Dear Diary: Teens Reflect on Their Weekly Online Risk Experiences

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ABSTRACT

In our study, 68 teens spend two months reflecting on their weekly online experiences and report 207 separate risk events involving information breaches, online harassment, sexual solicitations, and exposure to explicit content. We conduct a structured, qualitative analysis to characterize the salient dimensions of their risk experiences, such as severity, level of agency, coping strategies, and whether the teens felt like the situation had been resolved. Overall, we found that teens can potentially benefit from lower risk online situations, which allow them to develop crucial interpersonal skills, such as boundary setting, conflict resolution, and empathy. We can also use the dimensions of risk described in this paper to identify potentially harmful risk trajectories before they become high-risk situations. Our end goal is to find a way to empower and protect teens so that they can benefit from online engagement.

Author Keywords

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

ACM Classification Keywords

K.4.1 [Public Policy Issues]: Ethics, Human safety, Privacy

INTRODUCTION

A recent national Youth Internet Safety Study (YISS) conducted by the Crimes Against Children Research Center of U.S. youth Internet users found that 1 in 11 experience unwanted sexual solicitations, 1 in 9 deal with online harassment, and 1 in 4 are exposed to unwanted sexual materials online [27]. Over half of online sexual solicitations and "an overwhelming majority" of online harassment incidents occur through the use of social networking sites [27]. In a 2015 survey conducted by the Pew Research Center, 92% of teens access the Internet

daily, and 89% have at least one active social media account in which they engage online with others [14]. A number of large, nationally and internationally representative, cross-sectional surveys similar to the YISS have been conducted over the years to understand the prevalence of adolescent online risk exposure, the factors that contribute to risk, how teens generally handle various risky situations, and some of the consequences associated with risk exposure [18, 23, 25, 27]. The primary strength of such large-scale studies is the ability to generalize a nationally representative sample to a particular population, such as adolescents. This body of literature provides invaluable insights and a broad overview of the current state of adolescent online risks.

However, as with all research, there is a "three-horned" problem of generalizability, realism, and precision [24]. One limitation of survey studies is the inability to gain deep and contextualized knowledge of teens' surrounding their online risk experiences, such as the details of what happened. This lack of contextual richness decreases the realism and precision of the results. For instance, most of these studies capture risk events by asking teens if they have "ever" experienced unwanted online situations "in the past year" [18, 22, 27]. Worse, the phone-based methods used for phone interviews necessitates dichotomous (i.e., "Yes" or "No") or at most very brief responses from teens. In these studies, teens must also rely on their long-term memories to recall relevant experiences and may not remember enough to properly contextualize the experiences they report.

To address the inherent limitations of large-scale, cross-sectional survey studies, we employed a smaller, longitudinal research design: A two-month web-based diary study of 68 teens (ages 13-17), who provided first-hand accounts of their weekly online experiences that fell into 4 possible risk categories: information breaches, online harassment, sexual solicitations, and exposure to explicit content. When teens reported experiencing one or more of these risk types in a given week, they were asked to answer a number of open-ended diary questions. During the study, teens reported a total of 207 unique risk events, including 119 reports of exposure to explicit content, 31 information breaches, 29 sexual solicitations, and 28 incidents of online harassment. We qualitatively coded the diary entries based

on key risk dimensions, including risk severity, level of agency (i.e., whether the teen intended for the event to occur), coping strategies, and resolution (i.e., whether the teen felt that the issue had been resolved).

We analyzed the patterns and themes that emerged from our data and constructed new narratives regarding adolescent online safety and risk. First, teens can potentially benefit from being exposed to lower risk online situations, which allow them to develop crucial interpersonal skills, such as boundary setting, conflict resolution, and empathy. Therefore, trying to shield teens from these types of experiences may be detrimental to their overall developmental growth [2]. Second, we may be able to leverage the dimensions of risk described in this paper to identify potentially harmful risk trajectories before they become high-risk situations. Our end goal is to find a way to empower and help teens protect themselves so that they can benefit from engaging online with others.

BACKGROUND

Adolescent Online Safety

Most of the recent work in adolescent online safety has taken a "risk-adverse" approach to online safety, which emphasizes protecting adolescents from being exposed to online risks [36, 38]. Online risks examined in past research include teens becoming the victims of information breaches [18-19]; online harassment or cyberbullying [11, 25]; sexual solicitations [11, 31]; and exposure to pornography, violence, or other explicit content [11, 19-20]. These risks are sometimes studied in concert [20, 27, 36] while more often they are examined individually [23, 25-26, 28]. Literature in this domain is also characterized primarily by cross-sectional studies, reporting perceptions and experiences based on either a snapshot of parents' or adolescents' self-reports using survey methods and/or semi-structured interviews [3, 17, 20-21, 23, 36-39]. This research has been extremely useful in understanding factors that contribute to online risk exposure, highlighting key themes, as well as generalizing the prevalence in which teens are exposed to online risks.

However, as Davis et al. [5] points out, there is a need for the use of more naturalistic methods that afford more "situated" and "authentic" reporting. The rationale for such methods is that we are studying a particularly vulnerable population (i.e., minors) and soliciting information that is highly personal, sensitive, and potentially traumatic for our participants. As such, Davis et al. [5] conducted an in-depth content analysis of 1,094 comments posted on a blog regarding Internet users' experiences with bullying, why they were bullied, and how they coped. For instance, they found that seeking social support was the most common coping strategy for dealing with offline and online bullying [5]. Inspired by this study, we set out to apply a more naturalistic approach for understanding adolescents online risk experiences. The following section summarizes the theoretical foundations of our study design and explains

how our work builds upon and differs from the extant literature.

Risk, Resilience, and Family Systems

Our study frames adolescent online safety as a developmental process of adolescent growth, where the goal is to develop healthy ways for teens to cope with ever-present risks. We are interested in understanding the episodic and in-depth contextual details of adolescent online risk experiences as they occur, as opposed to trying to prevent them. We ground this study in two theoretical frameworks that support our goals: 1) the adolescent resilience framework [34] and 2) family systems theory [4]. The theoretical framework of adolescent resilience was derived and validated by researchers in developmental psychology [34]. It differs from the "risk-adverse" approach often taken in adolescent online safety research by "focusing on the assets and resources that enable adolescents to overcome the negative effects of risk exposure (p. 399)" [34] once it occurs. The outcomes associated with resilience theory are not simply whether or not teens are exposed to risk, but instead whether or not they are able to thrive *in spite* of it [34]. Our previous work in adolescent online safety has leveraged this framework to show how resilience plays a key role in protecting teens from the negative effects of Internet addiction and online risk exposure [36].

We also draw from family systems theory [4], which motivated the design of our study. The family systems movement also arose out of developmental psychology and recognizes that we cannot model family systems as unidirectional and bivariate influence of parents on children. Instead, a family system is more accurately portrayed as a dynamic process where parents and children are iteratively and bidirectionally influencing one another over time [4]. Family systems research is comprised of an emerging set of methods for studying families as a system. Dyadic diary methodologies are often employed by family systems researchers [7, 13, 16]; this is why we chose this particular method for our study. Benefits of diary studies include the ability to study family processes from "a natural setting, such as the home" [4], the flexibility of different mediums that can be used for diary studies (e.g., pen and paper, web, etc.), and the ability to collect event-contingent data over time [4]. To our knowledge, we are the first to employ this method in the context of understanding adolescent online risk experiences. Thus, the key contributions of our research that stand out from the existing work in our domain include:

- A theoretical focus on risk and resilience in the *face* of online risks, as opposed to a lens of risk prevention
- The use of a novel and naturalistic research design (i.e., web-based diary study) that promotes self-reflection and emphasizes "in-situ" reporting over time

- A robust and structured qualitative analysis approach that involved multiple iterations of coding by multiple coders to ensure reliability of our results
- The ability to compare and contrast patterns across four risk types (information breaches, online harassment, sexual solicitations, and exposure to explicit content)
- A framework in which to create risk narratives based on key risk dimensions (risk severity, agency, coping strategies, and resolution)
- Implications that support empowering teens online so that they can more effectively manage their online risk experiences and benefit from online engagement

METHODS

Diary Study Overview

We custom-built a web-based diary portal using PHP, MySQL, and the Qualtrics survey platform API [30]. The diary study consisted of a pre-survey, post-survey, and eight weekly diary entries, which were completed by each participant over an eight-week rolling period. Participants were provided a unique login that brought them to their "Diary Dashboards" (**Figure 1**), where they were able to view their past diary entries and complete their new diary entry for the current week.
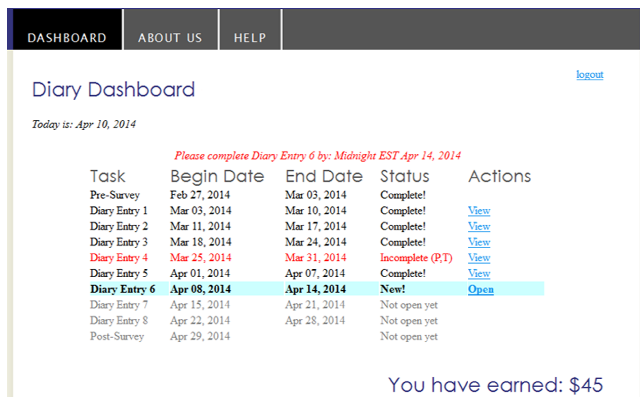

Figure 1: Web-Based Diary Dashboard for Teens

We sent automated weekly email reminders when new diary entries were available or incomplete diary entries (i.e., entries that had been started but not submitted) were about to close. Prior to submission, participants were able to come back to and edit the diary entry for the current week. Each participant had one week to complete a weekly diary entry before it expired.

Informed Consent

Because our participants were minors, they were legally unable to provide informed consent to participate in our diary study. We managed this constraint by requiring a parent or legal guardian to register, provide informed consent, and participate in the study with each teen participant. To ensure the confidentiality of the teen participants, parents were provided a separate login from their teens and asked to report on their own perceptions of risks experienced by their teens each week. It was left up to

the parent and teen whether they discussed their respective diary entries. We notified participants of our role as mandated reporters of child abuse and/or imminent risks. In most cases, this notification was unnecessary because parents or other authorities were already aware of high-risk situations, per the parent and/or teen diary reports. However, in one instance, a teen expressed suicidal thoughts, and we notified the parent immediately.

Diary Study Questions

In the pre- and post-surveys, we measured a number of contextual variables, including demographics and family characteristics. In the weekly diary entries, we asked participants to report on four major types of online risks teens may encounter online in a given week (**Table 1**). These categories were derived from a previous review of the literature and represent the most common categories of risk from the adolescent online safety literature [38]:

Table 1: Four Main Risk Categories

Risk Type	Definition
Information Breaches (INFO)	Personal information or photos being shared or used online without teens' permission or those shared by teen and later regretted.
Online Harassment (CYBY)	Cyberbullying and any other or negative online interactions that may make teens feel threatened, embarrassed, or unsafe.
Sexual Solicitations (SEX)	Sexting or any requests received by a stranger, acquaintance, or friend that is sexual in nature.
Exposure to Explicit Content (EXPL)	Voluntary or accidental viewing of pornographic (naked photos or videos of people having sex), extremely violent, or deviant (immoral or disturbing) online content.

Appendix A, Table 4 provides the exact words we used to prompt for reports relating to each risk type. We minimized the implied severity of the risk categories by relabeling them in the report to "information sharing," "online interactions," "online flirtations," and "online content," respectively. Whenever a teen reported one of the risk types, they answered 5 follow-up questions: 1) What happened? 2) Did you intend for this event to happen? Why or why not? 3) How did it make you feel? 4) What actions did you take when this happened? Did they help? 5) Do you feel like this was resolved? If so, how was it resolved?

A teen could submit zero (no risks) to four (all four risk types) reports each week, for a total of eight weeks of risk reports with maximum of 32 reports over the course of the study. Likert scale measures were also included in the weekly diary reports but these indicators are outside of the scope of the qualitative analysis presented in this paper. Similarly, parental responses were not included in this analysis but will be as part of our future research.

Recruitment

Participation in the diary study was incentivized with Amazon.com or Walmart gift cards. Parent and teen participants could jointly earn up to a $75 gift card based on their tiered level of participation in the diary study. Gift cards were mailed to participants at their home addresses after diary responses were verified. An initial gift card of $25 was sent after completion of the pre-survey. We sent a second gift card with the remaining balance due (ranging from $0 to $50 based on number of weekly diary entries submitted) after participants completed their post-surveys. Parents and teens had to both complete at least four of the eight weekly diary entries to get compensation beyond the initial pre-survey gift card. Diary reports were considered complete if participants accessed the report and submitted it with valid values, even if no risk events were reported.

We began recruitment during January 2014 and completed data collection August 2014. We first attempted to recruit parents and teens through public high schools across the U.S. but made little headway. Next, we reached out via phone calls and emails to public libraries, YMCAs, non-profit organizations, government-funded children and youth service organizations, family-based community centers, churches, and after-school programs. We also sent recruitment mailings though a contact database of parents based on birth announcements from the local vicinity, which is maintained by our university's psychology department. The majority of our participants were recruited from the state of Pennsylvania (74%); however, we had representation within 12 other U.S. states, including New York, South Dakota, and Florida.

Data Analysis Approach

We carried out a structured, qualitative data analysis to summarize and interpret the diary data we collected. Our analysis approach drew from related literature and the theoretical underpinnings of our study design, with the primary goal being the identification and analysis of central risk dimensions. The four key risk dimensions we identified and coded included: 1) *Risk Severity* - defined as the level of risk posed to the teen. 2) *Agency* - the extent to which the teen intended for the event to occur. 3) *Coping Strategies* - how the teen handled the situation. 4) *Resolution* - whether the teen felt that the issue was resolved by the time they made their weekly report.

The first author worked with 5 undergraduate assistants to code the data. The unit of analysis was an individual diary entry, which included all of the open-ended questions related to a particular risk event. Often one of the questions about the risk events were inherently mapped to a particular risk dimension (e.g., "*did you intend for this event to happen? Why or why not?*" was usually coded as agency). In some cases, additional information provided from the other open-ended diary prompts provided additional insights on how best to code the diary entry as a whole. The coders manually read each diary entry and coded the data

using Microsoft Excel, employing the use of built-in data filters. Codes for all dimensions were considered mutually exclusive, except for coping, where multiple codes were allowed and double coded. Due to the complex nature of the data set, multiple iterations of data coding and re-operationalization of the codes were necessary. For each iteration of data coding, two coders separately coded (and recoded) 100% the data (i.e., all open-ended diary reports) and inter-rater reliability (IRR) was calculated using Cohen's kappa. **Table 2** summarizes the final IRR metrics for the four dimensions of risk, as well as the number of iterations of coding that were necessary to ensure the robustness of our analysis. These IRR values were all above the recommended 0.80 threshold for Cohen's kappa [8, 33].

Table 2: Key Dimensions and Inter-Rater Reliability Metrics

Dimension	Cohen's κ	Iterations	Codes
Risk Severity	0.935	4	*Low, Medium, High*
Agency	0.843	2	*Victim, Accidental, Willing, Intentional*
Coping Strategy	0.885	2	*Fix, Confront, Communicate, Exit, Ignore, Pursue*
Resolution	0.882	2	*Irrelevant, Yes, Unsure, No*

The first author reviewed conflicting codes to resolve discrepancies and merge unnecessary codes. With four risk types, three levels of risk severity, four levels of agency, six coping strategies, and four possible resolutions, we had a total of 1,152 unique and plausible ways in which we could characterize each online risk experience. Excel pivot tables were used to uncover patterns between the different types and dimensions of risk, identify interesting case studies, pull out illustrative quotes, and identify the key emergent themes presented in this paper.

RESULTS

Participants

95 parent-teen pairs registered for our diary study and completed the process of informed consent. 72 pairs completed the pre-survey (which took approximately 40 minutes) and were invited to continue. Four pairs were removed from the study because they submitted no weekly risk events and did not complete the diary study in its entirety (i.e., through the post-survey). Therefore, 68 teens are included in the analysis for this paper. Of these 68 teens, 56 (82.4%) reported at least one risk event.

42 females and 26 males participated in our study. The age distribution of teens was as follows: 13 (15%), 14 (31%),

15 (24%), 16 (19%), and 17 (12%). The majority identified themselves as Caucasian; other ethnicities included African-American (15%), Hispanic (4%), Asian (3%), and Other (6%). The parent or legal guardian of our teen participants included 60 mothers, 7 fathers, and 1 grandmother. 85% of these parents or legal guardians were between the ages of 35 and 54 with 9% being younger and 6% older. 60% of our teen participants came from two-parent households; others resided with their mother only (21%), mother and step-parent (15%), or had other living arrangements. The annual household income of these families ranged from less than $30,000 (10%), $30,001-$60,000 (34%), $60,001-$100,000 (23%), $100,001-$150,000 (21%), to over $150,000 (7%).

Risk Reports by Type

We collected a total of 207 risk reports. On average, teens reported 3.04 risk events during the study with a standard deviation of 3.33 events, a median of 2 events, and a range of 0 to 15 risk reports. Reports were automatically categorized by risk type based on the prompts teens responded to each week (See **Appendix A**, **Table 4**). Subsequently, we reviewed all diary entries to confirm that diary entries reflected the risk identified by the teen. In the process, we reclassified 17 entries (8%). The matrix shown in **Table 3** shows frequencies for risk types reported by teens (columns post-fixed with "T" for teen) and the final set after some reclassifications (rows post-fixed with "R" for researcher) had been made by the research team.

Table 3: Distributions and Reclassification of Risk Types

Counts on the diagonal represent risks that remained in the risk category originally specified by teens.

	INFO-T	CYBY-T	SEX-T	EXPL-T	Total-R
INFO-R	30	1	0	0	31
CYBY-R	7	21	0	0	28
SEX-R	4	0	25	0	29
EXPL-R	1	1	3	114	119
Total-T	42	23	28	114	207

The most common reclassification (11 instances) was from information breaches (INFO) to online harassment (CYBY) or sexual solicitations (SEX). The rationale was that even though the risk report involved information sharing (often a photo), the primary focus of the report was the negative consequences and interactions that occurred after the information was shared.

"I posted a photograph of myself online to a website named tumblr. A 'friend' made a comment about my hair looking shitty, and meant it." -522, 15-year-old male

In a few instances, teens reported viewing sexually explicit content (EXPL) as sexual solicitations (SEX), even though their reports made it obvious that the exposure was accidental, not targeted at them specifically.

"I was using my twitter one day, and one of the accounts I follow re-tweeted a sexual picture." -570, 14-year-old male

The researchers' reclassification of risks by type will be used for the remainder of the results reported in this paper. Of the 68 teen participants, 74% percent of our participants made at least one report of exposure to explicit content, 15% reported online harassment, 24% information breaches, and 28% at least one sexual solicitation. Overall, teens were reported being exposed to explicit content 2.5 times more frequently than any of the three other risk types. This may be because of the wide variety of sub-categories of explicit content (e.g., sexual, violent, illegal, deviant, self-harm, etc.). Also, it could be because it is the only risk category that affords a "broadcast" mode where teens are not personally targeted.

Patterns of Online Risk Experiences

In **Appendix A**, **Table 5**, we summarize the percentages of each of our codes across all of the risk dimensions for each risk type. This representation allows us to identify patterns for each unique type of risk experience, as well as the ability to compare across the four different risk types. In the following sections, we summarize our high-level findings within each of the dimensions of risk.

Risk Severity

Risk severity measured the level of risk posed to teens from a lens of both objective and subjective risk. For example, *Low* risk was operationalized as little or no immediate or long-term threat posed to the teen with little or no emotional response from the teen. Comparing across risk types, information breaches had the most (33%) risk reports that fell into this category:

"I took an embarrassing selfie on my best friends phone and she posted it as her #wcw on instagram. Nothing bad, innocent really." -516, 14-year-old female

Medium risk included diary entries that implied a moderate threat to the teen or made the teen uncomfortable in some way. It also included reports where the teen may have been asked to engage in risky behaviors but was able to simply decline. Across all risk types, this was the most common level of risk severity with 66-77% of all risk reports coded as Medium. For example, the same teen as above reported the following medium risk sexual solicitation:

"One of my old friends asked for picutres and I said no… I didn't want to send them, and I didn't give him any idea that I was going to. It was random." -516, 14-year-old female

High-risk reports included those where a teen was faced with an immediate threat, engaged in under-aged sexual exchanges, intended to perform illegal activities, repeatedly pursued unhealthy patterns of risk behavior, and/or became extremely distraught because of the online experience. For exposure to explicit content, 12% of the risk reports fell into this category of risk severity; these reports came from four of the teens. Two male teens frequently sought out

pornography; one male was researching marijuana intoxication levels, and one female saw explicit content that encouraged her to commit self-harm:

"I have seen youtube videos of Challenges that people do and they can be fun to try… Like cinnamon challenge, ice cube challenge, erasor challenge and lots more… When my mom saw the mark on my hand she was upset. I used to cut myself, and she gets upset when I hurt myself. She cries and talks to me about treating my body better." -560, 15-year-old female

None of the information breaches reports were classified as high-risk, most likely because lower risk information sharing tended to escalate into more risky interactions, such as online harassment or solicitations. Eight percent of the online harassment reports were considered high-risk and involved three teens. The cyberbullying of teen 529, a 14-year-old female, was particularly worrisome and was the one situation where we exercised the mandated reporting protocol. She sent a boy a naked picture of herself at his request; the boy proceeded to share the picture with other teens at her school; as a result, she was harassed online and expressed suicidal thoughts:

"People path and kik kept calling me a thot and a liar… It made me want to kill myself✂<?" -529, 14-year-old female

Sexual solicitations represented the largest percentage of high-risk reports (31%), relative to the other risk types. Five teens from our sample engaged in under-age sexual encounters. Three of the teens engaged in sexting (i.e., sending naked pictures or sexual messages) and/or offline sexual activities with a romantic interest or friend. Teen 574, a 14-year-old female, was solicited by (and almost complied with) a stranger posing as a modeling agency in an attempt to get nude photos. Teen 560, met an adult acquaintance offline who gave her alcohol and raped her:

"I asked someone to meet up with me. it was a bad choice, it was unsafe. he was unsafe… I guess I was looking for attention… mom cried / went to police and da office / they took my phone and ipad to look at." -560, 15-year-old female

Agency

Agency represented teens' level of involvement in the risk experience. Teens were considered *victims* if they were a direct target of the risk occurrence and had no intention of being involved. This was the most common level of agency for information breaches (80%), online harassment (86%), and sexual solicitations (43%). However, victimization was not applicable for exposure to explicit content because teens were not specifically being targeted when the content was shared. In contrast, explicit content had the largest percentage (66%) of *accidental* risk occurrences. Teens often (58% of the time) accidentally encountered explicit content that was posted via social media, while only 10% of the accidental exposure was from pop-up ads and other

websites, and 31% of the explicit content reports were unclear as to how teens were exposed.

"On social networking I saw pornographic content and violent content. I didn't see anything that made me uncomfortable, I saw things that I was not surprised to see on Twitter." -505, 16-year-old male

Sexual solicitations had the largest percentage (36%) of *willing* reports where teens did not necessarily seek out the online experiences, but they were agreeable to it once it had occurred.

"A friend of mine was feeling particularly sexual, and it showed in her texts. It's not like I planned it, but I certainly wasn't opposed to it." -583, 16-year-old male

Finally, *intentional* risk experiences were defined as those that teens sought out. Exposure to explicit content (22%) and sexual solicitations (16%) had the highest relative percentages of intentional risk-seeking. These included teens who sought out pornography and violence, as well as teens who actively engaged in sexual activities with other teens. For these particular risk types, intentional risk-seeking tended to correlate with high-risk behaviors. To illustrate the pattern that emerged between risk severity and agency, we present excerpts from teen 522's diary as an in-depth case study of a particularly "high-risk" teen. **Teen 522**, a 15-year-old male, reported intentionally seeking out violence and pornography 7 out of the 8 weeks he was enrolled in the study. This teen also made 5 weekly reports of willing sexual interactions, involving online and offline sexual encounters with his boyfriend, and 3 reports of being the victim of online harassment:

Week 1: *"I viewed some pornographic content, and some excessive violence. I intended for both to happen, hear me out. I'm a 15 year old boy, and the violence was from a video game I was playing with a friend."*

"The same person I mentioned earlier harassed me over the aforementioned website, tumblr. For at least 30 minutes to an hour, they made rude, disgusting, annoying comments about me and my boyfriend."

Week 2: *"I viewed explicit material… I'm a 15 year old male, hormones and whatnot, man."*

Week 3: *"The boyfriend wanted to 'chat,' so I obliged him."*

Week 4: *"The pornographic content made me feel happy, isn't that essentially why we masturbate? Although the video games didn't do much for my boredom, so I stayed that way."*

Week 8: *"I was in a game of Dota and some dude started making rude and homophobic comments about me/ my voice."*

Coping Strategies

Coping strategies represented the actions the teen took after the risk event, in order to deal with the situation. ***Ignoring*** was the most common strategy for exposure to explicit content, online harassment, and sexual solicitations, ranging between 33-48% of reports in the respective risk categories. Of the risk types, ignoring was the highest for explicit content, likely because teens were most often exposed accidentally, expected to see it, and felt like they could not really do much to avoid exposure. Therefore, teens often ignored the content or simply ***exited*** (16% of explicit content reports) the site in which they were exposed.

"Oh, hon. Its the *internet*. Half of it is porn to start with. The other half is contaminated by violent material, illegal material, depression, anxiety, and morally dubious events by nature… It would really be a miracle if you managed to be on the internet without any exposure to it." -551, 15-year-old female

However, ignoring was less prevalent for information breaches (21%); instead, teens were more apt (50%) to ***confront*** the person who caused the breach or ***fix*** (21%) it themselves. This may be because 77% of information sharing reports involved friends or family members posting unwanted photos on social media. In these cases, teens often took actions, such as untagging the photo, or asking the offender to not post or remove it.

"A friend of mine shared a photo of me where I did not think I looked very good. I asked her to take it down and she did but a lot of people liked it and I felt self conscious." -550, 16-year-old female

"I either untag myself in the photo or I ask that it be removed. Both methods help." -531, 17-year-old female

Teens were most likely (33%) to ***communicate*** with someone else regarding an online harassment incident and least likely (5%) to communicate about exposure to explicit content. For online harassment, 77% of the reports said that teens told their mothers, 11% their best friend, and 11% reported it to the social media website.

"Someone spread a rumor that I am gay… Told mom… She talked with me about it and fixed the problem." -575, 13-year-old female

Often, when teens sought out risks intentionally, they continued to ***pursue*** the experience instead of mitigating it. This was the case for 16% of the explicit content reports and 23% of the sexual solicitation reports.

"I watched some violent movies and I played some violent video games. I took the action of turning down the volume so that others would not be destracted with my noises." -544, 15-year-old male

Resolution

Resolution was coded based on the teens' perception of whether the event that they reported was resolved by the time they made their weekly report. Across all risk categories, teens most often (38-71%) reported "***yes***" that the situation had been resolved. Exposure to explicit content was the least likely risk type to find a resolution, because 22% of reports said that resolution was ***irrelevant.*** The main rationale was that the exposure was not a big deal; therefore, nothing needed to be resolved. The quote below shows an emergent risk pattern of ***accidental*** (agency) exposure to ***low*** risk (risk severity) explicit content, where the teen ***ignored*** (coping strategy) the exposure, and felt the experience was insignificant or ***irrelevant*** (resolution).

"There were a couple instances where I came across pictures or videos on my facebook newsfeed or iFunny app that were sexual in nature… I just continued scrolling… I don't think the problem was significant enough to require any significant resolution." -127, 17-year-old male

In contrast, online harassment had no reports that were coded as irrelevant and produced the highest number (14%) of "***unsure***" reports across the risk categories.

"I dont know will have to wait and see if the person does it again" -553, 13-year-old female

Finally, sexual solicitations had the lowest number (8%) of unresolved (i.e., "***no***") reports across the categories and explicit content reports had the highest at 22% of reports. For sexual solicitations, this may be because the teens either intentionally pursued the experience or were willing participants, so they felt there was no problem. Otherwise, in medium to high-risk situations, the teens sought help and their parents somehow helped resolve the problem. For explicit content, teens often felt they did not intend for the event to happen, were unable to avoid it, and there was little or nothing they could do to fix it.

"No because I can't stop ads from popping up." -530, 16-year-old female

"It was not resolved because the video is still floating everywhere around the internet." -531, 17-year-old female

In some cases, teens who reported witnessing explicit content involving self-harm tried to confront the person to help them. Ultimately, however, they realized that their efforts were not enough to resolve the problem.

"someone posted an instagram picture of their scars… I commented 'stay strong…' [Resolved?] *no, one comment will not save her life."* -527, 13-year-old female

DISCUSSION

In this section, we discuss the emerging themes and theoretical implications of our research by initiating new risk narratives about positive and negative aspects of adolescent online safety. We also raise several important philosophical questions about online risk exposure. Then, we discuss the practical design implications of our study.

We close by presenting our research limitations and directions for future research.

Theoretical Implications from Emergent Themes

Emphasizing the Positives

For the most part, teens' online risk experiences appeared comparable to the types of offline risks teens experience in their day-to-day lives. An overwhelming 87% of the risks reported during the diary study were coded as low to medium risk severity, posing only minimal to moderate risk or discomfort to teens. In many cases, the experience gave teens the opportunity to build important social skills, such as the ability to set boundaries, problem-solve, and display empathy. For example, teens actively reached out to try to help others they saw committing self-harm. 84% of the risk reports suggested that teens did *not* intentionally seek out online risk experiences. Often when teens were solicited, they refused to engage in risky online behaviors, resisting peer pressure and online advances made by strangers.

Even though 40% of the risk reports indicated that teens often ignored the situation, 47% took active measures to confront the person who caused the issue, removed themselves from unwanted situations, fixed it themselves, or actively sought help. Finally, 49% of the reports were considered resolved by the time the teen recorded their diary entries with another 17% of the reports considered to be so insignificant to the teens that they felt no resolution was required. Obviously, such positive online risk narratives are not candidates for national headlines. Regardless, emphasizing the positive aspects and potential benefits of adolescent online engagement is a crucial perspective that needs to become part of the mainstream. Positive messages like these (in contrast to fear-mongering), encourage teens' social development, resilience, and online empowerment.

Addressing Problematic Risk Narratives

While our diary study did capture some concerning high-risk events (13% of all reports), these were by far the exception instead of the rule. Only eight teens out of 68 reported high-risk events during the diary study, as described earlier in the Risk Severity section. Fortunately, in most cases, parents were involved in mediating these high-risk situations. Never-the-less, these are concerning risk narratives that we must find a way to prevent before they escalate to such levels of risk severity. By examining risk level with the other dimensions of online risk, we are better able to pinpoint problematic risk trajectories in order to proactively address them. For instance, certain risk dimensions signal concern and may be used to prompt action. For instance, special care should be given to teens who are intentionally seeking out risks, being repeatedly victimized by others, or those who are unable to effectively cope and resolve lower to medium risk situations. These teens may need help building resilience [34, 36] to online risks by either engaging in lower risk online situations (with the active mediation from their parents [37]) so that they

can learn by doing [9], by finding healthier ways to cope with risk experiences, or by managing to avoid risky online situations on their own.

Raising Important (and Tough) Questions

We also need to pose important questions about the grey areas of adolescent online safety and risk. For instance, a number of teens appeared to be desensitized to their online risk experiences, reporting that these were "no big deal" or even enjoyable. This display of desensitization was especially true for exposure to explicit content. On one hand, it is good that teens did not seem to be adversely affected by the omnipresent explicit content, but on the other, over de-sensitization may lead to problematic or deviant behaviors in the future. If one thinks about phobias, the point of de-sensitization therapy is not to make someone, for example, enjoy insects or dangerous heights, and seek them out. Instead, it is to allow individuals to function in a world that contains insects and heights that they may encounter. Analogously, the idea for us is not to encourage teens to become absorbed with pornography (for instance), but rather to help them be resilient to the fact that it does and will exist, and help them not to become anxious or warped because they see such content.

Another controversial issue is the amount and types of information teens are sharing online. A number of studies have approached adolescent online safety from the perspective of information privacy and disclosure, implying that fewer disclosures would help alleviate safety concerns [6, 12, 40]. Our previous work has shown that information sharing starts a risk-escalation process that goes from sharing basic online information, to sharing more personal information, to engaging in riskier online interactions [9]. This study confirms this escalation pattern anecdotally, for instance, by the number of reports where teens regretted posting photos because of subsequent negative reactions from "friends." However, in-and-of-itself teens sharing information online is not a bad thing, and trying to tell them they cannot do so is simply unrealistic. On the contrary, without these learning experiences, teens may not have gained valuable knowledge and skills about appropriate information sharing for their future interactions.

Our emphasis on resilience [34] over prevention may also be considered controversial. Our stance is that teens will inevitably be exposed to some level of online risk; thus, they need to learn how to deal with it before the risk becomes too great. Resilience theory suggests that lower level risk experiences may actually help inoculate teens from higher risk situations by teaching them to avoid or cope with future risk experiences [34]. Our work serves to more clearly articulate *how* lower level online risks experiences may also help teens develop necessary interpersonal skills and coping strategies in online contexts. Unlike our study, most adolescent online safety studies measure risk experiences at higher risk thresholds. Such an approach can create false, negative impressions and

generate fear associated with teens engaging in potentially beneficial online activities. This may result in more restrictive solutions for protecting teens online, like as trying to curtail lower risk behaviors such as information sharing. Yet, developmental psychology reminds us that some level of risk-taking and experiential learning is necessary and normal aspects of adolescent developmental growth [2]. Thus, we need to strike a healthy balance between giving teens the opportunity to learn how to safely engage online through experiencing some risk and protecting them from high-risk situations.

Implications for Design

Empowering Teens to be Resilient to Online Risks

As designers, this means that we need to make a paradigm shift from developing technologies that protect teens to ones that *empower* them to protect themselves. One approach would be to intelligently detect concerning risk patterns and "nudge" teens in the "right direction" by providing subtle, paternalistic cues that support positive behaviors [35]. For example, instead of blocking teens from seeking out sexual encounters, viewing explicit content, or engaging in online harassment, intelligent designs could be used to detect these behaviors to nudge teens to reconsider their behavior and develop appropriate impulse control. For example, a 15-year-old girl recently developed a mobile application called ReThink that encourages teens to think twice before they send a potentially harmful message [1]. If trained researchers, psychologists, and designers collaborated to develop similar solutions, technology could serve as a teacher as well as a tool.

Another approach would be to build interfaces that directly promote positive values and behaviors, such as interpersonal communication and conflict resolution. For instance, unwanted photo sharing by "friends" was often unintentional but a common concern among our teen participants. Recent work on collaborative privacy management [10, 32], could be leveraged in the design of social media sites so that teens can proactively signal their privacy preferences to others, negotiate boundary conflicts [29], and develop respect for the personal privacy preferences of others. Such designs would promote more positive interactions between teens and facilitate resolution when information sharing conflicts occur.

Encouraging Social Media Sites to Take Responsibility

Finally, we urge social media sites to accept more responsibility for empowering and protecting teens. Even though most social media sites have terms of service that promote adolescent online safety, the reality is that more needs to be done to actively enforce such policies. Similar to other studies [27], at least 54% of the risk reports in our study were explicitly related to teens' interactions through social media (e.g., Facebook, Tumbler, Instagram, etc.). In most cases, teens were subjected to unwanted online experiences because of "friends" within their social networks. Unfortunately, researchers and designers cannot build solutions for these problems without first building partnerships with the social media giants, so that we can have access to teen users, deeply understand the problem space, design solutions, and test viable interventions to effectively change the status quo. Our hope is that social media providers are open to academic partnerships and that a coalition of researchers from academia and industry can come together to work on solutions that allow teens to benefit from positively engaging with others online.

Limitations and Future Research

Our sample was not nationally representative enough to generalize our results to all U.S. teens. Therefore, we urge readers to *not* use the descriptive percentages for how often teens in our sample reported the various risk types as a broad generalization of teen online risk prevalence. Instead, our goal was to provide insight into the nuances of teens' day-to-day online risk experiences and to better understand their unique risk narratives. Using the diary study approach from family systems theory [13] gave us richer insights of this nature. In our future work, we plan to extend the family systems approach from merely informing our design to also guiding our analysis; specifically, we plan to compare and contrast the weekly, dyadic-level diary entries made by teens and their parents to understand family communication about online risk experiences and the bi-directional influences [4] parents and teens have on one another regarding these experiences.

CONCLUSION

When talking about adolescent online safety, we often construct a logical narrative about how teens are early and eager adopters of the Internet, who are inherently more risk-seeking than young children and adults [15, 39], and therefore, they need our protection from online risk exposure. However, the results from our diary study challenge these underlying assumptions and suggest new narratives regarding adolescent online safety. For instance, the majority of teens did not intentionally seek out the risks they experienced online. Further, teens may actually benefit from lower risk online exposure, as we found numerous accounts of teens being able to ignore or proactively resolve these types of online situations. Overall, our main goal moving forward should be to find ways to empower teens so they can effectively protect themselves from high-risk online situations and to proactively identify teens who may need extra help.

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Table 4: Diary Risk Reporting Survey Instrument

Risk Categories and Items	% Teens
Information Breaches as "Information Sharing" (INFO)	**24%**
Someone else shared your information or a photo of you that you didn't want them to post.	19%
You shared personal information or a photo of yourself that you later regretted sharing.	12%
You have been the victim of what you felt was an improper invasion of privacy or misuse of your information in some other way.	9%
Online Harassment as "Social Interactions"(CYBY)	**15%**
You were treated in a hurtful or nasty way online (cyberbullied).	12%
Someone made rude or mean comments about you or threatened you in some way online.	12%
Someone tried to spread a mean rumor about you online.	9%
There are other types of negative and unwanted interactions that hurt your feelings, and made you feel embarrassed, or unsafe.	15%
Sexual Solicitations as "Online Flirtations" (SEX)	**28%**
Someone you know sent you a sexual message ("Sexting").	10%
Someone you know asked you to send them a sexual message, revealing, or naked photo of yourself.	13%
A stranger asked you to meet them offline.	6%
There are other types of sexually suggestive interactions that made you feel even a little uncomfortable.	12%
Exposure to Explicit Content as "Online Content"(EXPL)	**74%**
You saw online stories, images or videos that were pornographic (naked or sexual in nature).	46%
You saw online stories, images or videos that contained excessive violence.	52%
You saw online stories, images or videos of illegal or deviant (morally questionable) behavior.	43%
You saw online content that promoted self-harm (such as eating disorders, cutting, suicide, etc.).	38%
You saw other online content that made you feel uncomfortable some way.	40%

Table 5: Standardized Percentages of Risk Reports by Risk Dimensions

Percentages are standardized to 100% for each column and shown in bold to denote the highest values for each risk type.

	Exposure to Explicit Content (EXPL)	Information Breaches (INFO)	Online Harassment (CYBY)	Sexual Solicitations (SEX)
Risk Reports	57%	15%	14%	14%
Risk Severity	Low: 18% **Med: 70%** High: 12%	Low: 33% **Med: 67%** High: N/A	Low: 15% **Med: 77%** High: 8%	Low: 3% **Med: 66%** High: 31%
Agency	Victim: N/A **Accidental: 66%** Willing: 12% Intentional: 22%	**Victim: 80%** Accidental: N/A Willing: 13% Intentional: 7%	**Victim: 86%** Accidental: 7% Willing: 7% Intentional: N/A	**Victim: 43%** Accidental: 7% **Willing: 36%** Intentional: 14%
Coping Strategies	Fix: 10% Confront: 5% Communicate: 5% Exit: 16% **Ignore: 48%** Pursue: 16%	Fix: 21% **Confront: 50%** Communicate: 7% Exit: N/A Ignore: 21% Pursue: N/A	Fix: 8% Confront: 25% **Communicate: 33%** Exit: N/A **Ignore: 33%** Pursue: N/A	Fix: 8% Confront: 15% Communicate: 15% Exit: N/A **Ignore: 38%** **Pursue: 23%**
Resolution	Irrelevant: 22% **Yes: 38%** Unsure: 7% **No: 33%**	Irrelevant: 7% **Yes: 64%** Unsure: N/A No: 29%	Irrelevant: N/A **Yes: 71%** Unsure: 14% No: 14%	Irrelevant: 15% **Yes: 69%** Unsure: 8% No: 8%

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