



## Social media use, sleep, and psychopathology in psychiatrically hospitalized adolescents

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### ARTICLE INFO

#### Keywords:

Adolescents  
Sleep  
Social media  
Suicidal ideation  
Internalizing symptoms  
Attention problems

### ABSTRACT

Sleep disruption among adolescents represents a major public health concern, and social media use may play an important role in affecting sleep and subsequent mental health. While prior studies of youth sleep and mental health have often focused on social media use frequency and duration, adolescents' emotional experiences related to social media have been underexplored, particularly among clinically acute populations. This study offers a preliminary investigation of associations among negative emotional experiences using social media, sleep disturbance, and clinical symptom severity in a sample of psychiatrically hospitalized youth. A sample of 243 adolescents ( $M_{age} = 15.34$ ) completed self-report measures at a single time point. Measures assessed social media use, including frequency and duration, subjective experiences of use, and emotional responses to use, as well as sleep disturbance and clinical symptom severity, including suicidal ideation, internalizing symptoms, and attention problems. Results revealed that more frequent negative emotional responses to social media use were linked to greater sleep disturbance and higher clinical symptom severity. Furthermore, sleep disturbance mediated the relation between negative emotional responses to social media and clinical symptom severity. While gender differences were revealed in characteristics of social media use, sleep disturbance, and clinical outcomes, the associations among these constructs did not vary across gender groups. Overall, these findings highlight sleep disturbance as a potential mechanism through which negative emotional experiences on social media may impact clinical symptoms in psychiatrically vulnerable youth.

Sleep plays a critical role in adolescent mental health, and sleep disruption in youth represents a major public health concern (Owens et al., 2014). Indeed, insufficient sleep has been linked to a wide range of adverse medical and psychiatric outcomes in adolescents, including increased depressive symptoms and suicide risk (Littlewood et al., 2019; Owens et al., 2014; Short and Weber, 2018). In recent years, adolescents' use of digital devices and social media has increased exponentially (Anderson and Jiang, 2018), leading to questions regarding how these technologies may impact youths' sleep patterns and subsequent mental health (Carter et al., 2016). These questions may be particularly pressing among youth with acute mental health concerns, who are at high risk for both sleep disturbances and problematic patterns of social

media use (Boafo et al., 2019a,b; Nesi et al., 2019). However, very little is known about the intersection of social media use, sleep, and mental health among clinically acute adolescents.

### 1. The role of social media in adolescents' sleep and mental health

Over 95% of adolescents in the U.S. report using social media, with a large proportion of youth (45%) reporting being online almost constantly (Anderson and Jiang, 2018). Recent meta-analyses have shown significant associations between adolescents' social media use and depressive symptoms (Ivie et al., 2020), suicide attempts (Nesi et al.,

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<https://doi.org/10.1016/j.jpsychires.2021.10.014>

Received 8 March 2021; Received in revised form 11 August 2021; Accepted 18 October 2021

Available online 19 October 2021

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2021a; Sedgwick et al., 2019), and risky behaviors (Vannucci et al., 2020). However, high heterogeneity, small overall effect sizes, and mixed findings across studies suggest the need to examine more specific aspects of adolescents' social media experiences beyond frequency of use, and to examine potential mechanisms underlying associations with mental health outcomes (Beyens et al., 2020; Orben, 2020; Odgers and Jensen, 2020; Twenge, 2020).

One such mechanism by which social media use may impact mental health is sleep disturbance, or disruptions in the amount, restfulness, or quality of sleep (Forrest et al., 2018). A meta-analysis suggests that youths' nighttime use of digital devices, on which social media is often accessed, is associated with poorer quality sleep, reduced sleep quantity, and daytime sleepiness (Carter et al., 2016). Empirical work also finds that greater use of digital devices at bedtime and during the day, particularly for social media use and Internet browsing, is associated with longer sleep onset latency, shorter sleep duration, and increased sleep deficiency in adolescents (Hisler et al., 2020; Hysing et al., 2015; Johansson et al., 2016; Woods and Scott, 2016). Furthermore, a robust body of evidence suggests a relation between problematic or excessive use of social media and adolescent sleep and mental health (Yang et al., 2018; Li et al., 2018; Raudsepp, 2019), and some prior work finds associations between higher frequencies of digital media use and symptoms of inattention (Beyens et al., 2018; Ra et al., 2018).

However, recent work suggests that in addition to the timing, duration, and frequency of social media use, *how* it is used may also impact sleep (see Scott and Woods, 2019 for review). For example, youth who are more emotionally invested in their online activities and report fear of missing out (FoMO) associated with social media use may have greater difficulty disengaging from these platforms, thereby impacting sleep (Scott and Woods, 2018; Woods and Scott, 2016). Furthermore, sleep disruption has been found to mediate the longitudinal effects of problematic social media use (including greater emotional investment in use) on depressed mood in adolescents (Vernon et al., 2017).

Despite this important preliminary work, few studies have analyzed adolescents' emotional responses to the experiences they have on social media. This is important because one mechanism through which social media use may negatively impact sleep is by increasing cognitive and emotional arousal that interferes with the ability to fall and stay asleep (Scott & Woods, 2018, 2019). Adolescents who experience stronger or more frequent negative emotions in response to social media experiences (e.g., feeling left out or excluded by peers online, getting too few "likes" on photos; Nesi et al., 2021b) may thus be at risk for sleep disruption. Disrupted sleep may, in turn, interfere with the proactive use of cognitive-affective coping resources during the day (Krause et al., 2017; Alhola and Polo-Kantola, 2007). These processes may be especially relevant for psychiatrically vulnerable youth, who may experience stronger emotional responses to social media (Nesi et al., 2021b) and for whom disrupted sleep may contribute to clinical symptom severity.

## 2. Gender differences

Gender differences in adolescent sleep (Galland et al., 2017), internalizing symptoms (Nolen-Hoeksema, 2001), suicidal ideation (Miranda-Mendizabal et al., 2019), and attention difficulties (Rucklidge, 2010) have been well documented for boys and girls, and emerging evidence suggests that gender minority youth are at greater risk for psychopathology and suicide compared to cisgender youth (Bettis et al., 2020a; Spivey and Prinstein, 2019). A small but rapidly growing body of evidence also suggests gender differences in screen time and device use, with girls using social media more frequently than boys (Anderson and Jiang, 2018), and girls and gender minority youth more likely to show greater emotional investment in their social media use (Nesi et al., 2021b).

Preliminary evidence also suggests gender differences in relations among adolescents' social media use, sleep, and health. In one study,

greater social media use was linked to higher body mass index (BMI) in girls, but not boys, and shorter sleep duration mediated the link between social media use and BMI for boys, but not girls (Sampasa-Kanyinga et al., 2020). A recent longitudinal study also suggests that greater social media stress (i.e., emotional responses to and greater dependency on social media use), was associated with greater sleep latency and daytime sleepiness, among girls but not boys (van der Schuur et al., 2019). However, further work is needed to examine possible gender differences in specific characteristics of social media use and how these may be linked to adolescents' sleep and mental health.

### 2.1. The current study

To the best of our knowledge, no study has examined the relation between social media use, sleep disturbance, and mental health in psychiatrically hospitalized adolescents. Thus, this study aimed to: (1) examine adolescents' patterns of social media use, including both frequency and duration of use and subjective experiences of use (i.e., emotional responses to use, perceived overuse, importance of use), and their associations with sleep disturbance; (2) examine gender differences in social media use patterns, sleep disturbance, and clinical outcome; and (3) test whether sleep disturbance mediates associations between social media use and clinical outcomes that may be especially relevant in relation to sleep and social media use (i.e., suicidal ideation, internalizing symptoms, and attention problems).

## 3. Method

### 3.1. Participants

Participants were 243 adolescents admitted to an adolescent psychiatric inpatient unit between February 2020 and January 2021, who completed study measures and met the inclusion criteria of having access to a smartphone (when outside of the hospital). Participants were 11–18 years old and participant demographics can be found in Table 1. Due to small group sizes, participants who did not identify as male or female were collapsed into a single group (gender minority individuals) for analyses.

### 3.2. Procedures

As part of the inpatient unit's clinical intake process, adolescents completed a battery of self-report measures. These measures are used to aid assessment, guide intervention, and to improve the quality of clinical care on the unit. The present study was classified as a chart review and the hospital's Institutional Review Board granted a waiver of consent for

**Table 1**  
Study sample descriptive statistics.

	<i>n</i> (%) except where noted
Age, <i>M</i> ( <i>SD</i> )	15.34 (1.66)
Gender	
Female	110 (45.3)
Male	86 (35.4)
Transgender	18 (7.9)
Gender-queer/gender non-conforming/gender fluid;	20 (8.2)
Other	5 (2.1)
Prefer not to answer	4 (1.6)
Race/Ethnicity	
White	169 (69.5)
Black	30 (12.3)
Asian	3 (1.2)
American Indian or Alaska Native	1 (0.4)
Native Hawaiian or other pacific islander	2 (0.8)
Other	38 (15.6)
Hispanic	80 (32.9)

Note. *N* = 243.

participation.

### 3.3. Measures

#### 3.3.1. Sleep Disturbance

Sleep disturbance was measured using an 8-item self-report short-form questionnaire (PROMIS Sleep Disturbance; [Forrest et al., 2018](#)), assessing sleep quality and satisfaction, sleep restoration, and difficulty falling asleep and staying asleep within the past 7 days. This measure uses a 5-point Likert scale from 1 (*Never*) to 5 (*Always*), with higher scores representing greater sleep disturbance ( $\alpha = .92$ ). Prior research indicates that this brief measure is not only highly correlated with the well-established Pittsburgh Sleep Quality Index ( $r = .83$ ), but also may offer superior measurement precision ([Yu et al., 2011](#)). Furthermore, evidence indicates that it is moderately correlated with total sleep time as measured by actigraphy among youth ([Hanish et al., 2017](#)).

#### 3.4. Social media use measures

**Social media use duration.** A single item assessed participants' daily amount of social media use: "On average, how many hours per day do you typically spend on social media?" Response options ranged from 0 (*Less than 1 h*) to 24 (*24 h*). Due to the detection of univariate outliers, this variable was winsorized to set the maximum value at 12 h.

**Frequency of checking social media.** A single item assessed the frequency with which youth check social media: "How often do you check social media (for example, Instagram, Snapchat, or Facebook)?" Response options ranged from 0 (*Never*) to 7 (*Almost Constantly*) ([Rideout and Robb, 2018](#)).

**Perceived overuse of social media.** A single item assessed the perception of spending too much time and energy on social media. Participants were asked, "Which of the following statements comes closest to the truth for you?" and were presented with three response options: "I spend too much time and energy on social media", "I am comfortable with the amount of time and energy I spend on social media", and "I don't spend enough time and energy on social media" ([Rideout and Robb, 2018](#)). This item was coded dichotomously for analyses, with "I spend too much time and energy on social media" coded as 1 and the other two categories coded as 0.

**Importance of social media.** A single item assessed the importance of social media in adolescents' lives: "How important is social media in your life?" and response options ranged from 0 (*Not at all important*) to 4 (*Extremely important*) ([Rideout and Robb, 2018](#)).

**Emotional Responses to Social Media Experiences.** The frequency of positive and negative emotional responses to social media experiences were assessed using a 13-item self-report questionnaire ([Nesi et al., 2021b](#)). Examples of negative emotional response items include, "When you use social media, how often do you feel worried that you are missing out on things?", "When you use social media, how often do you feel left out or excluded?", and "When you use social media, how often do you feel hurt by a negative comment from someone?" Examples of positive emotional response items include, "When you use social media, how often do you feel more connected to your friends?", "When you use social media, how often do you feel supported and encouraged by your friends?", and "When you use social media, how often do you feel happy because of a positive comment from someone?" Items were rated on a 5-point Likert scale from 1 (*Never*) to 5 (*Always*), with items averaged to create the Positive and Negative subscales (Positive  $\alpha = .86$ ; Negative  $\alpha = .86$ ).

#### 3.5. Clinical outcomes

**Suicidal ideation.** The Suicidal Ideation Questionnaire-Junior (SIQ-JR; [Reynolds and Mazza, 1999](#)) assessed past month suicidal ideation severity. The SIQ-JR has a total of 15 items rated on a 7-point Likert scale from 0 (*I've never had this thought*) to 6 (*Almost every day*). Items

were averaged to create a total score, with higher scores reflecting more severe suicidal ideation ( $\alpha = .96$ ). The SIQ-JR has been used broadly and has evidenced strong psychometric properties among youth ([Reynolds and Mazza, 1999](#)).

**Internalizing symptoms.** The Internalizing subscale of the 17-item version of the Youth-Pediatric Symptom Checklist (PSC-17; [Gardner et al., 1999](#)) assessed internalizing symptoms. This subscale assesses experiences of depressive and anxious symptomatology (e.g., sadness, worrying, hopelessness). Adolescents rated the extent to which they experience these symptoms on a 3-point Likert scale from 0 (*Never*) to 2 (*Often*), and items were summed, with higher total scores reflecting greater internalizing symptomatology ( $\alpha = .87$ ).

**Attention problems.** The Attention subscale of the 17-item version of the Youth-Pediatric Symptom Checklist (PSC-17; [Gardner et al., 1999](#)) was used to assess attention problems, including feelings of being easily distracted, having trouble concentrating, and being unable to sit still. Adolescents rated the extent to which they experience these symptoms on a 3-point Likert scale from 0 (*Never*) to 2 (*Often*), and items were summed, with higher scores reflecting greater attention problems ( $\alpha = .73$ ).

## 4. Results

### 4.1. Associations between social media use and sleep disturbance

Bivariate correlations were conducted between all study variables ([Table 2](#)). No significant associations were revealed between sleep disturbance and the majority of social media variables, i.e., average duration of use, frequency of checking, perceived importance, perceived overuse, and positive emotional responses to social media use. However, there was a significant, small-to-medium association between sleep disturbance and frequency of negative emotional responses to social media experiences. Negative emotional responses to social media use and sleep disturbance were also associated with each clinical outcome: suicidal ideation, internalizing symptoms, and attention problems.

### 4.2. Mediation models for indirect effect of negative emotional response to social media on clinical outcomes, via sleep disturbance

To examine the indirect effect of negative emotional responses to social media on each clinical outcome via sleep disturbance ([Fig. 1](#)), three mediation models were tested using the PROCESS v3.3 macro (Model 4; [Hayes, 2013](#)) in SPSS 25.0. Each model also included the following covariates: gender (male, female, other gender); race (Black, White, other race); ethnicity (Hispanic vs. non-Hispanic); age; and average duration of social media use. The significance of the indirect effect was testing using bootstrapping procedures with 5000 bootstrapped samples, and 95% confidence intervals were constructed.

All three mediation models ([Table 3](#)) indicated a significant effect of negative emotional responses to social media on sleep disturbance ( $a$  path), after controlling for all covariates. The direct effect of negative emotional responses to social media, after controlling for all covariates and the effects of sleep disturbance ( $c'$  path), was significant for suicidal ideation and internalizing symptoms, but not for attention problems. The indirect effects ( $ab$  path) on each outcome via sleep disturbance were also significant, indicated by bootstrapped 95% Confidence Intervals that did not contain zero.

Sensitivity analyses were conducted examining whether duration of social media use (average daily hours) was also associated with each clinical outcome indirectly via sleep disturbance. Daily hours spent on social media was not significantly associated with sleep disturbance ( $a$  path;  $b = -0.19$ ,  $se = 0.15$ ;  $p = .229$ ). There was no significant direct ( $c'$  path) or indirect ( $ab$  path) association between daily hours on social media and any clinical outcome: for suicidal ideation, direct effect  $b = 0.03$ ,  $se = 0.03$ ,  $p = .317$ ; indirect effect  $b = -0.01$ ,  $se = 0.01$ , 95% CI  $[-0.04, 0.01]$ ; for internalizing symptoms, direct effect  $b = 0.05$ ,  $se =$

**Table 2**  
Correlations between study variables.

Variable	1	2	3	4	5	6	7	8	9
1. Sleep Disturbance									
2. SM Hours	-.02								
3. SM Importance	-.02	.51**							
4. Frequency of checking SM	-.07	.56**	.46**						
5. Perception of Too Much SM Time	-.00	.26**	.17**	.21**					
6. Negative Emotional Responses to SM	.24**	.15*	.22**	.20**	.25**				
7. Positive Emotional Responses to SM	-.11	.18**	.40**	.24**	-.02	-.16*			
8. Suicidal Ideation	.40**	.09	.04	.07	.07	.39**	-.16*		
9. Internalizing Symptoms	.46**	.08	.12	.01	.02	.43**	-.09	.76**	
10. Attention Problems	.40**	.03	.10	-.04	-.11	.19**	.02	.47**	.50**

Note: \* $p < .05$ . \*\* $p < .01$ ; SM = social media.

0.05,  $p = .315$ ; indirect effect  $b = -0.03$ ,  $se = 0.02$ , 95% CI  $[-0.07, 0.02]$ ; for attention problems, direct effect  $b = 0.00$ ,  $se = 0.04$ ,  $p = .942$ ; indirect effect  $b = -0.02$ ,  $se = 0.02$ , 95% CI  $[-0.05, 0.01]$ .

#### 4.3. Gender differences

As a preliminary test of gender differences in primary variables of interest, a series of one-way ANOVA tests was conducted to examine mean differences across gender groups (Table 4). Results suggested that compared to boys, girls and gender minority youth reported, on average, higher average daily hours of social media use and frequency of checking social media. Gender minority youth showed more frequent positive emotional responses to social media use compared to boys. No gender differences were revealed in frequency of negative emotional responses to social media, importance of social media, or perceived overuse of social media.

To examine gender differences in the effects of negative emotional responses to social media on sleep disturbance, and indirectly on clinical outcomes via sleep disturbance, three moderated mediation models were tested using the PROCESS v3.3 macro (Model 8; Hayes, 2013) in SPSS 25.0. Gender did not moderate the association between negative emotional responses to social media and sleep disturbance, the direct effect of negative emotional responses to social media on any outcome (suicidal ideation, internalizing symptoms, and attention problems), nor the indirect effect (complete results available upon request).

#### 5. Discussion

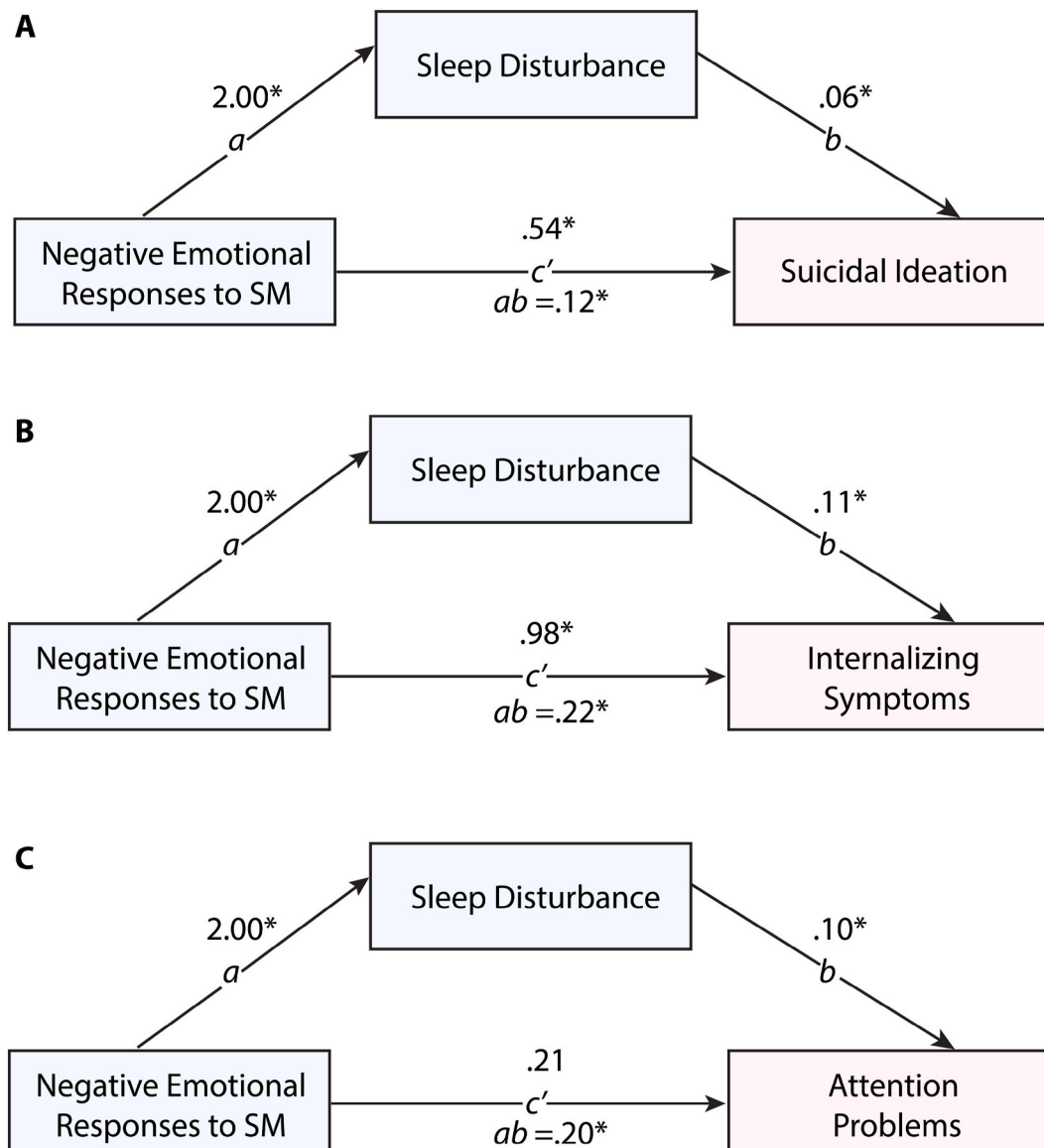
The role of social media use in adolescent sleep is an issue of critical importance for youth mental health. While prior work on sleep and mental health has often focused on social media use frequency and duration, adolescents' emotional experiences related to social media have been underexplored, particularly among clinically acute populations. The current study examined characteristics of youths' social media use (i.e., duration and frequency of use, emotional responses to use, perceived overuse, and importance of social media), in relation to sleep disturbance and clinical outcomes (i.e., severity of internalizing symptoms, suicidal ideation, and attention problems) among psychiatrically hospitalized youth. More frequent negative, but not positive, emotional responses to social media use were linked to greater sleep disturbance, as well as higher clinical symptom severity. Furthermore, sleep disturbance mediated the relation between adolescents' negative emotional responses to social media and clinical symptom severity in cross-sectional mediation models, even after controlling for overall time

spent using social media use. Although gender differences were revealed in various characteristics of social media use, sleep disturbance, and clinical outcomes, the associations among these constructs did not vary across gender groups. Overall, findings highlight the importance of examining specific, negative emotional responses to social media use, and the potential role of sleep disturbance as a mechanism through which such experiences influence clinical symptoms in psychiatrically vulnerable youth.

Results suggest that negative emotional responses to social media experiences were associated with higher severity of internalizing symptoms, suicidal ideation, and attention problems, and that this association was mediated by sleep disturbance. Notably, however, all other examined characteristics of social media use, including frequency of use and perception of overuse, were not related to sleep disturbance or clinical severity. These findings are in line with prior work suggesting heightened cognitive and emotional arousal as a potential mechanism by which social media use may impact adolescent sleep (Scott and Woods, 2019). Results are also consistent with past literature showing that sleep disturbance mediates the association between problematic social media use and depressive symptoms in youth (Vernon et al., 2017), and extend prior literature to a population of psychiatrically hospitalized adolescents. Sleep disruptions may be particularly impactful for clinically vulnerable youth, and as negative emotional experiences on social media may lead to sleep disruption in this population, this may be an important area of clinical intervention to mitigate symptom severity.

Furthermore, these findings highlight the need to examine nuanced characteristics of adolescents' social media use beyond simple frequency and duration. Many prior studies of sleep disruption have focused on overall device use (i.e., including overall time spent on the Internet, watching TV or videos, or playing games), rather than specifically on social media (Fobian et al., 2016; Hisler et al., 2020; Hysing et al., 2015; Johansson et al., 2016). It may be the case that, when it comes to sleep disruption, "screen time" is a more relevant factor for other screen activities, or for overall screen time across devices and platforms, than for social media in particular. Furthermore, it is possible that the time of day that social media is used is especially important, with social media use at bedtime having stronger associations with sleep disturbance compared to using social media use at other times of day (e.g., morning). Indeed, media use at bedtime has been linked to poorer sleep efficiency in adolescents (Fobian et al., 2016). Thus, overall measures of time spent and frequency of checking social media throughout an average day, as used in the current study, may not capture this nuance. However, it should be noted that adolescents reporting greater duration and frequency of





**Fig. 1.** Models tests mediation of associations between negative emotional responses to social media and clinical symptoms (suicidal ideation, internalizing symptoms, and attention problems) by sleep disturbance. All models also include control variables (social media hours, gender, race, ethnicity, and age) regressed on outcomes and mediator. \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

social media use were also more likely to report more frequent negative emotional responses to social media, which were associated with poorer sleep and clinical outcomes. Thus, future work will be needed to investigate temporal associations, particularly related to nighttime social media use, and interactions among these factors. Future work will also be needed to analyze the relationship between emotional responses to social media use and sleep duration in adolescents, as social media use and subsequent emotional arousal may be displacing sleep time. Future studies of this kind would also benefit from assessing the relationship between social media and sleep-related behaviors, like sleeping with a phone within reach or waking in the middle of the night to check social media, and clinical outcomes.

Findings reveal a complex portrait of the role of gender in sleep, social media use, and clinical symptoms. Specifically, girls and gender minority youth on average spent more time using social media daily and checked social media more often than boys. Gender minority youth also showed more frequent positive emotional responses to social media use compared to boys. Consistent with previous literature, girls and gender minority youth, compared to boys, reported greater sleep disturbance,

higher levels of suicidal ideation, and higher levels of internalizing and attention problems (Bettis et al., 2020; Nolen-Hoeksema, 2001; Galland et al., 2017). Notably, however, adolescents of all genders were equally likely to report negative emotional responses to social media use, and gender did not moderate associations among negative emotional social media experiences, sleep, and clinical symptoms. These findings are consistent with literature on gender differences in social media use frequency (Anderson and Jiang, 2018; Twenge and Martin, 2020), and add to research showing that gender minority status is a significant vulnerability factor for negative clinical outcomes (Bettis et al., 2020a; Spivey and Prinstein, 2019). However, results also suggest that negative emotional responses to social media may be a risk factor for poor sleep and subsequent mental health concerns among youth of all genders. It is important to note that this lack of variability in associations across gender groups could be due to the nature of the study population, which consists of high-risk, psychiatrically hospitalized adolescents.

**Table 3**

Mediation model statistics for effects of negative emotional responses to social media on clinical outcomes, via sleep disturbance.

Outcome Variable: Sleep Disturbance (a-path)	b	SE	p	95% CI
Intercept	23.32	5.13	<.001	[13.22, 33.43]
Negative Emotional Responses to SM	2.00	0.55	<.001	[0.93, 3.08]
SM Hours	−0.26	0.15	.086	[−0.57, 0.37]
Gender: Male	−3.42	1.13	.003	[−5.64, −1.21]
Gender: Other	2.71	1.35	.046	[0.04, 5.37]
Race: Black	1.86	1.57	.238	[−1.24, 4.96]
Race: Other	0.29	1.35	.832	[−2.38, 2.95]
Ethnicity: Hispanic	−2.05	1.10	.063	[−4.22, 0.11]
Age	0.16	0.31	.616	[−0.45, 0.77]
Outcome Variables: Clinical Outcomes (b-paths)				
Outcome: Suicidal Ideation				
Intercept	1.42	1.05	.178	[−0.65, 3.51]
Sleep Disturbance	0.06	0.01	<.001	[0.04, 0.09]
Negative Emotional Responses to SM	0.54	0.11	<.001	[0.33, 0.76]
SM Hours	0.01	0.03	.831	[−0.05, 0.07]
Gender: Male	−0.69	0.23	.002	[−1.14, −0.25]
Gender: Other	0.51	0.27	.057	[−0.02, 1.04]
Race: Black	−0.64	0.31	.040	[−1.25, −0.03]
Race: Other	−0.15	0.27	.575	[−0.67, 0.38]
Ethnicity: Hispanic	0.12	0.22	.578	[−0.31, 0.55]
Age	−0.07	0.06	.242	[−0.19, 0.05]
Bootstrapped Indirect Effect (ab-path)	0.12	0.04	–	[0.05, 0.22]
Outcome: Internalizing Symptoms				
Intercept	2.85	1.61	.078	[−0.32, 6.02]
Sleep Disturbance	0.11	0.02	<.001	[0.08, 0.15]
Negative Emotional Responses to SM	0.98	0.17	<.001	[0.65, 1.31]
SM Hours	0.00	0.05	.936	[−0.09, 0.09]
Gender: Male	−1.35	0.35	<.001	[−2.03, −0.67]
Gender: Other	0.18	0.41	.659	[−0.63, 0.99]
Race: Black	−0.84	0.47	.078	[−1.77, 0.10]
Race: Other	−0.05	0.41	.906	[−0.85, 0.75]
Ethnicity: Hispanic	−0.23	0.33	.486	[−0.89, 0.42]
Age	−0.02	0.09	.846	[−0.20, 1.66]
Bootstrapped Indirect Effect (ab-path)	0.23	0.08	–	[0.10, 0.40]
Outcome: Attention Problems				
Intercept	6.58	1.46	<.001	[3.70, 9.47]
Sleep Disturbance	0.10	0.02	<.001	[0.07, 0.20]
Negative Emotional Responses to SM	0.21	0.02	.174	[−0.09, 0.51]
SM Hours	−0.01	0.04	.786	[−0.07, 0.24]
Gender: Male	−0.43	0.31	.171	[−1.05, 0.19]
Gender: Other	0.57	0.37	.128	[−0.16, 1.30]
Race: Black	−1.08	0.43	.013	[−1.93, −0.24]
Race: Other	−0.13	0.37	.719	[−0.861, 0.595]
Ethnicity: Hispanic	−0.13	0.30	.676	[−0.72, 0.47]
Age	−0.23	0.08	.008	[−0.39, −0.06]
Bootstrapped Indirect Effect (ab-path)	0.20	0.07	–	[0.08, 0.35]

Note. SM = social media. Confidence intervals that do not contain zero are considered significant. Total  $R^2$  for models for Suicidal Ideation  $l = 0.15$ ,  $p < .001$ ; for Internalizing Symptoms  $= 0.39$ ,  $p < .001$ ; for Attention Problems  $= 0.15$ ,  $p < .001$ .

**Table 4**

Gender differences in sleep disturbance, social media use patterns, and clinical symptoms.

	Full Sample (N = 243)	Male (n = 86)	Female (n = 110)	Gender Minority (n = 47)	$\chi^2/F$ (df)
1. Sleep Disturbance	26.43 (8.06)	23.76 (8.83) <sup>a</sup>	27.16 (7.20) <sup>b</sup>	29.62 (7.05) <sup>b</sup>	9.50 (242) ***
2. SM Hours	4.15 (3.34)	3.42 (3.13) <sup>a</sup>	4.47 (3.17) <sup>b</sup>	4.72 (3.91) <sup>b</sup>	3.33 (242)*
3. SM Importance	1.77 (1.13)	1.59 (1.12) <sup>a</sup>	1.80 (1.14) <sup>a,b</sup>	2.04 (1.10) <sup>b</sup>	2.48 (241)
4. Frequency of checking SM	5.33 (1.71)	4.90 (1.93) <sup>a</sup>	5.57 (1.53) <sup>b</sup>	5.53 (1.57) <sup>b</sup>	4.31 (242)*
5. Perceived overuse of SM	35 (14.4)	11 (12.9)	14 (12.8)	10 (21.7)	2.34 (241)
6. Negative Emotional Responses to SM	1.45 (0.92)	1.29 (0.92)	1.52 (0.87)	1.60 (1.02)	2.24 (241)
7. Positive Emotional Responses to SM	2.53 (0.94)	2.35 (0.99) <sup>a</sup>	2.56 (0.92) <sup>a,b</sup>	2.76 (0.86) <sup>b</sup>	3.13 (241)*
8. Suicidal Ideation	2.56 (1.81)	1.70 (1.81) <sup>a</sup>	2.79 (1.59) <sup>b</sup>	3.59 (1.63) <sup>c</sup>	21.28 (242) ***
9. Internalizing Symptoms	6.41 (2.87)	5.00 (3.09) <sup>a</sup>	7.01 (2.55) <sup>b</sup>	7.57 (2.08) <sup>b</sup>	19.12 (242) ***
10. Attention Problems	5.72 (2.35)	4.98 (2.38) <sup>a</sup>	5.86 (2.28) <sup>b</sup>	6.72 (2.02) <sup>c</sup>	9.42 (242) ***

Note. Superscript letters denote column proportions or means differ from each other at the  $p < .05$  level. Due to small group sizes, youth who did not identify as male or female were combined into a single “gender minority” group; SM = social media.

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

## 6. Limitations

This study is one of the first to examine relations among social media use, sleep, and clinical symptom severity in a sample of psychiatrically hospitalized adolescents. However, there are a number of limitations that should be considered when interpreting the present findings. First, although a validated self-report measure of sleep disturbance was used, this measure assesses a wide range of sleep disturbance indices, inclusive of perceptions of quality, satisfaction, restoration, initial insomnia, and middle insomnia. Therefore, we cannot draw conclusions about the specific indices of sleep disturbance that may be driving associations. It is also important to highlight that self-report measures of sleep are inherently limited and are only moderately correlated with objective measures of sleep, such as actigraphy or polysomnography (Wolfson et al., 2003). Second, clinical symptoms were assessed only with self-report measures; interview measures, and particularly those that permit clinical diagnosis, should be considered for use in future studies in order to examine associations with emotional responses to social media use as well as sleep disturbance. Third, daily duration of social media use was assessed, but timing of use was not; there is evidence that nighttime social media use may be particularly important in the association between social media use and sleep (e.g., Caumo et al., 2020; Garay et al., 2020; Scott and Woods, 2018). Relatedly, we did not measure timing of negative emotional responses to social media use; it is likely that adolescents experiencing stronger emotional responses to social media at night will experience greater interference with sleep. Fourth, the present study was cross-sectional and thus conclusions regarding the temporal relationship between social media use, sleep,

and indices of psychopathology cannot be drawn. Mediation was used to test models; however given the cross-sectional design, these analyses should be considered preliminary, and must be replicated within a longitudinal framework in order to evaluate their validity. There may be other cognitive mediators besides sleep problems in the association between negative social media experiences and internalizing symptoms that were not assessed in this study. As cognitive factors such as a negative cognitive bias or ruminative tendencies are consistently linked to increased internalizing symptoms, including suicidal ideation, their potential role in how negative social media experiences affect clinical symptoms needs to be explored in future research (Beevers et al., 2019 (Beevers and Miller, 2004); Łosiak et al., 2019; Nolen-Hoeksema et al., 2008; Pinto and Whisman, 1996). Additionally, emotional reactions to social media experiences were assessed in this study, but not the specific type or context of these experiences. As objectively negative or challenging experiences on social media, including being cyberbullied or victimized, may affect the sleep quality and clinical symptoms, future research that accounts for the specific types of social media experiences is warranted (e.g., John et al., 2018; Viner et al., 2019).

The limitations of the present study's design and the conclusions that may be drawn underscore the importance of pursuing a number of future research directions. Future research should evaluate the present results using a longitudinal design, employing both the subjective measures used in the present study, in addition to objective metrics of sleep (e.g., actigraphy) and social media use (e.g., screen time), and the type of social media interactions. Longitudinal designs that permit the analysis of these associations at a daily level will reduce memory bias and allow for a more granular examination of the within- and between-persons associations between social media use, sleep, and psychopathology (e.g., Hamilton et al., 2020).

### 6.1. Clinical implications

Findings underscore the clinical importance of assessing sleep disturbance and emotional responses to social media use, particularly among psychiatrically vulnerable youth. Such information may help identify those in need of more intensive monitoring and intervention and allow for individual tailoring of treatments based on emotional responses and sleep difficulties. For example, because emotional arousal may impact adolescent sleep, youth who have more negative emotional reactions to social media may benefit from using various emotion regulation strategies particularly before bedtime. In addition, these youth may benefit from parental monitoring and behavioral interventions aimed at improving their sleep and limiting access to social media at night. Overall, these findings suggest the need to closely assess and intervene on emotional responses to social media use and sleep disturbance to decrease clinical symptom severity in psychiatrically vulnerable youth.

## 7. Conclusions

Studies of social media use and sleep disruption have been limited by a focus on frequency or duration of use, and have rarely investigated these processes in psychiatrically acute adolescents. The present study offers a preliminary investigation of the role of adolescents' emotional experiences using social media in sleep disturbance and clinical symptom severity. Findings suggest that negative emotional responses to social media may be an important factor in contributing to sleep disturbance and subsequent mental health outcomes in psychiatrically vulnerable youth.

### Declaration of interest

J.H. has received an editorial stipend from John Wiley publishers.

## Funding

The authors are supported by grants from the National Institute of Mental Health [grant numbers K23-MH122669 (J.N.), K23-MH126168 (T.A.B.), T32-MH019927 (T.A.B.), and K23-MH122587 (A.Y.K.)]. This publication was also made possible by a grant from the National Institute of General Medical Sciences (P20GM13974) from the National Institutes of Health. NIH had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; and preparation, review, or approval of the manuscript; or decision to submit the manuscript for publication. The content is solely the responsibility of the authors.

## CRediT authorship contribution statement

**Jacqueline Nesi:** Conceptualization, Methodology, Formal analysis, Writing – original draft, Supervision, Visualization. **Taylor A. Burke:** Conceptualization, Methodology, Writing – original draft. **Jonathan Extein:** Writing – original draft, Visualization. **Anastacia Y. Kudina:** Writing – original draft, Visualization. **Kara A. Fox:** Writing – original draft, Visualization. **Jeffrey Hunt:** Writing – review & editing, Resources. **Jennifer C. Wolff:** Writing – review & editing, Resources.

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