# A Matter of Control or Safety? Examining Parental Use of Technical Monitoring Apps on Teens' Mobile Devices

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## ABSTRACT

Adoption rates of parental control applications ("apps") for teens' mobile devices are low, but little is known about the characteristics of parents (or teens) who use these apps. We conducted a web-based survey of 215 parents and their teens (ages 13-17) using two separate logistic regression models (parent and teen) to examine the factors that predicted parental use of technical monitoring apps on their teens' mobile devices. Both parent and teen models confirmed that low *autonomy granting* (e.g., authoritarian) parents were the most likely to use parental control apps. The teen model revealed additional nuance, indicating that teens who were victimized online and had peer problems were more likely to be monitored by their parents. Overall, increased parental control was associated with more (not fewer) online risks. We discuss the implications of these findings and provide design recommendations for mobile apps that promote online safety through engaged, instead of restrictive, parenting.

## Author Keywords
Adolescent online safety; mobile smart phones; parental mediation; technical monitoring

## ACM Classification Keywords
K.4.1 [Public Policy Issues]: Ethics, Human safety, Privacy

## INTRODUCTION

According to a 2016 Pew Research report, 76% of teens in the United States have access to a smartphone, and 84% go online using some kind of portable or mobile device [1]. Of these teens, 91% go online, text, or use social media apps from these devices [36]. Mobile smartphones provide new opportunities for teens, but they may also expose them to more online risks [40]. For instance, research conducted in

2015 found that teens who have internet-enabled smartphones are at least *twice* as likely to experience online sexual solicitations and have sex with a partner that they first met online [50]. This heightened risk may be partly due to the limited visibility or "practical obscurity" [6] afforded by personal mobile devices that makes it harder for parents to regulate what their teens are doing online. The personal nature and portability of mobile devices, as well as their always "on" connectivity and pervasive use by teens [6], create new challenges for parents that make it even more difficult for them to regulate online content that their teens access in private as well as mediate the online interactions their teens may share with new and potentially unsafe others online [8].

To address this problem, a number of commercially available parental control apps provide parents more transparency around their teens' mobile online activities, including the websites they browse, text messages they send and receive, and the apps they install on their phones [66]. Yet, according to a 2016 Pew Research report, only 16% of parents report using parental control apps to monitor and restrict their teens' mobile online activities [1]. The low adoption rates of technical monitoring of teens' mobile smart devices suggests a potential disconnect between the technical solutions currently available for mobile online safety, their adoption, and use. It also warrants further exploration to answer the following research questions:

**RQ1:** *What factors predict whether parents use technical monitoring apps on their teens' mobile devices?*

**RQ2:** *How do these factors and relationships differ based on the perceptions of parents versus teens?*

**RQ3:** *How do these results inform parenting practices and/or the design of parental control apps used for adolescent online safety in mobile contexts?*

To answer these research questions, we conducted a web-based survey of 215 parent-teen (ages 13-17) dyads in the U.S. to examine the factors that explained whether or not parents opted to use technical monitoring of their teens' mobile devices. We ran two separate logistic regression models to understand both parent and teen perspectives. Based on parental reports, those who were more low

autonomy granting (e.g., authoritarian) and used the internet frequently were most likely to use parental control apps. For teens, those who reported using the internet frequently, being victimized online in the past, having peer problems, and who reported having more authoritarian parents were more likely to be monitored by their parents. Our post hoc analysis revealed additional nuance, suggesting that parental control apps may reinforce parenting practices that may actually be harmful to teens, leading to more peer problems and possibly even more online victimization, instead of protecting teens from these negative experiences.

In this work, we draw from developmental psychology to identify parent and teen factors that contribute to parental use of technical monitoring (i.e., "parental control apps") on their teens' mobile devices (**RQ1**). We examine the relationships among parenting styles, teen peer problems, online victimization, and technical monitoring of teens' mobile devices, and showed how these relationships differed based on parent and teen perceptions (**RQ2**). We demonstrate how existing parental control apps may reinforce authoritarian parenting styles, which have been shown in past research to negatively affect youth outcomes. Finally, we conceptualize new design guidelines for mobile online safety apps that promote more authoritative parenting styles through increased parental involvement and teen autonomy granting (**RQ3**). In the following section, we situate our research within the broader adolescent online safety literature, build a theoretical research framework, and present our research hypotheses.

## BACKGROUND
In recent years, adolescent online safety and parental mediation of their children's technology use have become important areas of research within the broader SIGCHI community [6,27,28,31] and at CHI [2,28,44,67,69–71]. We highlight research on families and mediating teen technology use and how mobile phones increase the challenges parents already face.

### Parents, Teens, and Technology Use
The dramatic increase in technology access has prompted a number of SIGCHI researchers to study how technology and mediating its use in the home has affected parent-teen relationships. A common theme across much of this literature shows that technology creates quite a bit of tension in families [6,31]. For instance, Yardi and Bruckman [70] found that parents desire more transparency and awareness about what their teens are doing online. Meanwhile, navigating these privacy boundaries is difficult; parents and teens struggle to find a balance between parental control and teen autonomy in virtual spaces [16], and both generally agree that teens should have some level of privacy in online spaces, so that they can gain independence [11]. Hiniker et al. [31] found that both parents and teens have a hard time unplugging from technology and both often break rules regarding appropriate use of technology in the home. Moser et al. [44] found that

parents and children disagree over what types of content are appropriate for parents to share about their children via social media. The key take away from this work is that the tension between keeping teens safe online and respecting their personal privacy is a non-trivial task for parents that deserves more attention.

### Mobile, Making Matters Worse
In more recent work, Blackwell et al. [6] found that personal devices, such as mobile smartphones, create even more challenges for parents and teens due to the limited visibility parents have into their teens online activities from these devices. They found that parents underestimate the amount of time and types of social media apps their children use, and their children often obfuscated their use of certain controversial apps (e.g., Snapchat). This is problematic because many of the online risks teens are exposed to occur via social media [43]. Vaterlaus et al. [64] found that when parents have less digital knowledge than their teens, it is harder for them to implement appropriate rules to protect their teens. As a result, some parents have resorted to using technical means to monitor their teens' mobile phones [1]. Yet, Czeskis et al. [12] note how the increasing number of mobile safety applications being offered to help parents monitor their teens through more technical means have far-reaching implications for parent-teen relationships, including potentially negative impacts on privacy, trust, and teen development. In this paper, we examine parents' decision to adopt and use technical monitoring apps on their teens' mobile devices to better understand the factors that influence this decision from the joint perspectives of parents and teens. In doing this, we provide additional insight into the tension between parents and teens when negotiating appropriate mobile technology use within families.

## RESEARCH FRAMEWORK
In this section, we define the theoretical constructs we used in our models and present our research hypotheses.

### Parental Technical Monitoring of Teen Mobile Devices
Technical monitoring involves parents checking teens' online activities, including browsing history, call logs, and messages, through the use of software packages [39]. A number of researchers have studied technical monitoring used on home computers [1,14,72], but less research has focused on the use of technical monitoring on mobile devices. In 2009, Mitchell et al. [42] conducted a study on family use of filtering and blocking software used on desktop computers. They found that 33% of parents adopted this technology, and those who did, tended to have younger children (ages 10-15), high levels of concern regarding exposure to inappropriate sexual content, and did not trust their children to use the internet responsibly on their own. In 2016, Pew Research reported a similar statistic – that 39% of parents used technical monitoring for blocking or filtering their teens online activities, but only 16% of parents did so on their teens' mobile devices [1].

In 2017, Wisniewski et al. [66] conducted a review of 75 parental control apps and found that these apps tended to be heavy-handed in terms of restricting teens' mobile activities and invading teens' personal privacy. To our knowledge, however, no empirical work has been conducted to examine the factors that contribute to whether or not parents use these types of parental control apps on their teens' mobile devices (**RQ1**). Thus, we treat this construct—technical monitoring of a teen's mobile device by their parent(s)—as the dependent variable of interest in our research framework. In the next sections, we draw from the literature to build a model of relevant parent and teen factors that may help explain the variance in this outcome variable.

## Parenting Styles

Baumrind's seminal work [4,5] on parenting styles has been widely used throughout the developmental psychology literature [34,62], and has also been applied within the adolescent online safety and risk literature [14,45,63]. According to Baumrind, there are four distinct parenting styles (i.e., *authoritative*, *authoritarian*, *permissive*, and *neglectful*) that vary along two separate dimensions: 1) **Responsiveness***,* the extent in which a parent is warm and supportive of their child's needs for autonomy and individual needs, and 2) **Demandingness**, the extent in which parents use behavioral and psychological control in order to ensure their child's compliance with societal standards. Steinberg et al. [59] developed the Parenting Style Index (PSI) to operationalize Baumrind's four parenting styles [5]. However, the PSI varies somewhat orthogonally with Baumrind's original work; it includes three dimensions of parenting: 1) *involvement* 2) *strictness/supervision*, and 3) *autonomy granting,* where involvement is most similar to responsiveness and strictness/supervision to demandingness. Authoritative parents are high on all three dimensions of Steinberg et al.'s PSI sub-scales, while authoritarian parents are high on strictness/supervision and low on involvement and autonomy granting [13,17].

Much of the literature has emphasized the divergent youth outcomes related to authoritative (highly responsive and demanding) versus authoritarian (low responsiveness and highly demanding) parenting styles. Authoritative parenting has been shown to lead to a number of positive youth outcomes, such as increased competence and fewer behavioral and psychological problems [34]. Meanwhile, authoritarian parenting is generally associated with negative youth outcomes, including poor mental health and behavioral problems [47,62] (though outcomes may vary with culture, race, and other factors [9,25,26]). Parenting style has also been shown to have a significant effect on the parental mediation strategies used to keep teens safe online [14]. In 2006, Eastin et al. [14] found that authoritative and authoritarian parents were both more likely to use technological monitoring on their home computers compared to parents who had indulgent (i.e., permissive) and neglectful parenting styles. In contrast, Nakayama et al. [45] studied parental use of monitoring systems that had GPS devices to track the location of one's child. They found that parental control (i.e., demandingness) was the strongest predictor of parental intention to use these tracking devices. While no studies have specifically examined parenting styles in relation to technical monitoring used on teens' mobile devices, based on this related work, we hypothesize:

**H1:** *Authoritative parents will be more likely to use technical monitoring on their teens' mobile devices than permissive or neglectful parents.*

**H2:** *Authoritarian parents will be more likely to use technical monitoring on their teens' mobile devices than permissive or neglectful parents.*

## Teen Characteristics

Responsive parenting depends on customizing one's parenting strategies to meet the unique needs of each child [32]. Yet, few studies have tried to understand how parental mediation strategies for online safety vary based on teen factors, such as their psychological disposition or their past online risk experiences. Therefore, we incorporate some of these teen factors in our research framework.

### Psychological and Behavioral Problems

In their 2014 comprehensive review of the online risk literature, Livingstone and Smith [40] conclude that there is little evidence to suggest that the use of online and mobile technologies pose any greater risk to teens than offline risk encounters. Instead, they emphasize several risk factors, such as psychological difficulties, behavioral problems, and social factors, that make some children more vulnerable to harm than others. The psychological literature has examined a myriad of different psychological and behavioral problems, some of the most common being emotional symptoms, inattention, peer relationship problems, and conduct problems [22,23]. For example, Sourander et al. [58] found that offline peer problems are associated with increased cyberbullying. The psychological literature has also confirmed a relationship between parenting styles and problematic youth behaviors, but has yet to examine the relationship of these constructs with the use of mobile monitoring technologies. For instance, Reitz et al. [49] found delinquent and aggressive behaviors of youth were both predicted by and a predictor of parental involvement and autonomy granting decisions. Douglas et al. found that parental monitoring of children' media use through limit setting and active mediation reduced screen time and exposure to violence, which in turn was associated with higher levels of prosocial and lower levels of aggressive behaviors [21]. Based on these empirical findings, we anticipate:

**H3:** *Teens who exhibit psychological, social, or behavioral problems will be more likely to have parents who use technical monitoring on their mobile devices.*

*Teen Online Victimization*
Livingstone et al. [39] created a taxonomy of risks relating to youths' internet use, which included viewing inappropriate content, engaging in inappropriate contact with others (e.g., sexual grooming or personal data misuse), and problematic behavior or conduct (e.g., bullying and sexual harassment). In this research, we draw from this framework and focus on teen online victimization, as opposed to the perpetration of these risks. Since past research on home use of filtering and blocking software [42] found that parents who know about what their children do online and have high level of concern about their online behaviors, we hypothesize that:

**H4:** *Teens who have been victimized online in the past will be more likely to have parents who use technical monitoring on their mobile devices.*

**Contextual Variables and Demographics**
In our research framework, we also wanted to control for a number of contextual variables, such as frequency of internet use, age, gender, and socioeconomic status, which have been shown in past research [20,35,42,63,65] to have significant effects on the various constructs in our model. We highlight some of the relevant relationships that have previously been found in the literature below.

*Internet Use.* In 2005, Wang et al. [65] found that parents who use the internet ("yes" versus "no") were significantly more likely to use website filtering software on their home computers. Meanwhile, the frequency in which teens use the internet has been consistently shown to be positively correlated with the frequency in which they encounter online risks [29,38,40].

**H5:** *Parents who use the internet more frequently will be more likely to use technical monitoring on their teens' mobile devices.*

**H6:** *Teens who use the internet more frequently will be more likely to have parents who use technical monitoring on their mobile devices.*

*Age.* Wang et al. [65] found that younger parents monitor their children more, but they did not find a significant result for monitoring software use. However, Valcke [63] found that parents between the ages of 25 and 44 use parental control software more than parents between the ages of 45 and 54. More consistency has been found around the effects of teen age; younger teens' are generally monitored (both manually and through technical means) more often than older teens [21,35,63,65].

**H7:** *Younger parents will be more likely to use technical monitoring on their teens' mobile devices.*

**H8:** *Younger teens will be more likely to have parents who use technical monitoring on their mobile devices.*

*Gender.* Valcke et al. [63] found significant differences in parental control exhibited between fathers and mothers,

where mothers were both more controlling and supportive. In contrast, Mitchell et al. [65] did not find a significant relationship between parent gender and the use of home computer filtering software. Other studies have also not found gender effects for teens in relation to the use of monitoring software [35,42,65], except Gentile et al.'s [20], who found that parents monitor their daughters' media use more than their sons'. Given the inconsistent findings we controlled for, but did not hypothesize, gender effects.

*Income.* Gentile et al. [20] found that parents with lower income are more likely to co-view media, while higher income parents are more likely to use restrictive mediation. However, other studies [42,65] have not found significant differences based on family income. Therefore, similar to gender, we tested, but did not hypothesize, income effects. In the next section, we describe our methods for how we tested our research framework.

**METHODS**
We conducted a web-based survey study with parents (or legal guardians) and their teens (ages 13-17) in the United States. Since parent and teen perspectives around digital media use, online risk experiences, and parental mediation strategies often differ [20,68], we chose to include both of their perspectives in our analysis. In doing so, this allowed us to answer **RQ2** on whether the different perspectives of parents and teens influenced the outcomes associated with our research framework. We explain our survey measures, data collection process, and data analysis approach next.

**Survey Design and Measures**
In this section, we describe how we operationalized each of the constructs from our research framework that were included in our web-based survey. All measures were asked to both parents and teens (except household income, which was only asked to parents) and reworded accordingly depending on the intended audience. Pre-validated measures from literature were leveraged whenever possible.

*Technical Monitoring.* The following questions were asked to measure our dependent variable on a 5-point Likert scale (1 = *Not at All*, 5 = *All of the Time*):

1) *How often do you use parental control technologies to monitor your teen's text or photo messaging activities from his/her cell phone?*
2) *How often do you use parental control technologies to monitor what apps your teen installs or uses on his/her cell phone?*

*Parenting Style.* Parenting style was assessed using Steinberg et al.'s [59] pre-validated Parenting Style Index (PSI) that includes 26 questions measuring involvement, strictness/supervision, and autonomy granting parenting. Questions were measured on a 5-point Likert scale (1 = *Strongly Disagree*, 5 = *Strongly Agree*), except for two *strictness/supervision* questions that were measured on a 7-point Likert scale. Since the scale for autonomy granting

was inverted coded (high values represented low autonomy granting parenting), we reverse coded the entire scale, so that high values equated to high levels of autonomy granting in our analyses. The PSI measures were originally designed for teens [59], but have since been adapted for parents [14]. To capture both, we asked analogous questions for parents (e.g., "*My teen can count on me to help him/her out, if he/she has some kind of problem.*") and teens (e.g., "*I can count on my parents to help me out, if I have some kind of problem.*").

***Teen Psychological and Behavior Problems.*** We used the Strengths and Difficulties Questionnaire (SDQ) to measure teen behavioral and psychological problems [22,23]. The SDQ is a pre-validated, multi-dimensional behavioral screening scale that consists of 25 questions that assess five subscales: 1) *prosocial behavior*, 2) *hyperactivity*, 3) *emotional symptoms*, 4) *conduct problems*, and 5) *peer problems*. All items were measured on a 5-point Likert scale (1 = *Not true at all*, 5 = *True almost all the time*).

***Teen Online Victimization.*** We drew from Wisniewski et al.'s [67] measures for online risk exposure, which generally align with Livingstone et al.'s conceptual framework of online risks [39], to measure four types on teen online victimization: 1) *information breaches*, 2) *sexual solicitations*, 3) *online harassment*, and 4) *exposure to explicit content*. Similar, to the prior research [67], we combined all four risk types to create a more holistic measure for online victimization, rather than treating each risk type as a separate construct. All items were measured on a 5-point Likert scale (1 = *Not at all*, 5 = *Almost every day*). Questions were asked based on the teens' experiences "within the past year."

***Contextual Variables.*** Internet use was adapted from Livingstone et al. [39] based on usage "in the past month" (e.g., for work, social networking, instant messaging, etc.) and included nine items scored on a 5-point Likert scale (1 = *Not at all*, 5 = *Almost every day*). Age was measured categorically for parents and as an integer (13-17) for teens. Socioeconomic status was also measured categorically based on household income.

### Data Collection and Recruitment

IRB approval was granted to conduct a web-based survey with pairs of parents (or legal guardians) and teens between the ages of 13 and 17-years old, who resided in the United States. Parents or legal guardians had to be 25 years of age or older to consent to taking part in the research study. Teens were also required to provide assent to participate in the research. We used a Qualtrics panel [74] to recruit a nationally representative sample of parents and teens. Parents were sent a link to the survey, completed the consent and assent process with their children, then were asked to complete their portion of the survey first, followed

by their teens. In the survey, we explicitly requested that all participants complete their portion of the survey "on their own" without their respective parent or teen present. However, we also asked whether or not they complied with these instructions. Attention screening questions (e.g., "*Please select 'Strongly Disagree' for this item response.*") were included throughout the survey to ensure data quality [41]. Qualtrics removed data from participant pairs that failed these quality checks prior to releasing the data to the researchers and compensated participants.

### Data Analysis Approach

We conducted a three-staged analysis: First, we assessed and prepared our data for analysis. This included creating composite variables by averaging across all items in each subscale and assessing construct validity. It also included assessing normality and conducting paired tests to detect between-group differences based on parent and teen constructs (**RQ2**). The psychometric properties and descriptive statistics for our main model constructs are shown in **Table 1**. We used this preliminary analysis to inform the second stage of our analysis, which explicitly tested the hypotheses (**H1-H8**) posed in our research framework. To do this, IBM SPSS Statistics 24 [75] was used to run two logistic separate regression models, one for parents and one for teens, to address **RQ1** and **RQ2**.

All requirements and assumptions (e.g., linearly related to the logit of the dependent variable) for the logistic regression models were considered prior to analysis. To test the hypotheses related to parenting styles (**H1** and **H2**), we examined interaction effects between the two parenting style dimensions (involvement and autonomy granting). Finally, we conducted an exploratory post hoc analysis to more deeply understand the relationships among the constructs that were found to be significant in our previous models (**RQ3**). We used SmartPLS 3.0 [51] and Partial Least Squares Structural Equation Modelling (PLS-SEM).

### RESULTS

### Descriptive Statistics

We collected data from 215 parent-teen pairs. The majority of the teen (56.3%) and parent (67%) participants were female. Most parents (42.3%) were between 35 and 44 years of age with another 32.5% of parents between the ages of 45 and 54. The average age of teen participants was 14.78-years-old with a median of 15 years old. Most teens (65.5%) reported living in traditional two parent households. Parents in our sample reported household incomes ranging between $20k and to over $150k with a median household income of $60k. Among parents about 70% said they were White/Caucasian. 13% were African American, 13% were Hispanic, and 4% came from other ethnic origins. Teen participants had similar ethnic distributions to their parents.

| Measure | Cronbach's ∝ | | Skewness | | Kurtosis | | Mean/Median | | St. Dev. | | Difference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Parent | Teen | P | T | P | T | P | T | P | T | |
| **Technical Monitoring^** | 0.94 | 0.93 | 0.49 | 0.30 | -1.13 | -1.29 | 2.00 | 2.50 | - | - | -1.20 |
| **Internet Use** | 0.88 | 0.86 | 0.51 | 0.31 | -0.39 | -0.34 | 2.72 | 2.77 | 0.95 | 0.85 | -0.99 |
| **Parenting Style** | | | | | | | | | | | |
| Involvement^ | 0.84 | 0.86 | -1.87 | -1.36 | 7.93 | 4.83 | **4.33** | **4.22** | - | - | **-2.46*** |
| Strictness/Supervision^ | 0.89 | 0.88 | -1.10 | -0.99 | 0.776 | 0.39 | **4.67** | **4.50** | - | - | **-2.16*** |
| Autonomy Granting | 0.83 | 0.83 | -0.34 | -0.06 | -0.32 | -0.45 | **3.34** | **3.18** | 0.74 | 0.79 | **4.57*** |
| **Strengths/Difficulties** | | | | | | | | | | | |
| Prosocial | 0.78 | 0.78 | -0.38 | -0.47 | -0.17 | -0.13 | 3.96 | 4.02 | 0.66 | 0.68 | -1.62 |
| Hyperactivity | 0.79 | 0.77 | 0.25 | 0.45 | -0.26 | -0.29 | **2.35** | **2.18** | 0.79 | 0.81 | **4.47*** |
| Emotional | 0.86 | 0.89 | 0.93 | 0.99 | 0.27 | 0.21 | 2.09 | 2.10 | 0.88 | 0.97 | -0.22 |
| Conduct^ | 0.83 | 0.77 | 1.14 | 1.11 | 0.35 | 0.39 | 1.60 | 1.60 | - | - | -0.40 |
| Peer Problems | 0.70 | 0.74 | 0.82 | 0.56 | 0.26 | -0.32 | 2.11 | 2.11 | 0.70 | 0.76 | 0.03 |
| **Teen Victimization^** | 0.87 | 0.94 | 0.61 | 1.54 | -0.73 | 1.19 | **1.50** | **1.25** | - | - | **2.03*** |

*P=Parent, T=Teen; ^ Signifies skewed distributions; Median and Wilcoxon Signed Ranked tests were used for assessing non-normal data; * Denotes p-value <= 0.05, ** <= 0.01, *** <= 0.001*

A total of 89% of parents and 87% of teens said they completed their portion of the survey on their own. As shown in **Table 1**, the Cronbach's ∝ for all of our measures were above the threshold of 0.7, suggesting adequate construct validity [54,76]. However, we removed 2 scale items from the *strictness/supervision* scale due to poor reliability. We also found that our dependent variable (i.e., mobile technical monitoring) was skewed, which persuaded us to run a logistic instead of a standard regression. Thus, we dichotomized our dependent variable (0 = *Did not use*, 1 = *Did use technical monitoring*). The percentage of parents who reported using technical monitoring (dependent variable) was higher than in the Pew report [1], with 54% of parent participants reporting at least minimal (1 = *Rarely*) use of technical mediation (Median scores prior to dichotomization are reported in **Table 1**). Approximately 19% of teens in our sample said they did not know if their parents used technical monitoring on their mobile devices.

We also found some significant differences in the perceptions between parents and their teens (**Table 1**). Parents reported significantly higher levels of parental involvement, strictness/supervision, and autonomy granting compared to their teens. These findings are consistent with previous literature, which suggests that parental reports may be subject to social desirability effects [20]. Parents also reported significantly higher levels of hyperactivity exhibited by their teens than the teens themselves reported and assumed higher levels of teen online victimization than reported by their teens. To account for these differences, we made a methodological decision to run two separate regression models to assess parent perceptions and teen perceptions as indicators of parental technical monitoring of their teens' mobile devices. We chose to use parental reports as our dependent variable for both models, assuming parents were the authoritative source on whether or not they used parental control apps on their teens' mobile devices.

**Parent Model**

Using the parent variables to predict the likelihood that they used parental mobile control apps on their teens' devices (**Table 2**), we correctly classified 73.3% of the cases. The model explained 35% of the variance in our dependent variable. The logistic regression model was statistically significant, $\chi2(13) = 43.487$, p < 0.0005 [77]. An increase in the frequency of parental internet usage was associated with an increased likelihood of use of parental control apps on their teens' mobile devices. For each unit increase in the frequency of parental internet usage, parents were 2.307 times more likely to use parental control apps on their teens' devices.

In contrast, an increase in parents' self-reported autonomy granting parenting style was associated with a reduction of use of parental control apps on their teens' mobile devices. Autonomy granting was negatively associated with parental decision of using mobile parental control apps. For each unit increase in self-reported autonomy granting parenting style, the odds of using parental control apps decreased by a factor of 3.134. None of the other variable in our model reached a level of significance. We also tested for interaction effects between involvement and strictness/supervision parenting styles and did not find any significant effects.

**Table 2: Parent Model. Binary logistic regression predicting likelihood of the use of mobile parental control apps. Nagelkerke $R^2 = 35\%$.**

| Variable Name | B | S.E. | Odds Ratio |
|---|---|---|---|
| Constant | 6.468 | 3.714 | 644.286 |
| **Demographics** | | | |
| Female | ref | | |
| Male | -0.352 | 0.494 | 0.703 |
| Age | -0.336 | 0.29 | 0.715 |
| SES | -0.123 | 0.152 | 0.884 |
| **Parent Internet Use** | **0.836**\*\* | 0.302 | 2.307 |
| **Online Victimization** | -0.179 | 0.148 | 0.836 |
| **Parenting Styles** | | | |
| Involvement | -0.026 | 0.534 | 0.974 |
| Strictness/Supervision | -0.492 | 0.424 | 0.611 |
| Autonomy Granting | **-1.141**\*\* | 0.392 | 0.319 |
| **Teen Strengths and Difficulties** | | | |
| Prosocial | 0.157 | 0.437 | 1.169 |
| Hyperactivity | -0.183 | 0.404 | 0.833 |
| Emotional Symptoms | 0.657 | 0.512 | 1.930 |
| Conduct Problems | -0.626 | 0.540 | 0.535 |
| Peer Problems | -0.118 | 0.461 | 0.889 |

*Denotes p-value <= 0.05, \*\* <= 0.01, \*\*\* <= 0.001*

**Table 3: Teen Model. Binary logistic regression predicting likelihood of the use of mobile parental control apps. Nagelkerke $R^2 = 31\%$.**

| Variable Name | B | S.E. | Odds Ratio |
|---|---|---|---|
| Constant | -1.080 | 2.539 | 0.340 |
| **Demographics** | | | |
| Female | ref | | |
| Male | -0.519 | 0.352 | 0.595 |
| Age | 0.014 | 0.119 | 1.014 |
| **Teen Internet Use** | **0.795**\*\* | 0.254 | 2.215 |
| **Online Victimization** | **0.693**\*\* | 0.266 | 1.999 |
| **Parenting Styles** | | | |
| Involvement | -0.041 | 0.377 | 0.960 |
| Strictness/Supervision | 0.284 | 0.308 | 1.329 |
| Autonomy Granting | **-0.605**\* | 0.254 | 0.546 |
| **Teen Strengths and Difficulties** | | | |
| Prosocial | -0.124 | 0.303 | 0.883 |
| Hyperactivity | 0.315 | 0.330 | 1.370 |
| Emotional Symptoms | -0.398 | 0.333 | 0.672 |
| Conduct Problems | -0.788 | 0.438 | 0.455 |
| Peer Problems | **0.696**\* | 0.336 | 2.006 |

*Denotes p-value <= 0.05, \*\* <= 0.01, \*\*\* <= 0.001*

**Teen Model**

Using the teen variables to predict the likelihood that their parents used parental mobile control apps on their mobile devices (**Table 3**), we correctly classified 71.2% of the cases. The model explained 31% of the variance in our dependent variable. The logistic regression model was statistically significant, $\chi 2(12) = 55.688$, p < 0.0005 [77]. Similar to parents, an increase in the frequency of teen internet usage was associated with an increased likelihood of use of parental control apps on teens' mobile devices. For each unit increase in the frequency of teen internet usage, parents were 2.215 times more likely to use parental control apps on their devices.

For each unit increase in the frequency of teen online victimization, parents were 1.999 times more likely to use parental control apps. Additionally, for each unit increase in

the frequency of teen self-reported peer problems, parents were two times more likely to use technical monitoring. Autonomy granting was negatively associated with parental decision of using mobile parental control apps. Autonomy granting was negatively associated with parental decision of using mobile parental control apps. For each unit increase in teens' reports of autonomy granting parenting style, the odds of their parents using parental control apps decreased by a factor of 1.831. None of the other variable in our model reached a level of significance, and no interaction effects were detected between the parenting style dimensions of involvement and strictness/supervision.

**Table 4** summarizes the results above in relation to each of the research hypotheses proposed earlier in our research framework. The significant main effect of autonomy granting parenting and absence of an interaction effect

**Table 4: Summary of Hypotheses Testing Results**

| Hypotheses | Parent Model | Teen Model |
|---|---|---|
| **H1:** Authoritative Parent Style → Technical Monitoring (+) | Not Supported | Not Supported |
| **H2:** Authoritarian Parenting → Technical Monitoring (+) | Supported | Supported |
| **H3:** Teen Psychological & Behavioral Problems → Technical Monitoring (+) | Not Supported | Supported (*Peer Problems*) |
| **H4:** Teen Online Victimization → Technical Monitoring (+) | Not Supported | Supported |
| **H5/H6:** Internet Use → Technical Monitoring (+) | Supported | Supported |
| **H7/H8:** Age → Technical Monitoring (-) | Not Supported | Not Supported |

Parenting Styles

Teen Problems

$R^2 = 19.6\%$

Involvement (P) —— -0.25*** —— Peer Problems (T)

-0.35***

Autonomy Granting (P) —— -0.26*** ——

-0.23***

0.17**

Strictness Supervision (P) —— -0.24*** ——

0.30***

Technical Monitoring (P)

$R^2 = 17.4\%$

Online Victimization (T)

0.21**

$R^2 = 36\%$
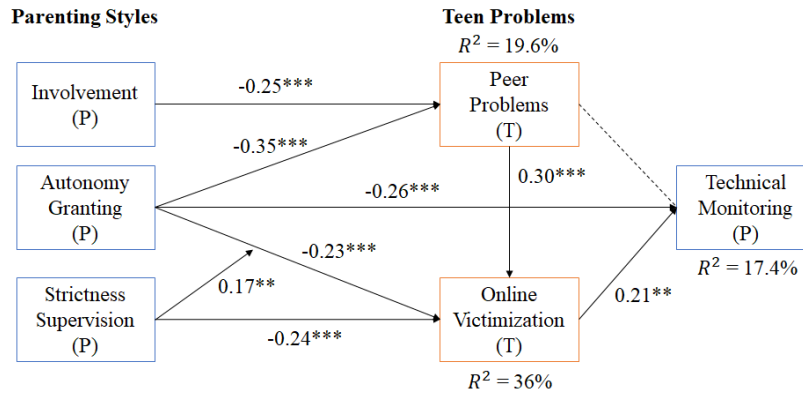
*P: Parent, T: Teen; * denotes p-value <= 0.05, ** <= 0.01, *** <= 0.001; Dotted line denotes non-significant path previously significant in the logistical regression*

**Figure 1. Post-Hoc Structural Equation Model**

between involvement and strictness/supervision provides support for **H2**, that authoritarian (low *autonomy granting*) parents are significantly more likely to use parental control apps. It also suggests a lack of support for **H1**, that authoritative (high *autonomy granting*) parents are also more likely to use these apps. However, because neglectful parents are also low *autonomy granting*, we felt it necessary to do further post hoc analyses.

**Post-Hoc Analysis**
To understand the differences found between our parent and teen models, why some of our hypotheses were not supported, and to disentangle the potential interaction effects between the three parenting style dimensions, we conducted an exploratory post hoc analysis. In our previous models, teen peer problems and online victimization were significant in the teen model, but not in the parent model. We wanted to further examine the relationships between parenting styles, these two salient constructs, and our dependent variable. To do this, we included parenting styles (as reported by parents), teen peer problems (as reported by teens), teen online victimization (also by teens), and technical monitoring (as reported by parents) into one structural equation model. We started our exploration by creating a saturated PLS-SEM model, which included paths between all constructs [19], to explore direct and indirect effects among constructs. Then, we tested all possible interaction effects among the three dimensions of parenting style and other model constructs. Next, we trimmed non-significant paths (i.e., paths not drawn are not significant) to arrive at the model presented in **Figure 1**.

As shown in **Figure 1**, we found a significant and positive relationship between teen peer problems and online victimization Interestingly, the direct path between peer problems and technical monitoring (represented by a dotted line in **Figure 1**, which was previously significant in our logistic regression model for teens in **Table 3**) became insignificant; this suggests that online victimization fully mediated the relationship between teen peer problems and

technical monitoring. The other direct paths that were significant in our earlier models remained unchanged; however, this new model uncovered additional nuance between the three dimensions of parenting styles, teen peer problems, and online victimization. Low autonomy granting parenting was associated with both increased peer problems and increased teen online victimization; in contrast, strictness/supervision was associated with lower levels of online victimization, and involvement with fewer peer problems (but not directly related to online victimization).

Next, we tested for any moderating effects of parenting style dimensions (involvement, strictness/supervision, and autonomy granting) on peer problems, online victimization, and technical monitoring. Using a two-stage method in SmartPLS 3 [51], we found a significant moderating effect between autonomy granting and strictness/supervision on online victimization (**Figure 2**). Based on the four distinct parenting styles [13], we found that teens of neglectful parents reported significantly higher levels of online
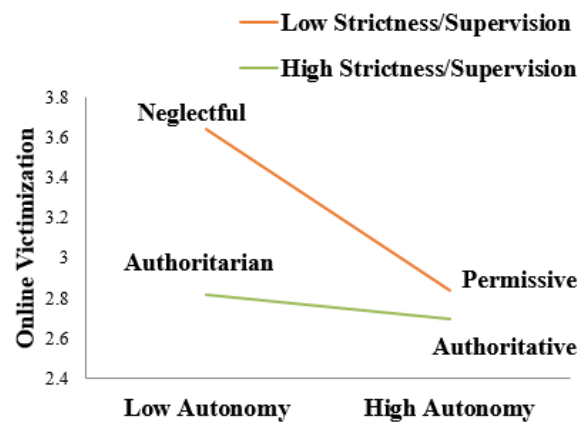


**Figure 2. Moderation Effect of Strictness/Supervision x Autonomy Granting on Online Victimization**

victimization than authoritarian, permissive, and authoritative parents. Finally, to account for the significant differences in parenting style as reported by teens versus their parents, we reran the model using the teen responses for parenting style. All paths in the model reached the same level of significance and were in the same direction as the model shown in **Figure 1**.

## DISCUSSION
Below, we discuss the implications of our results, provide design recommendations, and note the limitations of our work.

### A Matter of Control over Safety (RQ1)
Low autonomy granting parents were the most likely to use parental control apps on their teens' mobile devices (**H2**), and teens who experienced online victimization in the past year were the most likely to have parents who used technical monitoring on their mobile devices (**H4**). Meanwhile, low autonomy granting parenting styles (i.e., authoritarian or neglectful) were associated with increased teen peer problems and online victimization, suggesting what many researchers have already confirmed in offline contexts [57,62], that these parenting styles may not be the most effective in terms of protecting teens from experiencing online risks. As such, our results provide little evidence to suggest that use of parental control apps protect teens from experiencing online risks.

Instead, we found that low autonomy granting parents used parental control apps *regardless* of whether their teens were experiencing problems or not; our post hoc analysis showed that teen peer problems and online victimization only partially mediated the relationship between low autonomy granting parenting and technical monitoring (**Figure 1**). And, while authoritarian parenting was associated with less teen online victimization (**Figure 2**), it was at the expense of increased peer problems (**Figure 1**). Our findings provide empirical evidence that validates past research that suggested parental restrictions from the internet, as a means to safeguard teens from risks, may have the opposite result, making teens feel ostracized by their peers [15].

We found that authoritative parenting was not significantly associated with the use technical monitoring (**H1**) and believe this departure from Eastin et al.'s [14] earlier findings uncovers a unique difference between the social norms around in-home computers versus personal mobile devices. Compared to home computers, teens view their mobile smartphones as *personal* devices and the activities they engage on via these devices as private [6,11]. These devices afford a significant level of "practical obscurity" that shields teens from concerned oversight and/or potentially prying eyes of their parents [6]. However, many parents also believe that teens' mobile devices are more "off-limits" than home computers due to different norms around mobile versus stationary technologies and, in some cases, the fact that the teen purchased the mobile device [11,16,71]. Thus, existing parental control apps likely do not meet the needs of authoritative parents because these apps are designed for more authoritarian parents, who want to strictly monitor and control their teens' online activities via their mobile devices.

### A Disconnect between Parents and Teens (RQ2)
A methodological contribution of this work is that we triangulated the results from the differing perspectives of parents and teens. In doing this, we uncovered several insights. First, parents were optimistic about themselves and pessimistic about their teens: Parents reported significantly higher levels of involvement and autonomy granting parenting than their teens, which is consistent with Blackwell et al. [6], who found that parents thought they talked to their teens about appropriate technology use, while their teens just heard "no." In contrast, parents reported significantly higher levels of teen hyperactivity and online victimization than the teens themselves reported (**Table 1**). While we cannot confirm whether parents or teens were more accurate in their assessments, we can confirm that their perspectives on these topics were, indeed, different. As such, the relationships between model constructs changed based on parent versus teen reports. For instance, even though parents thought their teens were encountering more online risks overall, this perception was not significantly correlated with their use of technical monitoring on their teens' mobile devices (**Table 2**). Only the teen model showed any significant relationships between the teen factors and the use of parental control apps (**Table 3**). This suggests a disconnect, where parents may not be attuned to the social problems (peer and online victimization) their teens may be experiencing. Thus, they may be unable to adjust their parenting practices in a way that provides the understanding and support teens need to overcome these challenges [55].

### Implications for Good Parenting by Design (RQ3)
In terms of implications for design, the key insights, or rather questions, that arise from our findings, are: 1) *How we can design better parental control apps that promote healthy parenting styles and teen online safety?*, and 2) *Should we?* To tackle the first question, we argue that "parental control" apps should be done away with and replaced with "family online safety" apps that reinforce evidence-based parenting practices that have been shown to lead to the more beneficial outcomes for teens. We amplify Nouwen et al.'s [46] earlier recommendation, which was to take a value-sensitive design approach [18,46] to design online safety software for families. These researchers confirmed that parents value *involvement*, not just safety and control, when it comes to parental software solutions for child online safety. Several researchers have pushed for a shift away from parental controls toward more supportive structures that encourage children's autonomy, learning, and involvement in family online rule-setting and fostering intentional and appropriate use of technology (e.g., [28,31,33,67,73]). The central idea around this movement is to treat online safety more holistically, as not only

protecting teens from online risks, but also teaching them positive behaviors that support their developmental growth.

Authoritative parenting is characterized by high levels of involvement and autonomy support, coupled with high demands and engaged supervision [13], clear limits, effective communication, rational decision-making, flexibility, and warmth [10]. Our results showed that authoritative parenting was associated with fewer peer problems, less online victimization, and a lower likelihood of using parental control apps. Therefore, using an *Authoritative by Design* approach to create a new generation of family online safety apps could have a two-fold effect: 1) Increasing the likelihood that more parents will use these apps because they are consistent with their (positive) family values and norms, and 2) Having the potential to "nudge" [37] authoritarian, permissive, and neglectful parents toward more authoritative approaches that could improve youth outcomes.

This research potential direction ("nudging" parenting styles) warrants future investigation by interdisciplinary research teams (HCI researchers, Psychologists, etc.) to understand the potential good, as well as the ethical implications, of attempting such an endeavor. Parenting styles are influenced by a multitude of contextual factors, including culture, customs, laws, beliefs in childrearing [60]; yet, very few researchers have studied whether parenting style can potentially be influenced by technology. However, effective parenting styles vary by culture and race; for instance, authoritarian parenting practices in Black American families have been linked to lower suicidal behaviors, less aggression, and positive family interactions [9,25,26]. Thus, instead of designing online safety apps that promote a specific parenting style, it may be more effective to implement an intelligent design that personalizes parenting style based on context and user goals [61].

As we make these design recommendations for the next generation of parental controls apps, we must also acknowledge that the HCI research community is often guilty of taking an "evangelical" view towards technology, where we do our best to improve systems, and how people interact with these systems, to meet users' needs and, ultimately, increase technology acceptance through improved user experience. Yet, an underlying assumption of this approach is that all humans *should* be users [3] and that sociotechnical systems *can* and *will* (if designed correctly) fill unmet human needs. In many cases, this assumption is flawed and limits our ability to think beyond cutting-edge technology solutions to the human systems that these sociotechnical systems are designed to support. The use of technology to improve human interactions may actually harm human relationships instead of improving them [30,48,52]. As HCI researchers, we have an ethical responsibility to promote sociotechnical systems that better society, but we also have the responsibility to protect people from using systems that may (even if unintentionally) accomplish the opposite goal [24]. The results of this study provide an opportunity to reflect on the possibility that parental control apps (at least in their present form) may cause more harm than good.

**Limitations and Future Research**

A key limitation of our research is that it was cross-sectional in nature, which constrains us from making any causal statements. For example, while it is more likely that past online victimization would prompt parental use of technical monitoring, it is also possible that technical monitoring of a teen's mobile device may actually increase online victimization (based on the positive correlation). Some studies have alluded to similar "boomerang effects" [56], but were also cross-sectional, so should also be interpreted with caution. Thus, future research should conduct longitudinal studies that help confirm the causal effects of different parental mediation strategies, including the use of technical monitoring of mobile devices, on teen-related online safety outcomes. For our dependent variable, we only inquired as to whether parents used parental control technologies to monitor text messaging and app installations of their teens' phones. However, parental control apps may also monitor other activities, such as web browsing, social media use, screen time, and GPS location tracking [7,53,66]. We encourage future research to study these additional types of parental control features in more depth. We also conducted a quantitative survey-based study that lacked open-ended questions to gather additional insights from our participants. Future work should use more qualitative approaches to further disentangle why the relationships between constructs in our models and discrepancies between parents and teens perceptions exist. Finally, our findings, and thus our recommendations, toward designing for authoritative parenting styles were influenced by our sample of predominantly Caucasian families in the U.S., as well as our own Westernized views. Therefore, future research should verify whether our results are generalizable to other populations, cultures, and races.

**CONCLUSION**

This study is the first to investigate factors that contribute to the use of parental control apps. We found that these "control" apps are, indeed, appropriately named, as low autonomy granting or controlling parenting was one of the key factors that predicted adoption, but was also associated with higher levels of peer problems and online victimizations. Thus, we conclude that parental control does *not* equate to teen safety, and that autonomy-supportive, involved, yet strict parenting, whether through technology or not, is likely the best approach for online parenting.

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