

Resilience Mitigates the Negative Effects of Adolescent Internet Addiction and Online Risk Exposure

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ABSTRACT

We cannot fully protect adolescents from experiencing online risks; however, we can aim to better understand how online risk experiences impact teens, factors that contribute to or prevent teens from exposure to risk, as well as factors that can protect teens from psychological harm *in spite* of online risk exposure. Through a web-based survey study of 75 adolescents in the US, we develop and empirically validate a theoretical model of adolescent resilience in the presence of online risks. We show evidence that resilience is a key factor in protecting teens from experiencing online risks, even when teens exhibit high levels of Internet addiction. Resilience also neutralizes the negative psychological effects associated with Internet addiction and online risk exposure. Therefore, we emphasize the importance of design solutions that foster teen resilience and strength building, as opposed to solutions targeted toward parents that often focus on restriction and risk prevention.

Author Keywords

Adolescent Online Safety; Internet Addiction; Risk; Resilience

ACM Classification Keywords

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

INTRODUCTION

Understanding adolescent online behaviors and experiences is critical to teens' safety and wellbeing. In 2011, Yardi and Bruckman [40] called for studies of what teens do online and what might be done to mediate their use of technology. Three years later, there remains a paucity of research in the CHI community that has focused specifically on understanding adolescents as online users, even though

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teens are often early adopters and heavy users of Internet and social media technologies. It is crucial for HCI researchers to invest resources in studies that examine how teens interact within online contexts, pinpoint the key challenges associated with their online activities, identify theories that can help to address these challenges, and design solutions that support teens as well as their families and friends in optimizing the benefits while navigating the risks associated with online technology use.

To help fill in this research gap, we conducted a web-based survey study of 75 US adolescents (13 to 17-years-old). Our intent was to study the negative effects (i.e. psychological and affective responses) that Internet Addiction and Online Risk Exposure might have on adolescents and to examine how teens' level of Resilience might mitigate the possible negative effects associated with these risks. *Resilience* is the ability to overcome negative effects associated with risk exposure, helping an individual cope with traumatic experiences [34]. It is an intrinsic capability but also a competence that can be acquired and developed [1]. Therefore, if resilience can reduce the negative effects associated with Internet Addiction and Online Risk Exposure, our research will provide researchers, educators, designers, and parents with new insights on how to help protect teens online. Further, we will gain a better understanding of how teens can protect themselves against online risk exposure.

In this paper, we first draw from past research on adolescent online safety to develop a theoretical framework of adolescent resilience in the presence of online risks. We then empirically validate the resulting framework through a quantitative survey study. Using path and mediation analyses [23], we confirmed the negative impact of Internet Addiction on Negative Affect. We also observed that Risk Exposure partially mediates the relationship between Internet Addiction and Negative Affect. Most importantly, we found that Resilience plays a key role in protecting teens, either neutralizing or reducing the negative effects of Internet Addiction and Online Risk Exposure. We discuss the key implications of our findings.

BACKGROUND

Many researchers interested in online safety for adolescents have investigated factors that influence teens' exposure to

various online risks. A common perspective in these studies is what might be termed a “risk-adverse” view of adolescent online safety, where risk exposure is framed as the dependent variable of interest, with the presumption that minimizing exposure to such risks is the desirable outcome [38]. Few studies move beyond examining the factors that affect adolescent online risk exposure, for example to seeking to understand the negative effects that such exposure might have on teens or how one might mitigate the negative effects once risk exposure occurs [38].

To illustrate why a deeper analysis is needed, consider this contrast: Two teens view the same unwanted pornographic online content; one teen ignores the explicit sexual imagery while the other is traumatized. In both cases, it is unrealistic to believe that we (as parents, designers, researchers, and adults) could have prevented either teen from viewing such undesired content – that is, eliminating exposure to the risk. Thus, it becomes increasingly important to understand how and why such exposure negatively impacts some teens (and not others), as well as to explore protective measures for keeping teens safe online *in spite* of online risk experiences.

Researchers from EU Kids Online were among the first to explain that adolescent exposure to online risks does not necessarily equate to harm [9, 29]. They found that youth who reported having more psychological problems and/or lower self-efficacy tended to become more bothered when experiencing these online risks while other teens remained unbothered [9]. Yet, the authors admit that a key limitation of their study was their simplified, dichotomous treatment of resilience as being “not bothered” [9]. Our research draws from and builds on this prior literature, offering a more detailed examination of adolescent resilience in the presence of online risks. Our research therefore makes the following key contributions:

- Draws from developmental psychology to build a theoretical framework of adolescent resilience in the presence of online risk exposure;
- Operationalizes theoretical constructs with pre-validated psychological instruments for measuring Resilience and Negative Affect; and
- Empirically validates the resulting theoretical model to demonstrate relationships among Internet Addiction, Online Risk Exposure, Resilience, and Negative Affect for adolescents.

THEORETICAL FRAMEWORK

Adolescent Resilience Framework

We designed our study around a theoretical framework of *adolescent resilience* that was derived and validated by researchers in developmental psychology [34]. The framework has been useful in explaining outcomes related to a number of risky teen behaviors, including substance abuse, violent behavior, and sexual promiscuity. We are one of the first to apply the adolescent resilience framework to risky behaviors that are linked to Internet use. Research

grounded on theories of adolescent resilience differs from the “risk-adverse” approach often taken in adolescent online safety research by “focusing on the assets and resources that enable adolescents to overcome the negative effects of risk exposure (p. 399)” [34], rather than trying to limit exposure to risk. Another way of understanding the contrast is that the resilience perspective leads to a focus on teen strengths rather than their deficits. A key point in this theoretical view is that both *risk* (negative influencing) and *promotive* (positive influencing) factors are seen as contributors to risk exposure and outcomes. Additionally, the outcomes associated with resilience theory are not simply whether or not teens are exposed to risk, but instead whether or not they are able to thrive *in spite* of it [34].

We are particularly interested in the *protective model* [34] of resilience in which promotive factors mitigate the effects of risk exposure on negative outcomes in two ways: First, a promotive factor can have a *protective-stabilizing effect* such that the presence of the factor neutralizes the effect of risk exposure on the negative outcome (i.e. moderating the relationship between risk exposure and a negative outcome so that it is no longer operative). Alternatively, it can have a *protective-reactive effect* where it diminishes the effect of risk exposure on a negative outcome but does not remove it. **Figure 1** illustrates the generalized theory summarizing the protective model of adolescent resilience [34]. In the following sections, we introduce the salient constructs of our theoretical model for online risk exposure as they map to the adolescent resilience framework [34].

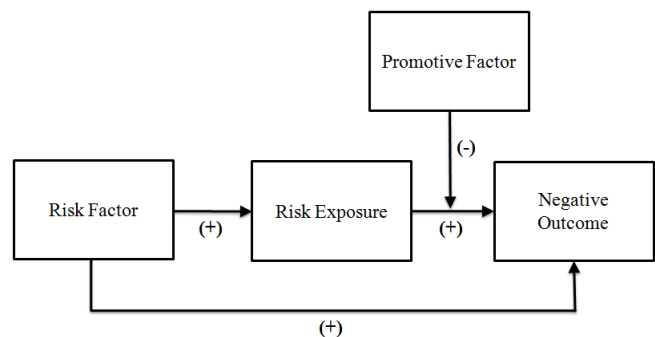


Figure 1: Protective Model of Adolescent Resilience

Online Risk Exposure

Adolescents encounter a number of different types of risks when they engage with others online. Online risks examined in past research studying adolescent online safety include teens becoming the victims of information breaches [27-28]; online harassment or cyberbullying [25, 30]; sexual solicitations [25, 32]; and exposure to pornography, violence, or other explicit content [25, 28-29]. Therefore, we define *Online Risk Exposure* as a culmination of these various negative online risk experiences. Online Risk Exposure as a construct is central to our research: We seek to understand the negative effects associated with Risk Exposure, factors that contribute to or limit Risk Exposure;

and especially factors that may protect teens from online risks once they have been exposed.

Negative Outcome: Negative Affect

The EU Kids Online studies [9, 29] conceptualized the negative outcome associated with a range of online risk exposures as whether or not youth were “bothered” by the experience; that is, the study operationalized Resilience as a dichotomous outcome variable [9]. We extend that earlier research by reframing resilience using the adolescent resilience framework [34] derived from developmental psychology; we also integrate the theoretically sound and clinically proven construct of Negative Affect to capture negative outcomes associated with Online Risk Exposure. *Negative Affect* is a psychological, self-reported measure of “distress and unpleasurable engagement that subsumes a variety of aversive mood states, including anger, contempt, disgust, guilt, fear, and nervousness (p. 1063)” [36]. The construct has been validated and widely used in social and behavioral psychology research [13, 36]. It is associated with anxiety, stress, poor coping, and health complaints [36], and has been deemed “clinically useful for identifying youth with anxiety and mood problems (p. 191)” [13]. Given the relevance of Negative Affect as a potential negative outcome of Online Risk Exposure, we adopt it as our dependent variable.

Risk Factor: Internet Addiction

We defined *Internet Addiction* as the problematic [26] or excessive use of the Internet to the point where it becomes a psychological dependence [5] that “displaces [teen’s] social or personal needs in a way that they cannot control (p. 30)” [27]. Internet Addiction has been studied as a risk factor that contributes to negative, emotional and psychological responses, such as depression, loneliness and hostility in adolescents’ online communication [35]. Studies have directly linked adolescent Internet users’ compulsive or excessive use of the Internet to Negative Affect [5, 41]. However, even though Internet Addiction is seen as a pathologically problematic behavior [5, 41], it is not clear how addictive Internet use leads to these undesirable outcomes. We argue that teens’ exposure to negative, Online Risk experiences may help to explain why excessive and problematic use of the Internet correlates with these negative psychological outcomes. Some studies have shown that compulsive Internet use influences the frequency with which adolescents are exposed to online risks [12, 26]; others indicate that experiencing online risks such as peer aggression and unwanted sexual material upset teen users and sometimes result in more severe, public health problems [10, 31]. Nonetheless, there is little evidence that relates Online Risk Exposure to the psychological well-being of teens; in particular there has been no empirical test of the potential mediation effect of Online Risk Exposure on the relationship between Internet Addiction and Negative Affect. Therefore, we propose that:

H1: Online Risk Exposure mediates the relationship between Internet Addiction and Negative Affect.

Promotive Factor: Resilience

Reducing the Negative Effects of Online Risk Exposure

Resilience “embodies the personal qualities that enable one to thrive in the face of adversity (p.76)” [8], and can be viewed as a measure of one’s stress coping ability for reducing negative psychological outcomes, such as anxiety, depression, and other stress-related outcomes associated with negative experiences. Based on the protective model of resilience, a promotive factor can moderate the relationship between risk exposure and a negative outcome by either neutralizing the relationship between the two or weakening it [34]. For example, Héber et al. [20] found that Resilience played a protective role against post traumatic stress in the context of adolescent sexual abuse. Fincham et al. [16] similarly identified Resilience as a moderating factor which significantly reduced the effects of child abuse and neglect on symptoms of post traumatic stress.

Past research has confirmed a strong, negative correlation between Resilience and Negative Affect [2]. Yet, to date, we could not find any study that specifically used resilience theory to investigate a protective role for Resilience as a moderator in the relationship between Online Risk Exposure and Negative Affect. One study by D’Haenens et al. [9] found that adolescents who took more proactive approaches to coping with online risk experiences felt more empowered and less bothered by negative online experiences. Thus, applying resilience theory and the results of this related empirical study as our justification, we propose that:

H2: Resilience moderates the relationship between Online Risk Exposure and Negative Affect by reducing the effect of Online Risk Exposure on Negative Affect.

Reducing Risk Exposure for the Internet Addicted

Because resilience implies the presence of risk [6], researchers tend to consider resilience as consequential to risk and discuss the effect of resilience in terms of reducing negative outcomes after risk exposure (as we do in H2). However, this approach may oversimplify the role of resilience and overlook the interplay of risk and resilience over time. More recently, researchers have pointed out the need for examining risk and resilience at multiple stages, emphasizing their dynamic relationship through adolescents’ development [7]. Resilience may have an “inoculation effect,” where past negative experiences may help build resilience to experiencing future risks [34]. Previous, negative online experiences may facilitate the development of coping strategies, which can directly influence adolescents’ future online activities and behaviors, including avoidance of or protection against online risk [24]. From a developmental point of view – considering risk exposure as part of a learning process –

resilience that develops through previous risk encounters may either reduce the possibility of exposure to risk in the future or reduce the negative impact felt in the present [24].

Research that has used Social Cognitive Theory and Protection Motivation Theory to study adolescent online behaviors provides theoretical support for the effects of resilience on risk protection. Scholars [18] have suggested that the self-perception of being able to anticipate, control, avoid, or cope with the potential risks can positively influence individuals' reaction to potential online risks. Such resilience can determine adolescents' decision as to whether or not they would be engaged with risky online activities [33]. Studies of online risk intervention [4] have shown that positive coping appraisals and previous safe behaviors can reduce online risk to which frequent teenaged Internet users are susceptible. Yet, empirical evidence is still needed to see if Resilience may effectively limit Online Risk Exposure of adolescents, especially in cases of Addictive Internet Use. Therefore, we also propose a moderation effect of Resilience as a *first-stage* moderator between Internet Addiction and Online Risk Exposure:

H3: Resilience moderates the relationship between Internet Addiction and Online Risk Exposure by reducing the effect of Internet Addiction on Online Risk Exposure

In summary, we propose to examine the mediating effects of Online Risk Exposure (H1) as well as the possible moderating effects of Resilience, both with respect to reducing Negative Affect in the presence of Online Risk Exposure (H2), and limiting Online Risk Exposure as a result of Addictive Internet Use (H3). **Figure 2** illustrates the corresponding two-stage (pre- and post-risk exposure) theoretical framework of adolescent resilience in online contexts. In our Methodology section, we will explain how we empirically validate this theoretical framework.

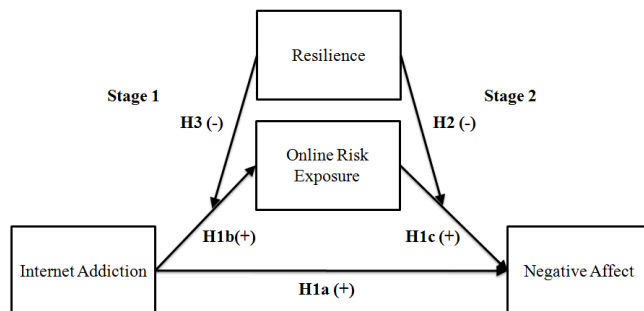


Figure 2: Theoretical Model of Adolescent Online Resilience

METHODOLOGY

Operationalizing Constructs

We used pre-validated measures to operationalize the majority of our constructs. All measures were based on 5-point Likert scales and indices were created based on standardized, average scores across all items. **Negative Affect** was measured by asking teen participants to indicate their degree of negative feelings and emotions based on 15

adjectives such as “sad,” “frightened,” and “ashamed” from Watson’s Positive and Negative Affect Scales (PANAS) [36]. **Internet Addiction** was measured using six items from previous research [27]; for example, how often teens “felt bothered when [they could not] be on the Internet.” **Resilience** was measured using the proprietary Connor-Davidson Resilience Scale (CD-RISC 10) [3], which we licensed from the authors [8]. It was comprised of ten items, for example, asking teens if they handled “painful feelings” effectively [3]. We created our own scale for adolescent **Online Risk Exposure**, working from a meta-review of the adolescent online safety literature to compile 16 items that probed unique yet common online risk experiences across four risk types (information breaches, online harassment, sexual solicitations, and exposure to explicit content; see **Appendix A, Table 2**). To encourage teen reporting, we minimized the implied severity of the risk categories by relabeling them in the survey to “information sharing,” “online interactions,” “online flirtations,” and “online content,” respectively. The four risk types were collapsed to create an overall measure of Online Risk Exposure because we found them to be highly intertwined, both conceptually and empirically.

Data Collection and Recruitment

We designed a web-based survey study using the Qualtrics survey platform. Because our target population consisted of minors (US-based adolescents between the ages of 13 and 17-years old), we obtained informed consent from both teens and a parent or legal guardian. Participation was incentivized with a \$25 Amazon.com or Walmart gift card mailed to participants at their home address after survey responses were verified. We began recruitment during January 2014 and completed data collection May 2014. We first attempted to recruit teens through public high schools across the US but encountered too many barriers to entry. Therefore, we reached out via phone calls and emails to public libraries, YMCA’s, non-profit organizations, government-funded children and youth service organizations, family-based community centers, churches, and after-school programs across the US. We also sent recruitment mailings through a contact database of parents based on birth announcements from the local vicinity, which is maintained by our university’s psychology department. The majority of our participants were recruited from the state of Pennsylvania (74%); however, we had representation within 12 other states, including New York (8%), South Dakota (3%), Florida (3%), and others (12%).

Data Analysis Approach

To test our theoretical model, we leveraged path analysis techniques using IBM SPSS AMOS 22 [23]. Mediation effects and moderated mediation effects were analyzed using PROCESS, an SPSS macro for observed variable mediation, moderation, and conditional process modeling [19]. When examining the moderating role of Resilience, three path models and three moderated mediation models

were examined, framing Resilience as: 1) a *second-stage* moderator (H2: Online Risk Exposure X Resilience → Negative Affect), 2) a *first-stage* moderator (H3: Internet Addiction X Resilience → Online Risk Exposure), and 3) as both a *first-stage* and *second-stage* moderator (**Figure 2**), respectively. In the Results section, descriptive statistics, path model, and mediation results will be reported.

RESULTS

Participant Profiles

Ninety-five teens originally registered to participate in our online survey study and completed the process of informed consent. However, we had a total of 75 complete survey responses from our participants, including 46 girls and 29 boys between the ages of 13 and 17-years old. The age distribution of teens was as follows: 13-years old (17%), 14 (31%), 15 (21%), 16 (17%), and 17 (13%). The majority of our participants were Caucasian (73%), 13% African-American, 5% Hispanic, 3% Asian, and 5% of reported being of “other” descent. Most of the teens lived in two parent homes with their mother and father (60%), while 17% reported living with their mother only, 18% reported living with one biological parent and one step-parent, and 5% reported having other living arrangements. We asked teens how frequently they used the Internet; 33% of teens reported being online several times an hour, 41% went online several times a day, 24% reported going online every day or almost every day, and 1% of teens reported going on the Internet once or twice a week. **Table 1** summarizes the scale reliabilities and descriptive statistics for all of the main constructs in our model.

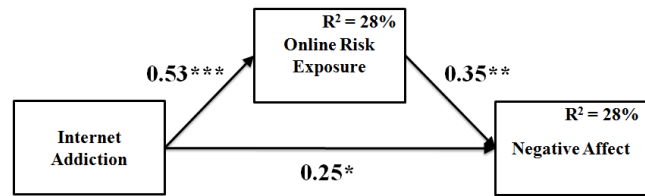
Table 1: Scale Reliabilities and Descriptive Statistics

Construct	Cronbach's α	Mean	SD
Negative Affect	0.95	1.85	0.77
Online Risk Exposure	0.85	1.51	0.42
Resilience	0.91	3.56	0.76
Internet Addiction	0.78	2.46	0.80

Path Model Results

Mediation Model of Risk Exposure

First, the proposed mediating model (H1) of Online Risk Exposure between Internet Addiction and Negative Affect was tested. **Figure 3** shows the path model, indicating positive significant paths between Internet Addiction and Negative Affect (H1a); Internet Addiction and Online Risk Exposure (H1b), as well as Risk Exposure and Negative Affect (H1c). The indirect effect of Addiction on Negative Affect was also statistically significant at the $p = 0.05$ level. These combined findings confirm a significant, yet partial, mediation effect of Online Risk Exposure, providing support for our first hypothesis. Overall, this mediation model had fairly high explanatory power, explaining 28% of the variance in Online Risk Exposure and 28% of the variance in Negative Affect.



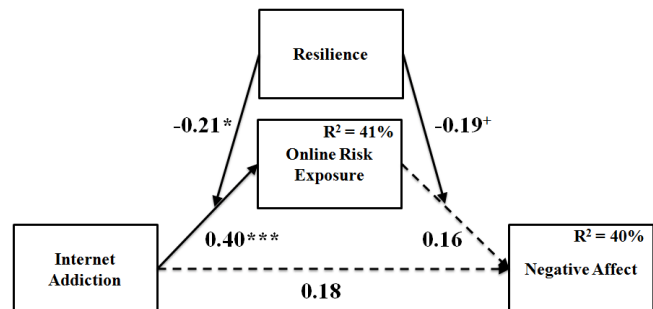
* p -value < 0.05, ** < 0.01, *** < 0.001

Figure 3: Effects of Internet Addiction and Risk Exposure

Moderated-Mediation Models of Resilience

Next, we iteratively tested the competing theoretical models of Resilience. We first tested Resilience as only a second-stage moderator between Online Risk Exposure and Negative Affect (H2), as this model is most consistent with resilience theory [34]. Second, we tested Resilience as only a first-stage moderator between Internet Addiction and Online Risk Exposure (H3). Third, we tested our proposed model of Resilience that includes the construct as both a first and second (two-stage) moderator (**Figure 2**). Fit statistics of all three models are included in **Appendix A, Table 3**. Only our proposed model of Resilience as both a first and second stage moderator indicated a good fit with the data; therefore, we present the results of our proposed model below.

As shown in **Figure 4**, our proposed model indicated a significant interaction between Internet Addiction and Resilience (H3; $p < 0.05$), which predicted Risk Exposure and a marginally significant interaction between Risk Exposure and Resilience (H2; $p = 0.07$), which predicted Negative Affect. The direct effect of Online Risk Exposure on Negative Affect became non-significant; the direct and indirect effects of Addiction also became statistically insignificant. This model yielded a good fit to the data (**Appendix A, Table 3**) and indicated high explanatory power, explaining 41% of the variance in Online Risk Exposure and 40% of the variance in Negative Affect.



+ p -value < 0.10, * < 0.05, ** < 0.01, *** < 0.001

Figure 4: Effects of Resilience (Full Model)

In order to illustrate how Resilience moderated Online Risk Exposure (H2) and Internet Addiction (H3), we dichotomized (High/Low) each variable based on one +/- standard deviation from the mean and graphed the

interaction effects [11]. **Figure 6** shows the marginally significant interaction between Online Risk Exposure and Resilience on Negative Affect. This pattern is consistent with adolescent resilience theory's *protective-stabilizing model* of a promotive factor on negative outcomes [34]. In the presence of frequent Risk Exposure, Resilience essentially neutralizes the negative effects of Online Risk Exposure on Negative Affect. However, we also see a strong main effect of Resilience, where teens who are more resilient tend to have lower levels of Negative Affect.

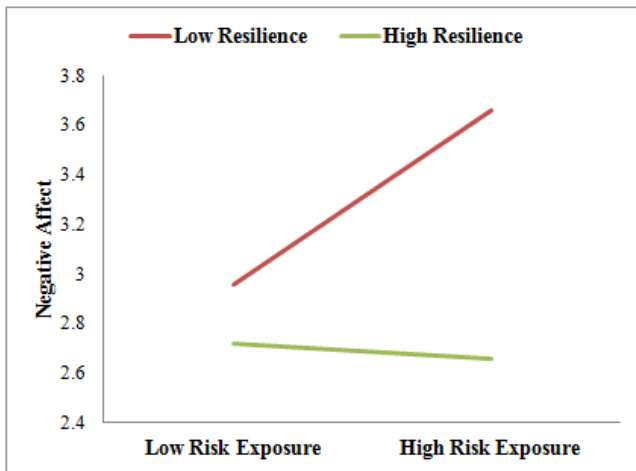


Figure 5: Protective-Stabilizing Effect of Resilience

Figure 7 shows the significant interaction effect between Internet Addiction and Resilience. The graph indicates that, as the level of Internet Addiction increases, a higher level of Resilience is likely to reduce, but not neutralize, the amount of Risk Exposure teens experience online.

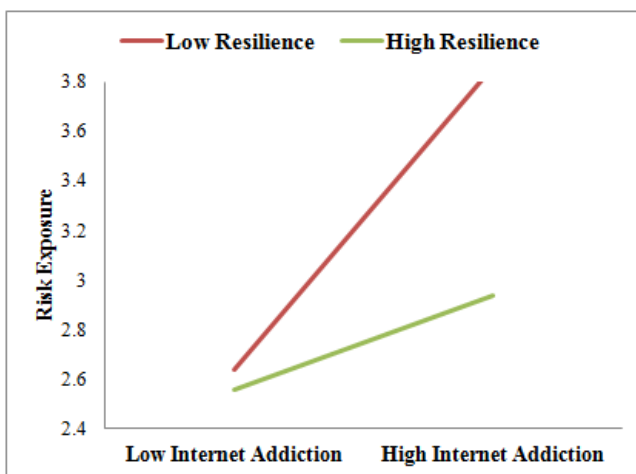


Figure 6: Protective-Reactive Effect of Resilience

This pattern is consistent with Resilience theory's *protective-reactive model* [34], where a negative outcome associated with risk is effectively reduced by the presence of a third factor. However, we observed this Resilience effect as a *first-stage* moderator (pre-risk exposure), instead

of after risk occurs. This somewhat differs from resilience theory, and we will further consider the implications of this effect in our Discussion.

DISCUSSION

Overall, we found support for our main hypotheses. When Resilience was not in the model (**Figure 4**), Online Risk Exposure partially mediated the relationship between Internet Addiction and Negative Affect (H1): While Internet Addiction shows a significant direct effect on Negative Affect, Online Risk Exposure appears to be a key factor that helps explain the effect of Internet Addiction on Negative Affect. After testing three alternative theoretical models, we found that Resilience acts as a two-stage moderator (**Figure 5**) between Online Risk Exposure and Negative Affect (H2; marginal significance) and between Internet Addiction and Online Risk Exposure (H3). It reduces the effects of Internet Addiction on Online Risk Exposure (**Figure 7**) and neutralizes the direct effects of Internet Addiction and Online Risk Exposure on Negative Affect (**Figures 5 & 6**). Next, we will discuss the theoretical and practical implications of our findings.

Key Implications

Mediating Effects of Online Risk Exposure

While past studies often assume that adolescent online risk exposure leads to psychological problems [38], we provided empirical confirmation of a relationship between Online Risk Exposure and Negative Affect (H1c). However, we also found evidence suggesting that exposure to online risks helps explain why Internet Addiction can cause psychological problems for teens (H1). Practical implications of this finding include the importance of 1) identifying teens who suffer from severe Internet addiction; 2) being vigilant in interventions of Internet addiction that can limit risk exposure experienced by these higher-risk teens; and 3) treating psychological symptoms that arise due to addictive behaviors or negative online experiences. A key point to note is that overly restrictive parental rules for limiting teen Internet use do not address the underlying psychological dependence teens may have on the Internet. Therefore, limiting Internet use without otherwise helping teens meet their psychological needs for social interaction, acceptance, support, etc. may trigger deeper psychological issues.

Resilience in the Presence of Risk Exposure

Our findings include empirical evidence that adolescent resilience theory [34] can be applied to risks that teens experience online, not just to offline risks such as substance abuse, violent behavior, and sexual promiscuity. We found that resilient teens seem able to experience higher levels of online risk without incurring serious, psychological harm (H2). A key implication of this finding is a shift in research focus from an "abstinence-only," risk-adverse approach to adolescent online safety, to one that focuses on ways to help teens effectively cope when they do encounter online

risks [24]. Especially in high-risk situations, resilience theory [34] and thus clinical interventions that build teen resilience [1], provide potential solutions for educating teens about Internet safety literacy and suggesting positive resources, such as proactive parenting strategies, community support, and evidence-based group interventions, to help protect high-risk teens from serious online risks.

Resilience as Risk Prevention

In addition to the widely established effect of resilience as a coping mechanism once risks occur (*second-stage*), our results show that resilience can also affect outcomes both pre- and post-risk exposure. Our findings confirmed that Resilience served to mitigate Online Risk Exposure as the negative effect of Addictive Internet Use (H3). In particular, the role of Resilience as a first-stage moderator in the two-stage moderated mediation model (**Figure 5**) suggests a new conceptualization of resilience as a form of *risk prevention*. This new view yields important theoretical and practical implications. First, it offers a more proactive way of reducing the negative outcomes of online risk (e.g., Negative Affect). Instead of relying on resilient coping to lessen the post-risk exposure harm or trauma, it suggests that resilience may also reduce the effects of Internet addiction on adolescents' psychology and emotions, perhaps by directly reducing their exposure to online risks. In other words, by cultivating the abilities to adapt to stress and adversity through minimal-risk experiences or practices of online safety behaviors, adolescents are likely to avoid risk events or become victimized when facing such harms and threats. Second, the new view suggests an alternative to the "over-protective, risk averse (p. 364)" approach that restricts online exploration entirely [33]. It highlights the benefits of allowing adolescents more freedom of exploration in their online communication, which will equip them with sufficient skills as well as resilience for navigating challenging situations in the future.

Practical Implications

Online systems should attempt to protect adolescents from excessive harm while still allowing them to engage online with others. Unfortunately, the current design solutions and strategies for promoting adolescent online safety often tend to focus on risk prevention, for instance by limiting Internet use and attempting to eliminate teens' exposure to online risks. This is contrary to research that suggests that teens make better online decisions when they have parents who are actively engaged in what they do online but yet allow them to engage online and learn from their online experiences [24, 37, 39]. For instance, direct intervention by parents through the use of parental monitoring software has been associated with fewer basic disclosures made by teens through social media; however, teens who experience high levels of direct intervention from their parents also tend to use SNSs less frequently and take fewer protective measures to ensure their online privacy [37]. Many parental

monitoring packages often implement parental controls that limit when a teen can go online, block unwanted content, and otherwise prevent teens' from having negative online experiences. This preventative approach does little to help teens build resilience to the online risks that they will eventually encounter.

Thus, in addition to designing systems that support parental mediation of teens' online behaviors, we should also focus on design solutions that promote teen resilience so that teens can effectively and wisely protect themselves from online risks. Resilience can be promoted indirectly by supporting other factors that are known to contribute to teen resilience, such as heightened self-awareness [17, 21]. Thus, we support Yardi and Bruckman's [40] earlier proposal to use social translucence theory for implementing a semi-transparent "digital window" that facilitates visibility, awareness, and accountability between parents and teens. Yet, we extend this idea by encouraging designers to also give teens access to view their own digital footprints in order to form self-awareness of their potentially risky online behaviors and patterns. Providing teens a more transparent view of what strangers or friends of friends are able to see about them via social media, for example, may promote self-awareness that translates into resilient behaviors when online interactions escalate into risky situations.

Additionally, we can promote teen resilience directly through web-based educational or counseling programs that help build resilience [1] or through interface designs that empower teens to take protective measures upon encountering online risks. For example, Facebook provides a "Family Safety Center" that offers tips for teens to develop better online safety practices [14]. If popular social media platforms simultaneously offered highly visible yet simple safety features, such as the anonymous reporting of cyberbullying, sexual solicitations or sharing of inappropriate content, teens would be able to leverage these mechanisms to protect themselves online without requiring the intervention of their parents. Providing protective mechanism within interactive systems would allow teens to engage with others online and encourage them to effectively work through lower risk situations to build resilience for handling more severe online risks they may encounter in the future.

Limitations and Future Research

Before we conclude, we would like to discuss some of the limitations of our current study that can be used to inform the design of future research. First, the implied causal paths in our theoretical and empirical models are based on theory and validated through iterative model testing, which exhibits support for our hypotheses, good fit statistics, and high explanatory power. However, survey studies like this may not be the most ideal methodological approach to fully capture the causal effects and the interplay of the various factors. Future studies should investigate these underlying

mechanisms through longitudinal studies or controlled experiments to confirm causality and long-term effects.

Second, our findings may be limited by our modest sample size ($N = 75$). We calculated the statistical power [15] associated with our model to assess the likelihood that we made any Type II errors (i.e. accepting the null hypothesis that no significant relationship existed between two variables when, in fact, it does). The current sample size is capable of detecting effect sizes greater than 0.18, and only one of our path coefficients fell slightly below this value (See **Figure 5**. H1; $\beta = 0.16$). This does not negate any of the statistically significant relationships in our model, but follow-up studies with a larger sample size would help confirm our findings. Thus, we plan to launch a national survey in order to further investigate the resilience effect in teens' online experiences.

Finally, in our future studies, we plan to explore the role of other protective factors beyond resilience that might also inoculate teens from the negative impact of online risk exposure. These factors include potential promotive assets possessed by teens [34] (e.g. social self-efficacy, coping skills, etc.) and external resources provided to teens [34] (e.g. parental mediation, family communication, etc.).

CONCLUSION

Instead of focusing on ways to limit adolescents' exposure to online risks, our study shows how teen resilience can act as a protective mechanism for reducing online risk exposure as an effect of Internet addiction and neutralizing the negative psychological effects of Internet addiction and exposure to online risks once it has already occurred. A key to adolescent online safety is to teach teens how to effectively cope with negative online experiences so that they can more readily benefit from the vast resources and beneficial social interactions the Internet can provide.

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APPENDIX A

Table 2: Item Wording for Online Risk Exposure Measures

Below are some possible experiences that you may have had online during the past 12 months. Please select how often these types of events have occurred. If you haven't experienced a particular event, select "Not at all." (Likert Scale: 1 = "Not at all," 5 = "Almost every day")

Information Breaches/Information Sharing

- Someone else shared my personal information or a photo of me that I didn't want him/her to post.
- I shared my personal information or a photo of myself that I later regretted sharing.
- I have been the victim of what I felt was an improper invasion of privacy or misuse of my information in some other way.

Online Harassment/Social Interactions

- I was treated in a hurtful or nasty way online ("Cyberbullied").
- Someone made rude or mean comments about me or threatened me in some way online.
- Someone tried to spread a mean rumor about me online.
- There are other types of negative and unwanted interaction that hurt my feelings, and made me feel embarrassed, or unsafe.

Sexual Solicitations/ Online Flirtation

- Someone I know sent me a sexual message ("Sexting").
- Someone I know asked me to send them a sexual message, revealing, or naked photo of myself.
- A stranger asked me to meet them offline.
- There are other types of sexually suggestive interactions that made me feel even a little uncomfortable.

Exposure to Explicit Content/ Online Content

- I saw online stories, images or videos that were pornographic (naked or sexual in nature).
- I saw online stories, images or videos that contained excessive violence.
- I saw online stories, images or videos of illegal or deviant (morally questionable) behavior.
- I saw online content that promoted self-harm (such as eating disorders, cutting, suicide, etc.).
- I saw other online content that made me feel uncomfortable some way.

Table 3: Goodness of Fit Statistics for Competing Theoretical Models of Resilience

Moderated-Mediation Model	Chi-square	DF	CMIN/DF	SRMR	CFI	RMSEA
First-stage only	17.1***	2	8.55	0.1	0.84	0.32
Second-stage only	14.51***	2	7.25	0.11	0.88	0.29
First and Second-stage	3.21	2	1.61	0.02	0.99	0.09

*** p -value < 0.001. *Note:* A fair to good model fit is characterized by a χ^2 that is not statistically significant ($p > 0.05$); $CMIN/DF < 2$; $CFI > 0.95$; and $RMSEA < 0.10$ [22].