logistic regression with appropriate sample weights to examine bivariable and multivariable associations between each social media variable and depression. We decided *a priori* to include all covariates in our primary multivariable models. We also used regression analyses to examine whether there was an overall linear trend between each ordered categorical independent variable and the dependent variable. In order to take advantage of the nationally representative nature of the data, all primary analyses were conducted using survey weights, which took into account sex, age, race/ethnicity, education, household income, census region, metropolitan area, and Internet access.

We also conducted four sets of sensitivity analyses to examine the robustness of our results. First, we conducted all analyses with the

outcome variable as dichotomous instead of in tertiles. For these analyses, those above the APA cutoff for the PROMIS depression scale were compared with all others.^[32] Second, we conducted all analyses with independent variables as continuous instead of ordered categorical variables. Third, we conducted all analyses using only covariates that had a bivariable association of $P < .15$ with the outcome. Fourth, we conducted all analyses without survey weights. Results from all sensitivity analyses showed similar levels of significance and magnitude to those described here.

Statistical analyses were performed with Stata 12.1 (Stata Corp., College Station, TX), and two-tailed P -values $< .05$ were considered to be significant.

RESULTS

PARTICIPANTS

A total of 1,787 participants completed the questionnaire. The weighted sample was 50.3% female, 57.5% White, 13.0% African American, 20.6% Hispanic, and 8.9% biracial/multiracial or other. Of these, slightly more than half (55.6%) were in a committed relationship and approximately a third (35.7%) reported living with a significant other. In terms of household income, 22.9% were in the “low” category (under \$30,000) and 38.7% were in the “high” category (\$75,000 and above). About one-third (36.0%) of participants had not attended any college, while a quarter (25.8%) had a B.A. or higher (Table 1). There were no differences between responders and nonresponders in terms of age ($P = .12$), sex ($P = .07$), or race ($P = .21$).

DEPRESSION

Accounting for survey weights, 44.5% of the sample reported no indicators of depression in the past week and were placed in the “low” group. About one-fourth (26.3%) were classified as “high,” and the remaining 29.2% of participants were in the “medium” group.

SOCIAL MEDIA USE

Median total time on social media was 61 min/day (interquartile range [IQR] = 30–135). Median social media site visits per week across all platforms was 30 (IQR = 9–57) and median global frequency score was 11 (IQR = 6–17). Only 58 individuals (3.2%) reported zero site visits per week.

BIVARIABLE ANALYSES

Bivariable analyses showed significant associations between all social media use variables, depression, age, sex, race/ethnicity, and education level (Table 1). A greater percentage of participants aged 27–32 were in the “high” depression category (38.7%) as compared to participants aged 19–23 (28.8%) and 24–26 (32.5%). Female sex and lower education level were also both associated with being in the “high” depression group. Additionally, bivariable analyses demonstrated significant associations between total time per day on social media and age, sex,

TABLE 1. Whole sample characteristics and bivariable associations with depression

Independent variables	Whole sample (<i>N</i> = 1,787)	Depression			<i>P</i> Value ^a
		Low (<i>n</i> = 731)	Medium (<i>n</i> = 544) Column % ^b	High (<i>n</i> = 512)	
Social media use					
Total time per day (min)					.006
Q1 (0–30)	29.8	36.0	24.9	24.7	
Q2 (31–60)	20.8	22.0	22.7	16.6	
Q3 (61–120)	24.0	20.3	24.1	30.1	
Q4 (121 and above)	25.5	21.8	28.3	28.6	
Visits per week ^c					
Q1 (0–8)	28.3	36.6	23.8	19.4	<.001
Q2 (9–30)	25.1	24.0	25.6	26.4	
Q3 (31–57)	24.1	23.1	24.2	25.5	
Q4 (58 and above)	22.5	16.4	26.4	28.7	
Global frequency score ^{c,d}					
Q1 (0–6)	27.5	35.6	21.0	20.9	<.001
Q2 (7–11)	27.0	28.1	27.5	24.8	
Q3 (12–17)	22.4	20.1	25.0	23.6	
Q4 (18–66)	23.1	16.2	26.6	30.7	
Covariates					
Age, y					
19–23	33.6	34.5	36.6	28.8	.03
24–26	24.7	20.5	24.2	32.5	
27–32	41.6	45.0	39.2	38.7	
Sex					
Female	50.3	44.1	57.7	52.5	.006
Male	49.7	55.9	42.3	47.5	
Race/ethnicity					
White, non-Hispanic	57.5	60.0	54.9	56.1	.02
Black, non-Hispanic	13.0	15.9	10.5	10.7	
Hispanic	20.6	18.9	21.1	23.0	
Other ^e	8.9	5.2	13.5	10.2	
Relationship status					
Single ^f	44.4	39.9	47.7	48.6	.08
Committed relationship ^g	55.6	60.1	52.4	51.4	
Living situation					
Parent/Guardian	34.0	33.1	30.5	39.4	.10
Significant other	35.7	39.0	33.5	32.4	
Other ^h	30.4	27.9	36.0	28.2	
Household income					
Under \$30,000	22.9	19.0	20.4	32.3	.003
\$30,000–\$74,999	38.4	38.7	38.5	37.8	
\$75,000 and above	38.7	42.3	41.1	29.9	
Education level					
High school or less	36.0	32.7	31.6	46.3	.002
Some college	38.3	37.9	40.1	36.8	
B.A. or higher	25.8	29.4	28.3	16.9	

^a*P* value derived using Chi-square analyses comparing proportion of users in each category.

^bColumn percentages are based upon survey weighted data, therefore may not be congruent with the cell frequency proportion of total *N*. Values may not total 100 due to rounding.

^cIncludes Facebook, Twitter, Google+, YouTube, LinkedIn, Instagram, Pinterest, Tumblr, Vine, Snapchat, and Reddit.

^dBased on a 7-point Likert-type response scale ranging from “I don’t use this platform” to “5 or more times a day.” A summary score was created for the 11 SM platforms with scores ranging from 0 to 66.

^eIncludes multiracial.

^fIncludes widowed, divorced, and separated.

^gIncludes engaged, married, and in a domestic partnership.

^hDefined as not living with a parent/guardian or significant other.

TABLE 2. Associations between covariates and social media use

Covariate	Total time per day, min ^a				P Value ^b
	0-30	31-60 Column % ^c	61-120	121+	
Age, y					<.001
19-23	26.7	27.6	37.2	43.3	
24-26	27.4	20.3	26.1	23.2	
27-32	45.9	52.1	36.8	33.5	
Sex					<.001
Female	42.7	43.4	53.4	61.0	
Male	57.3	56.6	46.6	39.0	
Race/ethnicity					.13
White, non-Hispanic	63.5	63.7	54.0	48.4	
Black, non-Hispanic	10.5	10.4	15.0	16.6	
Hispanic	16.5	17.3	23.3	25.4	
Other ^d	9.4	8.6	7.8	9.6	
Relationship status					.09
Single ^e	41.3	38.3	46.8	50.5	
Committed relationship ^f	58.7	61.7	53.2	49.5	
Living situation					.13
Parent/guardian	31.3	29.5	36.9	37.7	
Significant other	41.0	40.4	31.2	29.1	
Other ^g	27.7	30.1	32.0	33.3	
Household income					.17
Under \$30,000	18.2	20.7	24.4	28.0	
\$30,000-\$74,999	41.4	36.2	41.4	34.1	
\$75,000 and above	40.4	43.2	34.1	37.9	
Education level					.003
High school or less	31.9	26.3	38.4	45.0	
Some college	37.1	41.7	39.1	36.9	
B.A. or higher	31.0	32.0	22.5	18.2	

^aIncludes Facebook, Twitter, Google+, YouTube, LinkedIn, Instagram, Pinterest, Tumblr, Vine, Snapchat, and Reddit.

^bP value derived using Chi-square analyses comparing proportion of users in each category.

^cValues may not total 100 due to rounding.

^dIncludes multiracial.

^eIncludes widowed, divorced, and separated.

^fIncludes engaged, married, and in a domestic partnership.

^gDefined as not living with a parent/guardian or significant other.

and education level (Table 2). Younger age, female sex, and lower education level were all associated with greater time per day on social media. Age was the only covariate significantly associated with social media site visits per week ($P < .001$), with younger age associated with being in the highest category of site visits per week. Age, living situation, and household income were all significantly associated with the global frequency score (P from $<.001$ to $.03$), with younger age, not living with a significant other, and being in the highest tertile of household income associated with a greater global frequency score (data not shown).

MULTIVARIABLE ANALYSES

In fully adjusted models, participants in the highest quartile of total time per day on social media had significantly greater odds of having depression (AOR = 1.66, 95% CI = 1.14-2.42) compared to those in the lowest quartile (Fig. 1). Compared to those in the lowest quartile, participants in the highest quartiles of social

media site visits per week (AOR = 2.74, 95% CI = 1.86-4.04) and global frequency score (AOR = 3.05, 95% CI = 2.03-4.59) reported greater depression. Sensitivity analyses demonstrated that all associations between independent variables and depression had strong, linear, dose-response trends ($P = .002$ for total time per day and $P < .001$ for both visits per week and global frequency score).

DISCUSSION

This study demonstrates a strong and significant association between social media use and depression in a nationally representative sample of U.S. young adults. There was a linear association between social media use and depression for all three social media use variables. While some prior studies have found no association or mixed results,^[16,33] our findings are consistent with prior research that showed an association between social media use and mood dysregulation.^[17,34]

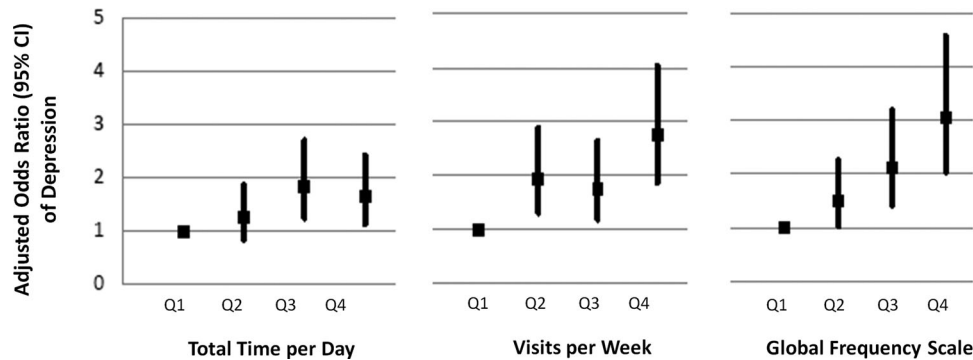


Figure 1. Multivariable associations between depression and social media use variables. Each social media use variable is divided into quartiles from lowest (Q1) to highest (Q4). Vertical bars represent 95% confidence interval and point estimates of adjusted odds ratio. *P* value for overall linear effect was .002, <.001, and <.001, respectively, for each social media use variable. The multivariable model adjusted for age, sex, race, relationship status, living situation, household income, and education level.

Our findings regarding prevalence of depression were generally consistent with prior research. In particular, Christakis et al. found that 56% of college-aged adults reported no depression according to the PHQ-9,^[35] which has been validated against the PROMIS depression measure.^[36] Our findings regarding the linear association between social media use and depression were somewhat surprising given prior research that has shown increased depression in those with low Internet use.^[33] However, one reason for our finding may be that our sample had so few individuals who did not use social media (only 3.2% of the sample). It is notable that our results showed a consistent linear trend between the independent and dependent variables even when the independent variable was operationalized as continuous.

Because our data were cross-sectional, the directionality of this association is not clear. It may be that individuals with depression tend to use more social media. For example, depressed individuals with a diminished sense of self-worth may turn to social media based interactions for validation.^[37,38] Subsequently, individuals may suffer from continuous rumination and guilt surrounding Internet use, while feeling compelled to continue the cycle due to low self-efficacy and negative self-appraisal.^[37,39] Due to the high accessibility of social media and the possibility of socialization in a controlled setting, individuals with underlying depression and anhedonia may be more drawn to social media interactions rather than face-to-face interactions.^[40,41]

It may also be that those who use increased amounts of social media subsequently develop increased depression. Multiple studies have linked social media use with declines in subjective mood, sense of well-being, and life satisfaction.^[17,21,34] For example, passive consumption of social media content—as opposed to active communication—has been associated with decrease in bonding and bridging social capital and increase in loneliness.^[42] One explanation may be that exposure to highly idealized representations of peers on social media

elicits feelings of envy and the distorted belief that others lead happier and/or more successful lives.^[43,44] Consequently, these envious feelings may lead to a sense of self-inferiority and depression over time.^[45] It is also possible that the feeling of “time wasted” by engaging in activities of little meaning on social media negatively influences mood.^[34] Additionally, the substantial rise in the amount of time young individuals spend on the Internet—particularly on social media—has led some to call for the recognition of “Internet addiction” as a distinct psychiatric condition that is closely associated with depression.^[46,47] Finally, it is possible that increased social media exposure may increase the risk of cyber-bullying, which may also increase feelings of depression.^[48,49]

Regardless of the direction of association between social media use and depression, these findings should be of interest to clinicians and public health practitioners. For example, it may be valuable for clinicians to assess social media use among depressed individuals to probe for maladaptive patterns of use, which may be contributing to mood dysregulation. Additionally, there may be useful ways of leveraging social media to decrease stigma of depression and identify individuals at risk, such as detecting self-disclosures of depression on social media.^[50] Because social media has become an integrated component of human interaction, it is important for clinicians interacting with young adults to recognize the important balance to be struck in encouraging potential positive use but redirecting from problematic use. With regard to public health practitioners, these findings suggest that social media may provide valuable venues to screen for depression or to disseminate targeted educational messages regarding depression. Such messages could promote awareness regarding maladaptive use and its association with mood disorders.

The teams behind some social media sites have already begun to reach out to users who show signs of serious depression. When one searches blog site Tumblr for tags

indicative of a mental health crisis such as “depressed,” “suicidal,” or “hopeless,” the search function redirects to a message which begins with “Everything okay?” and provides links to pertinent resources.^[51] Similarly, in early 2015, Facebook tested a feature by which users’ friends could easily and anonymously report worrisome posts.^[52] Authors of problematic content received pop-up messages on their next visit to the site voicing concern and encouraging them to speak with a friend or helpline worker. Although this button has since been removed, Facebook still accepts reports of suicidal content via an online form. Continued research into the factors that relate SM and depression will allow sites to refine their procedures and reach out to those with greatest need.

It is important to note that there are many different types of interactions that can occur over social media, and our study assessed only overall time spent and frequency of visits to social media sites. Moreover, because previous work in this area has tended to focus on one specific platform, most commonly Facebook, we aimed to look at the relationship between total social media use and depression,^[16,21] as opposed to focusing on specific platforms. Our fine-grained assessment of multiple platforms likely improved our measurement of overall frequency of social media use. However, given the unique features of each platform, it may be valuable for future work to assess associations between specific social media sites and depression.

Furthermore, it will be an important task of future qualitative and quantitative research to comprehensively assess content and contextual elements related to social media use. For example, time on social media may be primarily spent viewing profiles, or it may be spent as an active participant, and these distinct patterns of use may have differential associations with mood conditions. Thus, it may be that those who are more active users feel more engaged and derive more sense of social capital from social media interactions.^[19,53] However, it may also be that active users are more prone to having negative exposures, which can affect self-cognitions. Therefore, active versus passive character of social media interaction and its effect on mood may be valuable to assess in the future.

Additionally, it will be important to assess the overall emotional valence of social media interactions. Some individuals may primarily spend time “liking” others’ posts, wishing friends happy birthday, and making positive comments. Others, however, may be prone to posting negative status updates or engaging in contentious interactions, which may be detrimental to relationship building and lead to depression.^[54]

LIMITATIONS

Given the rapid proliferation of social media platforms, we attempted to capture broad and representative use of social media by young adults by including multiple social media platforms and creating three complementary methods of assessing social media use based

on self-report. However, it was a limitation of our work that we were unable to use “gold standard” measures of social media exposure such as ecological momentary assessment or empirical data from social media sites due to the large sample size. Additionally, our frequency measure, although it was adapted from a validated scale,^[14] may not have been sufficient for modern users. In particular, the highest exposure level we assessed for each platform was “5 or more times per day,” while other scales include options such as use “several times an hour” and “all the time.”^[55] It may be valuable for future studies to use more fine-grained measures such as these. It is also a limitation that we were unable to conduct a complete diagnostic interview to determine if participants met clinical diagnosis of depression. Further longitudinal studies involving ecological momentary assessment or empirical data from multiple social media platforms may help identify the directionality of the association between social media and depression and guide anticipatory guidance around social media use for patients with depression in particular.

CONCLUSION

In conclusion, this study assessed depression and social media use across multiple social media platforms in a large, nationally representative sample of young adults. Given the increasing prevalence of social media and the substantial morbidity and mortality associated with depression worldwide, the positive association we found between social media use and depression has important implications for future research and intervention. For example, longitudinal evaluation and finer-grained assessment of content and contextual factors will ultimately improve our understanding of these associations and our ability to intervene. Additionally, social media platforms may be a useful tool to identify individuals at risk for depression and to provide intervention.

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Conflicts of interests. We have no conflicts of interest to report.

Compliance with ethical standards. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

REFERENCES

1. Kessler RC, Chiu WT, Demler O, et al. Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication. *Arch Gen Psychiatry* 2005;62(6):617–627.
2. Andrade L, Caraveo-Anduaga JJ, Berglund P, et al. The epidemiology of major depressive episodes: results from the International Consortium of Psychiatric Epidemiology (ICPE) Surveys. *Int J Methods Psychiatr Res* 2003;12(1):3–21.
3. Murray CJL, Vos T, Lozano R, et al. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2012;380(9859):2197–2223.
4. Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. *PLoS Med* 2006;3(11):e442.
5. Greenberg PE, Kessler RC, Birnbaum HG, et al. The economic burden of depression in the United States: how did it change between 1990 and 2000? *J Clin Psychiatry* 2003;64(12):1465–1475.
6. Burcusa SL, Iacono WG. Risk for recurrence in depression. *Clin Psychol Rev* 2007;27(8):959–985.
7. Burke KC, Burke JD, Rae DS, Regier DA. Comparing age at onset of major depression and other psychiatric disorders by birth cohorts in five US community populations. *Arch Gen Psychiatry* 1991;48(9):789–795.
8. Hankin BL, Abramson LY, Moffitt TE, et al. Development of depression from preadolescence to young adulthood: emerging gender differences in a 10-year longitudinal study. *J Abnorm Psychol* 1998;107(1):128–140.
9. Hasler G. Pathophysiology of depression: do we have any solid evidence of interest to clinicians? *World Psychiatry* 2010;9(3):155–161.
10. Kaplan AM, Haenlein M. Users of the world, unite! The challenges and opportunities of social media. *Bus Horiz* 2010;53:59–68.
11. Subrahmanyam K, Reich SM, Waechter N, Espinoza G. Online and offline social networks: use of social networking sites by emerging adults. *J Appl Dev Psychol* 2008;29(6):420–433.
12. Fox S, Rainie L. The Web at 25 in the US. Pew Research Center. The Web at 25 in the US. 2014. Available at: <https://www.webcitation.org/6eVfaSdN6>.
13. Roisman GI, Masten AS, Coatsworth JD, Tellegen A. Salient and emerging developmental tasks in the transition to adulthood. *Child Dev* 2004;75:123–133.
14. Pew Research Center. Social Media Update 2014. 2015. Available at: <http://www.webcitation.org/6ajEhvS11>.
15. Nielsen. State of the Media: The Social Media Report 2012. 2012. Available at: <http://www.webcitation.org/6bXTvRwTJ>.2012.
16. Jelenchick LA, Eickhoff JC, Moreno MA. “Facebook depression?” Social networking site use and depression in older adolescents. *J Adolesc Heal* 2013;52(1):128–130.
17. Kross E, Verduyn P, Demiralp E, et al. Facebook use predicts declines in subjective well-being in young adults. *PLoS One* 2013;8(8):e69841.
18. Bessière K, Pressman S, Kiesler S, Kraut R. Effects of internet use on health and depression: a longitudinal study. *J Med Internet Res* 2010;12(1):e6.
19. Ellison NB, Steinfield C, Lampe C. The benefits of Facebook “friends”: social capital and college students’ use of online social network sites. *J Comput Commun* 2007;12(4):1143–1168.
20. Valenzuela S, Park N, Kee KF. Is there social capital in a social network site?: facebook use and college students’ life satisfaction, trust, and participation. *J Comput Commun* 2009;14(4):875–901.
21. Chou HTG, Edge N. “They are happier and having better lives than I am”: The impact of using Facebook on perceptions of others’ lives. *Cyberpsychol Behav Soc Netw* 2012;15(2):117–121.
22. GfK KnowledgePanel®. KnowledgePanel Design Summary. 2013. Available at: <http://www.webcitation.org/6ajEWO5mb>.
23. Baker R, Blumberg SJ, Brick JM, et al. Research synthesis. *Public Opin Q* 2010;74(4):711–781.
24. Wagner TH, Baker LC, Bundorf MK, Singer S. Use of the Internet for health information by the chronically ill. *Prev Chronic Dis* 2004;1(4):A13.
25. Cleveland MJ, Reavy R, Mallett KA, et al. Moderating effects of positive parenting and maternal alcohol use on emerging adults’ alcohol use: does living at home matter? *Addict Behav* 2014;39(5):869–878.
26. Shiffman S, Ferguson SG, Rohay J, Gitchell JG. Perceived safety and efficacy of nicotine replacement therapies among US smokers and ex-smokers: relationship with use and compliance. *Addiction* 2008;103(8):1371–1378.
27. Cella D, Riley W, Stone A, et al. The Patient-Reported Outcomes Measurement Information System (PROMIS) developed and tested its first wave of adult self-reported health outcome item banks: 2005–2008. *J Clin Epidemiol* 2010;63(11):1179–1194.
28. Cella D, Gershon R, Lai J-S, Choi S. The future of outcomes measurement: item banking, tailored short-forms, and computerized adaptive assessment. *Qual Life Res* 2007;16(Suppl 1):133–141.
29. Choi SW, Schalet B, Cook KF, Cella D. Establishing a common metric for depressive symptoms: linking the BDI-II, CES-D, and PHQ-9 to PROMIS depression. *Psychol Assess* 2014;26(2):513–527.
30. Pilkonis PA, Yu L, Dodds NE, et al. Validation of the depression item bank from the Patient-Reported Outcomes Measurement Information System (PROMIS) in a three-month observational study. *J Psychiatr Res* 2014;56:112–119.
31. Pilkonis PA, Choi SW, Reise SP, et al. Item banks for measuring emotional distress from the Patient-Reported Outcomes Measurement Information System (PROMIS®): depression, anxiety, and anger. *Assessment* 2011;18(3):263–283.
32. American Psychiatric Association. LEVEL 2 - Depression - Adult. 2013. Available at: <http://www.webcitation.org/6eVeBFb6E>.
33. Moreno MA. Depression and Internet use among older adolescents: an experience sampling approach. *Psychology* 2012;3:743–748.
34. Sagioglou C, Greitemeyer T. Facebook’s emotional consequences: Why Facebook causes a decrease in mood and why people still use it. *Comput Human Behav* 2014;35:359–363.
35. Christakis DA, Moreno MM, Jelenchick L, et al. Problematic internet usage in US college students: a pilot study. *BMC Med* 2011;9(1):77.
36. Choi SW, Schalet B, Cook KF, Cella D. Establishing a common metric for depressive symptoms: linking the BDI-II, CES-D, and PHQ-9 to PROMIS depression. *Psychol Assess* 2014;26(2):513–527.
37. Caplan SE. Problematic Internet use and psychosocial well-being: Development of a theory-based cognitive-behavioral measurement instrument. *Comput Human Behav* 2002;18(5):553–575.
38. Sanders CE, Field TM, Diego M, Kaplan M. The relationship of Internet use to depression and social isolation among adolescents. *Adolescence* 2000;35(138):237–242.
39. Davis RA. Cognitive-behavioral model of pathological Internet use. *Comput Human Behav* 2001;17(2):187–195.
40. Morahan-Martin J, Schumacher P. Loneliness and social uses of the Internet. *Comput Human Behav* 2003;19(6):659–671.
41. Young KS, Rogers RC. The relationship between depression and Internet addiction. *Cyber Psychol Behav* 1998;1(1):25–28.

42. Burke M, Marlow C, Lento T. Social network activity and social wellbeing. In: CHI 10: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. 2010 April 10-15; Atlanta, GA. pp. 1909–1912.
43. Krasnova H, Wenninger H, Widjaja T, Buxmann P. Envy on Facebook: a hidden threat to users' life satisfaction? Presented at the 11th International Conference on Wirtschaftsinformatik. 2013 February. Leipzig, Germany.
44. Tandoc EC, Ferrucci P, Duffy M. Facebook use, envy, and depression among college students: is facebooking depressing? *Comput Human Behav.* 2015;43:139–146.
45. Smith RH, Kim SH. Comprehending envy. *Psychol Bull* 2007;133:46–64.
46. Block JJ. Issues for DSM-V: internet addiction. *Am J Psychiatry* 2008;165(3):306–307.
47. Morrison CM, Gore H. The relationship between excessive Internet use and depression: a questionnaire-based study of 1,319 young people and adults. *Psychopathology* 2010;43(2):121–126.
48. O'Keeffe GS, Clarke-Pearson K. The impact of social media on children, adolescents, and families. *Pediatrics* 2011;127(4):800–804.
49. Pew Research Center. Cyberbullying. 2007. Available at: <http://www.webcitation.org/6eVgbqVbe>.
50. Moreno MA, Jelenchick LA, Egan KG, et al. Feeling bad on Facebook: depression disclosures by college students on a social networking site. *Depress Anxiety.* 2011;28(6):447–455.
51. Tumblr. "Everything Okay?" 2014. Available at: <http://www.webcitation.org/6aKw1PTdP>.
52. Facebook. Updates in Facebook Safety. 2015. Available at: <http://www.webcitation.org/6aKw1PTdP>.
53. Burke M, Kraut R, Marlow C. Social capital on facebook. In: CHI11: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. 2011 May 7–12. Vancouver, BC. pp. 571–580.
54. Forest AL, Wood JV. When social networking is not working: individuals with low self-esteem recognize but do not reap the benefits of self-disclosure on Facebook. *Psychol Sci* 2012;23(3):295–302. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/22318997>.
55. Rosen LD, Whaling K, Carrier LM, et al. The media and technology usage and attitudes scale: an empirical investigation. *Comput Human Behav* 2013;29:2501–2511.