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Social Media and Mental Health in Youth During COVID-19: A Narrative Review

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ABSTRACT

Social media effects on youth during COVID-19 have been studied in the context of excessive use and mental health. Although some positive effects have been reported including connecting and social support, the COVID-19 research has typically noted negative effects including sedentary behavior, limited social interaction, depression and anxiety. This narrative review of eighteen COVID-19 publications on social media effects on youth includes sections on prevalence, on effects and on mediators/moderators of those effects. The prevalence of social media use by youth during COVID-19 has varied between 5% and 97% across 22 countries as a function of location, quarantine/lockdown, and type of social media, although the overall prevalence has significantly increased by 27% during the pandemic and has averaged 38% across studies. The most popular social media have been Facebook, What's App, Instagram and Twitter. The prevalence of mental health symptoms has also varied across countries but has averaged 27% for anxiety, 34% for depression and 35% for stress. Mediators for the relationships between excessive social media and mental health symptoms have included rumination, psychological capital, sense of control and active use and moderators have included mindfulness, academic burnout and "flow". Limitations of this literature are its sampling of self-reports from university students via cross-sectional surveys and confounding variables including pre-existing psychopathology, lockdown conditions, and sedentary behavior. Research is needed on the specific reasons for excessive social media use (e. g. information seeking, social interaction and escape from negative feelings including loneliness and touch deprivation) to inform intervention protocols for reducing this addictive behavior and its negative consequences on mental health symptoms in youth.

Keywords: Social media use, mental health, youth, COVID-19

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Introduction

Social media has been studied in the context of Infomedia (false news, informative and disturbing news), educational and exercise classes on zoom, and mobile apps and messaging to improve physical health and decrease anxiety, stress and depression [1]. Although web-based interventions have been effective, research has suggested that excessive social media use has negative effects on mental health [2]. This narrative review of the COVID-19 literature on social media effects on the mental health of youth is based on 18 peer-reviewed publications (2019-2021) found on PubMed and PsycINFO. Pilot studies and foreign language papers were excluded from this review. The paper is organized by sections that reflect the literature including pre-COVID studies on social media effects and COVID-19 studies on prevalence of social media use, prevalence of mental health symptoms related to excessive use, mediator/moderator variables that contribute to the relationships between excessive social media use and mental health symptoms and limitations of the literature.

Pre-COVID Research on Social Media Effects

In the pre-COVID literature, social media effects were typically differentiated as texting, internet or Facebook effects. For example, texting was noted to increase anxiety [3] or to increase both anxiety and depression that are often co-morbid [4.5]. Sleep disturbances have also been associated with excessive texting. In a review of the pre-COVID literature on texting, excessive use was associated with shorter sleep and inferior sleep quality [6], especially texting in bed, which was associated with insomnia and shorter sleep duration as well as anxiety [7]. In these cross-sectional studies, the directionality/causality could not be determined.

Excessive internet use has also had negative effects including depression [8] and both depression and anxiety [9,10]. The excessive internet use and negative mood states appeared to be reciprocal at least in cross-sectional studies involving arbitrary selection of independent and dependent variables. For example, greater anxiety levels have been related to internet addiction [11]. In this study, age was the independent variable and internet use was the dependent measure. That younger age contributed to greater internet use was not surprising given that internet addiction has been especially prevalent among youth in several countries [10]. But Internet use has also had positive effects. For example, internet use has been related to lower rates of suicidal ideation reputedly via less depression [12]. The authors of the suicidal ideation study suggested that internet use provided both relief from negative feelings and satisfaction with social relationships.

Facebook use has also been the focus of pre-COVID research and has typically had negative effects referred to as “Facebook depression” [13]. Excessive Facebook use has also led to more social stress and insomnia, although these findings were based again on cross-sectional data making it difficult to determine directionality of effects [14]. Others have labeled excessive use as “Facebook intrusion” and reported that it occurs more often among the young and in males [14,15]. These data were summarized along with other data showing greater prevalence in young males in a review entitled “Facebooking” [16].

None of the pre-COVID studies were conducted during social isolation conditions like quarantines/lockdowns. Social media effects might be expected to be even more negative during lockdowns like COVID-19. However, it is also possible that social media use would ameliorate the effects of social isolation by providing social experiences and increasing connectedness and thereby reducing depression and anxiety. Although COVID-19 studies have assessed feelings of isolation and loneliness [17], depression [18,19], anxiety [20], sleep disturbances [21,22] and PTSD symptoms [23], the COVID-19 lockdown studies have less frequently referred to social media effects [17].

The authors of an interesting systematic review on 30 pre-COVID studies (published in 2016) ironically suggested that a similar review should be written 5 years later which would be 2021 during the COVID-19 pandemic [24]. In the 2016 review, social media use had both positive and negative effects [24]. That review included studies from 14 different countries representing several platforms including Facebook, Twitter and My Space and a significant number of participants (N=35,044). Sixteen percent of the studies noted positive but small correlations between social media use and depression (r= .15-.26), 6% reported negative correlations and 13% reported no relationships between social media use and depression. The data were complex by virtue of their cultural heterogeneity, but they yielded several suggested mediators/moderators including usage variables such as frequency, quality and type of social media use, The current review summarizes social media effects on youth that occurred 5 years later during the COVID-19 pandemic.

Prevalence of Social Media Use By Youth During COVID-19

The sample sizes of the studies reviewed here for COVID-19 are derived from 15 studies (13 quantitative and 2 qualitative) from 14 different countries. These studies totaled 773,812 participants, but when omitting the outlier sample size for China (746,217), the average sample size was 1,971 per study (range=439-5,511). The range was wide even within countries. For example, the sample sizes in Bangladesh were 880 in one study [25] and 5,511 in another study [26]. And, in Wuhan, the sample size in one survey was 439 [27] and in another study the sample size was 10 times that at 4,872 [28].

Table 1. Prevalence (%) social media in different countries.

Country	Prevalence
France, Belgium & Switzerland	15-89
Australia	27
US (Facebook)	97
UK	38
UK	54-75
Italy	5-90

The prevalence of social media use has also ranged widely from 5-97% but has averaged 38% for the world based on a systematic review of 18 studies [29] (see table 1). Although the prevalence was given in only 6 of the 18 studies, as can be seen in table 1, the prevalence varied significantly by country, and it also varied by age group and by social media platform. In Australia, for example, the use averaged 27% for adolescents and, surprisingly, an even greater prevalence occurred for adults (40%) [30].

The prevalence varied to an even greater extent across different social media platforms. For example, In Italy, an extreme range was noted including 5% for Twitter, 64% for Facebook as well as 64% for Instagram and 90% for What's App [31]. And the prevalence there significantly changed from pre-COVID (40% for 1-2 hours per day and 7% for >4 hours per day) to COVID (a significant decrease to 27% for 1-2 hours per day but a significant increase from 7% to 21% for >4 hours per day).

Similarly, in the UK, social media use increased significantly from pre-COVID to COVID at 72% with 30% prevalence for 1-2 hours/day, 27% for 2-4 hours per day and 15% for greater than 4 hours per day [32]. The prevalence in the UK also varied by social media platform with UTube at 54%, Facebook at 70% and What's App at 75%.

In a survey that involved French, Belgian and Swiss participants, the prevalence also varied by social media platform [33]. The prevalence was 15% for Tik Tok (video), 38% for Twitter (text), 63% for Instagram (photos) and 89% for Facebook (text and photos) [33].One of the U.S. studies in this review only surveyed Facebook use (much like the pre-COVID studies) and reported 70% pre-COVID but a 27% increase during COVID to 97% Facebook use [34], which was the same prevalence (98%) reported in another U.S. COVID survey [35].

Prevalence of Psychological Effects of Social Media Use on Youth

Anxiety and depression are the most frequently reported effects of social media use on youth during COVID-19. Given the cross-sectional design of these studies, the directionality of effects is not clear. Although, excessive social media use has typically been reported to lead to anxiety and depression, It is also possible that anxiety and depression led to greater social media use as a form of coping or that these psychological symptoms and social media use are reciprocal or bidirectional. The prevalence of these effects has varied by country, although prevalence was not reported in most of the studies in this review (see table 2).

Table 2. Prevalence (%) anxiety and depression in different countries.

Country	Anxiety	Depression
Ukraine	24	33
China	11	21
Bangladesh	49	
Wuhan	23	48

As can be seen in table 2, the prevalence of anxiety ranged from 11% in China [36] to 49% in Bangladesh [25], which may reflect the difference between lockdown times, with anxiety being greater during lockdowns. And, the prevalence of depression has ranged from 21% in the large global sample of China [36] to 48% in the small sample of Wuhan [28], again possibly reflecting a lockdown timing difference or just the difference in the sample sizes. Further, as many as 81% were frequently exposed to social media in Wuhan and they were specifically exposed to news and information regarding COVID as the first epicenter of the epidemic which would have likely contributed to the high prevalence of depression. The authors of this study suggested that information overload could have contributed to the high rate of depression. Comorbid depression and anxiety was also uniquely reported for this sample at a prevalence of 19%. The average prevalence across these samples was 27% for anxiety and 34% for depression.

Associations Between Social Media and Mood States

Typically, excessive social media use has been associated with negative mood states including anxiety and depression, although some have reported positive mood states like "flow" (defined as fully immersing activity). And mood states have varied as a function of social media use versus other electronic media use, the frequency

of use, the different social media platforms used, active versus passive use of social media and use during quarantine versus non-quarantine times.

Social Media Use Versus Other Electronic Media Use

In a study that compared social media use with other electronic media use during COVID-19, the rate of anxiety (at 49%) was notably 10 times higher than the rate of anxiety in 2019 prior to COVID-19 [25]. In this study on university students from Bangladesh (N= 880), those engaging in more than four hours of social media use per day as compared to those engaging in less than two hours per day had greater anxiety and lower self-related health scores. Excessive media exposure led to mental health issues as well as suicidal ideation depending on the frequency of exposure and the source of information. Social media was used more frequently by highly educated and married participants. The rate of electronic media use was 36%. Electronic media use occurred more frequently in males and in older individuals. The use of electronic media more than four hours versus less than two hours per day led to 1.52 times greater anxiety and health problems.

Smartphone use has been assessed in at least two studies on youth during COVID-19. In a study from Bangladesh, smartphone use and social media use were assessed in a sample of 5,511 students [37]. The Physical Health Questionnaire-9 and the General Anxiety Disorder -7 scales were used to assess depression and anxiety respectively. Based on an hierarchical regression, both problematic Smartphone and social media use were associated with lower age, poor sleep, TV, anxiety and depression. Other related factors were being female, living in a nuclear family in an urban area, having irregular exercise, poor academics and avoiding work. Thirty per cent of the variance in problematic Smartphone use was explained by irregular exercise, poor academics, social media use, TV, avoiding work, anxiety and depression. Twenty-five per cent of the variance in problematic social media use was explained by younger age, poor sleep, alcohol consumption, anxiety and depression. Methodological limitations of the study included the cross-sectional design, self-report, university samples that are not representative, and arbitrary selection of dependent, mediating and moderating measures.

In this cross-sectional study it's not clear whether problematic smartphone and problematic social media use led to depression and anxiety or vice versa. Confounding variables included the lack of exercise, sleep disturbances, lockdown versus non-lockdown use, the small amount of variance explained, and the use of mediation/moderation versus structural equations models and hierarchical logistic versus stepwise regression.

In another COVID-19 lockdown survey, the effects of social and electronic media were assessed including texting, internet, and Facebook [35]. Self-report data were collected via Survey Monkey and were analyzed via correlation analyses and ANOVAs. Positive effects were noted on health and work activities as well as connecting with others and the negative effects included stress, depression, anxiety, sleep disturbances and PTSD symptoms.

Social and electronic media including texting, internet use, and Facebook time had differential effects on individuals during this COVID-19 lockdown. As many as 98% of 260 respondents reported texting, 100% were using the internet, and 91% of the sample were on Facebook. The percentiles for those using the different media "a lot" were 45%, 77% and 42% respectively. Correlation analyses suggested that texting and internet use were positively related to Connecting Scale scores. However, internet use also had negative effects including high scores on Stress, Anxiety and Depression Scales. And, Facebook use had exclusively negative effects including positive relationships to not only scores on Stress, Anxiety and Depression Scales but also to scores on Fatigue, Sleep

Disturbance and PTSD scales. ANOVAS based on comparisons between no use to moderate use groups versus a group of “a lot” of use participants were typically confirmatory of the correlation analyses. These results are limited by their being self-reported data from a non-representative, cross-sectional sample. Nonetheless, they highlight the positive and negative effects of different social and electronic media use during a COVID-19 lockdown.

Frequency of Use Versus Total Time of Use Per Day

In a study comparing frequency of social media use versus time used per day, problematic social media use was associated with a 9% increase in depression in youth from the U.S. (N= 1,796) [38].The Bergen Facebook Addiction Scale was used to assess problematic social media use including the six core elements of addiction, i.e. salience, mood modification, tolerance, withdrawal, conflict and relapse. Eleven social media platforms were included in the study. The authors concluded that problematic social media use may relate to multi-tasking and excessive self-comparison with others’ idealized self-portrayals. Positive features of the study were that it was anonymous and it included a certificate of confidentiality. The cross-sectional design was a negative feature of this study given that that these variables might be reverse direction or at least bi-directional. Also, confounding variables included face-to-face interaction problems, disturbed sleep and limited physical activity. Further, there was a notable lag between the time of the survey and publication and the data on the eleven different platforms were not presented.

Social Media Use For COVID-19 News

In the largest sample study on university students in China (N=746,217), use of social media for coverage of COVID-19 more than three hours per day versus less than 1 hour per day led to a 2.13 greater likelihood of students being stressed [36]. In this sample, 35% scored high on the Impact of Events Scale that measures stress (intrusion, avoidance and hyperarousal). In addition, 21% were depressed based on the Physical Health Quotient- 9 scale and 11% had anxiety based on the General Anxiety Disorder-7 Scale. The data that were analyzed via hierarchical logistic regression analyses yielded odds ratios that were significant. A limitation of the study is that the students did not live in the epicenter of the pandemic.

Active Versus Passive Use of Social Networking Sites

In a study that tapped social media use in French, Belgian and Swiss youth during lockdown (N= 793), overall use significantly increased [33]. Surprisingly, active use of social network sites (messaging and responding to messages) increased the well-being of students via improving social capital and connectedness [33]. In contrast, passive use (viewing messages on the site) decreased the well-being of students by fostering social comparison and envy. This may explain why Facebook was used more frequently than other platforms during early COVID-19 because at that time, Facebook provided more opportunity for active use, as in both texting and photos (89%) versus Instagram that involved only showing photos (63%) and Twitter that featured only texting (38%). Interestingly, despite its greater opportunity for active use, Facebook was negatively related to well-being reputedly because of upward social comparison and feelings of envy. Instagram was positively related to satisfaction with life if it was being actively used and Twitter was positively related to satisfaction with life through social support. Not surprisingly, the authors concluded that social network sites need to be differentiated for their effects in future studies.

Another study suggested that active use of social media led to social media flow [39]. In this smaller sample study (N=512) from China, students were given the Bergen Facebook Addiction Scale as well as the Active Social Media Scale which includes updated status on life, updated COVID, shared others’ updates and liked COVID news. In addition, social media use

time was measured in hours per day on six widely-used social media platforms. The authors suggested that social media use was needed for disaster-related information, entertainment and interpersonal communication. In a path analysis, active use and social media flow were mediators for the relationship between stress and addictive social media use. Flow and active use were bi-directional in this path analysis. Flow was measured by six elements including focused attention, enjoyment, curiosity, telepresence (world created by social media is real), time distortion (loss of sense of time) and self-disclosure. The limitations of this study were that the unknown reasons for active social media use including social interaction, information seeking and escape from negative emotions were not documented. Potential confounds were pre-existing psychopathology, susceptibility to external stress and addictive Internet use. An interesting question for future research would be the relationships between social media use, "flow" and posttraumatic growth. The authors suggested that future research might incorporate a cross-lagged design (a structural equations model across two or more points in time) or an experience sampling method (a daily diary method).

Social Media Use During Quarantine Versus Non-quarantine

In a study on problematic social media use during quarantine versus non-quarantine times, correlation analyses were conducted for each of those groups and Cohen's q was used to determine the effect sizes of the group differences in the correlation coefficients [40].The quarantine group versus the non-quarantine group had greater problematic social media use, depression, anxiety and stress, although effect sizes were small. Additional limitations of the study were that the sample of 529 students from Germany and Lithuania was primarily female, young and well educated. Those who had greater education had less anxiety.

Perceptions of Social Media Use By Parents and By Their Youth

In a study that compared parents' and their adolescents' perceptions of social media use, a qualitative design was used including interviews of the parents and depressed adolescents from the US [34]. The transcripts from the interviews were reviewed for horizontalization (where the researcher gives equal value to all of the participants' statements) and cross- analysis for overlaps and contrasts between the comments by the adolescents and their parents, as in a thematic content analysis [34]. Most of the parents and adolescents used social media (83% and 96% respectively). Most of the parents used Facebook (78%) while the adolescents used more diverse social media including 43% on Facebook and 17% on Twitter, Tumble and Instagram combined. The depressed adolescents had more negative experiences with social media including cyberbullying and problematic social media use along with suicidal risk. The adolescents' perceptions of social media were that it was a place where they could honestly express their emotions while the parents' perceptions were that the adolescents' posts were inconsequential and interfered with the adolescents' lives. The parents reported using a wide range of strategies to gain knowledge and to ensure safety of their adolescents' social media use including keeping the adolescent's password, asking friends or siblings about their adolescents' social media use and restricting their use. However, none of these strategies appeared to work.

Mediators/Moderators for Relationships with Social Media Use

As already discussed, social media use has typically led to negative mood states, although occasionally positive effects have been noted. The reverse direction of negative moods leading to problematic social media has been reported very occasionally. Regression models have frequently been used, although some have used mediation/moderation models. The mediators/moderators have differed across studies, as have the independent and dependent variables.

Problematic Social Media Use Mediated by a Sense of Control and Moderated by Anxiety

In a very unusual arrangement of variables, problematic social media use instead of being the culprit predictor variable was treated as the dependent measure and was noted to result from other problems [41]. In this complex data analysis of survey data from 550 German students, the relationship between perceived burden and problematic social media use was mediated by perceived sense of control. And, anxiety moderated the relationship between sense of control and problematic social media use. That relationship was only significant for medium and high levels of anxiety.

Rumination as a Mediator and Mindfulness as a Moderator Variable

In this group of mediator/moderator studies, at least two have treated social media as the independent/predictor variable [26,27].In a survey on 439 university students from Wuhan, social media exposure was related to COVID information and psychological stress with rumination as a mediator and mindfulness as a moderator (see table 3) [27]. The authors defined mindfulness as "being aware of one's moment to moment experiences in a non-judgmental way and in an accepting manner". They cited the Diathesis Stress model for their findings, suggesting that stressful events and individual characteristics interactively influenced psychological symptoms.

Table 3. Mediator/Moderator Variables for Relationships Between *Social Media Use* and Psychological Variables.

Predictor Variable	Outcome Variable	Mediator	Moderator
Social media use	Stress	Rumination	Mindfulness
Social media use	Anxiety	Psychological capital	Academic burnout
Perceived burden	Social media use	Sense of control	Anxiety
Stress	Social media use	Active use	"Flow"
Loneliness	Anxiety	Social media use	

Psychological Capital as Mediator and Academic Burnout as Moderator Variables

In a study from Shanghai on 3,123 university students, problematic social media use was said to result in higher anxiety scores which were mediated by psychological capital and moderated by academic burn-out (see table 3) [26]. Psychological capital was defined as self-efficacy, optimism, hope and resilience and academic burnout was defined as emotional exhaustion, cynicism and low sense of accomplishment. Academic burnout was related to both the effects of psychological capital on anxiety and the effects of problematic social media use on anxiety (see table 3).

Loneliness as a Mediator Variable

Other independent/predictor variables including loneliness and physical activity have been explored with anxiety as the dependent measure and social media use as the mediating variable. In the loneliness study, loneliness led to anxiety with social media mediating that relationship (see table 3) [31].In this study, snowball sampling (participants recruit their acquaintances) was used as a recruitment strategy and the Italian Loneliness Scale which was adapted from the University of California Loneliness Scale included emotional, social and general loneliness scores. Anxiety was assessed by the Depression, Anxiety and Stress Scale and social

media use was assessed by the Bergen Social Media Addiction Scale. Loneliness predicted both excessive social media use and anxiety. Isolation increased loneliness and social media, in turn, increased anxiety. A bias-corrected bootstrapping mediator test indicated that loneliness predicted anxiety via excessive social media use which explained 23% of the variance in anxiety.

Regarding the use of specific social media, the authors reported that 90% were using WhatsApp, 64% Instagram, 64% Facebook, 16% Facebook Messenger and 5% Twitter [31]. In this longitudinal study, 40% were engaging in social media 1 to 2 hours per day prior to COVID and 7% more than four hours per day. During COVID, social media was used by significantly fewer participants at 1 to 2 hours per day (27%) and significantly more participants at more than four hours per day (21%). Females and younger participants were using social media more frequently and they had higher anxiety scores. A limitation of the study is that different geographical areas were differentially affected by COVID-19 and a small number of variables were tapped. Further, the different social media were not analyzed for their effects even though those data were apparently available.

Physical Activity as a Mediator Between Social Media Use and Anxiety and Depression

Physical activity is another mediator between social media use and anxiety. In a study from Ukraine on 1,512 students from 11 universities, 43% engaged in physical activity more than 150 minutes per week [42]. More students engaged in physical activity prior to COVID-19 than during the pandemic. Several other studies suggest that the intensity of physical activity decreased during COVID-19 including students from Asia, the US, Canada, Africa and Europe. In the Ukraine study, anxiety was reported by 24% of the students and depression by 33% of the students. Physical activity had greater effects on depression than anxiety. And the greatest association with physical activity was comorbid anxiety and depression. Depressed and anxious students were two times less likely to engage in physical activity. The inactive group experienced more anxiety and depression.

Other studies have explored the relationship between social media use and physical activity. In a lockdown study on 4,079 Australian adolescents, streaming services for exercise including YouTube, Instagram and Facebook platforms as well as Zoom were used for exercise by 27% of adolescents [30]. The users versus the non-users met moderate to vigorous intensity physical activity criteria and muscle strengthening exercise guidelines. Previous to COVID-19, only 10% of adolescents met these guidelines, surprisingly suggesting that there was an increase in physical activity by these adolescents during COVID-19. Those who used these platforms for exercise had two times the odds of meeting the moderate to vigorous intensity physical activity guidelines, three times the odds of meeting the muscle strengthening exercise guidelines and four times the odds of meeting the combination of those two guidelines.

In an explanatory sequential research design (quantitative data collected during time one and qualitative data collected during time two), a six-step thematic analysis was made of interviews on physical activity, diet and quality of life [32]. These steps included familiarization, coding, theme searching, reviewing themes, defining and narrowing themes and reporting/explanation followed by the drawing of thematic maps. The results suggested that greater social media content related to physical activity (65%) than diet (53%) or quality of life (30%). However, the numbers for use were different with 56% reporting use of diet information versus 53% noting quality of life and only 41% citing physical activity. And still different percentiles were noted for actual reduced engagement in those activities during COVID-19. Of the sample of 786 students from the UK, 55% reported a reduction in physical activity during COVID, 65% a reduction in quality of life and 44% reported no change in diet. Although the authors suggested

that social media could be used to facilitate self-management of behaviors related to physical activity, diet and quality of life, social media, as already noted, has been shown to reduce health-related behavior including less physical activity, sleep loss, poor diet, cognitive impairment, anxiety, depression, stress, body dissatisfaction, negative self–perception and social isolation.

In a systematic review on the use of social media for physical activity and diet information by university students, 18 studies were reviewed that included the platforms Facebook, Instagram, Reddit, We Chat and Twitter [29].Seventy five percent of adolescents did not meet World Health Organization guidelines for physical activity (30 minutes of daily moderate physical activity). And most were on an unhealthy diet including high sodium, low whole grains and fruits. The benefits of these social media exercise and diet programs were an increase in health information, health surveillance and peer social and emotional support. Text-based programming was shifted to images and videos and “gamification” principles including the use of competition, challenges and rewards. Fitbit tracking helped fitness inspiration that was labeled ‘fitspiration”. Unfortunately, a meta-analysis could not be conducted as the design and measures were highly variable in the 18 studies.

Potential Underlying Motivations for Social Media Use By Youth During COVID-19

Although several mediating and moderating variables have been suggested for social media use by youth during COVID-19, they are motivating factors that are not necessarily unique to COVID-19, i.e., the need for information, entertainment or an escape from negative feelings. Loneliness is an exception that has already been discussed. Loneliness may especially accompany isolation associated with lockdowns/quarantines and touch deprivation has also been prevalent during the pandemic.

Isolation and loneliness have been associated with negative mood states, sleep disturbances and health problems. People experiencing pandemic lockdowns are susceptible to feelings of isolation and loneliness. In a Survey Monkey study conducted during a COVID-19 lockdown (N= 260 respondents), 81% reported feeling isolated and 68% feeling lonely even though 68% were living with someone [17]. Correlation analyses suggested that feeling isolated and lonely were related to each other and were, in turn, negatively related to Health Practices Scale scores and positively related to scores on scales measuring COVID-related stress, negative mood states including anxiety and depression, fatigue, sleep disturbances, and posttraumatic stress symptoms. The young living alone had the worst symptoms. Analyses of variance revealed significant differences between isolated and non-isolated groups as well as between lonely and non-lonely groups on these measures, although only a weak correlation was noted between living alone and loneliness, suggesting that feelings of isolation and loneliness extended to those living with others as well. Positive correlations between both feeling isolated and lonely and time on Facebook and gaming suggested that these activities did not compensate for their isolated and lonely feelings. Feelings of isolation and loneliness and their associated problems also increased across the lockdown survey period. The lack of touch and exercise suggested that those activities might have alleviated the negative feelings and associated problems. The results of this survey are limited by the self-reported data from a non-representative sample that is cross-sectional. Nonetheless, they highlight the negative effects of isolation and loneliness during a COVID-19 lockdown.

In the same Survey Monkey study conducted during a COVID-19 lockdown, as many as 60 % said that they were touch deprived with 26% saying they were touch deprived a lot [43]. As few as 21% said they were touching their kids a lot, 33 % touching their partner a lot, and 32% self-touching a lot (e.g. yoga and stretching). Correlation analyses suggested that touch

deprivation was related to scores on the Stress, Anxiety, Depression, Fatigue, Sleep Disturbances and PTSD scales. In contrast, the three types of touching were positively related to scores on the Health Scale, at home projects, and outdoor exercising with others. Touching partner was also related to lower scores on the Stress, Depression, and PTSD Scales and Self-touching was related to lower scores on the Fatigue and Sleep Disturbance Subscales. As already mentioned, these Survey Monkey data analyses are limited by the self-reported data from a non-representative, cross-sectional sample but they highlight the negative effects of touch deprivation and the positive effects of partner touch and self-touch during a COVID-19 lockdown.

The touch deprivation noted during COVID-19 was apparently already happening prior to the pandemic and was just exacerbated by the pandemic. Very few researchers have studied touching during natural stressors but an exception was a pre-COVID naturalistic observation study that took place at airport gate waiting areas [44]. Those data suggested that a form of touch deprivation was occurring even before COVID-19 lockdowns, as evidenced by fellow travelers being on cell phones 66% of their waiting time. They were scrolling and texting, not talking on their phones. Touching occurred only 4% of the observation time.

Methodological Limitations of this Literature

Methodological limitations of this literature include the cross-sectional design of the studies that limits any conclusions about causality or direction of effects. Further, although surveys have the advantage of being anonymous, with the participants being less likely to give social desirability or "faking good" responses, the surveys are typically limited to quantitative ratings that might be less informative than the open-ended questions of live interviews.

The convenience sampling of the unrepresentative university students limits generalizability to broader populations. Further, meta-analyses have been limited as the surveys are from different countries at different stages of COVID-19. Some surveys are from lockdown and others from non-lockdown resulting in significant variability even when the same measures have been used. Although the independent measure/predictor variable has typically been social media use as measured by the Bergen Facebook Addiction Scale and the dependent measures have been anxiety as measured by the GAD-7 and depression as measured by the PHQ-9, that arrangement has been arbitrary as it is as likely that anxiety and depression have led to excessive social media use as problematic social media use has led to anxiety and depression or that these variables are at least bi-directional. Longitudinal data are needed to determine directionality of effects but have been relatively unavailable because of the unpredictability of the onset of the pandemic or the timing of epicenter lockdowns.

The relationships between social media use and mental health appear to have been affected by the difference in the use of social media and other forms of electronic media use, by the specific social media platforms, by the reasons for the use with the seeking of COVID news having more negative effects on mood than the use for entertainment, social interaction or escaping from negative feelings. And active use such as messaging and responding to messages has had positive effects on well-being while passive use as in simply observing has had negative effects on well-being. Further, the frequency of social media use appears to have been a more important variable than total time used.

The selected mediating and moderating measures appear to reflect authors' interests, as in "pet variables". This has resulted in widely diverse mediating variables including having a sense of control, rumination, social capital, loneliness and physical activity and highly variable moderating variables including anxiety, mindfulness and academic burnout. Potential confounding variables including pre-existing psychopathology, individual differences in

personality characteristics, the lack of exercise, lack of sleep, and use during lockdown versus non-lockdown have rarely been entered into the regression or mediation/moderation analyses. Even sociodemographic variables have been frequently overlooked. Given the large number of variables that have been included, it is surprising that the amount of variance explained is relatively small. The variance was often unknown as hierarchical logistic regressions yielding odds ratios were often used as opposed to stepwise regressions that would determine the relative significance of predictor variables. The number of relevant variables affecting and affected by social media use may indicate the use of the more complex structural equations models rather than the hierarchical logistic regression and mediation/moderation models that have frequently been used.

Intervention studies have not appeared in the COVID-19 literature on social media use. Just prior to the onset of COVID-19, a longitudinal study showed an increase in well-being in individuals who had been advised to reduce their social media use for two weeks [45]. It's not clear whether that increase in well-being occurred because of less time on social media or because of the increased activity that accompanied the decrease in social media time. Nonetheless, the data suggest that might be an effective intervention for pandemic periods. Exercise was a significant buffer for the anxiety, depression and sleep disturbances noted in the Survey Monkey study just described [46].

Conclusions

Two of the potentially most important conclusions based on this literature contrast the positive and negative effects of social media use. The positive effect has been called media "flow" or the pleasant enjoyment of the loss of sense of time and being curious, focused and self-disclosing. The unique negative effect aside from the typically measured anxiety and depression is the "feeling bad about oneself related to excessive self-comparison with others' idealized self-portrayal" which has led to feelings of envy. The negative effects appear to outweigh the positive effects and suggest that social media reduction or exercise protocols may be needed as this pandemic continues to ameliorate the addictive and depressing effects of excessive social media use by youth during COVID-19.

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