'Just-in-Time' Parenting: A Two-Month Examination of the Bi-directional Influences Between Parental Mediation and Adolescent Online Risk Exposure

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Abstract. Parental mediation is a key factor that influences adolescents' exposure to online risk. Yet, research on this topic has mostly been cross-sectional and correlative, not exploring whether the relationship between parental mediation and adolescent online risk exposure could be bi-directional, where teens' risk exposure influences parenting practices. To address this gap, we conducted an eight week, repeated measures web-based diary study with 68 adolescents (aged 13–17) and their parents to examine the relationships between three parental mediation strategies (active mediation, monitoring, and restriction) and three adolescent online risk types (explicit content, sexual solicitations, and online harassment) teens reported encountering online. Overall, parents and teens had significantly different perceptions regarding parental mediation, which yielded some consistent and conflicting results. Parents and teens agreed that *parental restriction* significantly increased the week in which the teen encountered all three risk types, and *active mediation* increased during the week in which the teen encountered online harassment. Parents and teens also consistently reported that *restriction* significantly decreased the week after an online harassment incident. Overall, we found that parental mediation and teen online risk exposure were most often significantly correlated in the same week, suggesting parenting occurred 'just-in-time,' rather than parents and teens' behaviors bi-directionally influencing one another significantly from week-to-week. Our findings provide new insights into parent-teen perspectives on parental mediation and highlight the bi-directional relationship of parental mediation and online risk. We offer recommendations to facilitate 'just in time' parenting and provide teens with the necessary support to help keep them safe online.

Keywords: Adolescent online safety · Parental mediation · Online risks · Online harassment · Sexual solicitations · Explicit content

1 Introduction

Despite the numerous benefits the internet and social networking sites (SNS) provide to teens, evidence shows teens are still susceptible to online risks [1]. For instance, a recent study by Pew Research Center found online harassment to be a serious issue for 90% of the teens in the US, and almost 59% of these teens previously experienced some form of online risk [2]. Consequently, adolescent online safety has been an increasingly important topic in the HCI community, studying teens' online wellbeing from different perspectives [3, 4]. Meanwhile, parental mediation is considered within the literature to be an effective strategy to ensuring teens' online safety [5, 6]. As a result, the influence of parental mediation on teens' online activity has been studied extensively; with respect to different parenting styles [7, 8], parental digital literacy [9, 10], and cross-national differences [11]. However, this existing literature provides conflicting results. For example, Lwin et al. found parental mediation increases teens' risk-seeking behaviors [12]; yet, Sorbring and Lundin found parental mediation to have no significant effects on teens' exposure to online risks [13]. Given these conflicting results, Wisniewski et al. emphasized the importance of moving beyond cross-sectional studies to conduct research that examines both parent and teen behaviors, to get a better understanding of parental mediation in relation to teens' online risk experiences [14].

To address this gap, we conducted an eight-week repeated measures web-based diary study with adolescents (aged 13–17) and their parents to understand the dynamics of parent-teen influences with respect to online risk experiences. We took a family systems approach, which posits that the influences within the parent-teen relationship can be bi-directional [15], implying that parents and teens can influence one another in regards to parental mediation strategies and teens' online risk experiences. This approach is unique as it steps away from the traditional mode of studying teen online risks exposure as a unidirectional outcome of parental mediation. The over-arching research questions for this study were:

- **RQ1:** *How do parental mediation strategies influence teens' exposure to online risks in the subsequent week?*
- **RQ2:** *How does teens' online risk exposure influence parental mediation strategies in the subsequent week?*
- **RQ3**: *In the same week, how do teens' online risk exposure and parental mediation influence one another?*

To answer these questions, we asked teens to report weekly on their online risks, specifically these three types: exposure to explicit content, sexual solicitations and online harassment, [14]. We also asked teens and parents to report on parental mediation strategies each week. We focused on three parental mediation types defined by Valkenburg; including ***active mediation*** – involving conversation and discussion between the parent and teen regarding online activity, ***restrictive mediation*** - involving rules and limits on the teens' online activity, and ***monitoring*** – involving surveillance and checking of the teen's online activity [16]. To analyze participants' responses, we used cross-lagged panel modeling and conducted the analysis based on teen responses only, and the joint responses of parents (regarding their mediation each week) and teens (regarding their

weekly exposure to online risks). Our work makes important contributions to adolescent online safety literature by applying the theoretical framework of family systems to identify bi-directional influences between parents and teens with respect to teens' online risk exposure. We move beyond cross-sectional and individual level analyses by conducting repeated measures analysis on dyadic data. Based on the joint perspective of parents and teens, we found that teens' risk exposure significantly influences parental mediation (parents tend to support teens after online risk exposure by reducing restrictions). Our paper introduces important comparisons between parent-teen perceptions on parental mediation and provides recommendations for researchers that can facilitate parents' timely response to teens' risk exposure in the same week.

2 Background

In the sections below, we synthesize the literature related to adolescent online safety and risks, along with research on parental mediation in relation to teens' online risks.

2.1 Adolescent Online Safety and Risks

To maximize the benefits and mitigate the risks associated with teens use of technology use and online engagement, adolescents' online safety has become an important area of interest within the HCI community. Adolescent online safety researchers have studied different perspectives of teens online behaviors and safety; ranging from teens use of mobile devices [1] and social media [3] to the involvement of parental controls [17] and mediation of teens' online activity [9]. More recent approaches to online safety have focused on empirical methods that can empower youth and develop effective adolescent online safety, such as involving teens in design-based activities [18], interviews [19], participatory design [4], and co-mediation with parents [20].

In studying adolescent online safety, the types of risks faced by teens have been operationalized in several ways. For example, Livingstone et al. conducted a survey study on the online safety of European children which divided online risks into three broad groups of content, contact, and conduct related risks [11]. A different study by Wisniewski et al. extended this approach by categorizing online risks based on risk events, including harassment, solicitations, exposure, informational, and ethical risks [14]. These categories were later refined into four major types of risks; online harassment, sexual solicitations, exposure to explicit content, and information breaches [21]. We build upon these risk types to get an authentic understanding of the risks encountered by teens. The next section synthesizes the literature on parent-teen influences regarding online safety and identifies the gaps in existing research.

2.2 Parental Mediation Influence on Adolescent Online Risk Exposure

Adolescents' use of technology has been widely studied in relation to parental me issues between parents and teens regarding technology mediation in the home [22, 23]. A commonality among these works is that they largely studied the effects of parental mediation strategies, considering parental mediation as a predictor for adolescent online

risks. For example, Yardi et al. [24] found that parents struggled with mediating their teen's social media use and identified tensions between balancing parental authority and teen autonomy. Similarly, Blackwell et al. found that parents underestimate teens' online activity, while teens often felt that parental mediation invaded their privacy [25]. Wisniewski et al. found that direct interventions may reduce teens' exposure to online risks but could be most beneficial for teens when combined with active mediation [26]. Subsequent research by Hiniker et al. [27] found that restrictive mediation is more impactful when the rules limit certain technologies completely (e.g., no Snapchat), than restricting technology use in context-specific situations (e.g., no phone at the dinner table). Yet, effects in the opposite direction remain under-studied, as the influence of teens' online risk exposure on parental mediation has rarely been investigated.

Moreover, the current literature on the impact of parental mediation on teens online well-being and safety [8, 22, 26] provides inconsistent results and no decisive findings regarding causality. For example, Lwin et al. conducted a quasi-experimental study to see the effects of parental mediation strategies and found active mediation to be effective in reducing teens online information disclosure behaviors, whereas restrictive mediation was shown to be associated with more risk-seeking behaviors [22]. Alternatively, a survey study reported that active mediation and conversational strategies have no effect on teens online behaviors [26]. Similarly, conflicting findings can be observed for monitoring where Berson et al. reported monitoring to be associated with a decrease in teens exposure to online harassment [28], whereas Ghosh et al. found monitoring to be associated with increased risk exposure [29]. These conflicting results may be related to the cross-sectional nature of these studies, forming mostly correlational findings instead of causations. Alternatively, the inconsistencies may be a result of reliance on either parents or teens as the informants reporting on parental mediation and teens' risk exposure. In the next section, we explain the family systems theory and its relevance to studying parental mediation in relation to teens' online safety.

3   A Family Systems Approach

The family systems theory [15] provides a comprehensive framework for overcoming the limitations of cross-sectional data and one-sided reports, which has rarely been employed in the study of adolescent online safety. Family systems theory builds upon the model of "transactional family theory," introduced by Schermerhon et al. [30], which describes the familial influences process between the parent and child to be bi-directional and multi-dimensional. Where previously a child's behavior was studied as a function of parenting, the transactional family theory brought the inverse effect into light, in which a child can equally influence a parent [30]. Family systems theory consists of three main principles including: 1) a focus on transactional and bi-directional influences, 2) longitudinal effects, and 3) multi-level analysis [15]. While family systems approach has been employed in youth research including youth obesity [31], or cognitive disorders [32], it has seldom been used in adolescent online safety research. Wisniewski et al. emphasizes the need to utilize the family systems approach in studying teens' online risks and safety to get a full picture of the parent-teen influences and perspectives regarding online safety [14]. Proposed methods to study transactional theory in family systems

research include longitudinal studies [15], which can help better understand the family dynamics and consequences [14].

Researchers have begun using longitudinal approaches and dyadic data to examine unexplored bi-directional influences between parents and adolescents. For instance, Koning et al. [33] conducted a two-wave study and found bi-directional effects between parental mediation and adolescents' symptoms of internet gaming disorder and social media disorder. We derived motivation from these related works and the family systems theory, extending beyond the existing literature by incorporating both parents and teens reports of parental mediation in establishing bi-directional influences between parental mediation and teens' online risk exposure. In the next section, we elaborate on our study design and methodology.

4 Methods

In this section, we provide an overview of our diary study design and methodological details regarding study measures, recruitment, and data analysis.

4.1 Diary Study Overview

To get an authentic understanding of the effects of teens' risk exposure and parental mediation, we chose diary studies as the most suitable method for this study due to their "in-situ" nature, providing participants with the ability to report in real-time. The diary study was conducted online for 8 weeks, through a web-based application developed using PHP and MySQL, along with surveys linked to the Qualtrics API. All participants were given access to a custom dashboard with a personal log-in to enter their responses each week over the course of eight weeks. Parents and teens were provided with separate logins to protect the privacy of both parties. To collect responses for the diary study, participants could use the custom dashboard to enter new responses each week, as well as view their old entries. Each participant had one week to complete a weekly diary entry and were able to edit their responses till the end of the week. Surveys utilized an in-situ approach, with participants providing a qualitative description of each event along with responses to structured, standardized scales. The next section describes the measures utilized in these surveys.

4.2 Diary Study Measures

Teens' Online Risk Exposure. To measure risk exposure on a week to week basis, teen participants were asked if they had encountered risks within each category over the last week on a 5-point Likert Scale (1 = never, 5 = almost every day), The following risk categories were measured: online harassment, sexual solicitations and exposure to explicit content. However, in the survey questions, these risk types were relabeled to be less severe and more relatable for teens. Online harassment was referred to as "online interactions" and was defined as bullying and other negative online interactions that may be considered threatening or harassing. Sexual solicitations were labeled as "online flirtations" and described as sexual requests from people that the teens may or

may not have known, with examples such as "cybering" or "sexting." Explicit content exposure was labeled as "online content" and included pornographic, violent or upsetting content online. The responses for each risk type were averaged and used as a measure for the weekly risk exposure. Cronbach's alpha was calculated and indicated acceptable reliability with values above .70 on average.

Parental Mediation Strategies. To measure weekly parental mediation strategies, we utilized items from Livingstone et al. [11] that included questions on three different mediation types; active mediation, restrictive mediation and monitoring. Parents and teens responded to these questions on a 5-point Likert frequency scale. Scale point labels were the same for active mediation, restrictions and monitoring (1 = None of the time, 5 = All of the time), to assess the level of mediation employed by the parent. Cronbach's alpha indicated excellent reliability across weeks and in the pre-study survey (above .80 on average).

4.3 Data Analysis Approach

To study both parents' and teens' reports of parental mediation with teens' online risk exposure, we ran two separate models for each of the risk types: 1) a **teen model**, solely based on teens' reports of online risk exposure and parental mediation, and 2) a **parent-teen model** which included teens report of online risk exposure and parental reports of mediation behaviors. Our goal was to see how parental mediations influence teens' future risk exposures and how teens' risk exposures influence future parental mediation behaviors. Therefore, we conducted a cross-lagged panel model [34] with R language to analyze this data. Cross-lagged panel models are used to analyze reciprocal relationship or directional influences of one variable to another over time [35]. This approach is common in studies that use diary or longitudinal data since it helps researchers estimate the effects of a variable at time t on another variable at time t+1 [36–38].

Since we collected data from both parents and teens, we ran two separate models for parent and teen reports in our analysis. Using recommendations from the literature, we compared the change in deviance between a full model (with independent variables) and an intercept only model (the "null" model) to assess model fit [39]. In addition, we used the sum score of each construct for the analysis. To study the effects of parental mediation on teens risk exposure (RQ1), we regressed each risk type (dependent variables) on parental mediation behaviors of the week before (independent variables). We conducted a separate analysis for each of the mediation strategies (active mediation, restrictive mediation, and monitoring). To address RQ2, we studied the effect of teens' online exposure on parental mediation. Therefore, we regressed parental mediation behaviors (dependent variables) on each of the four risk types of the week before (independent variables). Likewise, we carried out separate analysis for each parental mediation strategy. Lastly, to address RQ3, we studied the correlations between teens' risk exposure and parental mediation in the same weeks.

4.4 Participant Recruitment

Participants were recruited through two channels. Firstly, recruitment was conducted through a database of local parents provided by the psychology department of the university. We also contacted youth serving organizations, such as YMCAs, non-profit organizations, family-based community centers, churches, clinics, and after school programs. We reached out to participants in these organizations via phone calls and emails. After completion of the pre-survey, a collective gift card of $25 was sent to the parent and teen. After that, participants earned their incentive based on the number of weekly diary entries completed. The maximum reward was a $75 Amazon or Walmart gift card, which was given in case of all diary entries being completed. Recruitment and participation in this study occurred over the course of eight months in 2014.

5 Results

In this section, we present the descriptive statistics of our participants, followed by the key findings for each risk type based on the teen and parent-teen models to answer each of our research questions.

5.1 Descriptive Statistics

Data was collected from 68 teens and their parents living in the US, with participants identifying as White/Caucasian (73%); African American (13%), Hispanic (5%), Asian (3%), and other (5%). Teen participants were between the ages of 13–17 with more female (63%) than male participants. The age distribution of teens was as follows: 13 (15%), 14 (31%), 15 (24%), 16 (19%), and 17 (12%). 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. Most of the parent-teen dyads (87%) completed all parts of the study, including all eight weekly diary surveys. An additional 10% of participants completed at least half of the weekly diary surveys. A power analysis was conducted which confirmed that the number of observations (434) were enough to detect effects with a small effect size ($\beta = .04$) and .80 power. A total of 176 online risk events were reported during the study, where most of the teens (80%) reported at least one risk event. Explicit content exposure (N = 119) was observed to be the most experienced risk type, followed by sexual solicitations (N = 29) and online harassment (N = 28). We report the mean and standard deviation of the frequency of teens' risk exposure (per risk type) and parental mediation strategies based on parent and teen reports in Table 1. The responses to each item are coded as (1- not at all, 2- once, 3- two to three times, 4- four to five times, 5- six or more). In the following sections, we answer our research questions by presenting results from the teen model and the parent-teen model for each risk type.

Table 1. Risk exposures' and mediations' descriptive statistics

Construct	Mean (SD)		Cronbach's alpha		Mean Difference
Parental Mediation	**P**	**T**	**P**	**T**	t-value
Active Mediation	2.08 (0.91)	1.73 (0.94)	0.90	0.92	8.41***
Restriction	3.61 (1.19)	3.90 (1.08)	0.91	0.88	6.87***
Monitoring	1.72 (1.09)	2.13 (1.10)	0.92	0.92	9.05***
Risk Exposure	**T**		**T**		
Online Harassment	1.05 (0.21)		0.860		N/A
Sexual Solicitations	1.04 (0.21)		0.692		N/A
Explicit Content	1.24 (0.53)		0.829		N/A

P=Parent, T=Teen; *** indicates p <.001, ** indicates p <.01, * indicates p <.05, † indicates p <.10.
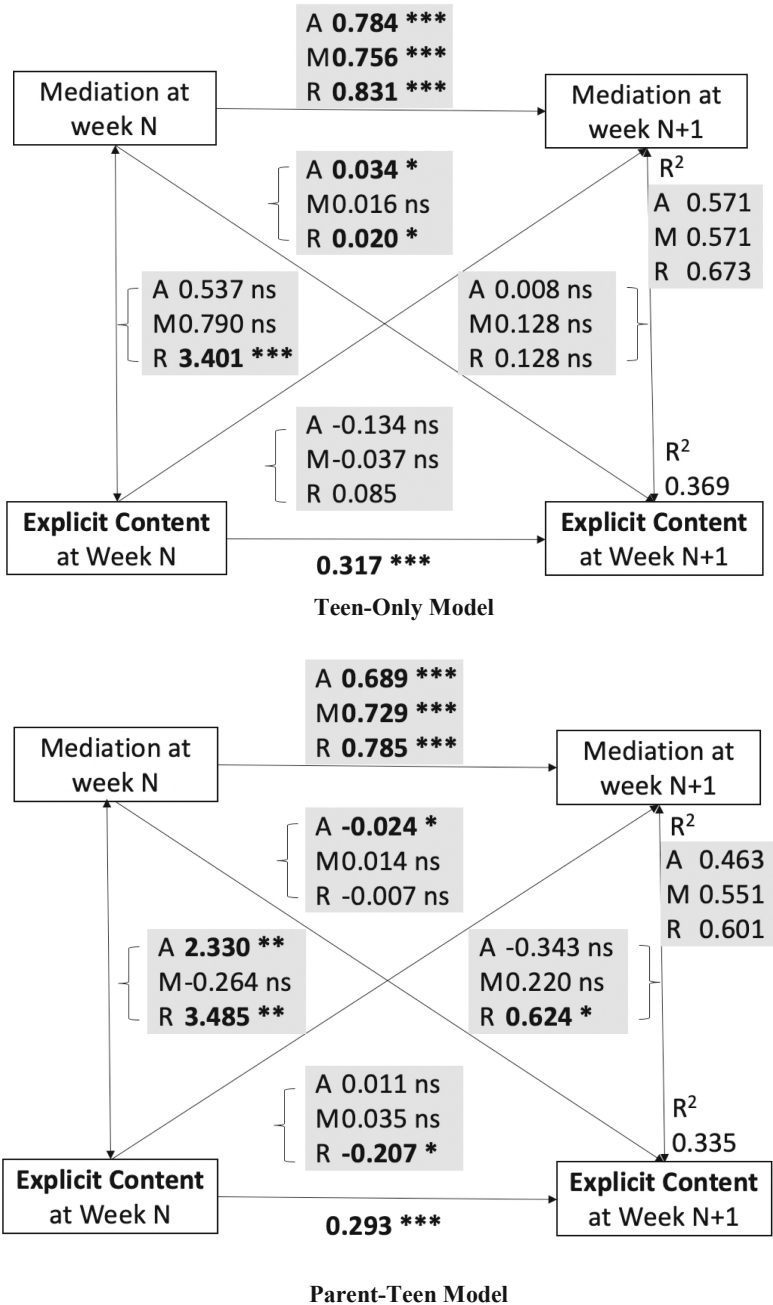
5.2 Exposure to Explicit Content

We found significant effects of parental mediation on teen's exposure to explicit content in the next week (**RQ1**). The teen model presented unusual results where active ($\beta = 0.034, p < .05$) and restrictive mediation ($\beta = 0.020, p < .05$) lead to an *increase* in teens' exposure to explicit content in the following week. In contrast, the parent-teen model–relying on parental reports of mediation and teen reports of risk exposure–showed active mediation ($\beta = -0.024, p < .05$) to significantly *decrease* exposure to explicit content in the next weeks (see Fig. 1).

Our analysis in the opposite direction showed teens' explicit content exposure to also influence parental mediation significantly in the next week (**RQ2**). According to the teen model, we found that teens' exposure to explicit content had a positive relationship with restrictive mediation in the next week ($\beta = 0.085, p < .05$), indicating that parents increase restrictions on teens in the week after they are exposed to explicit content. The parent-teen model contradicted with this result, suggesting that exposure to explicit content would lead to significantly lower levels of restrictive mediation in the week after ($\beta = -0.207, p < .05$).

Lastly, we found bi-directional influences between parental mediation and teen's exposure to explicit content in the same week (**RQ3**). The teen model showed adolescent exposure to explicit content to be significantly correlated with restrictive mediation in the same week ($\beta = 3.401, p < .01$). Similar effects were observed with the parent-teen model which showed a positive correlation between parents increased active mediation ($\beta = 2.330, p < .01$) and restrictions ($\beta = 3.485, p < .01$) with teen's exposure to explicit content in the same week. In summary, we found the effects from the teen and parent-teen models to contradict with each other, except for consistent bi-directional effects between parental mediation and teen exposure to explicit content in the same week.

A **0.784 *****
M**0.756 *****
R **0.831 *****

A **0.034 ***
M0.016 ns
R **0.020 ***

R^2
A 0.571
M 0.571
R 0.673

A 0.537 ns
M0.790 ns
R **3.401 *****

A 0.008 ns
M0.128 ns
R 0.128 ns

A -0.134 ns
M-0.037 ns
R 0.085

R^2
0.369

Mediation at week N

Mediation at week N+1

Explicit Content at Week N

Explicit Content at Week N+1

0.317 ***

Teen-Only Model

A **0.689 *****
M**0.729 *****
R **0.785 *****

A **-0.024 ***
M0.014 ns
R -0.007 ns

R^2
A 0.463
M 0.551
R 0.601

A **2.330 ****
M-0.264 ns
R **3.485 ****

A -0.343 ns
M0.220 ns
R **0.624 ***

A 0.011 ns
M0.035 ns
R **-0.207 ***

R^2
0.335

Mediation at week N

Mediation at week N+1

Explicit Content at Week N

Explicit Content at Week N+1

0.293 ***

Parent-Teen Model

*** indicates $p < .001$, ** indicates $p < .01$, * indicates $p < .05$, † indicates $p < .10$.

Fig. 1. Bi-directional influences between parental mediation and explicit content
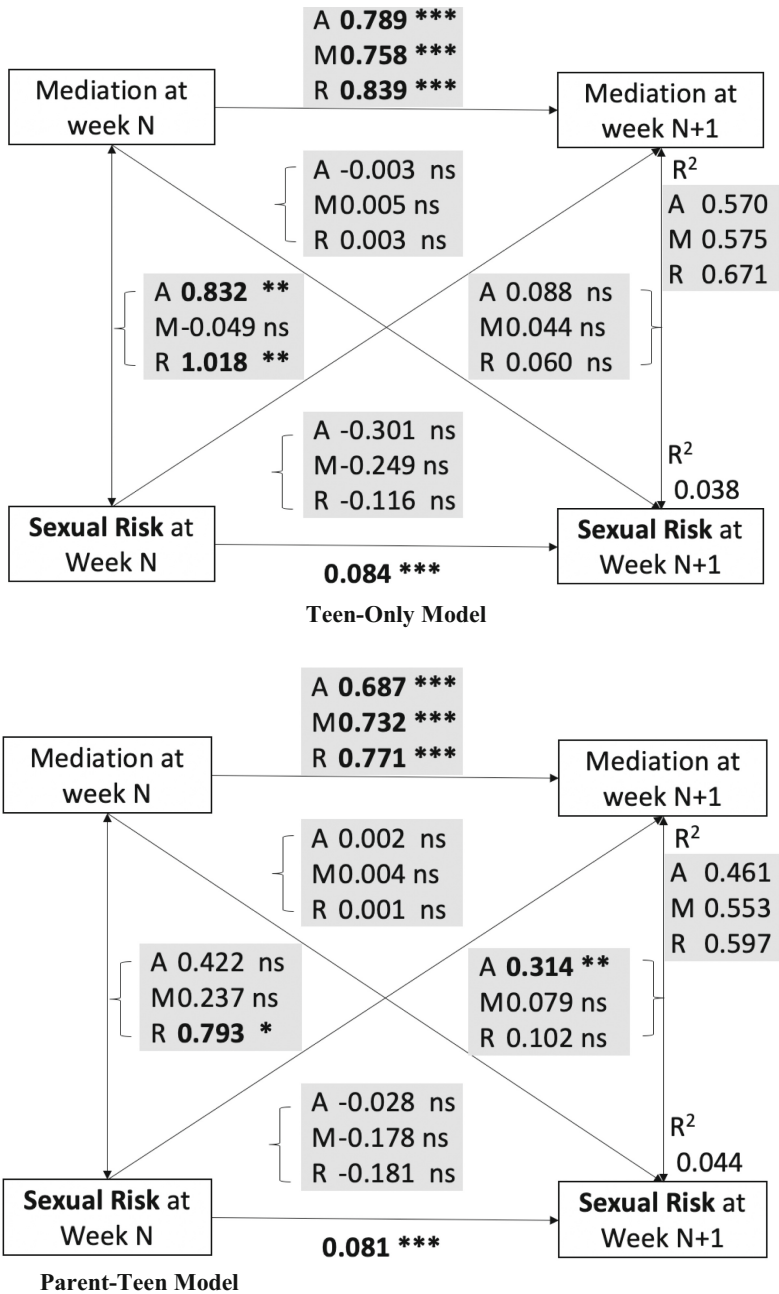
5.3 Risk Exposure to Sexual Solicitations

The teen and parent-teen models did not present any significant effects of parental mediation on teen's exposure to sexual risks in the subsequent week **(RQ1)**. Similarly, both models did not establish any significant effects of teen's exposure to sexual solicitations on any parental mediation strategies in the following week **(RQ2)**. Although parental mediation and adolescent exposure to sexual risks did not affect each other in subsequent weeks, we observed significant bi-directional influences between them in the same week **(RQ3)**. Specifically, the teen model showed active mediation ($\beta = 0.832, p < .01$) and restrictive mediation ($\beta = 1.108, p < .01$) to significantly increase in the same week as an online sexual risk experience. The parent-teen model supported this finding, where we found a positive correlation between restrictive mediation and sexual risk exposure in the same week ($\beta = 0.793, p < .01$). However, unlike the teen model, active mediation did not have a significant correlation with sexual risk exposure in the same week, based on the parent-teen model. Overall, our results indicate that when teens face online sexual risks, parents respond by increasing their active and restrictive mediation levels in the same week, as shown in Fig. 2 (next page).

5.4 Exposure to Online Harassment

Results from the **teen model** showed parental mediation to significantly affect adolescent exposure to online harassment in the next week **(RQ1)**. In particular, active mediation significantly increased the risk of online harassment in the subsequent week ($\beta = 0.011$, $p < .001$). However, the **parent-teen** model did not show any significant effects of mediation strategies on teens' exposure to online harassment in the subsequent week.
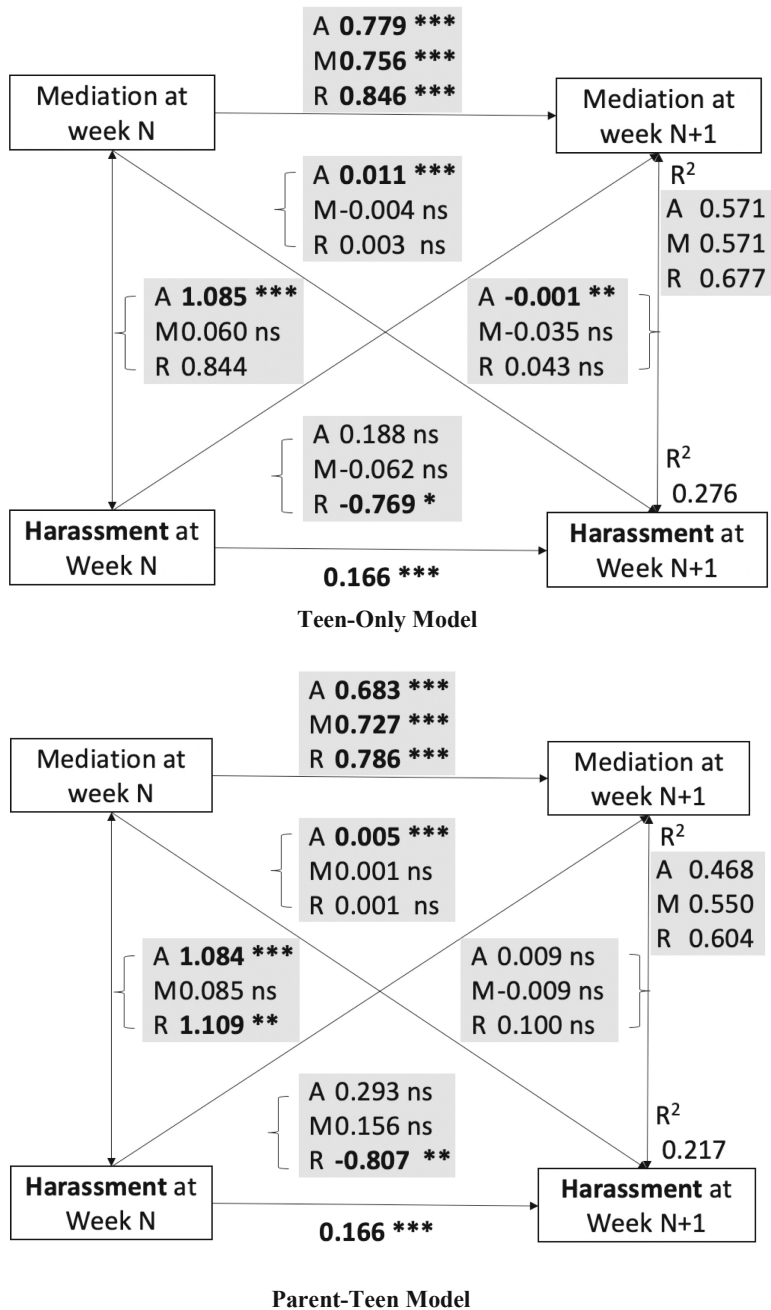
We also found online harassment to significantly influence parental mediation strategies in the coming week **(RQ2)**. According to the **teen model**, online harassment had a negative relationship with parental restrictive mediation in the subsequent week ($\beta = -0.769, p < .05$), indicating that parents reduce restrictions in the week after harassment incidents. Corresponding to the teen model, the **parent-teen model** also demonstrated that exposure to online harassment ($\beta = -0.807, p < .05$) would lead to lower levels of restrictive mediation in the next week (Fig. 3).

Our findings confirmed that parental mediation and teen's online harassment encounters significantly influence one another in the same week **(RQ3)**. For example, the **teen model** revealed that both active mediation ($\beta = 1.085, p < .001$) and restrictive mediation ($\beta = 0.844, p < .01$) increased in the same week when the teen experienced online harassment. The **parent-model** showed identical results where parents raised their active mediation ($\beta = 1.084, p < .001$) and restriction ($\beta = 1.109, p < .01$) levels in the same week as online harassment.

A **0.789** ***
M**0.758** ***
R **0.839** ***

A -0.003 ns
M0.005 ns
R 0.003 ns

R²
A 0.570
M 0.575
R 0.671

A **0.832** **
M-0.049 ns
R **1.018** **

A 0.088 ns
M0.044 ns
R 0.060 ns

A -0.301 ns
M-0.249 ns
R -0.116 ns

R²
0.038

Mediation at week N

Mediation at week N+1

Sexual Risk at Week N

Sexual Risk at Week N+1

0.084 *

Teen-Only Model

A **0.687** ***
M**0.732** ***
R **0.771** ***

A 0.002 ns
M0.004 ns
R 0.001 ns

R²
A 0.461
M 0.553
R 0.597

A 0.422 ns
M0.237 ns
R **0.793** *

A **0.314** **
M0.079 ns
R 0.102 ns

A -0.028 ns
M-0.178 ns
R -0.181 ns

R²
0.044

Mediation at week N

Mediation at week N+1

Sexual Risk at Week N

Sexual Risk at Week N+1

0.081 *

Parent-Teen Model

*** indicates p <.001, ** indicates p <.01, * indicates p <.05, † indicates p <.10.

Fig. 2. Bi-directional influences between parental mediation and sexual solicitations

A **0.779 *****
M**0.756 *****
R **0.846 *****

Mediation at week N → Mediation at week N+1

A **0.011 *****
M-0.004 ns
R 0.003 ns

R^2
A 0.571
M 0.571
R 0.677

A **1.085 *****
M0.060 ns
R 0.844

A **-0.001 ****
M-0.035 ns
R 0.043 ns

A 0.188 ns
M-0.062 ns
R **-0.769 ***

R^2
0.276

Harassment at Week N

Harassment at Week N+1

0.166 ***

Teen-Only Model

A **0.683 *****
M**0.727 *****
R **0.786 *****

Mediation at week N → Mediation at week N+1

A **0.005 *****
M0.001 ns
R 0.001 ns

R^2
A 0.468
M 0.550
R 0.604

A **1.084 *****
M0.085 ns
R **1.109 ****

A 0.009 ns
M-0.009 ns
R 0.100 ns

A 0.293 ns
M0.156 ns
R **-0.807 ****

R^2
0.217

Harassment at Week N

Harassment at Week N+1

0.166 ***

Parent-Teen Model

*** indicates $p < .001$, ** indicates $p < .01$, * indicates $p < .05$, † indicates $p < .10$.

Fig. 3. Bi-directional influences between parental mediation and online harassment

6   Discussion

In this section, we compare the results from the teen-only and parent-teen models to discuss the implications of our findings and opportunities for future research. Table 2 summarizes the high-level results from each model.

Table 2. Summary of results between parental mediation and teen's risk exposure

Risk / Mediation Type	Teen Model		Parent-Teen Model	
Risk Type	**Same Week**	**Subsequent Week**	**Same Week**	**Subsequent Week**
Explicit Content	*+Restriction*	**+Restriction**	+Active Mediation *+Restriction*	**-Restriction**
Sexual Solicitations	+Active Mediation *+Restriction*	*ns*	**+Restriction**	*ns*
Online Harassment	*+Active Mediation* *+Restriction*	*-Restriction*	*+Active Mediation* *+Restriction*	*-Restriction*
Mediation Type	**Same Week**	**Subsequent Week**	**Same Week**	**Subsequent Week**
Active Mediation	+Sexual Solicitations *+Online Harassment*	**+Explicit Content** +Online Harassment	+Explicit Content *+Online Harassment*	**-Explicit Content**
Monitoring	**ns**	**ns**	**ns**	**ns**
Restriction	*+ Explicit Content* *+Sexual Solicitations* *+Online Harassment*	+Explicit Content	*+Explicit Content* *+Sexual Solicitations* *+Online Harassment*	ns

Note: **Bold Italic** font denotes parent-teen agreement across models, and **Red Bold** font denotes conflicting results. Normal font indicates significant and non-significant effects identified in one model but not the other.

6.1   Parent vs. Teen Perceptions of Mediation and Risk Exposure

Like past studies [22, 27], we uncovered some conflicting results based on the self-reported accounts of parents and teens. For instance, parents reported significantly higher levels of active mediation and monitoring, while teens reported significantly higher levels of parental restriction overall (Table 1). As shown in Table 2, teens reported increased levels of parental restriction the week after they were exposed to explicit online content, while parents reported decreased levels of restriction. The teen model suggested that active mediation increased subsequent exposure to explicit content, while the parent-teen model implied that active mediation decreased such exposure. A theme across these conflicting findings is that teens tend to report more negative outcomes associated

with parental mediation (e.g., increased restriction and exposure to risk), while parents' reports tend to suggest more positive outcomes (e.g., decreased restriction and reduced exposure to risk).

An important implication of these conflicting findings is that both teens and parents seem to exhibit social desirability biases [40], which surface the unique developmental tensions within the parent-teen relationship. These tensions arise due to the boundary negotiation process between asserting teen autonomy versus parental control regarding online safety and risks that has been highlighted in past research [19]. For instance, differences in parent-teen perspectives regarding teens' online risk exposure have been brought up by researchers previously, where Blackwell et al. [25] found that parents underestimate teens' online experiences and think they actively mediate, but teens are more likely to view this mediation as restriction. Another possible explanation for these conflicting findings may be that parents are often unaware of the risks their teens are exposed to online; therefore, it is difficult to mediate these situations [21]. Therefore, it is important in future research that studies continue to incorporate and triangulate the perceptions of teens and their parents when examining the relationships between online risk exposure and parental mediation strategies. Not including both perspectives would likely lead to knowledge gaps and biases that could negatively impact recommended parenting interventions, policy changes, and design implications.

Inversely, a strength of our research is that we uncovered several consistent results across the teen and parent-teen models. For instance, all parental mediation types (active mediation, restrictive mediation, and monitoring) significantly predicted their respective mediation for the subsequent week for both teen and parent-teen models (see Fig. 1, Fig. 2, Fig. 3). This implies that parents tend to mediate in the same way through consecutive weeks and overall, parental mediation levels remain consistent over time. The same applies to risk exposure. A main predictor of each of the risk exposures, was the level of exposure to that risk in the previous week (Fig. 1, Fig. 2, Fig. 3). Further, our results showed significant agreement between the teen model and the parent-teen model results in the same week, both of which showed bi-directional influences between parental mediation and adolescent online risk exposure (see Table 2). Given these convergent results between teen and parent-teen reports in Table 2, we can say with a good amount of confidence that these relationships hold and give unique insights into the cross-sectional and bi-directional influences between teen risk exposure and parental mediation strategies. Moving beyond cross-sectional data and individual reports, our study confirms that parents and teens have similarities in their perceptions of mediation in the same week that teen is exposed to online risks, but differences arise in the influence of parental mediation in subsequent weeks.

6.2   Risk Exposure Affects Parental Mediation

While earlier research on the topic studied teens' risk exposure as a function of parental mediation [24, 26], our study is the first to bring the inverse effect of risk exposure on parenting into light. Findings from both models demonstrated a lower level of restrictive mediation by parents in response to teens experiencing online harassment or explicit context exposure. This leniency may be due to parents offering support in the form of reduced restrictions to help their teens cope with an unpleasant experience. Our results

provide a contrast to the established understanding that parents always seek to protect through limiting teens' online interactions [17]. Instead, we demonstrate how parents can prefer protecting the wellbeing of their teens by allowing them to self-regulate their online experiences and overcome the negative effects of an online risk. Therefore, designers and practitioners working on mediative technologies should provide features that offer parents flexibility to adjust restrictions on teens' online activity.

Additionally, researchers should consider ways for parents to assess effective ways to support their teen struggling with online risks. For example, creating peer support platforms for parents [41] where they can engage with others on best practices to help teens after a risky encounter will improve the support provided to teens along with fostering a sense of community for parents. An alternative explanation for reduced restrictions after the risk exposure is parents' lack of awareness on the online risks their teens may be experiencing. We encourage researchers to extend our work by incorporating parental perceptions of online risks to form more conclusive findings on the effects of adolescent risk exposure on parental restrictions and other strategies.

6.3 'Just-in-Time' Parenting

Our findings from both the teen and the parent-teen reports strongly suggested active and/or restrictive mediation significantly increases in the same week as teens exposure to online harassment, explicit content, or sexual solicitations. However, no significant effects were seen for monitoring, which may be due to the passive nature of technical monitoring leaving it unaffected by risk exposure. Moreover, for sexual solicitations, parenting did not have much effect on risk exposure (low r-square). This may be because teens do not have control over when they are solicited and sexual interactions (such as flirting) are often concealed from parents. Overall, we presented consistent bi-directional effects between parental mediation and teens' risk exposure in the same week across both models. Therefore, we encourage researchers to move beyond studying online risk exposure as an outcome of parental mediation and to equally consider the influence of parents and teens on each other in shaping the online safety of a child.

Additionally, an essential implication of increased active and restrictive mediation in the same week as online risks is that parents respond just-in-time to their teens' risk exposure by adjusting their mediation levels. Designers of online safety features or collaborative mediation apps should consider this immediate parental concern and create tools that provide teens with the option to ask for parental support or notify parents about online risks in a timely manner. One way to keep parents well-informed about online risks is to design real-time interventions or "nudges" [42] that can ensure timely parental support for the teen. However, implementing nudging interventions for online safety without compromising on teen's privacy and autonomy is a challenging task. As recently found by Badillo-Urquiola et al., teens often wish to keep their online activity and risks confidential from parents [43].

One approach that can negotiate differences or value conflicts between different stakeholders is Value Sensitive Design (VSD) [44], which aims to incorporate important human values into the design process. Previously, adolescent online safety researchers have employed VSD to identify and balance tensions between teen autonomy and

parental control [45]. For instance, Badillo-Urquiola et al. [18] used VSD to design features for parental control apps that improve parent-teen communication and promoted values such as trust and support. To accommodate both parents and teens perspectives regarding parental mediation [46], we encourage future researchers to utilize collaborative approaches such as value sensitive design that integrate similar parent-teen values and resolve differences of parents and teens regarding mediation, leading to online safety strategies that can cater to all.

6.4 Limitations and Future Research

A limitation of our work is that we conducted this study with a relatively small sample size over a relatively short (two-month) period. Future work should recruit a larger and more diverse sample and extend the length of the study to span multiple years for more conclusive findings. Additionally, we used cross-lagged panel modeling which relies on a few assumptions, such as synchronicity [47], which assumes that all participants reported at the same time points. However, since we used rolling recruitment, participants did not report at the same times. This method also assumes stationarity - that the relationship between the independent and dependent variables is completely uniform across time points [47], which might not have been the case. Lastly, it assumes that there are no stable between group differences throughout the course of the study, leading to a higher rate of Type I errors [48]. Moreover, some of the patterns we uncovered may vary based on demographic information, such as the age and gender of the teen. Future work may overcome these limitations by using alternative methods, such as hierarchical linear modeling, that address between group differences and invariance when controlling such these factors. We also encourage adolescent online safety researchers to extend our work and take a socio-ecological perspective in studying bi-directional influences regarding online safety, by involving other support figures in the teens' life, including other family members, teachers, and peers.

7   Conclusion

We established the importance of bi-directional influences of parental mediation and teen's online risk exposure and identified gaps between parents' and teens' perception on parental mediation. We also introduced new narratives regarding the impact of teens' online experiences on parental mediation, such as parents reducing restrictions to support teens after negative online experiences. Our research sets the foundation for identifying significant bi-directional parent-teen influences in the same week which indicated quick parenting in response to online risks.

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