Most Teens Bounce Back: Using Diary Methods to Examine How Quickly Teens Recover from Episodic Online Risk Exposure

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Cross-sectional research suggests that online risk exposure (e.g., cyberbullying, sexual solicitations, and explicit content) may negatively impact teens, increasing concerns over the risks teens are exposed to online. Yet, there has been little research as to how these experiences impact teens' mood over time, or how long these effects may last. To examine the effects of online risk exposure on mood, we asked 68 teens to report their weekly online risk experiences, emotions, and sense of well-being for two months. We found that teens experienced more negative emotions the week that they reported cyberbullying and exposure to explicit content, but these effects were gone one week later. In addition, teens reported a slight increase in positive emotions and mental well-being during weeks they were exposed to other risks. Our results suggest that most of the risks teens in our study experienced online only pose brief negative effects, if any, and initiates a discussion on how our society may overly problematize the negative effects of online risk exposure on teens.

CCS Concepts: • **Software and application security→ Social network security and privacy**; • Networks → Social and professional topics → Adolescents

KEYWORDS

Adolescent online safety; cyberbullying; sexual solicitations; explicit content; information breaches; privacy; diary study

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1 INTRODUCTION

Teens are spending more time online than ever before; most use the internet daily [101]. Increased access to Wi-Fi enabled personal devices has "tethered" teens to the internet [113], creating new challenges for parents [8]. As teens interact with others, they may be bullied by

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known peers or adults [103]; otherwise, strangers who hide behind a layer of anonymity [109] could make unwanted sexual solicitations [99]. Teens may also be exposed to inappropriate explicit content, such as pornography [65] or violence [98] that may be emotionally damaging [42]. Despite concerns over these risks, there is very little information on how online risk exposure impacts teens over time. While numerous research has focused on the effects of online bullying, sexual solicitation, and explicit content exposure [84,86,87,91], most of this data was collected long after the fact and during one snap shot in time. To date, no research has conducted an in-depth examination of online risk exposure's effects soon after they occur and during the subsequent weeks after occurrence. Such an examination would yield more information on how individual online risk events impact teens' short-term emotional health (e.g., mood). Moreover, it would provide more detailed data and without the recall error that often occurs in cross-sectional designs [51]. In addition, utilizing intensive study designs with multiple time points and short time periods (e.g., the diary method [11]) allows researchers to more easily detect emotional changes related to stressful events [121]. By tracking changes in emotions following stressful events, these methods can help researchers gauge teens' resilience to online risks by measuring their emotional equilibrium [88].

Therefore, we conducted a web-based diary study with 68 teens using weekly reports over a period of two months to examine the frequency in which they encountered online risks. Diary methods have already been embraced within the CSCW community, as well as the broader academic research community as a whole, to provide a more fine-grained examination of participants' experiences [23]. Our analyses help address the following research questions:

1. Does online risk exposure have an immediate impact on teens' positive and negative emotions or their mental well-being?
2. If so, how long do the negative effects of online risk exposure last?

Each week, the teens who participated in our study were asked the frequency in which they had been exposed to three different categories of online risks: 1) exposure to explicit content, 2) cyberbullying, and 3) sexual solicitations. To assess mood, teens were also asked how often they had experienced positive and negative emotions using the Parent and Child Positive and Negative Affect Schedule (PANAS-CP) [35]. To measure mental well-being, we utilized the Warwick Edinburgh Mental Well-Being Scale (WEMWBS-7) [110], which assesses how well a teen feels they can handle their problems, how useful they feel, and how optimistically they view the future. We then utilized hierarchical linear modeling to determine if online risk exposure impacted emotions and well-being the week risk exposure occurred, one week after risk exposure, and two weeks after risk exposure.

Explicit content exposure and cyberbullying appeared to have a detrimental effect on teens' mood, as evidenced by a significant rise in negative emotions. These effects were fleeting, however. Risk exposure no longer had an effect on negative emotions one week and two weeks later. In fact, while teens who were exposed to more online risks experienced more negative emotions, exposure to certain risks (i.e., cyberbullying) actually had a significant effect on positive emotions and mental well-being (though these effects were also gone one week later). Our results suggest that certain online risks may have a negative short-term impact on teens' emotions and well-being. However, the majority of teens seem to quickly recover from risk exposure. Moreover, the slight spike in positive emotions and well-being suggest that the coping techniques that accompany online risk exposure may temporarily lead to positive changes in mood.

Our study explores the possibility that most teens may be able to recover from online risk exposure. Based on resiliency theory [40], online risk exposure may have a short-term negative impact on teens' mental health, as evidenced by changes in emotions and self-reported mental well-being [48]. Given that teens may have developed resiliency through frequent online use, it is unclear how long the negative effects may last. Previous research suggests that teens may build

resiliency towards negative online experiences that reduce or eliminate negative effects on their mental health [122], but does not examine how long these effects impact mood. Our study hopes to build on this previous work on adolescent resilience and online risk exposure to make several unique contributions:

- Provides a comparison of the effects of common online risks (cyberbullying, sexual solicitation, explicit content) on teens' mood.
- Assesses the magnitude of short-term negative effects of online risk exposure on teen mental health.
- Examines the stability of the negative effects of online risk exposure on teens' mood over time (i.e., how long effects impact emotions).
- Uncovers the unanticipated role of positive emotions following online risk exposure, given its role in coping with negative events.

2 BACKGROUND

The advent of social media platforms, anonymous forums, and online video games [73] have created a generation that builds and maintains relationships online [125]. Unfortunately, these new modes of communication may also make teens more vulnerable to certain risks. These risks may include hurtful or demeaning remarks from other users on online platforms (i.e., cyberbullying) [105]; pressure or invitations to engage in sexual behaviors online (i.e., sexual solicitations) [126]; and accidental or intentional viewing of violent, disturbing, or sexually explicit videos or images (i.e., explicit content exposure) [26]. In the sections below, we will first situate our research in the larger context of the CSCW community, then we discuss related literature to adolescent online safety and risks.

2.1 CSCW and Adolescent Online Safety

The CSCW community has shown a great amount of interest in understanding how increased internet use presents new challenges for teens and their parents. Some of this research has focused on the effect of excessive internet use on family life [8]. Yardi and Bruckman [128] examined how parents monitor or restrict teen internet use (e.g., reading a teens' email or signing into their accounts) to prevent teens from oversharing online or using the internet during school hours. However, the CSCW community has also begun exploring the potential risks adolescents may be exposed to online, as well as what parents can do to ensure that teens are safe online [49]. For example, researchers have examined how parents restrict, mediate, and/or become more aware of teens' online activities as a means of managing risk [8,50].

While parents may be eager to prevent risk exposure by restricting internet use, researchers have more recently started to caution against such parental control-oriented approaches [49]. Others have shown that parents and teens may not properly communicate well enough to co-constructively address the risks teens experience online [124]. As such, the SIGCHI community has started to move away from only examining parent-centric approaches to online safety to also examining the roles teen resilience and self-regulation can play in protecting adolescents online [49]. Many of the risks teens encounter online are mild or consensual [124], making it hard to justify extreme restrictions of teens' internet use. Instead, teens need to learn how to effectively cope with risk exposure by learning to set boundaries that protect their privacy and resolve online interpersonal conflicts. Thus, as teens are exposed to and navigate potential online risks, they can slowly build resilience and overcome these negative experiences [122].

2.2 Adolescent Online Risk Exposure

A common theme across the broader landscape of adolescent online safety literature is the intense focus on preventing online risk exposure [96]. Therefore, we synthesize relevant literature regarding teens and cyberbullying, sexual solicitations, and explicit content exposure below.

2.2.1 Cyberbullying and Online Harassment. The detrimental effects of offline bullying are well-documented. Bullying has been shown to increase depression, lower self-esteem, reduce mental well-being, and even lead to suicidal ideation [66]. Online bullying appears to be no exception [118]. There are now several well-publicized cases of teens suffering consequences from extended, frequent cyberbullying [131]. Cyberbullying may be especially harmful for several reasons. First, unlike traditional bullying, teens may be unable to escape their bullies because they are constantly connected to the internet [113]. Second, unlike a spoken insult, insults that are posted online can be viewed multiple times by the victim and other viewers, which may lead to more rumination and repeated harm [39]. Since online bullies do not see the emotional consequences of their behaviors, online users may also engage in more extreme behaviors without feeling guilt [5]. Moreover, the anonymity of certain online communities allows users to insult or demean others without real world repercussions. The combination of these factors may mean that cyberbullying can have an especially detrimental and long-lasting impact on teens' mood.

2.2.2 Online Sexual Solicitations. The internet allows adults to easily connect with underage users [10]. Thus, sexual solicitations by adults is one of the most feared adolescent online risks [106]. Teens may receive unwanted solicitations from adults [25], which could lead to molestation or statutory rape [22]. In addition, users often use social media to search for romantic partners [85], which could explain why many teens report being asked for sexually explicit photos through social media by strangers and their peers [32]. Media reports suggest that there are many online communities that sexually exploit teens [120], though research suggests this danger is rare and exaggerated by the media [15].

2.2.3 Explicit Content Exposure. Exposure to sexually explicit content is common for teens: 22% of 12-year-old girls and 66% of 14-year-old boys have viewed online pornography [18]. The products designed to shield teens from unwanted explicit content appear to be ineffective, as many websites advertise explicit content to all users, regardless of age [63]. Further, certain websites, such as Facebook, forbid sexually explicit or violent images and video, but these policies are often loosely enforced and rely on users to report violations [29]. There are many other online communities that allow explicit content, such as 4chan [6] that also have underage users. Though parents and lawmakers believe that explicit content may be harmful to young viewers [98], there is little research on how quickly the negative effects of explicit content exposure lasts.

2.3 A Reflection on the Gaps in the Literature

While the factors leading to or away from adolescent online risk exposure have been studied with considerable depth [78], the extant literature is limited in two ways. First, online risk exposure in and of itself should not infer harm [96]. In fact, the mild to moderate risks teens may experience online may be beneficial because they allow teens to learn important conflict resolution skills and coping skills [125]. Thus, some level of risk may be a fair tradeoff for the advantages teens gain by being able to interact with their peers and trusted adults online. Second, the majority of these studies have been cross-sectional in nature, making it impossible to understand the actual effects of episodic (i.e., a specific event) risk exposure [96]. We discuss these two perspectives in more depth and explain how they motivate the design of our research.

2.3.1 Examining Whether Risk Leads to Harm. Many of the risks teens face are risks that previous generations of teens have faced offline. However, the media has characterized online risks as

more insidious than traditional offline risks. For instance, some have argued that since teens' are constantly "tethered" [113] to social media through smart phones and the internet, it may be harder to escape from online perpetrators than offline perpetrators. This may especially be applicable to teens who are bullied. Teens who are already facing social stigma at school (e.g., openly LGBT youth) may continue to be harassed after school through social media [130]. Some research has examined the effects of explicit content exposure, online sexual solicitation, and cyberbullying on teen mental health [7]. Past studies have demonstrated that increased internet use is linked to lower mental well-being [67], and an increase in negative emotions [74]. Excessive internet use may even aggravate negative emotions caused by other life circumstances, such as poor emotional intelligence [30]. Increased internet use may be harmful to some teens because they may be more likely to be exposed to these online risks. Indeed, teens may be emotionally scarred if they are victimized online [33]. Abuse from others online has been linked to depression, lower self-esteem, and attachment problems, as well as suicide risk in young adults [118]. Many teens report a "snowballing effect" where a few comments turn into a wave of harassment on social media [117]. In addition, many users who maintain online profiles do not properly manage their privacy settings, which may allow sexual predators to find them [54].

On the other hand, there is still some debate whether teens frequently encounter these online risks, and if they have a significant effect on teens' emotional health. For example, a review of trends in online risk exposure suggest that prevalence of online sexual solicitation, cyberbullying, and explicit content exposure are relatively low (about 10-20% of teens surveyed), and may not be increasing as teens spend more time online [78]. Other researchers have suggested that current concerns about the internet are another form of the "stranger danger" that fueled parents' fears of child and teen victimization in the nineties [15]. Created by exaggerated media attention, this stranger danger motivated parents to restrict adolescents' access to public spaces and impose ineffectual curfews as a safety measure [82]. This fear of public spaces has now been transferred to digital public spaces. Media stories now focus on teens' risk of being sexually exploited online, though this is a very rare occurrence [15]. Even when teens are approached by a sexual predator online, it rarely leads to an in-person meeting [126].

More recent research on teens' social media use also indicates that teens benefit significantly from the same online platforms that are considered to put them at risk. For example, social media profiles may put teens at risk for bullying or sexual solicitation from strangers [15]. However, these profiles are more typically used to interact with and share memories with peers [13], while also helping the teen develop and express their identity in a way that is healthy for adolescent development [76]. Teens may use these online platforms to test boundaries and engage in risky behaviors [107]. This risk-taking process is often considered a normal part of adolescent development [38]. Moreover, online opportunities (e.g., using the internet to seek out useful information or learn a new skill) is positively related to online risk experience regardless of internet self-efficacy, suggesting that risk exposure may be a tradeoff for using the internet to pursue opportunities [77].

2.3.2 Understanding the Effects of Episodic Risk Exposure.   We argue that previous research may not tell the whole story; most of the adolescent online risk research has been cross-sectional in nature, where participants were asked how frequently they had experienced an online risk in the past (usually within the last year) at the same time indicators of their mental health were measured [52,80,96]. This type of model cannot test the short-term, immediate effects of a particular online risk occurrence or address how long these short-term effects last. Additionally, asking teens to recall an event long after it happened may yield inaccurate reports. Individuals are likely to recall events after a long time period more easily when they had a stronger emotional impact. This leads to biased responses, with only the most harmful events being reported [16]. Thus, it is difficult to tell when teens are emotionally harmed by everyday risk

exposure because teens are most likely to only recall online risk events that emotionally harmed them.

2.4 Applying the Theoretical Lens of Resilience

One question that has been explored in offline contexts but rarely explored in online contexts is why some teens may be emotionally damaged by negative online experiences like cyberbullying and sexual solicitations, while other may not. Research on offline contexts suggest that teens' personal characteristics may determine how they recover from negative experiences such as sexual harassment [41] and exposure to violence [60]. These personal factors may include emotional support or economic resources [68] and the presence of additional stressors [71]. One of the most important factors may be the ability to use emotional coping techniques following a negative event [24]. As such, some research has shown that teens can be resilient to the negative outcomes related to online risk exposure [122]. *Resilience* is the ability to recover or "bounce back" from a negative event or stressful experiences [70].

Resilient individuals are able to stabilize their emotions following stressful life events, such that exposure to negative life events do not cause long-term harm [88]. Regardless of their level of resiliency, however, individuals may experience negative emotions directly after the stressful event [48]. Thus, individuals who are resilient to a particular risk are able to maintain an emotional equilibrium following occasional or even frequent negative events [94], and the process of resilience may be observed via mood stabilization subsequent to an adverse event [55]. Yet, when individuals are low on resilience, stressful life events will impact mood for longer periods of time [90].

Resilience is generally considered an acquirable trait [83], helping individuals who experience negative events as youth develop into more resilient adults [93]. Empirical research has shown that by regulating the effects of stressful events on mood, resilient individuals are able to shield themselves from the negative effects of traumatic events including domestic abuse [56], fires [72], running away from home [37], and chronic pain [129].

There are several ways teens can build resilience. The resilience framework [40] suggests that teens may develop resilience through *external resources*, such as social support [34]], a cohesive family unit [47], and material resources [12]. In addition, adolescents may also be more resilient based on factors that protect or buffer them from the effects of risk exposure, such as mentoring relationships [61], a supportive peer network at school [119], and community resources offered to teens following a negative event [127]. Like external resources, protective factors can also help teens reduce their negative emotions and repair their mental well-being that follow risk exposure, leading to greater emotional equilibrium [88].

Teens may also cultivate *internal assets* that help them be more resilient. For example, teens with an internal locus of control [119] and high self-efficacy [3] may be able to more quickly recover from a risk event. Coping is another learned strategy; as teens are repeatedly exposed to a stressor, they learn which techniques they can use to regulate negative emotions caused by the event [31]. Since teens may have to learn which coping technique is appropriate for a given stressor, they may become more effective copers as they get older, or as they are more frequently exposed to a specific stressor [93]. In this way, teens who are exposed to *more* stressful events in childhood may be better active copers than their more fortunate peers [40]. There are several coping techniques an adolescent may employ while building resiliency. Teens may learn to reinterpret a negative or stressful event to have positive meaning [53]. For example, if someone bullies them, they may reframe the event by feeling pity for the person who has mistreated them. Teens may also use humor to boost positive emotions, such as making jokes about an unwanted sexual solicitation. In addition, they may try to engage in more optimistic thinking [68].

When teens utilize these coping techniques, they may increase their positive emotions to overcome negative emotions caused by stressful events [43]. Increases in positive emotion can reduce negative emotions by broadening and refocusing thoughts, and avoiding rumination [44] leading to increases in mental well-being [111], even though they may initially experience negative emotions when the stressful event occurs [79]. Thus, greater resilience is associated with a concerted effort to increase positive emotions [22], which may speed emotional recovery after a negative event [112]. This process is evident in past research on resiliency. Individuals who boost their positive emotions maintain composure in emotionally draining situations [27]. This process can also be induced through interventions; resiliency increases when individuals are asked to engage in meditative activities that create more positive emotions [45].

3 METHODS

3.1 Diary Study Overview

Based on past research on best practices for conducting diary studies, we utilized this in-situ approach, elicited descriptive accounts of events with a structured question and answer-based format, and gave participants a reasonable window of time to provide responses [89]. We elected to use online data collection because many features (e.g., automated reminder emails) provided by these systems have been shown to increase participation [95]. Therefore, the present study was conducted using a custom-built diary-based survey website. Each teen participant was given a personal log-in, which they used to access a dashboard where they could complete the current week's survey or view previous surveys. Participants received an email invitation when a weekly survey was available, as well as a reminder when the survey was about to expire. Since our participants were minors (ranging from age 13-17), we obtained informed consent from their parents. However, to protect teens' privacy, parents were not given their children's log-in information. Responses remained anonymous, unless teens indicated that they were in immediate danger (e.g., experiencing child abuse, reporting suicidal ideation).

3.2 Diary Study Questions

3.2.1 Assessing Mood and Well-Being . We incorporated measures of mood that have been recommended for examining the effects of short-term stress [4] and have been used in previous diary studies [28,102]. To measure the mental and emotional effects of online risks, we analyzed data from three pre-validated psychological measures meant to capture momentary well-being and mood. To assess teens' positive and negative emotions, we utilized the Child and Parent version of the Positive and Negative Affect Schedule (PANAS C-P) [35]. The PANAS C-P asks participants to rate the extent that they experienced discrete positive emotions (e.g., joyful, calm) as well as negative emotions (e.g., mad, sad) on a 5-point Likert scale. To assess well-being, we utilized the 7-item version of the Warwick-Edinburgh Mental Well-Being Scale (WEMWBS-7) [110]. The WEMWBS measures subjective well-being by asking participants to rate the extent that they agree with statements such as, "I've been dealing with problems well," measured on a 5-point scale.

3.2.2 Measuring Risk Frequency. Participants were asked how often they had encountered three distinct types of online risks: 1) online sexual solicitations, 2) cyberbullying, and 3) explicit content exposure. The descriptions of each risk type that were provided to participants are included in Table 1.

To encourage teens to be more honest, we gave each risk type less severe labels (see "survey label" column above). For example, sexual solicitations were called online flirtations in the

survey. Several different scenarios of risk exposure were included in each category. For cyberbullying, teens were asked whether they had been treated in a nasty or hurtful way online; been the target of rude or mean comments online; been the topic of a rumor spread online; or any other interaction that made them feel embarrassed or unsafe. Sexual solicitation included receiving sexual messages; requests for sexual messages or photos; requests to meet offline; and any other sexually suggestive interactions. Explicit content included seeing pornographic or excessively violent stories, images, or videos; content that promoted deviant behavior; content that encouraged self-harm; and any other unsettling content. To measure the frequency of each event, teens were asked how often each event occurred that week on a 5-point Likert Scale (1= never, 5=almost every day). Indices were created for each risk category (average of response for all in each scale) and construct validity was assessed through Cronbach's alpha. All constructs reached the recommended threshold of 0.70.

In addition to the Likert-scale items, teens were prompted to give a qualitative description of their risk experiences. These descriptions were used to confirm that risk experiences were properly labeled. Qualitative descriptions were also used to code risk experiences for teens' intentionality (i.e., whether they had sought out the experience). Ad hoc analyses indicated that intentionality was not significantly related to our dependent variables.

3.3 Recruitment

To recruit participants, we contacted organizations that serve youth across the U.S. This included community centers, libraries, YMCAs, churches, clinics, after school programs, and other publicly funded organizations for teens. In addition, we recruited participants through a parent contact list maintained by the university's psychology department. This contact list was generated by the university's psychology department based on public records of birth announcements near the university. Teens were given up to $75 for participating via Amazon.com or Walmart gift cards. Total compensation depended on how many weekly surveys teens completed. Teens were recruited and participated on a rolling basis from January 2014 to August 2014.

3.4 Data Analysis Approach

Hierarchical linear modeling was utilized to answer our research questions. Hierarchical linear modeling is recommended for analysis of diary studies and longitudinal data because it nests data from multiple time points within each person [14]. Hierarchical linear modeling is also typically used when a large portion of the variance comes from differences between people [9]. Based on recommendation from the literature for assessing model fit for hierarchical linear modeling, we assessed model fit by testing whether adding our independent variables to an intercept only model caused significant change in deviance scores [2]. We utilized separate models to test the effect of risk frequency (i.e., cyberbullying, sexual solicitation, and explicit content exposure) on each indicator of emotional health (i.e., positive affect, negative affect, and mental well-being). We centered [59] each of our independent variables (frequency of each risk type) around the group mean (i.e., the mean frequency for each participant over the course of the study). To test for longer effects on mood (i.e., how online risk exposure impacts teens in subsequent weeks), we modeled the effect of frequency of each risk type on positive affect, negative affect, and mental well-being scores from the next time point and two time points later.

Table 1. Online Risk Categories

Risk Type	Survey Label	Definition
Cyberbullying	Online Interactions	Bullying and any other negative online interactions that may make teens feel unsafe, embarrassed, or threatened
Sexual Solicitations	Online Flirtations	Requests received by a stranger, acquaintance, or friend that is sexual in nature, including "sexting"
Explicit Content	Online Content	Accidental or intentional viewing of pornographic, extremely violent, immoral, or disturbing online content

4 RESULTS

4.1 Descriptive Statistics

We obtained data from 68 teens. A total of 59 teens completed surveys from all weeks, in addition to a post-survey, while seven of the teens submitted surveys from at least four weeks but did not complete the post-survey. This yielded 434 usable observations (i.e., reports from all participants across time points). Within these usable observations, teens reported a total of 185 online risk events during the course of the study (i.e., one or more instances of risk exposure within a one-week span). Fifty-six (80%) reported experiencing at least one risk event throughout the course of the study. The most common risk was explicit content exposure (N= 122), followed by cyberbullying (N= 32) and sexual solicitations (N= 31). This sample size yielded enough observations to find even small effects using hierarchical linear modeling, according to a power analysis conducted in the program Optimal Design [97]. Only approximately 300 observations across all participants were needed to achieve adequate statistical power for a very small effect size (β = .04) and .80 power.

All teens who participated in the study said they used the internet every day or almost every day (only one person indicated that they did not go online this frequently). Participants were from thirteen different states, though most (74%) were in different regions from the same state as the university. The demographics of our sample were similar to previous national surveys (e.g., the Pew Internet and American Life 2010 survey [73]) with the exception of participants' ages (which included twelve year olds) and location. The demographics were also consistent with population estimates of the state where the majority of participants were recruited from [108]). Our participants tended to be younger adolescents (M=14.79, SD= 1.30). Most were 14-years-old (31%), followed by 15 (21%), 13 (17%), 16 (17%), and 17 (13%). Teens who participated were mostly female (63%) and Caucasian (73%); with 13% African-American, 5% Hispanic, 3% Asian, and 5% other).

4.2 Immediate Effects of Online Risk Exposure (RQ1)

We examined the first research question by modeling the effects of frequency of each risk type on positive emotions, negative emotions, and well-being at the concurrent time point (i.e., scores from the week the risk(s) occurred). Results are displayed in Table 2. Results indicated that cyberbullying (β_1 = 0.46, p < .05) and explicit content exposure (β_1 = 0.16, p < .05) led to an increase in negative emotions the week the risks occurred. However, our results indicated that sexual solicitation had no effect on negative emotions during the week of risk occurrence (β_1 = -0.13, p > .05). When we tested the effects of each risk on positive emotions, we found that risk types generally did not decrease positive emotions the week a risk occurred (β_1 = 0.08, p > .05 for sexual solicitation; β_1 = 0.04, p > .05 for explicit content). Contrary to the results above, cyberbullying actually *increased* positive emotions during the weeks it occurred (β_1 = 0.32, p < .05). Similarly, cyberbullying was also associated with slightly *higher* well-being (β_1 = 0.29, p < .05), while sexual solicitation (β_1 = 0.31, p > .05) and explicit content (β_1 = -0.12, p > .05) had no significant effect on well-being.

Table 2: Negative Affect, Positive Affect, and Well-Being Across Weeks

	Negative Affect						Positive Affect						Well-Being					
	β	SE	β	SE	β	SE	β	SE	β	SE	β	SE	β	SE	β	SE	β	SE
	Week 1		Week 2		Week 3		Week 1		Week 2		Week 3		Week 1		Week 2		Week 3	
Intercept	**1.65**†	0.07	**1.62**†	0.07	**1.61**†	0.08	**3.15**†	0.11	**3.11**†	0.12	**3.08**†	0.12	**3.30**†	0.19	**3.42**†	0.12	**3.41**†	0.12
Bullying	**0.46**†	0.12	0.11	0.11	-0.01	0.11	**0.32***	0.15	0.30	0.14	0.12	0.15	**0.29***	0.15	0.19	0.15	-0.13	0.15
Sexual Solicitation	-0.13	0.10	0.07	0.09	0.03	0.09	0.08	0.13	-0.04	0.13	0.00	0.13	0.03	0.13	0.01	0.13	-0.03	0.13
Explicit Content	**0.16***	0.05	0.01	0.05	0.02	0.05	0.04	0.06	-0.04	0.06	0.03	0.07	-0.12	0.06	-0.01	0.07	0.04	0.02

† indicates $p < .01$, * $p < .05$. Time was included as a covariate for tests of well-being

4.3 Short-Term Effects of Online Risk Exposure (RQ2)

To test how long effects on teens' emotions and well-being last, we modeled frequency of each risk type on positive emotions, negative emotions, and well-being one week and two weeks later. Our results suggested that none of the risk types had enduring effects on teen mood. Cyberbullying ($\beta_1 = 0.11$, $p > .05$), explicit content ($\beta_1 = 0.01$, $p > .05$), and sexual solicitation ($\beta_1 = 0.07$, $p > .05$) had no effect on negative emotions one week later. The same was true for negative emotions two weeks later ($\beta_1 = 0.11$, $p > .05$ for cyberbullying, $\beta_1 = 0.09$, $p > .05$ for explicit content exposure, $\beta_1 = 0.05$, $p > .05$ for sexual solicitation).

Though risk occurrence led to an immediate short-term *increase* in positive emotions and mental well-being in concurrent weeks, it had no impact on positive emotions one week ($\beta_1 = 0.14$, $p > .05$ for cyberbullying, $\beta_1 = 0.06$, $p > .05$ for explicit content exposure, $\beta_1 = 0.13$, $p > .05$ for sexual solicitation) and two weeks ($\beta_1 = 0.15$, $p > .05$ for cyberbullying, $\beta_1 = 0.07$, $p > .05$ for explicit content exposure, $\beta_1 = 0.1$, $p > .05$ for sexual solicitation) later. The same was true for well-being one week ($\beta_1 = 0.17$, $p > .05$ for cyberbullying, $\beta_1 = -0.08$, $p > .05$ for explicit content exposure, $\beta_1 = -0.02$, $p > .05$ for sexual solicitation) and two weeks ($\beta_1 = 0.16$, $p > .05$ for cyberbullying, $\beta_1 = 0.07$, $p > .05$ for explicit content exposure, $\beta_1 = 0.13$, $p > .05$ for sexual solicitation) later. In addition, many of the models we tested for longer effects on mood had poor model fit, as measured by changes in deviance from a null model [2] (negative affect and positive affect at weeks two and three). This also suggests that risk exposure did not adequately predict changes in emotions at later time points.

5   DISCUSSION

We found many interesting trends in our study that contradict popular perception of teens' online risk experiences. Our results suggested that the effects of online risk exposure on emotions and well-being may be more complicated than suggested by previous research [118]. We first compare and contrast some of these various findings, then highlight the key implications of our research.

5.1 Frequency of Online Risk Exposure

Our results were not consistent with online risk exposure prevalence rates estimated by cross-sectional and national surveys of teens [78,80]. Contrary to previous research [78], which found that only one fifth of teens were exposed to online risks, risk exposure was relatively common in

our study. The majority of teens in our study experienced at least one risk event. There are several possible explanations for this discrepancy. First, our definition of risk broader than in previous surveys (though we based our survey items on previous research [123]). It is also possible that previous research underestimated how commonly teens face many of these risks due to the extended time period in which risk reporting was measured (i.e. the past year versus the past week). Individuals are more likely to recall events that are negative or emotionally charged (e.g., flashbulb memories [19]). Thus, previous research may have underestimated risk exposure because teens may have been more likely to recall risk events that had a greater emotional impact. It is also possible that teens were more forthcoming about their experiences in the present study, as we gave risk types less severe labels (e.g., social interactions instead of cyberbullying). Regardless, a key methodological implication of our study is that *how* and *when* online risks are measured has a significant impact on recall and the frequency in which risks are reported.

5.2 Negative Effects of Online Risk Exposure

Cyberbullying and exposure to explicit content were both shown to have an immediate negative impact on teens' mood. This is consistent with research on bullying in offline contexts. Bullying has been shown to increase depression [64] and suicidal ideation [20], while also decreasing self-esteem [92] and well-being [100]. Negative emotions were also higher during weeks that teens were exposed to explicit content, which included exposure to pornography, violent imagery, and other disturbing material. Again, this is consistent with previous research, which suggests viewing disturbing imagery may be emotionally harmful to younger viewers [104].

Yet, while these risk types led to an increase in negative emotions during the concurrent week, this effect was short-lived. Teens reported normal levels of negative emotions the next time they completed their diary entry, only one week later. This suggests that, despite concern over the impact of cyberbullying and explicit content exposure on teens' emotional development [75], the effect of these risks on teens' emotions and well-being appeared to be very short-lived. This is contrary to theory on online risks that supposes that online risks may be even more problematic than offline risks because teens are too "tethered" to their online persona to escape online risks [113]. Again, a methodological implication of our findings may be that when teens report their online risk experiences closer to the time that they occurred, the severity of the risk experiences may decrease as the frequency of risk reporting increases. Overall, we argue that our in-situ, event contingent diary-based approach [69] is more accurate in terms of capturing the true nature of adolescent online risk experiences than cross-sectional studies that require teens to recall events that may have occurred in the past.

5.3 Theoretical and Practical Implications

5.3.1 Building a Case for Online Resilience to Online Risks.   While risk experiences were prevalent among teens in our study, not all risk exposure resulted in short-term negative consequences. There are several reasons risks may have had only a temporary or no impact on mood. Since online risk exposure was relatively common (and sometimes sought out by the teen, in the case of explicit content exposure), teens in the study may have built resiliency against certain online risks that could have otherwise caused them emotional harm. Like other studies have found, teens may have learned coping techniques to reduce the impact of cyberbullying and explicit content on mood, such as avoiding rumination, speaking to a friend, or seeking out positive experiences [125]. This finding could inform parents and clinicians on how to teach teens to cope with risk exposure. Teaching a teen to see the humor in a situation, for example, may be useful for helping teens recover from being cyberbullied. In fact, allowing teens to cope with negative

emotions by boosting positive emotions may actually increase their overall mental well-being [43,46].

Increases in positive emotions and well-being, in some cases, suggest that the effects of online risk exposure may sometimes be short-lived. Short-term changes in positive affect also may indicate that coping and resilience may play a role in teens recovery from online risks [112]. While a small, temporary increase in positive emotions may be surprising, it is consistent with past research on resilience. Many conceptualizations suggests that resilient individuals may reduce stress by boosting their own positive emotions after they have experienced a negative event [46], either through the use of humor [17], meditation, or social support [45]. Indeed, research on bereavement also suggests that negative life events may actually be beneficial in the short-term because it prompts individuals to interact with and strengthen their support network [58]. These interactions with friends and family often lead to an increase in positive emotions directly after the event [112].

The slight increase in well-being found in our study does not necessarily suggest that online risk exposure is beneficial to teens. However, it may provide some evidence that teens may be building resiliency to online risks. According to the resiliency framework [40], teens who engage in coping techniques to improve their mood may also experience an increase in positive emotions, which may also temporarily increase mental well-being. In addition, many of the coping mechanisms that teens may utilize following a traumatic event, such as reaching out or building their social support network [58], may actually improve well-being. Therefore, while online risks may be harmful to teens, the coping mechanisms that accompany these risks may indirectly be beneficial to teens' mental health.

5.3.2 Cautioning Against Problematizing All Online Risk Exposure. Negative online communication may have a detrimental effect on teens' emotional health [33,131]. On the other hand, when online communication is used primarily for prosocial interactions, teens and young adults may have higher well-being due to an increase in overall social capital [36]. For instance, teens may use the internet to connect with family, friends, and mentors in positive ways [73], exposing them to more negative interactions as a potential side-effect. As a consequence, negative interactions, such as insults, may increase negative emotions, while positive interactions co-occur and simultaneously increase positive outcomes. Therefore, overly problematizing online risks without taking into account the potential positive effects associated with online engagement may push us towards trying to solve a problem that is not really an epidemic (statistically speaking) or may cause unintentionally, negative side effects, such as isolating teens from online interactions by means of protecting them.

While cyberbullying and explicit content had short-term impacts on emotional health, these effects typically lasted only a week. In the present study, sexual solicitation exposure had no impact on positive emotions, negative emotions, and well-being. While it is possible there was no effect because of a low base rate (sexual solicitation was relatively rare), our results are also consistent with other research that suggests that sexual victimization online is uncommon [78]. Based on the qualitative descriptions teens provided of their risk experiences, many sexual solicitations were consensual. For example, a teen may have used the internet to have a sexual conversation with a romantic partner [80]. Many parents, lawmakers, and advocates have expressed concern over the potential for teens to be sexually victimized online [25]. These experiences did not reflect the typical interactions that parents may be concerned about (e.g., being targeted by a pedophile; [54]). This is consistent with past research, which suggests that the internet has not led to a significant increase in teen sexual victimization [15,78]. Cases of unwanted sexual contact and sexual molestation do have severe consequences for teens. Yet many of the experiences participants described were consensual interactions with another teen. These experiences may have been typical sexual exploration with their peers in an online context, which is normal and healthy for adolescents [62]. Since online sexual interactions can be

safer for teens than face-to-face interactions, these interactions may also be less risky for teens than in-person sexual interactions, and may be a healthy way of exploring their sexuality [116].

As such, our study has important implications for designers, researchers, parents, clinicians, and legislators. We found no evidence that typical online risk exposure had a lasting effect on teens' mood. Yet, problematizing extreme online risks is a prevalent approach taken in news media [78]. Though some researchers have pointed out that these media portrayals of online risks are exaggerated [15,78], many designers also tend to approach adolescent online safety through a lens of risk prevention [96], resulting in solutions that serve to "protect" teens from online risks [25], regardless of the costs. Instead, we may want to turn our attention from trying to prevent any and all online risks to detecting and mitigating the negative effects from more severe online encounters. Overall, our findings imply that typical online risk experiences may not have a lasting, significant impact on teens' mood. Consistent with research on teens' risk experiences online [33,57] and offline [21], our study suggests that it is more useful to examine what factors may prevent teens from bouncing back from risk exposure (e.g., previous psychological difficulties [81]). Such research can help parents and lawmakers understand what teens may need better resources for coping with traumatic events in the digital age.

5.4 Limitations and Areas For Future Research

There are many ways the current study could be expanded. First, the present study did not address *how* or *why* teens' positive emotions increased after risk exposure. Future research should examine the specific techniques teens used to successfully overcome the negative effects of risk exposure. Second, the present study only measured risk exposure and mental health weekly. A future study could provide more insight into how quickly teens recover emotionally from risk exposure by surveying teens once a day or more. This method may also yield more detailed information on the risks teens were exposed to. Finally, while the use of diary methods yielded more data points over a longer period of time than past cross-sectional studies, our study only provided snap-shot of teens' online experiences over the course of two months. This duration was too short to capture long-term effects of teens' online experiences on developmental processes. Future analyses could use true longitudinal approaches, for example, recording teens' online experiences from the point they are first given access to social media in early adolescence to subsequent years of engaged use that occurs through mid- to late-adolescence.

Most teens in our study were able to emotionally recover from online risk exposure. However, future research should examine the personal factors that separate teens who quickly emotionally recover from those who do not. This may help teens and parents better determine how to cope with cyberbullying and explicit content exposure. Some variables that may be of interest include social support, socioeconomic status, and past exposure to risks. In addition, it may be interesting to see if age is related to teens' resilience, as resilience may increase as teens age [40]. Post-hoc analyses indicated that age did not relate to teens' recover experiences. However, future research could use a wider range of ages to see if emotional effects of online risks may decrease (or even disappear) in early adulthood.

6 CONCLUSION

Many parents and legislators are concerned about teens' safety online. In line with these fears, many teens are exposed to online risks. However, the emotional effects of risk exposure were relatively minor. Overall, our results indicate that many teens have built enough resilience to

emotionally cope following common online risks. The effects of online risks are typically short-term, suggesting that most online risks do not have a long-term emotional impact on teens.

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