Electronic Dating Violence in Adolescence: Trajectories, Implications for Depressive Symptoms and Delinquency, and Identifying Events and Behaviors that are Most Predictive of EDV Engagement

by

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Dedication

I dedicate this dissertation to my friends, family and loved ones. Thank you for your support, encouragement, love and laughter over the past few years – doctoral work is a marathon, and I could not have done it without you all by my side.

In particular, to my mom Chris, who always encouraged me to shoot for the stars; to my dad, Josh, who taught me to not carry around the heavy parts of the past; to my brother, Jase, who is almost an exact inverse of my personality, does not always understand my "why" in life, and yet is a most ardent and reliable cheerleader. To my grandparents, Walt and Joan, for their dedication to lifelong learning, travel, and love of nature. To my cousins, Natalie and Walter, for meeting up virtually and across the US, and slaying mountains with me. And to my Aunt Robin and Uncle Steve, who are always up to give a listening ear and pour a glass of wine.

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Table of Contents

List of Tables

List of Figures

Abstract

Electronic dating violence (EDV) is a prevalent problem during adolescence, but little is known about trajectories across time, implications of EDV on depressive symptoms or delinquent behaviors, or what specific events or behaviors are most predictive of EDV. The work presented in this dissertation aims to fill those gaps.

In my first dissertation paper, I found that risk of EDV generally increases, the rate of increase varies across adolescence, with rapid increase occurring in mid-adolescence. I found that both risk (e.g., threat-based adverse childhood experiences) and protective factors (parental monitoring, social support) predicted the average starting point (intercept), rate of increase (slope), and inflection points (quadratic term), though differences existed by age. These findings could inform intervention work particularly during mid-adolescence, when risk of EDV is highest.

In my second dissertation paper, I found that specific domains of EDV have longitudinal effects on depressive and delinquent behaviors with differential effects by age and gender (e.g., older females are more likely to report depressive symptoms). In particular, electronic coercion was predictive of both depressive symptoms and delinquency, electronic monitoring was only predictive of delinquency, and electronic harassment was not directly predictive of either depressive symptoms or delinquency. The implications of these findings stress the need for interventions to reduce EDV engagement, and potential prevention efforts to avoid the negative effects that EDV has on depressive symptoms and delinquent behaviors.

Finally, in my third empirical paper, I evaluated a broad set of known (e.g., alcohol use) and more subtle risk factors (e.g., behaviors that are highly normative and can be innocuous or risky depending on the circumstance) during adolescent development to understand what individual events or behaviors are most predictive of each domain of EDV. Deprivation-based adverse childhood experiences and greater use of technology for interpersonal communication were predictive of multiple domains of EDV. However, many of the predictors were predictive of only one domain further emphasizing the distinct nature of each domain of EDV. These findings have several broader implications. First, finding several predictors across multiple domains of EDV provides an opportunity for the future development of a screener for any domain of EDV. Secondly, that many of the unique predictors were more subtle forms of risk that become highly normative during adolescence is an opportunity to develop preventative programs that address both obviously risky behaviors (like the use of physical violence in dating relationships) as well as behaviors that are more subtle and could potentially be leveraged by preventative programming to be used in ways that promote healthy interpersonal interactions within youth dating relationships.

The findings of the present dissertation provide both novel information and opportunities for future screening, intervention and prevention efforts.

Chapter 1 Introduction and Overview

Introduction

Dating violence is a prevalent problem, with one in five youth reporting physical violence (Wincentak et al., 2017), one in three reporting psychological violence (Haynie et al., 2013) and three in four reporting electronic dating violence (EDV) (Ellyson et al., 2021). Most researchers who have studied dating violence etiology focus on physical, sexual, and/or verbal types of dating violence, but few account for electronic domains despite the substantial increase usage of electronics among adolescence (Twenge et al., 2019). Generally, EDV is violence perpetrated through technological spaces, including through email, instant message, text message, social media websites and apps, among others. One can perpetrate via a computer, tablet or phone. Researchers have identified several sub-domains of EDV, including electronic harassment, electronic coercion, and electronic monitoring (Thulin, Heinze, Kernsmith, et al., 2020). Electronic harassment includes messaging, calling, or sending other forms of communication electronically to a dating partner to illicit compliance, via intimidation and fear tactics. Electronic coercion is the pressuring of a partner to share sexual and/or illicit messages, pictures or videos, and can include the sharing of private messages, pictures or videos of one's dating partner. Electronic monitoring is the viewing, listening or reading of messages, images and/or videos of one's partner when asked not to, and can include demanding passwords to electronic communication or social network sites.

EDV is important to evaluate for several reasons. First, researchers find that it is qualitatively different from in-person forms and presents a novel risk that is unique to the online

space (Stonard, 2020). Second, EDV appears to be more prevalent than in-person domains of dating violence (Caridade et al., 2019). Third, researchers have found that EDV presents distinct risk beyond in-person domains (Duerksen & Woodin, 2019). Though EDV research has expanded greatly in the past 10 years, given the novelty of this risk factor and the field of EDV research, there are still many gaps to fill (Caridade et al., 2019; Rocha-Silva et al., 2021; Rodríguez-deArriba et al., 2021; Stevens et al., 2020).

In the present dissertation, I contribute important and novel information to the field of EDV through three main aims. First, within the framework of adolescent development and changes in autonomy and interpersonal interactions, I evaluated the unique trajectories of three domains of electronic dating violence (electronic harassment, electronic coercion, and electronic monitoring). The first aim provides novel information on change over time, supplementing existing literature on trajectories and change over time during adolescence of in-person domains of dating violence (W. L. Johnson et al., 2015). Second, maintaining the application of a developmental framework to EDV, I assessed the temporal effect of exposure to EDV engagement (perpetration and/or victimization) on internalizing (depressive symptoms) and externalizing (delinquent behaviors) outcomes. This supplements existing cross-sectional literature on the effect of EDV on depressive symptoms (Cava, Tomás, et al., 2020; Y. Lu et al., 2018; Zweig et al., 2014) and delinquent behaviors (Peskin et al., 2017; Van Ouytsel et al., 2017; Zweig et al., 2013), and provides novel insights into the effect of each domain of EDV (as compared with studies that have evaluated EDV as a wider construct, and thus were not able to report on the effects of each distinct domain of EDV). For my third and final aim of this dissertation, I employed advanced analytic and computational skills to explore additional nuance in individual events or behaviors and their predictive power for each of the three domains of

EDV explored in this dissertation (electronic harassment, electronic coercion, and electronic monitoring). This provides new insights on which specific events and behaviors are most predictive of each domain at two developmentally significant ages (age 12 and 15), and provides clarification on risk factors that are consistently problematic across domains and ages, as well as what unique risk factors are important to consider for each domain at the two ages. This information may be critical for future screening and intervention work.

Understanding Dating Violence within a Developmental Framework

Adolescence is a key developmental phase physically and socially, where brain matter transformations occur, synapses are strengthened or weakened, and where environmental exposures including peer interactions are uniquely influential due to the developmental stage of adolescence (Dow-Edwards et al., 2019). Socially, youth begin taking on more autonomy and independence within interpersonal interactions during this phase (Crone & Dahl, 2012). In line with social learning theory (Bandura & Watlers, 1977), as adolescents develop autonomy and independence exemplified in adulthood, their frames of reference come largely from what has been modeled for them. Experiences come from the supervision of parents, caregivers or other adults, or that which they have seen in their own families, communities and cultural norms (Dardis et al., 2015; Hossain et al., 2020). Social development theories postulate that as individuals go through adolescence, their individual experiences of interpersonal interactions that are independent from family or other adults grow (Bronfenbrenner, 1986; Catalano & Hawkins, 1996). Adolescents learn how to maintain friendships and other types of social interactions with less influence from caregivers or other adults (Claes, 2018; Collins & Steinberg, 2007). They begin to make their own plans with others, and as compared with younger children or pre-adolescents have less minute-to-minute influence from adult monitoring (Keijsers & Poulin,

2013). Moments of independence and autonomy within interpersonal relationships are critical for preparation of the independence of emerging and early adulthood, particularly when youth are able to balance moments of autonomy with guidance and support from caregivers or other adult mentors who are more experienced in autonomous interactions (Brown & Bakken, 2011; Capaldi, 2003; Collins & Steinberg, 2007).

The introduction of electronics into adolescent life has resulted in substantial changes in how youth utilize their time and how interactions occur. Whereas around 60% of youth regularly read books, magazines or newspapers in the 1970's, around 15% of contemporary adolescents in 8th,10th and 12th grade regularly read these media sources (Twenge et al., 2019). Even as compared with adolescents in 2006, those in 2016 spend an hour less per day watching television; instead, youth have increased utilization of the internet, data and smart phones for entertainment and connection, with modern 12th graders spending a collective six hours a day between texting, time online, social media and gaming. Though children are exposed to electronics from a very early age, having ownership of a device and thus at least some privacy in use is occurring from preadolescence, with half of youth owning a smart phone by age 11 (Lucero et al., 2014). Access and availability continue to increase throughout adolescence, and by age 19 over 90% own a smart phone (Lucero et al., 2014). Social engagement through technology may increase slightly by age, with researchers of a study utilizing nationally representative data finding that 75% of 8th graders utilize social media sites almost every day as compared with ~80% of 10th graders (Twenge et al., 2019). Beyond changes of technology use by age in contemporary adolescence, it is also important is highlight the novel effect of technology on adolescent development and engagement that is due to greater use of technology to communicate with others as compared with adolescents in prior decades (Twenge et al.,

2019). While the internet presents opportunities for connection across distance, a space to seek out information, or a source of entertainment, it can also pose threats for unhealthy behaviors including compulsive use, online gaming additions, pathological video game use, and forms of interpersonal violence (E. L. Anderson et al., 2017).

According to life course theory, interest in romantic relationships is a normal change at the start of puberty, when physical and social changes are paired with increasing autonomy of youth (Elder, 1994). Dating norms change substantially throughout adolescence. In early adolescence, relationships are less intimate emotionally and physically, and often based on overlapping activities or interests. By late adolescence, the role and meaning of dating relationships transform into deeper attachments that can be formed and sustained beyond overlapping geographic space due to increased autonomy and ability to physically move (i.e., drive in a car, take a bus on one's own, etc.) (Collins et al., 2008; Connolly et al., 2013). Technology is commonplace in contemporary adolescent romantic relationships, with three in four youth interacting with their partner by posting on their social media page and 92% of youth regularly engaging their romantic partner through text messages (Lenhart & Page, 2015). While there is some evidence that engaging in positive messaging through text can promote romantic satisfaction (Juhasz & Bradford, 2016; Luo & Tuney, 2015), or help couples stay connected when physically separate (Chien & Hassenzahl, 2020; Juhasz & Bradford, 2016), there are a variety of ways that technology can be utilized in unhealthy ways, including control, coercion and aggression (Cava, Buelga, et al., 2020; Kernsmith et al., 2018; Zweig et al., 2013). Though patterns of adolescent normative electronics use exist, less is known about the etiology of electronic dating violence.

Electronic Dating Violence

Electronic dating violence (EDV) is recognized as a significant form of dating violence by the Centers for Disease Control and Prevention (*Preventing Teen Dating Violence*, 2020). Though providing opportunities to connect in more ways with others, electronic spaces also present novel risks for youth. The recent expansion of dating violence literature to examine the influence of electronic forms of communication on adolescent dating relationships shows that electronic domains of dating violence appear to be most pervasive in adolescent populations (Caridade et al., 2019; Draucker & Martsolf, 2010; Kernsmith et al., 2018; Wincentak et al., 2017; Zweig et al., 2014). Though most figures are based on cohort studies and prevalence rates vary substantially across studies, in a national study, researchers found that three in four individuals report electronic dating violence in during their adolescence, with initial exposure most frequently happening by age 16 (Ellyson et al., 2021). Similar to findings of in-person domains of teen dating violence (Choi et al., 2017), in cross-sectional work researchers have found victimization and perpetration of EDV to co-occur and use the term EDV engagement to represent perpetration and/or victimization (Thulin, Heinze, Kernsmith, et al., 2020).

Though the field is relatively new, researchers have found compelling evidence that electronic domains of violence present a novel risk that is qualitatively different from in-person domains in several distinct ways. First, electronic dating violence is not confined to a specific geographic location, as is common in-person dating (Stonard et al., 2017). Leaving a given physical location (as emblematic in the conflict resolution tactic of walking away) will not remove the possibility for interaction through technology. The creation of new numbers or accounts, fake or anonymous accounts through which one can act as another person (i.e., sometimes referred to as catfishing) (Paat & Markham, 2021; Stonard, 2020), and use of one's

social network to contact an individual (Stonard et al., 2017) uniquely counteracts an individual's attempt and ability to block or unlink with someone through social media and electronic means (Stonard, 2020). Secondly, the frequency of electronic interactions can be very high, and electronics present the possibility to engage directly with another person many times in a short time frame (Stonard et al., 2017). Electronic interactions can also occur during times when youth would typically be with family or other forms of social support (for example, around dinner time) or even during times that are typically somewhat private, such as bedtime or when an individual first wakes up. Third, electronic domains of communication, including messages, pictures or videos, can be shared more widely with a single click of a button (Paat & Markham, 2021), which can be particularly threatening when done to evoke retaliation (Stonard, 2020). The boundaries of private and public space are not static but rather intersect in a way that is unique to the digital space (Papacharissi, 2014). Though electronic spaces may feel more private to youth, actions taken online are uniquely permanent (Low & Espelage, 2013). Unlike the ability to destroy a physical copy of a photo or even a video tape, words, pictures, audio, and video shared online exist forever. Even if an individual attempts to remove a file, a carbon trace of it persists in the online sphere. Fourth, the electronic world is a space that is harder for parents or caregivers to monitor, at least in part due to lesser tech savviness and discordant reporting by parents and youth of knowledge on adolescent electronic use (Symons et al., 2017). Even in cases where parents are engaging with their youth on use of electronic communications and technologies, youth often do not want to disclose their behaviors or activities (Wisniewski et al., 2017) and at times perceive risky online behaviors as normative and may not relay information to their parents. Finally, online abuse overlaps and may lead to in-person domains of violence (Stonard, 2020; Thulin, Heinze, Kernsmith, et al., 2020).

Present Studies

This dissertation is composed of an introductory chapter (Chapter 1, present chapter) defining electronic dating violence, describing the dataset used in the three empirical studies, and briefly providing rational for the empirical studies; three empirical papers which provide new insights and findings to the field of EDV (Chapters 2-4); and a conclusion chapter, contextualizing the contribution of the three empirical papers (Chapter 5). In the first empirical study (Chapter 2), I add nuanced understanding of youth's experience of EDV by studying the unique trajectories of electronic coercion, electronic harassment, and electronic monitoring. Each trajectory was evaluated relative to potential risk and promotive factors. In the second study (Chapter 3), I longitudinally evaluated the effects of each domain of EDV on depressive symptoms and delinquent behaviors, and investigated these associations by age and gender. Using a multi-level model, I explored depressive symptom and delinquent behavior trajectories with time varying exposure to electronic harassment, electronic coercion, and electronic monitoring, while accounting for known covariates of depressive symptoms and dating violence. Finally, in the third and final empirical study (Chapter 4), I studied a large set of both known and obvious risk factors (e.g., substance use) and more subtle risk factors and the unique predictive power of individual behaviors or events on each domain of EDV at ages 12 and 15. Descriptions of existing literature and details of the gaps each empirical paper aims to fill are described in Chapters 2-4. The remainder of this chapter outlines the studies.

Dataset and Study Sample

For all three empirical studies in this dissertation, I used data from the Strengthening Healthy Adolescent Relationships and Environments (SHARE) study, led by primary investigators Dr. Joanne Smith-Darden, PhD and Dr. Poco Kernsmith, PhD (Kernsmith et al.,

2018; Smith-Darden et al., 2017). SHARE is a prospective longitudinal cohort study, following two cohorts of youth starting in 6th and 9th grades. Data were collected annually for four years, between 2013-2016. Youth were sampled from within schools. Schools were selected based on a risk-index composite score that was created based on publicly available data on population density, median household income, percent of households below the poverty line, and owner occupied housing (see Kernsmith et al., 2018 for more details). Two school districts were selected for participation at each level of community risk (low, medium, high). All middle and high schools in each local school district participated in the research (n=13 schools, total).

Within each school, the sample was selected using stratified random sampling by grade level (6th and 9th grades at Year 1) and sex, with equal numbers recruited within each group. Demographic statistics are located in Table 1. At the first wave of data collection, 588 6th and 648 9th graders, for a total of 1,236 youth, were recruited into the study. The average age of the younger cohort at wave 1 was 12.0 years (standard deviation = 0.45 years) while the average age of the older cohort at wave 1 was 15.0 years (standard deviation = 0.56 years). The majority of youth self-identified as white (59.1%), followed by youth self-identifying as black (17.4%) and multi-racial (self-identifying as two or more races) (10.5%). Just under one third of students were from a low (31.5%) or medium (29.1%) risk school district, with slightly more than one third of the sample coming from a high-risk school district (39.4%).

Table 1. Demographics of Full SHARE Sample

Table 1. Demographics of Full SHARE Sample

	Cohort 1 - Younger	Cohort 2 - Older	Full Sample
Sample Size n(%)	588(47.6%)	648(52.4%)	1236

Average Age at Wave 1 in Years

(std)	12.0(0.45)	15.0(0.56)	--
Race			
Black	102(17.4%)	113(17.4%)	215(17.4%)
White	328(55.8%)	402(62.0%)	730(59.1%)
Other	59(10.0%)	45(6.9%)	104(8.4%)
Multi-racial	55(9.4%)	75(11.6%)	130(10.5%)
Missing	44(7.5%)	13(2.0%)	57(4.6%)
Risk-Level			
Low	200(34.0%)	189(29.2%)	389(31.5%)
Medium	181(30.8%)	179(27.6%)	360(29.1%)
High	207(35.2%)	280(43.2%)	487(39.4%)

A passive parent consent procedure was used in the study. Parents had the opportunity to refuse consent for their child's participation by returning a written form or by calling or e-mailing the school or researchers. Eight parents refused participation for their child. Prior to survey administration, all students provided oral or written assent (depending on age) and were informed of their right to withdraw from the study at any time. Informed consent was obtained from all individual participants in the study. No more than 10 students refused to participate per school, though number of youth refusals by school was not tracked given privacy and approved study design. Surveys were administered during the school day at a mutually agreed upon time and place and generally took one class period to complete. The written questionnaires were completed in a large group setting, with space between youth to protect privacy. A Certificate of

Confidentiality was obtained through the Centers for Disease Control and Prevention. The Institutional Review Board for Wayne State University and the University of Michigan and the funding agency approved the data collection protocols.

Empirical Study 1: Electronic Teen Dating Violence Curves by Age

Several researchers have found the risk of perpetration and/or victimization of physical, sexual and/or psychological domains of dating violence to increase throughout adolescence, peaking in late adolescence for boys and early emerging adulthood for girls (W. L. Johnson et al., 2015; Sianko et al., 2019). In another nationally representative study, researchers found that most women who experience physical, sexual and/or psychological intimate partner violence do so before the age of 25, with 25.8% having experienced violence before the age of 17 (Smith et al., 2018). Researchers have suggested that electronic dating violence (EDV) is particularly problematic in adolescence, and less common in adult populations; this may reflect that modern youth have greater access to electronics (Twenge et al., 2019) and may be more likely to use electronics in their romantic interactions than older generations who did not have electronics when they were younger and are not as socialized to use electronics in romantic interactions (Lenhart & Page, 2015). Though researchers have begun to examine trajectories of dating violence that include electronic domains (Cutbush et al., 2021; Thulin, Smith-Darden, et al., Under Review), at this time, I am unaware of any longitudinal studies examining unique trajectories of electronic dating violence engagement (perpetration and/or victimization).

Though researchers generally agree that electronic dating violence is a pervasive problem, the experiences of domains of dating violence (e.g., physical, sexual, verbal, electronic) are heterogeneous across youth (Choi et al., 2017; W. L. Johnson et al., 2015; Thulin, Heinze, Kernsmith, et al., 2020). Multiple researchers have found that patterns of exposure are defined by

11

domain of engagement, and that many youth are experiencing the co-occurrence of victimization and perpetration (often termed engagement) (Choi et al., 2017; Thulin, Heinze, Kernsmith, et al., 2020). A critical missing gap in the literature is evaluating the etiology of unique domains of electronic dating violence engagement (perpetration and/or victimization), such as electronic harassment, electronic coercion and electronic monitoring (Thulin, Heinze, Kernsmith, et al., 2020). It is important that the three types are distinctly examined over time given cross-sectional findings that these three types have different patterns of engagement by youth. For example, some youth report engaging primarily in only one domain of EDV while other youth report engaging in all three forms. While heterogeneity at specific times (i.e., cross-sectionally) has illuminated important differences in experience, researchers have found evidence that risk of dating violence is not constant across time (W. L. Johnson et al., 2015). Rather, in addition to heterogeneity across youth at a given time point, youth's individual levels of risk change over time. Despite knowing that EDV is highly prominent, at this time, little is known about the trajectories of youth's exposure to each unique domain of electronic dating violence (i.e., electronic monitoring, electronic coercion, and electronic harassment).

In the first empirical paper of this dissertation, I fill a gap in the literature by examining trajectories of each type of electronic dating violence engagement across time by age. In this analysis, I used all four waves of data from each cohort. First, I reviewed data descriptively. Next, I employed longitudinal growth curve analyses to evaluate the trajectory of each type of electronic dating violence across time. I modeled each cohorts (younger cohort: 6th-9th grade, older cohort: 9th-12th grade) independently, given the developmental theoretical framing of this project. I first evaluated trajectories as linear growth models, to see the direction of trends; next, I added a quadratic term to the equation, to test if there are any inflection points. I used full

information maximum likelihood (FIML) to estimate missing data. To determine whether the linear or quadratic term model was superior, I examined if the means and variance were significant, and compared BIC, though I expected that BIC would be likely be slightly larger in the models containing more terms (i.e., the model with the quadratic term). Due to the bias of number of terms on BIC, I decided to prioritize any findings of significance of variance to determine superior model fit, in the case that significance and BIC were conflicting. Finally, I used demographic (sex, age), individual (dating behaviors, substance use), and interpersonal (adverse childhood experiences, parental monitoring, parental account knowledge, parental password knowledge, social support) risk and promotive factors at wave 1 to predict latent growth curve intercept, slope and quadratic term.

My first empirical paper is presented in Chapter 2.

Empirical Study 2: Longitudinal Effects of Electronic Dating Violence on Depressive Symptoms and Delinquent Behaviors Across Adolescence

Adolescents are at high risk of experiencing internalizing or externalizing behaviors. Nationally, one in ten youth will report depression (internalizing behavior) (Avenevoli et al., 2015; W. Lu, 2019). In a different nationally representative study, researchers found a mean of 40.6 delinquent behaviors and 8.8 substance use disorders per 100 youth aged 12-17 (Grucza et al., 2018). Given the pervasive nature of EDV, researchers have a growing interest in possible negative outcomes related to electronic dating violence exposure, including implications for depressive symptoms and delinquent behaviors.

Several researchers have found an association between exposure to EDV and increased depressive symptoms in cross-sectional research. In a US sample of older adolescents (mean age ~19), researchers found concordant association between cyber violence victimization (a

generalized way of measuring electronic dating violence) and depressive symptoms (Y. Lu et al., 2018). In a Spanish sample of older adolescents (mean age ~ 19 years), researchers found that online dating violence victimization increased the odds of suicidal ideation and attempts, and this effect was compounded by concurrent in-person victimization (Gracia-Leiva et al., 2020). However, other researchers have found that the association between EDV and depressive outcomes were no longer significant when accounting for in-person domains (Duerksen & Woodin, 2019; Weingarten et al., 2018). While important findings, these three studies were conducted in emerging adult populations, which, as shown in Paper 1 of this dissertation, may not be appropriate given that the highest risk for EDV engagement is in mid-adolescence.

In a cross-sectional study of 7th to 12th graders, researchers found that electronic domains of violence had greater effect on mental health outcomes as compared with other domains of dating violence (Zweig et al., 2014), possibly in part due to younger adolescents engaging less in physical domains of dating violence than electronic domains (Thulin, Smith-Darden, et al., Under Review). Although some researchers note that the effect size of the relationship between EDV and worse depressive symptoms is somewhat small, they also note the possibility of cumulative effects and that over time small effects can grow (Cava, Tomás, et al., 2020). It may be that the depressive effects of EDV engagement can also morph into maladaptive behaviors due to negative coping strategies, including alcohol or substance use (both of which are linked with exposure to EDV). Despite emerging knowledge on the correlation of exposure to EDV and worse depressive symptoms, in a 2019 systematic review, authors noted that less is known about the effect of EDV on depressive symptoms over time (Caridade et al., 2019).

While depressive symptoms are important to understand, researchers argue that measures of depression are differential by gender with a bias towards internalizing depressive symptoms

14

(Cavanagh et al., 2017). A solution to this gender bias is to evaluate externalizing problems (i.e., delinquency), which has been found by researchers to be a common way that males express depressive symptoms. As delinquency is often not included in depressive symptoms screeners, and that males engage in EDV at roughly the same rate as females (Ellyson et al., 2021), it is important to evaluate the role of EDV on the negative outcome of delinquent behaviors.

At this time, only a handful of researchers have examined forms of delinquency related to EDV (Caridade et al., 2019). Of those who have studied forms of delinquency and EDV, researchers have found association between alcohol consumption and EDV (particularly for males) (Van Ouytsel et al., 2016) and increased bullying perpetration (Peskin et al., 2017). However, similar to research on the association between EDV and depressive symptoms, much of the literature on the effect of EDV on delinquency has been cross-sectional, and thus the longitudinal effects have not been tested. It may be particularly important to use a longitudinal design when evaluating the effect of EDV on delinquency given that the risk of both EDV and delinquency are not constant over time, but rather increase with adolescent age.

In this second empirical paper, I utilize multi-level modeling to evaluate the effect of EDV on depressive symptoms and delinquent behaviors. First, I reviewed data descriptively. Next, I used multi-level models to evaluate depressive symptoms and delinquent behavior outcomes by exposure to electronic harassment, electronic coercion, and electronic monitoring, while accounting for verbal dating violence, physical dating violence, sexual dating violence, exposure to threat-based ACEs, and exposure to deprivation-based ACEs across all four waves of data collection (see Chapter 3 for rationality of inclusion of these covariates). I created a categorical variable to explore the interaction of gender and age within both models.

In this second empirical study, I opted to use multi-level models for several reasons. First, using multi-level models, I can account for the potentially correlated nature of the repeated measures present in this data (Raudenbush & Bryk, 2001; Singer & Willett, 2003). Second, multi-level models do not require complete data at each wave. Rather, they can use any data across all waves. This is important for reasons of attrition, but also when dealing with an outcome that is associated with a behavior that is not constant (i.e., youth are not always in a dating relationship). In this sample, 1,236 youth participated at Wave 1, 1,116 (90.0%) at Wave 2, 1,008 at Wave 3 (81.2%) and 887 at Wave 4 (71.5%). Broken down by number of waves of participation, 835 (67.6%) youth participated in four of four (all) waves, 175 (14.2%) participated in 3 of 4 time points, 110 (8.9%) participated in 2 of 4 time points and 115 (9.3%) participated in 1 of 4 time points. Of the 1,236 participants in Wave 1, 889 reported dating in the prior year (71.2%), followed by 595 at Wave 2 (66.9%), 526 at Wave 3 (52.8%) and 471 at Wave 4 (53.1%). A mixed effects models incorporates all available data, whereas other modeling techniques would utilize listwise deletion to include only youth who participated in all waves of data AND who dated in all waves (n=242, 19.6%). As few youth dated at every year, utilizing listwise deletion would provide biases results.

My second empirical paper is presented in Chapter 3.

Empirical Study 3: Identifying Predictors of Adolescent Electronic Dating Violence Harassment, Coercion and Monitoring: An Applied Machine Learning Approach

As expansion of technology accessibility and use of electronics to facilitate interpersonal communication by adolescents is a relatively new phenomena (Twenge et al., 2019), the field of electronic dating violence research has only existed for a little over a decade (Caridade et al., 2019). In a systematic review, researchers noted the variety of definitions of electronic dating

violence, including cyber dating aggression, digital dating aggression, electronic dating aggression, online teen dating violence, among others (Caridade et al., 2019). The variety of definitions and measurements of electronic domains of dating violence are representative of the infancy of the area of study, and the need to account for various conceptualizations of these types of behaviors. Though a relatively new field, various domains of EDV have been found conceptually and statistically distinct from one another including electronic harassment, electronic coercion, and electronic monitoring (Cava, Buelga, et al., 2020; Ellyson et al., 2021; Thulin, Heinze, Kernsmith, et al., 2020; Thulin et al., 2021). Though multiple researchers have identified several factors that are consistently predictive of EDV domains (e.g., substance use, delinquency, and adverse childhood experiences), less is known about what specific events and behaviors are most predictive of each domain of EDV.

Given the infancy of the field, using individual items (as opposed to scales or indices of constructs) provides additional nuance that is helpful in thinking about the conceptual differences and potential risk factors associated with each unique domain. In the third and final empirical paper of this dissertation, I explored and tried to capitalize on item unique variability to understand what specific events and behaviors predict each domain of EDV. The findings of this type of analysis could be important to inform future screening and intervention work. In addition to exploring unique items, in the third empirical study of this dissertation, I expanded the potential indicators beyond some of the factors typically used in EDV research (i.e., substance use, delinquency, and ACEs) to include other factors which are prevalent and often innocuous in adolescence, but can become risky under certain circumstances. These factors are important to explore because most typical risk factors are not as common as compared with the prevalence of EDV, and thus can only account for a subset of youth who are at risk of engaging in EDV. By

identifying risk factors that are more prevalent and potentially subtle, it is possible to account for a larger set of youth who engage in EDV behaviors. The behaviors which I identified as prevalent and innocuous but potentially risky were technology use, dating behaviors (which represent obviously risky behaviors such as slapping a partner to behaviors that are under most circumstances probably beneficial for the relationship, such as trying to understand a partner's feelings), youth's use of pornography, and youth's perception of parental monitoring. The selection of these innocuous but potentially risky behaviors was guided by existing literature; but all share the common theoretical framework of developmental changes including increased autonomy, the lessening of parental involvement and increase in autonomous management of interpersonal relationships as youth progress through adolescence, and the emergence and debut of sexual hormones and behaviors, including dating and desire for sexually explicit material. For further exploration of theoretical framings and descriptions of existing literature, please see Chapter 4.

To accomplish the goal of examining a large number of potential predictors, I used a machine learning technique called penalized models (or model minimization). This technique allowed me to identify the items that are most predictive of each domain of EDV at ages 12 and 15. The purpose of these types of models is to identify which risk factors account for the most variance. This is done by using a shrinkage approach, meaning that covariates that provide less information are minimized in the model in order to identify items that provide more information. There are three types of penalized regression: ridge regression, lasso regression, and elastic net regression. Ridge regression does not force any covariate coefficients to 0, even if the covariate provides minimal information. Lasso regression forces covariates with smaller coefficients to 0.

Elastic net regression is the combination of lasso and ridge, allowing some smaller coefficients to remain small while forcing the smallest to 0.

In this final empirical paper, I opted for elastic net regression, as it has the benefits of ridge and lasso with more flexibility in the shrinkage approach (Zou & Hastie, 2005). To adjust for amount of covariate shrinkage, penalized regression requires a specified lambda (i.e., the optimal point between the Ridge approach and the Lasso approach). The best lambda is that which minimizes the cross-validation prediction error rate, which will be determined using the automated function in R, cv.glmnet. The glmnet function in R also requires a specified alpha term. As elastic-net regression is being used, an alpha value of ~0.5 will be used (an alpha value of 1 specifies lasso regression while an alpha value of 0 specifies ridge regression). With the optimal lambda and specified alpha, the model can be trained using a portion of the sample and the efficacy and fit can be tested by predicting the outcome (e.g., if a youth engaged in a specific domain of EDV) in the remainder of the sample. Model fit will be assessed using area under the curve statistics (AUC) and model accuracy. Higher AUC statistics indicates that the model accounts for a greater proportion of data variance. I also evaluated model accuracy to check and see how well it classifies the observations (i.e., youth) into exposure or no exposure as compared with their observed (i.e., binary calculated) classification.

My third empirical paper is presented in Chapter 4.

Dissertation Contribution

In the present dissertation, I provided novel and important information related to three overarching aims. First, I examined the linearity of trajectories of electronic harassment, electronic coercion, and electronic monitoring. Finding non-linear increases across adolescence is an important contribution, and provides meaningful evidence for starting intervention and

prevention efforts in early adolescence or late childhood. In the second empirical paper, I found

that engagement in electronic coercion and monitoring increases youth risk for depressive

symptoms and delinquency across time, though gender and age differences do exist (e.g., older

female adolescents are more likely to report depressive symptoms as compared with younger

females and older and younger males). This contribution expands existing cross-sectional

research and further supports the application of a developmental framework when studying

EDV. In the third and final empirical paper, I was able to identify what specific events or

behaviors predict each domain of EDV. I found several factors were consistent across domain

and age, but ultimately found different sets of indicators by domain and age. The largest

takeaway for the third empirical study is that known risk factors such as alcohol use and

deprivation-based ACEs are important, but that each domain of EDV was predicted by subtle

risk factors that are more normative exposures during adolescence. These types of exposures

could be included in screening and intervention efforts, and could identify a larger set of

adolescents at risk of EDV engagement.

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Chapter 2 Electronic Teen Dating Violence Curves by Age

Electronic dating violence is a prevalent problem, with three in four adolescents reporting victimization and/or perpetration at some point in their youth (Ellyson et al., 2021). The risk of electronic dating violence begins in pre-adolescence (Peskin et al., 2017) and perpetration and victimization often co-occur (Thulin, Heinze, Kernsmith, et al., 2020) at similar rates among boys and girls (Reed et al., 2017). While cross-sectional research on electronic dating violence is growing, authors of a recent systematic review noted a substantial lack of longitudinal studies on the developmental trajectories of electronic dating violence (Caridade et al., 2019). This is particularly problematic given that the behavior of electronic dating violence appears to increase in adolescence, with initial exposure occurring by age 16 (Ellyson et al., 2021). Notably, the risk of in-person domains of dating violence do not increase linearly over time (W. L. Johnson et al., 2015), suggesting sensitive periods of development where risks are increasing faster or where protective factors can better mitigate exposure. Yet at this time, there is a lack of understanding about the shape of risk trajectories of specific domains of electronic dating violence (e.g., electronic harassment, electronic coercion, electronic monitoring) across adolescence. The near universal use of electronic mediums by youth mean that domains of electronic dating violence may manifest earlier and increase in risk faster than the in-person analogue (M. Anderson & Jiang, 2018). The present study fills three gaps by examining linear and non-linear trajectories of electronic dating violence, by evaluating trajectories by specific domain of electronic dating violence (e.g., electronic harassment, electronic coercion, and electronic monitoring), and then

evaluating both risk and protective factors that are predictive of the trajectory of each domain of electronic dating violence.

Adolescent Developmental Theories, Dating and Dating Violence

According to the Life Course Theory, the premier of dating behaviors are normative during adolescence (Elder, 1994) in response to individual biological changes (Gur & Gur, 2016), increasing social autonomy (Connolly et al., 2013) as well as other contextual influences across the socioecological model (Reitz-Krueger et al., 2015). Complementary to the Life Course theory is the application of social developmental theories, which postulate that as individuals go through adolescence, individual experiences of interpersonal interactions that are independent from family or other adults increase and inform future behaviors, possibly as a function of identity formation as stated in Identity Theory (Ragelienė, 2016). Further application of Social Learning Theory (Bandura & Watlers, 1977) to adolescent dating supports that youth behaviors are initially informed by behaviors modeled by those around them (Celsi et al., 2021). While taking on greater autonomy in their interpersonal relationships, beginning to date, and dating more frequently throughout adolescence are considered normative, romantic relationships also represent a novel type of relationship for a youth and present risk of a new form of violence (i.e., dating violence) that becomes highly prevalent during this period.

In existing studies on in-person dating violence, researchers have found evidence that the risk of physical dating violence is non-linear through adolescence, with a pinnacle of risk around late adolescence or early adulthood (W. L. Johnson et al., 2015), which then stabilizes to a constant risk level in early adulthood (Thulin, Heinze, Kusunoki, et al., 2020). That risk is not linear nor constant supports the application of Life Course Theory and Identity Theory to dating violence, whereby youth behaviors are not constant but rather are informed by a variety of

individual and contextual influences that change across time. These influences include exposures

in childhood (such as adverse childhood experiences) as well as school and neighborhood

characteristics that exist during adolescence, which have been found to be predictive of

engagement in in-person dating violence (Jennings et al., 2017). Childhood and concurrent

exposures leading to increased risk of in-person violence support the application of Social

Learning Theory and the evaluation of risk factors across the socioecological model. While

researchers could assume that the trajectories of electronic forms of dating violence would be

similar to in-person forms of dating violence given evidence of overlap between electronic and

in-person forms (Thulin, Heinze, Kernsmith, et al., 2020), electronic dating violence is unique as

compared with in-person dating violence due to ubiquitous access and characteristics specific to

connection through electronics (e.g., not geographically confined, ability to engage with high

frequency over short periods, etc.) (Stonard, 2020). Thus, domains of electronic dating violence

may have different patterns of engagement and differential risk factors as compared with

domains of in-person dating violence.

Conceptualizing Electronic Dating Violence

Technology is commonplace in contemporary adolescent romantic relationships, with

three in four teens interacting with their partner by posting on their social media page and 92%

of adolescents regularly engaging their romantic partner through text messages (Lenhart & Page,

2015). While healthy engagement in technology holds potential to enhance romantic interactions

(Juhasz & Bradford, 2016), or facilitate communication when physically apart (Chien &

Hassenzahl, 2020), there are a variety of ways that technology is utilized in unhealthy ways,

including control (Cava, Buelga, et al., 2020), coercion (Kernsmith et al., 2018) and aggression

(Zweig et al., 2013). Unlike in-person forms of interaction, electronic dating violence (also

called cyber dating violence) is a conceptually and behaviorally unique form of violence (Peskin et al., 2017). This uniqueness is due to a variety of reasons including its limitless geographical nature (Stonard et al., 2017), ability to mass share information with a single click of a button (Paat & Markham, 2021), and ability to utilize fake accounts or friend accounts to access an individual even when steps are taken by that individual to block or remove access (Stonard, 2020). Additionally, the effect of electronic forms of dating violence presents a distinct risk for re-victimization that is not temporally confined to adolescence due to the inability to fully remove content from online spaces (Stonard et al., 2014).

Given the unique risks it presents and the various forms in which electronic dating violence are expressed, researchers have a growing interest in delineating domains (or forms) of electronic dating violence (Thulin, Heinze, Kernsmith, et al., 2020). In US samples of adolescents (aged 12-18), researchers identified three domains of electronic dating violence: electronic harassment, electronic coercion, and electronic monitoring. Electronic harassment includes messaging, calling, or sending other forms of communication electronically to a dating partner to illicit compliance via intimidation and fear tactics. Electronic coercion is the pressuring of a partner to share sexual and/or illicit messages, pictures, or videos, and can include the sharing of private messages, pictures, or videos of one's dating partner. Electronic monitoring is the viewing, listening, or reading of messages, images, or videos of one's partner when asked not to, and can include demanding passwords to electronic communication or social network sites. Though researchers have identified that it is important that the three domains be distinctly examined given differential patterns of engagement by youth, measurement of distinct domains has utilized binary measurement of prevalence, which fails to capture frequency of experience. Additionally, despite the growing acknowledgement of researchers of various domains of electronic dating

violence, most longitudinal studies fail to distinguish the various forms of electronic dating violence or fail to capture non-linear change over time.

Factors Associated with Electronic Dating Violence

Researchers find associations between socio-demographic and behavioral factors and electronic dating violence engagement. Age and engagement with electronic dating violence are correlated, with 9th graders being more likely to engage in electronic dating violence as compared to 6th graders (Smith-Darden et al., 2017). However, research is mixed regarding the association between gender and engagement (Caridade et al., 2019), which may be due to the use of cross-sectional and linear trajectory models. Such models might not account for differences in hormonal and pubertal development that is differential by sex and changes in relation to age. For example, domains of social cognition that improve with increases in age but are differential by sex starting at age 11 and directly influence social interactions, which may include violence (Gur & Gur, 2016).

Adolescents who engage in sexual activity (Zweig et al., 2014), use alcohol or drugs (Van Ouytsel et al., 2016), and spend more time using electronics (Zweig et al., 2014) are more likely to engage in electronic dating violence. Adolescents who endorse the permissibility of violence in intimate relationships are also at increased risk of engaging in electronic dating violence (Doucette et al., 2018). Greater exposure to adverse childhood experiences increases the risk of electronic dating violence (Smith-Darden et al., 2017). However, researchers have recently advocated for greater nuance in the evaluation of adverse childhood experiences, such as the division of threat-based (i.e., exposure to violence) versus deprivation-based (i.e., neglect) (Hawkins et al., 2021) experiences. This delineation may be particularly important for dating violence given the conceptualization that exposure to threatening experiences may increase

externalizing behaviors such as violence perpetration (Heinze et al., 2021) while deprivation-based experiences may be less influential in externalizing behaviors (Tanzer et al., 2021).

In addition to risk factors, there are also possible protective factors that are important to account for when studying dating violence. Researchers have found that higher levels of parental involvement (Smith-Darden et al., 2017) and feeling closer with parents (Zweig et al., 2014) protect against electronic dating violence. This may be due to parental interpersonal skills that provide an example for children and adolescents on how to act towards others, including communication, making requests, and setting and respecting individual boundaries (Smith-Darden et al., 2017). Social support from peers is also protective against electronic dating violence engagement (Peskin et al., 2017); it may be that youth who report greater levels of social support have healthier peer relationships overall.

While the empirical base on electronic dating violence is growing, it is limited in several ways. First, the vast majority of studies are cross-sectional, and thus researchers are unable to describe trajectories of perpetration and victimization over time (Caridade & Braga, 2020), which limits the development of effective age-appropriate prevention and intervention strategies. Drawing parallels to in-person dating victimization, it is unlikely the online dating violence is homogeneous across adolescents in either its debut or pattern over time. Longitudinal assessments capture heterogeneity in first experiences of victimization, as well as periods of rapid increase or decline. Second, few researchers have examined specific domains of electronic dating violence, with only one cross-sectional study examining electronic harassment, electronic coercion, and electronic monitoring. Finally, far less attention has been given to protective factors which could prevent exposure to this form of violence, with the majority of studies focusing on risk factors (Caridade et al., 2019). Filling these three gaps would provide

information that could be important in prevention and intervention work, and increase the safety of dating in adolescence.

Current Study

Exposures that are not static and sensitive to developmental timing, like electronic harassment, electronic coercion and electronic monitoring, are likely to be best summarized with growth curve models that capture both within and between person variability in change over time. The first aim of this study is to examine linear and non-linear trajectories of electronic dating violence across time and identify period(s) of higher risk. Given age-curve findings on physical dating violence, a non-linear pattern with a peak at some point in mid to late adolescence is expected. The second aim is to examine trajectories of three unique forms of electronic dating violence: electronic harassment, coercion and monitoring. Given prior findings of differential patterns of engagement, it may be that linear or non-linear trajectories differ by domain of electronic dating violence. The third objective is to investigate both risk and protective factors that may predict the trajectory of each domain of electronic dating violence (harassment, coercion, monitoring). Dating behaviors, drug use, alcohol use, and exposure to adverse childhood experiences are expected to be risk factors for engagement with electronic dating violence, while parental monitoring, parental knowledge of accounts and passwords and social support are expected to be protective of electronic dating violence.

Methods

Study Design, Data Sources, and Study Population

Data for the study are drawn from the longitudinal Strengthening Healthy Adolescent Relationships and Environments (SHARE) study. In this study, data were collected annually for four years between 2013-2017 from 1,236 youth composing two cohorts. The younger cohort of

youth (n=588) were in 6th grade at the first wave of data collection, while the older cohort of youth (n=648) were in 9th grade at the commencement of the study. Youth were sampled from within schools; schools were selected based on a risk-index (low-, medium-, high-) composite score that was created based on publicly available data on population density, median household income, percent of households below the poverty line, and owner occupied housing (see Kernsmith et al., 2018 for more details). Two districts at each level of risk (low-, medium-, high-) were selected, and all middle and high schools were invited to participate for a total of 13 schools. Information about the study was sent home to parents by school staff, informing parents of the study and presenting parents an opportunity to decline their child's participation by contacting the study team (i.e., passive consent). Eight parents refused participation for their child. Prior to data collection, youth were informed about participation assent and the option to withdraw at any time without penalty from the study. No more than 10 students refused to participate per school, though number of youth refusals by school was not tracked given privacy and approved study design. Data collection occurred during one school hour at each wave missing a single class to participate. Study participation occurred in a mutually agreed upon time and space that included cafeterias, auditoriums, and media centers. Within the given space, participants were spread out to ensure confidentiality and provide privacy to respond to the pencil-paper questionnaires on topics including their interactions with romantic partners, friends and their families.

Of the 1,236 participants, 96 (n=45 younger cohort youth, n=51 older cohort youth) did not report on at least one of the three domains of electronic dating violence at any wave of data collection (i.e., they did not date at all throughout the 4 years, or for the waves in which they did participate in data collection, they did not report any dating behaviors), and were thus excluded

from all analyses. Data from the remaining 1,140 youth (n=543 younger cohort youth, n=597 older cohort youth) were used for latent growth curve modeling. Those who did not report any dating were not significantly different in terms of race (χ^2= 2.26, df=3, p=0.520), gender (χ^2=2.18, df=1, p=0.140) or cohort (χ^2=0.02, df=1, p=0.887). For the prediction of the latent growth curve intercept, slope and quadratic term, covariates from the first wave of data collection were used. Of the 1,140 participants who had data used in the latent growth curve models, 95 were missing data on at least one predictor covariate. The regression models utilize data from 1,045 individuals (n=475 younger cohort, n=570 older cohort). Participants missing from the regression models (n=95) were similar in terms of race (χ^2=2.33, df=3, p=0.507), but males (χ^2=5.86, df=1, p=0.016) and those in the younger cohort (χ^2=12.17, df=1, p<0.001) were more likely to be missing wave 1 covariate data and be excluded from analysis. Of the 1,045 sample in the regression models, 46.5% (n=486) were male and 45.5% (n=475) were in the younger cohort.

Measures

Electronic Dating Violence Engagement

All electronic dating violence measures were adapted based on the Safe Dates program to have consistent response categories across forms of violence (Foshee et al., 1996). Constructs of electronic dating violence were determined based on psychometric evaluations including factor analysis and have been presented elsewhere (Thulin, Heinze, Kernsmith, et al., 2020).

Electronic Monitoring

Engagement with electronic monitoring was evaluated with four items (Cronbach α range: 0.79-0.81), two representing victimization, two representing perpetration. Youth first reported the frequency in the past year with which they had experienced victimization or

perpetrated reading texts, emails or instant message (IM) when they/their partner did not want them to. They then reported on if they or their partner had demanded passwords to electronic communication or networking sites in the past year. For both items, youth responded on a 5-point frequency scale from "Never" (0) to "10+ times" (4). A sum across items was calculated for each wave with possible scores ranging from 0 to 16.

Electronic Coercion

Electronic coercion dating violence was measured by six items (Cronbach α range: 0.75 – 0.84), three for perpetration and three for victimization. Youth reported the frequency from "Never" (0) to "10+ times" (4) they had experienced or perpetrated coercive actions, such as pressuring a partner to send nude or sexy photos. A sum across items was calculated for each wave with possible scores ranging from 0 to 24.

Electronic Harassment

Electronic harassment dating violence was measured using twelve items (Cronbach α range: 0.82 – 0.90), six representing victimization and six representing perpetration. Items including spreading rumors about a partner through electronic means including networking sites like Facebook were responded to by youth from "Never" (0) to "10+ times" (4) in the prior year. A sum across items was calculated for each wave with possible scores ranging from 0 to 48.

Predictors

All predictors were evaluated at wave 1 of data collection.

Dating Behaviors. Dating behaviors were assessed with eleven binary items. Youth reported if they had ever done a given behavior (1), such as holding hands, cuddling, and kissing, or not (0). A mean across items was calculated with possible scores ranging from 0 to 1.

Drug Use. Drug use was assessed with two items (correlation: 0.43) (Elliot et al., 1985). Youth were asked to report their frequency of use of marijuana and illicit drugs in the past year. Youth responded on a 5-point frequency scale from "Never" (0) to "10 or more times" (4). The item with the greatest reported frequency was used, with possible scores ranging from 0 to 4.

Alcohol Use. Alcohol was assessed with one item asking the youth to report their frequency of alcohol use in the past year (Elliot et al., 1985). Youth responded on a 5-point frequency scale from "Never" (0) to "10 or more times" (4).

Adverse Childhood Experiences. Adverse childhood experiences were evaluated with twelve items on eight potential experiences (Felitti et al., 1998). As suggested by researchers, adverse childhood experiences were divided into threat-based and deprivation-based adverse childhood experiences (Hawkins et al., 2021). Threat-based adverse childhood experiences included emotional violence, physical violence, sexual violence, witnessing parental intimate partner violence, and witnessing parental alcohol or drug use. Deprivation-based adverse childhood experiences included neglect, having a parent commit suicide, and having a parent who was incarcerated. For each of the eight potential adverse childhood experiences, if the participant reported any activity in their lifetime they received a 1 for that experience; no report received 0. A summed total number of threat-based adverse childhood experiences was calculated with possible scores ranging from 0 to 5, and a summed total number of deprivation-based adverse childhood experiences was calculated with possible scores ranging from 0 to 3.

Parental Monitoring. Perceived parental monitoring was evaluated with 13 items (Cronbach $\alpha = 0.82$) from the Communities that Care study (Arthur et al., 2002) on how much adults who live with the youth know about the youth's life. Items included knowing if the family had clear rules, if parents would know if the youth skipped school, or if the parents would know

if the youth completed their homework. Youth responded on a 4-point agreement scale of "NO!" (1), "no" (2), "yes" (3), or "YES!" (4). The two items that were asked in the opposite direction were reverse scored. A mean across items was calculated, with possible scores ranging from 0 to 4.

Parental Knowledge of Electronic Accounts. Parental knowledge of their youth's electronic accounts was evaluated by asking youth if their parents knew of five specific types of accounts, such as knowing about all of the youth's email accounts or knowing of all of their social networking profiles. Youth were able to indicate yes (1), no (0) or if they did not have the account (98). A mean of parental knowledge was calculated relative to the number of accounts a child indicated they had (e.g., if a youth indicated they did not have 2 accounts, a sum across the other three accounts ranging from 0 to 3 was calculated, then divided by 3). Possible scores ranged between 0 and 1.

Parental Knowledge of Passwords to Electronic Accounts. Parental knowledge of passwords to youth's electronic accounts was evaluated by asking youth about five specific types of accounts, such as knowing the password to the youth's voicemail or email. Youth were able to indicate yes (1), no (0) or if they did not have the account (98). Similar to the coding of knowledge of accounts, a mean of parental knowledge of passwords relative to the number of accounts a youth indicated they had was calculated (e.g., if a youth indicated they did not have 2 accounts, a sum across the other three accounts ranging from 0 to 3 was calculated, then divided by 3).

Social Support. Social support was evaluated with six items (Cronbach $\alpha = 0.76$) regarding the level to which youth felt they had people in their life who they could turn to and share their feelings, request advice, and ask for help from (Vaux, 1988). Youth responded on a 3-

point agreement scale from "Not at all" (1) to "A lot" (3). A mean across items was calculated, with possible scores ranging from 1 to 3.

Demographic Covariates. Gender was evaluated as male (1) or female (0). Age was calculated based on birthdate reported by youth.

Analysis

Descriptive statistics were used to review data distributions, ranges, and percent of electronic dating violence engagement over time. Next, latent growth modeling was used to evaluate trends of each type of electronic dating violence engagement (i.e., monitoring, coercion, harassment). In the first set of models, the intercept and slope was modeled. Then, a quadratic term was added to each model. The quadratic term was retained in all models where the quadratic variance was significant. The models were then graphed for visual review. Once the shape of the model was determined (i.e., linear or quadratic), the baseline covariates (dating behaviors, drug use, alcohol use, threat-based adverse childhood experiences, deprivation-based adverse childhood experiences, parental monitoring, parental knowledge of electronic accounts, parental knowledge of passwords to electronic accounts, social support, age and gender) were added to predict intercept, slope, and quadratic term (as applicable). All models were stratified by cohort (6th grade and 9th grade at Wave 1), to account for developmental differences between the two age ranges, and utilized count distributions, given the count-nature of the dependent variables. Analyses were conducted in Mplus 8.0.

Results

Study Population

Demographic statistics are presented in Table 2. Of the younger cohort, 57.3% (n=272) identified as white, 16.4% (n=78) identified as black, 9.7% (n=46) identified as a race other than

white or black, 9.5% (n=45) identified as multiple races and 6.5% (n=31) declined to report race. Slightly less than half of the sample (n=224, 47.2%) identified as male. On average, youth in the younger cohort were 12.00 years old (standard deviation = 0.46 years) at the first wave of data collection. In the older cohort, 62.5% (n=356) of youth self-identified as white, 17.4% (n=99) identified as black, 11.2% (n=64) identified as multiple races, 7.0% (n=40) identified as a single race other than white or black and 1.9% (n=11) declined to report race. Slightly over half of the sample (n=308, 54.0%) was male. On average, youth in the older cohort were 15.00 years old (standard deviation = 0.54 years) at the first wave of data collection.

Table 2. Demographic Statistics by Cohort, Study 1

Demographic Statistics by Cohort

	Cohort 1	Cohort 2
	n(%)	*n(%)*
Sample Size	475(45.5%)	570(54.5%)
Race	*n(%)*	*n(%)*
Black	78(16.4%)	99(17.4%)
White	272(57.3%)	356(62.5%)
Other	46(9.7%)	40(7.0%)
Multi-race	45(9.5%)	64(11.2%)
Missing	31(6.5%)	11(1.9%)
Gender (N%)	*n(%)*	*n(%)*
Male	224(47.2%)	308(54.0%)
Female	251(52.8%)	262(46.0%)
	Mean(Standard Deviation)	*Mean(Standard Deviation)*
Age	12.00(0.46)	15.00(0.54)

Descriptive Statistics of Predictors by Cohort

Descriptive statistics of each variable by cohort are presented in Table 3. For the younger cohort at age 12 (Wave 1), youth averaged between one and two dating behaviors such as holding hands, cuddling, and kissing ($\mu=0.18$, standard deviation=0.21). The vast majority of

youth in the younger cohort (pre-adolescence) did not indicate any drug use (μ=0.05, standard deviation = 0.33) nor alcohol use (μ=0.11, standard deviation = 0.51). On average, participants from the younger cohort reported less than one threat-based adverse childhood experiences (μ=0.77, standard deviation = 1.15) and even less exposure to deprivation-based adverse childhood experiences (μ=0.23, standard deviation=0.54). For protective factors, participants reported that their parents did monitor them (μ=3.24, standard deviation=0.36), knew about the majority of their accounts (μ=0.65, standard deviation = 0.30), but were slightly less knowledgeable about their passwords (μ=0.48, standard deviation = 0.39). On average, participants reported between "some" and "a lot" of social support (μ=2.24, standard deviation = 0.42).

Table 3. Descriptive Statistics of Regression Covariates by Cohort, Study 1

Descriptive Statistics of Regression Covariates by Cohort

	Cohort 1	Cohort 2
	n(%)	*n(%)*
Sample Size	475(45.5%)	570(54.5%)
	Mean(Standard Deviation)	*Mean(Standard Deviation)*
Dating Behaviors	0.18(0.21)	0.50(0.30)
Drug Use	0.05(0.33)	0.49(1.14)
Alcohol Use	0.11(0.51)	0.84(1.25)
Threat-based Adverse Childhood Experiences	0.77(1.15)	1.39(1.46)
Deprivation-based Adverse Childhood Experiences	0.23(0.54)	0.29(0.65)
Parental Monitoring	3.24(0.36)	3.00(0.42)
Parental Account Knowledge	0.65(0.30)	0.58(0.26)

Parental Password Knowledge	0.48(0.39)	0.30(0.34)
Social Support	2.44(0.42)	2.35(0.41)

For the older cohort at the first wave of data collection when adolescents were aged 15, participants averaged between five or six dating behaviors (out of thirteen) such as holding hands, cuddling, and kissing (μ=0.50, standard deviation=0.30). The 15 year old adolescents averaged between "never" (0) and "1 time" (1) for drug use (μ=0.50, standard deviation=0.30), and closer to "1 time" for alcohol use (μ=0.84, standard deviation = 1.14). On average, participants from the older cohort reported more than one threat-based adverse childhood experience (μ=1.39, standard deviation = 1.46) but less exposure to deprivation-based adverse childhood experiences (μ=0.29, standard deviation=0.65). For protective factors, the 15 year old adolescents reported that their parents did monitor them at least some of the time (μ=3.00, standard deviation=0.42), knew about just over half of their accounts (μ=0.58, standard deviation = 0.26), but were less knowledgeable about their passwords (μ=0.30, standard deviation = 0.34). On average, participants reported between "some" and "a lot" of social support (μ=2.35, standard deviation = 0.41).

Electronic Dating Violence between 6th and 9th Grade (Younger Cohort)

Figure 1

Percent of 12-15 Year Old Daters Engaging in Electronic TDV, by Electronic TDV Domain
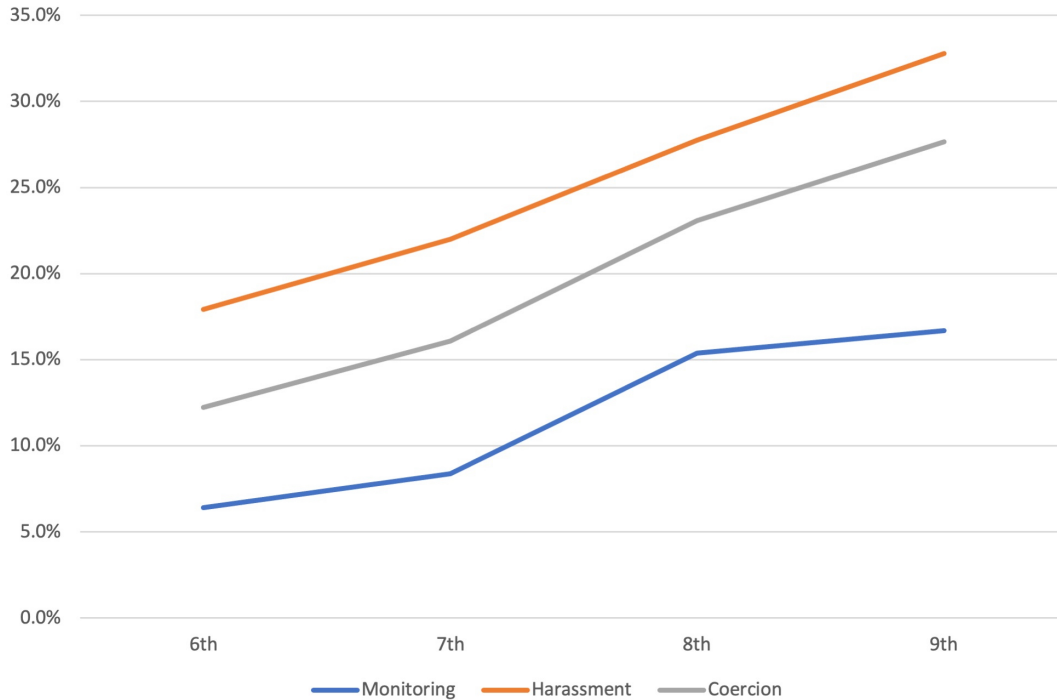
Figure 1. Percent of 12-15 Year Old Daters Engaging in EDV, by Domain of EDV

The percent of participant engaging in electronic dating violence from 6th to 9th grade (spanning age 12 to 15) generally shows an increase across time (Figure 1). The domain with the highest percent of participant report is electronic harassment, starting out with 17.9% of participants reporting harassment engagement, which steadily increases across time. At 9th grade (age 12), 32.8% of the younger cohort report harassment engagement (Table 4). Electronic coercion is the domain with the next largest percent of participants reporting engagement, with

12.2% of participants reporting coercion engagement in 6th grade (age 12), which increases to 27.7% of adolescents reporting coercion in 9th grade (age 15). Electronic monitoring is the domain with the smallest percent of participants reporting engagement, with 6.4% reporting monitoring in 6th grade (age 12), increasing to 16.7% reporting in 9th grade (age 15). Across the three domains, 12.3% of the younger youth report engagement with two domains, and 12.0% report engagement with all three domains. Of the two domain overlap, 7.6% of youth report harassment and coercion, 3.9% report harassment and monitoring, and 0.9% report monitoring and coercion.

Table 4. Percentage of Participants Reporting Engagement with Domain of Electronic Dating Violence in Prior Year, by Wave of Data Collection

Percentage of Participants Reporting Engagement with Domain of Electronic Dating Violence in Prior Year, by Wave of Data Collection

Age 12-15, Younger Cohort	Wave 1	Wave 2	Wave 3	Wave 4
Average Age of Participant at Wave	12	13	14	15
Electronic Monitoring	6.4%	8.4%	15.4%	16.7%
Electronic Harassment	17.9%	22.0%	27.8%	32.8%
Electronic Coercion	12.2%	16.1%	23.1%	27.7%
Age 15-18, Older Cohort	Wave 1	Wave 2	Wave 3	Wave 4
Average Age of Participant at Wave	15	16	17	18
Electronic Monitoring	22.4%	25.0%	25.8%	27.9%
Electronic Harassment	32.0%	38.8%	38.7%	32.5%
Electronic Coercion	31.4%	38.5%	32.2%	30.7%

Electronic Dating Violence between 9th and 12th Grade (Older Cohort)

Similar to the trends seen in the younger cohort, the older cohort following adolescents from 9th through 12th grade (spanning age 15 to 18) reported the greatest engagement in electronic harassment, followed by electronic coercion, and the least engagement with electronic monitoring (Figure 2). The trajectories of the domains, however, look very different. At 9th grade (age 15), just under one third of participants (32.0%) report electronic harassment, which peaks in 10th grade (age 16) with 38.8% of participants reporting engagement, and by 12th grade (age 18) is down to 32.5% of participants reporting engagement. The trend looks similar for electronic coercion, starting with 31.4% of participants reporting coercion engagement at 9th grade (age 15), increasing to 38.5% at 10th grade (age 16), and decreasing in 11th grade (age 17) to 32.2% of adolescents reporting and then to 30.7% in 12th grade (age 18). Electronic monitoring has a slightly different trend across time than electronic harassment and coercion. In 9th grade, 22.4% of adolescents report electronic monitoring engagement, and this percent gradually increased over 4 years cumulating in 12th grade with 27.9% of adolescents reporting this behavior. Across the three domains, 20.3% of older youth report engagement with two domains, and 28.0% report engagement with all three domains. Of the two domain overlap, 11.2% of older youth report harassment and coercion, 6.4% report harassment and monitoring, and 2.7% report monitoring and coercion.

Figure 2

Percent of 15-18 Year Old Daters Engaging in Electronic TDV, by Electronic TDV Domain
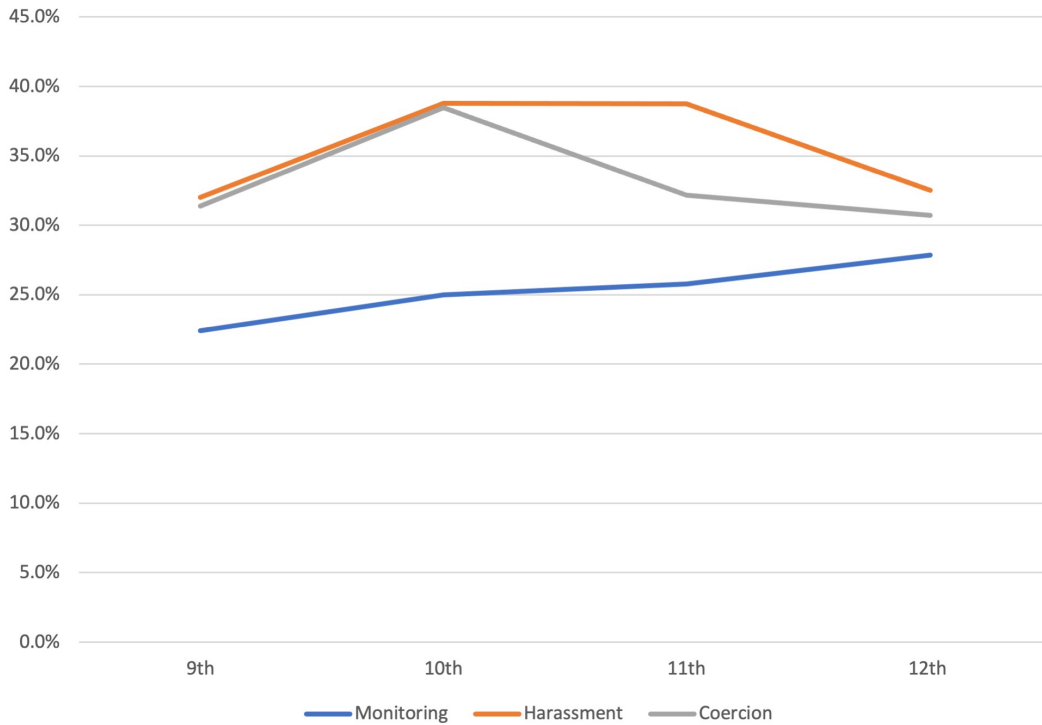
Figure 2. Percent of 15-18 Year Old Daters Engaging in EDV, by EDV Domain

Latent Growth Curve: Electronic Harassment

Age 12-15, 6ᵗʰ-9ᵗʰ Grade (Younger Cohort)

For the younger cohort (6ᵗʰ-9ᵗʰ grade, age 12 to 15), the model containing the quadratic

term had better fit statistics (AIC: 2844.829, BIC: 2883.520, sample-size adjusted BIC:

2854.950) as compared to the linear model (AIC: 3046.998, BIC: 3068.492, sample-size adjusted

BIC: 3052.62) (Table 5). The variance of the quadratic term was also significant (β=1.167, S.E.=0.199, p<0.005). The intercept of the model was negative (β=-2.643, S.E.=0.270, p<0.005) while the slope (β=0.483, S.E.=0.484, p=0.318) and quadratic term (β=0.068, S.E.=0.148, p=0.646) were positive but insignificant. The risk of electronic harassment for participants in the younger cohort slowly increases from 6th to 7th grade (age 12 to 13), but begins to increase more rapidly between 7th and 9th grade (age 13 to 15). It does not plateau or slow (see Figure 3).

Figure 3

Growth Curves of Electronic Harassment by Age
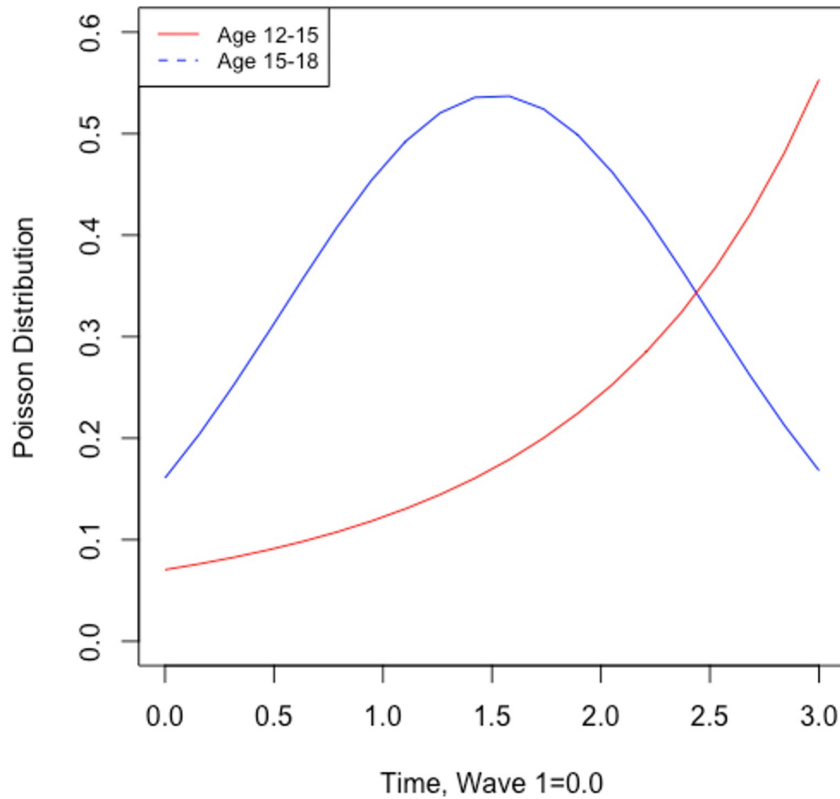
Figure 3. Growth Curves of Electronic Harassment by Age

Greater reported dating behaviors (β=3.116, S.E.=0.871, p<0.005) and exposure to threat-based adverse childhood experiences (β=0.419, S.E.=0.197, p=0.034) were positively predictive of the intercept while parental monitoring (β=1.399, S.E.=0.640, p=0.029) was negatively predictive of the intercept (Table 5). Drug use (β=-2.029, S.E.=0.674, p=0.003) was negatively

predictive of the slope and positively predictive of the quadratic term (β=0.811, S.E.=0.304, p=0.008).

Table 5. Covariates Predicting Electronic Harassment Latent Growth Curve, by Age Cohort

Covariates Predicting Electronic Harassment Latent Growth Curve, by Age Cohort

Age 12-15, Younger Cohort	Intercept			Slope			Quadratic		
Variable	*beta*	*S.E.*	*p-value*	*beta*	*S.E.*	*p-value*	*beta*	*S.E.*	*p-value*
Dating Behaviors	3.116	0.871	0.000	0.323	1.364	0.813	-0.573	0.449	0.202
Drug Use	0.459	0.435	0.292	-2.029	0.674	0.003	0.811	0.304	0.008
Alcohol Use	0.179	0.293	0.542	-0.136	0.459	0.767	-0.081	0.145	0.576
Adverse Childhood Experiences – Threat	0.419	0.197	0.034	-0.259	0.326	0.427	0.037	0.111	0.737
Adverse Childhood Experiences – Deprivation	-0.416	0.489	0.395	1.525	0.805	0.058	-0.448	0.239	0.061
Parental Monitoring	-1.399	0.640	0.029	-0.109	0.939	0.908	0.129	0.307	0.674
Parental Account Knowledge	0.274	0.700	0.695	1.336	1.141	0.242	-0.587	0.382	0.124
Parental Password Knowledge	-1.005	0.585	0.086	0.049	0.902	0.956	0.121	0.298	0.684
Social Support	0.212	0.529	0.688	0.862	0.969	0.374	-0.330	0.335	0.324
Male	-0.643	0.393	0.102	-0.083	0.677	0.902	0.131	0.229	0.565
Age	0.358	0.431	0.406	-0.909	0.703	0.196	0.322	0.235	0.171
Age 15-18, Older Cohort	*beta*	*S.E.*	*p-value*	*beta*	*S.E.*	*p-value*	*beta*	*S.E.*	*p-value*
Dating Behaviors	1.929	0.500	0.000	-2.063	0.738	0.005	0.683	0.250	0.006
Drug Use	0.074	0.132	0.573	-0.020	0.209	0.924	0.000	0.069	0.996
Alcohol Use	0.217	0.137	0.114	-0.041	0.210	0.845	-0.038	0.071	0.587
Adverse Childhood Experiences – Threat	0.453	0.111	0.000	-0.336	0.174	0.053	0.119	0.059	0.044

Adverse Childhood Experiences – Deprivation	0.021	0.211	0.921	-0.165	0.343	0.631	0.054	0.123	0.658
Parental Monitoring	-0.030	0.383	0.937	0.471	0.594	0.427	-0.187	0.204	0.359
Parental Account Knowledge	-0.222	0.597	0.710	-0.744	0.855	0.384	0.209	0.290	0.470
Parental Password Knowledge	0.383	0.441	0.385	0.018	0.635	0.977	-0.043	0.213	0.840
Social Support	-0.951	0.356	0.007	0.154	0.530	0.771	0.004	0.177	0.982
Male	-0.235	0.272	0.387	0.164	0.418	0.694	0.012	0.145	0.933
Age	-0.105	0.212	0.623	0.865	0.339	0.011	-0.338	0.125	0.007

The electronic harassment model that fit best for the older cohort (9th-12th grade, ages 15-18) was the one with the quadratic term (AIC: 5005.259, BIC: 5044.816, sample-size adjusted BIC: 5016.243) as compared to the linear model (AIC: 5597.356, BIC: 5619.332, sample-size adjusted BIC: 5603.458). The variance of the quadratic term was significant (β=1.064, S.E.=0.175, p<0.005). The intercept term (β=-1.828, S.E.=0.246, p<0.005) and quadratic term (β=-0.527, S.E.-0.107, p<0.005) were negative while the slope was positive (β=1.596, S.E.=0.33, p<0.005). The risk of electronic harassment curve for adolescents in the older cohort is concave. The slope begins steeply, rising through 10th grade (age 16), and starting to fall at 11th grade (age 17) and continuing on a downward trajectory through 12th grade (age 18) (see Figure 3).

Reporting more dating behaviors (β=1.929, S.E.=0.500, p<0.005) and a greater number of threat-based adverse childhood experiences (β=0.453, S.E.=0.111, p<0.005) were positively predictive of the intercept, while social support (β=-0.951, S.E.=0.356, p=0.007) was negatively predictive. Dating behaviors (β=-2.063, S.E.=0.738, p<0.005) was negatively predictive of the slope, while age (β=0.865, S.E.=0.339, p=0.011) was positively predictive. This trend was flipped for the quadratic term, with dating behaviors (β=0.683, S.E.=0.250, p=0.006) and threat-based adverse childhood experiences (β=0.119, S.E.=0.059, p=0.044) positively predicting the quadratic term while age (β=-0.338, S.E.=0.125, p=0.007) was negatively predictive.

Latent Growth Curve: Electronic Coercion

6th-9th Grade (Younger Cohort)

In the younger cohort (6th-9th grade, age 12 to 15), the fit statistics of the model containing the quadratic term (AIC: 2158.085, BIC: 2196.759, sample-size adjusted BIC:

2168.190) as compared to the linear model (AIC: 2333.415, BIC: 2354.901, sample-size adjusted

BIC: 2339.029) made the model with the quadratic term superior. The significance of the

quadratic term variance (β=1.362, S.E.=0.257, p<0.001) was also indicative of superiority of this

model. In this model, the intercept (β =-4.500, S.E.=0.492, p<0.001) and quadratic (β=-0.260,

S.E.=0.201, p=0.197) terms were negative, while the slope was positive (β=1.582, S.E.=0.687,

p=0.021). Visually, the younger cohort showed a gradual increase over time; notably, this curve

is the closest to a linear trajectory (as evidenced by the quadratic not being significant, although

variance and fit statistics were superior for the quadratic model) (Figure 4).

Figure 4

Growth Curves of Electronic Coercion by Age
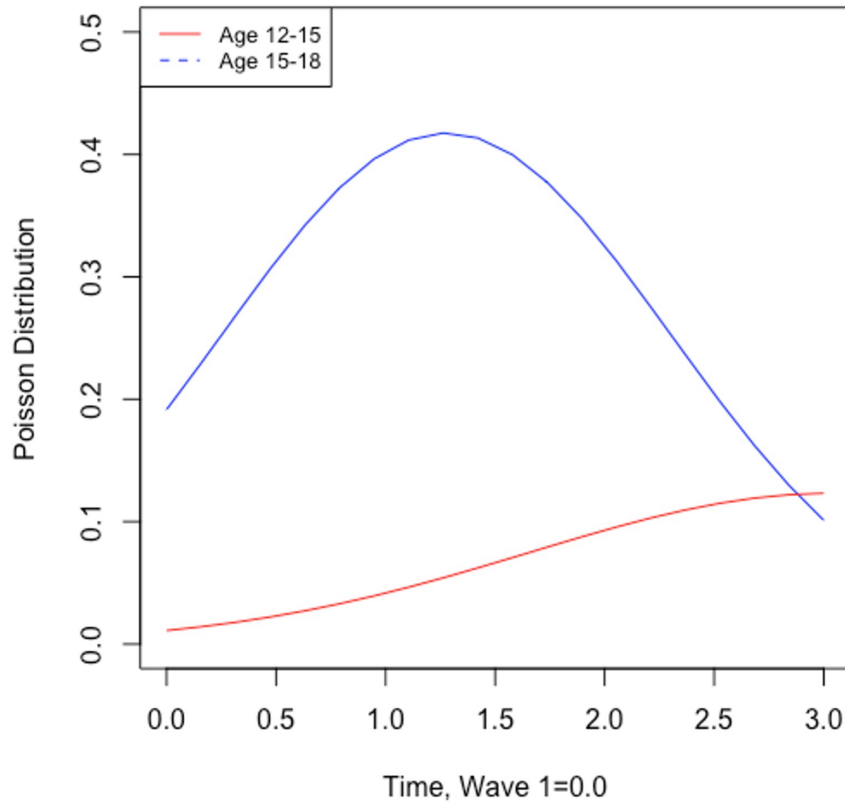
Figure 4. Growth Curves of Electronic Coercion by Age

Greater report of dating behaviors (β=4.897, S.E.=0.966, p<0.005), threat-based adverse childhood experiences (β=0.414, S.E.=0.196, p=0.035) and social support (β=1.209, S.E.=0.535, p=0.024) were positive predictors of the intercept (Table 6), while parental monitoring (β=-2.147, S.E.=0.672, p<0.005) was negatively predictive. None of the covariates significantly predicted the slope or quadratic term for the younger cohort.

Table 6. Covariates Predicting Electronic Coercion Latent Growth Curve, by Cohort

Covariates Predicting Electronic Coercion Latent Growth Curve, by Cohort

Age 12-15, Younger Cohort	Intercept			Slope			Quadratic		
Variable	*beta*	*S.E.*	*p-value*	*beta*	*S.E.*	*p-value*	*beta*	*S.E.*	*p-value*
Dating Behaviors	4.897	0.966	0.000	-2.103	1.794	0.241	0.160	0.577	0.782
Drug Use	0.029	0.425	0.946	0.045	0.841	0.958	0.026	0.364	0.943
Alcohol Use	0.167	0.278	0.547	-0.517	0.510	0.310	0.214	0.198	0.279
Adverse Childhood Experiences – Threat	0.414	0.196	0.035	-0.084	0.312	0.787	-0.053	0.104	0.610
Adverse Childhood Experiences – Deprivation	-0.233	0.433	0.591	0.199	0.583	0.733	0.019	0.195	0.924
Parental Monitoring	-2.147	0.672	0.001	-0.066	1.011	0.948	0.160	0.336	0.634
Parental Account Knowledge	1.145	0.861	0.183	-1.960	1.251	0.117	0.413	0.413	0.317
Parental Password Knowledge	-0.062	0.677	0.927	0.101	1.048	0.923	0.009	0.341	0.978
Social Support	1.209	0.535	0.024	-0.703	0.861	0.414	0.188	0.284	0.508
Male	-0.397	0.443	0.370	-0.421	0.669	0.529	0.242	0.228	0.287
Age	-0.275	0.435	0.527	0.510	0.619	0.410	-0.224	0.206	0.278
Age 15-18, Older Cohort	*beta*	*S.E.*	*p-value*	*beta*	*S.E.*	*p-value*	*beta*	*S.E.*	*p-value*
Dating Behaviors	3.572	0.425	0.000	-1.905	0.730	0.009	0.296	0.254	0.244
Drug Use	-0.306	0.121	0.011	0.354	0.213	0.097	-0.124	0.074	0.094
Alcohol Use	0.329	0.103	0.001	-0.323	0.160	0.044	0.100	0.056	0.076
Adverse Childhood Experiences – Threat	0.326	0.092	0.000	-0.376	0.150	0.012	0.165	0.053	0.002

Adverse Childhood Experiences – Deprivation	0.095	0.186	0.612	0.082	0.325	0.801	0.002	0.109	0.987
Parental Monitoring	-0.489	0.356	0.169	0.507	0.587	0.388	-0.163	0.205	0.428
Parental Account Knowledge	-0.709	0.504	0.159	0.436	0.809	0.590	-0.248	0.289	0.391
Parental Password Knowledge	0.764	0.370	0.039	-0.575	0.616	0.351	0.075	0.216	0.730
Social Support	0.254	0.301	0.399	-0.430	0.493	0.383	0.128	0.175	0.463
Male	0.090	0.230	0.695	-0.261	0.389	0.503	0.242	0.138	0.079
Age	-0.061	0.200	0.761	-0.036	0.342	0.916	-0.015	0.138	0.916

For the older cohort (9th-12th grade, ages 15-18), the model with the quadratic term had superior fit statistics (AIC: 4772.039, BIC: 4811.581, sample-size adjusted BIC: 4783.009) as compared to the linear model (AIC: 5204.732, BIC: 5226.700, sample-size adjusted BIC: 5210.826). This was supported by significance of the quadratic term variance (β=0.995, S.E.-0.179, p<0.001). The intercept of the model with the quadratic term was negative (β=-1.653, S.E.=0.210, p<0.001) as was the quadratic term (β=-0.478, S.E.=0.128, p<0.001), while the slope was positive (β=1.221, S.E.=0.343, p<0.001). The older cohort begins at roughly the same level where the younger cohort ended (the overlap of the two groups was at 9th grade). The curve of the older cohort is pronounced and concave, peaking between 10th (age 16) and 11th grade (age 17) before dropping off.

More dating behaviors (β=3.572, S.E.=0.425, p<0.005), alcohol use (β=0.329, S.E.=0.103, p<0.005), exposure to threat-based adverse childhood experiences (β=0.326, S.E.=0.092, p<0.005) and parental knowledge of youth's passwords (β=0.765, S.E.=0.370, p=0.039) positively predicted the intercept, while drug use (β=-0.306, S.E.=0.121, p=0.011) negatively predicted the intercept. Dating behaviors (β=-1.905, S.E.=0.730, p=0.009), alcohol use (β=-0.323, S.E.=0.160, p=0.044) and exposure to threat-based adverse childhood experiences (β=-0.376, S.E.=0.150, p=0.012) negatively predicted the slope. Exposure to threat-based adverse childhood experiences (β=0.165, S.E.=0.053, p<0.005) positively predicted the quadratic term.

Latent Growth Curve: Electronic Monitoring

6th-9th Grade (Younger Cohort)

Similar to the models for electronic harassment and coercion, the fit statistics of the model without the quadratic term (AIC: 1403.690, BIC: 1425.176, sample-size adjusted BIC: 1409.304) were substantially worse than the fit statistics of the model that included a quadratic term (AIC: 1286.329, BIC: 1325.003, sample-size adjusted BIC: 1296.434) for the younger cohort (6th-9th grade, age 12 to 15). The variance of the quadratic term was also significant (β=1.866, S.E.=0.546, p=0.001). Thus, the quadratic model was the superior fitting model, with a mean intercept term of -6.971 (S.E.= 0.900, p<0.005), a positive slope (β=3.248, S.E.=1.167, p=0.005) and a negative quadratic term (β=-0.667, S.E.=0.341, p=0.051). The younger cohort starts out at a very low rate of electronic monitoring; the slope increases after 7th grade (age 13) (Figure 5).

Figure 5

Growth Curves of Electronic Monitoring by Age
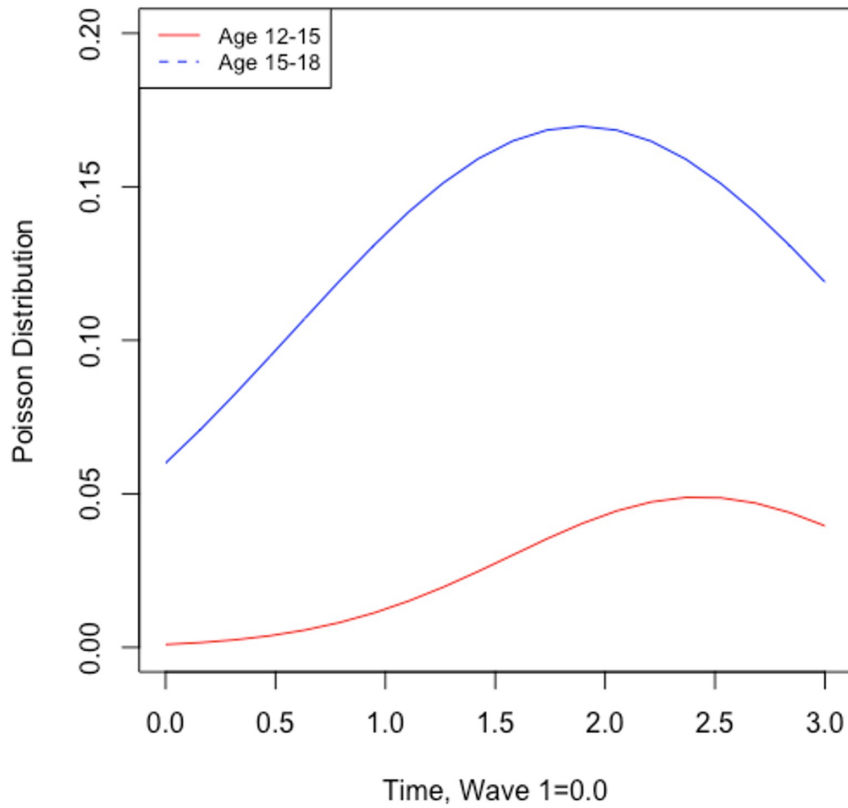
Figure 5. Growth Curves of Electronic Monitoring by Age

Dating behaviors (β=1.113, S.E.=0.564, p=0.048), drug use (β=0.772, S.E.=0.241, p<0.005), alcohol use (β=1.300, S.E.=0.210, p<0.005), exposure to threat-based adverse childhood experiences (β=0.385, S.E.=0.122, p<0.005), parental knowledge of accounts (β=1.271, S.E.=0.477, p=0.008), parental knowledge of account passwords (β=1.325, S.E.=0.313, p<0.005), and being male (β=0.943, S.E.=0.324, p<0.005) were all predictive of the

intercept of electronic monitoring, while parental monitoring (β=-2.422, S.E.=0.632, p<0.005) was negatively predictive (Table 7). Dating behaviors (β=2.441, S.E.=1.036, p=0.018) positively predicted the slope, while drug (β=-1.775, S.E.=0.577, p<0.005) and alcohol use (β=-1.749, S.E.=0.304, p<0.005) remained significantly predictive, but in the negative direction for slope. Dating behaviors were negatively predictive of the quadratic term (β=-0.685, S.E.=0.327, p=0.036) while drug (β=0.521, S.E.=0.249, p=0.036) and alcohol use (β=0.552, S.E.=0.116, p<0.005) were positively predictive of the quadratic term.

Table 7. Covariates Predicting Electronic Monitoring Latent Growth Curve, by Cohort

Covariates Predicting Electronic Monitoring Latent Growth Curve, by Cohort

Age 12-15, Younger Cohort	Intercept			Slope			Quadratic		
Variable	*beta*	*S.E.*	*p-value*	*beta*	*S.E.*	*p-value*	*beta*	*S.E.*	*p-value*
Dating Behaviors	1.113	0.564	0.048	2.441	1.036	0.018	-0.685	0.327	0.036
Drug Use	0.772	0.241	0.001	-1.775	0.577	0.002	0.521	0.249	0.036
Alcohol Use	1.300	0.210	0.000	-1.979	0.316	0.000	0.693	0.104	0.000
Adverse Childhood Experiences – Threat	0.385	0.122	0.002	-0.101	0.377	0.788	0.004	0.126	0.974
Adverse Childhood Experiences – Deprivation	-0.245	0.128	0.054	0.873	0.609	0.152	-0.066	0.210	0.753
Parental Monitoring	-2.422	0.632	0.000	1.838	1.032	0.075	-0.285	0.293	0.330
Parental Account Knowledge	1.271	0.477	0.008	-0.912	1.216	0.453	0.258	0.389	0.507
Parental Password Knowledge	1.325	0.313	0.000	-0.827	1.107	0.455	0.031	0.363	0.932
Social Support	1.445	0.782	0.065	0.278	1.211	0.819	-0.225	0.347	0.516
Male	0.943	0.324	0.004	-1.147	0.741	0.121	0.311	0.232	0.180
Age	0.280	0.327	0.391	-0.866	0.821	0.292	0.375	0.269	0.165
Age 15-18, Older Cohort	*beta*	*S.E.*	*p-value*	*beta*	*S.E.*	*p-value*	*beta*	*S.E.*	*p-value*
Dating Behaviors	2.764	0.605	0.000	-0.701	0.931	0.451	0.144	0.312	0.644
Drug Use	0.181	0.154	0.241	-0.337	0.217	0.120	0.093	0.069	0.177
Alcohol Use	-0.024	0.163	0.881	0.136	0.222	0.539	-0.049	0.068	0.477
Adverse Childhood Experiences – Threat	0.269	0.132	0.042	-0.045	0.185	0.809	0.039	0.061	0.521

Adverse Childhood Experiences – Deprivation	0.349	0.243	0.151	-0.881	0.381	0.021	0.262	0.119	0.028
Parental Monitoring	0.015	0.437	0.972	-0.098	0.684	0.886	-0.002	0.218	0.991
Parental Account Knowledge	0.193	0.712	0.786	-1.257	1.111	0.258	0.323	0.356	0.364
Parental Password Knowledge	0.806	0.517	0.119	-0.293	0.745	0.694	-0.075	0.245	0.758
Social Support	-0.788	0.389	0.043	0.379	0.621	0.541	-0.019	0.205	0.927
Male	-0.731	0.319	0.022	0.295	0.499	0.555	-0.023	0.170	0.892
Age	0.128	0.267	0.630	0.479	0.449	0.286	-0.206	0.160	0.199

9th- 12th Grade (Older Cohort)

In the older cohort (9th-12th grade, age 15-18), the model containing the quadratic term had superior AIC (3447.224), BIC (3486.751) and sample-size adjusted BIC (3458.179) fit statistics as compared with the linear model (AIC: 3680.99, BIC: 3702.958, sample-size adjusted BIC: 3687.085). As the variance of the quadratic term was also significant (β=0.954, S.E.=0.198, p<0.005), the model containing the quadratic term was selected (intercept β=-2.813, S.E.=0.299, p<0.001; slope β=1.098, S.E.=0.459, p=0.017; quadratic β=-0.290, S.E.=0.152, p=0.057). The older cohort begin at roughly the same rate as where the younger cohort left off (the overlap of 9th grade). Those in the older cohort experience a rising rate of engagement until 11th grade (age 17), at which time the risk begins to fall (Figure 5).

Dating behaviors (β=2.764, S.E.=0.605, p<0.005) and exposure to threat-based adverse childhood experiences (β=0.269, S.E.=0.132, p=0.042) were positively predictive of the electronic monitoring intercept for the older cohort, while social support (β=-0.788, S.E.=0.389, p=0.043) and being male (β=-0.714, S.E.=0.312, p=0.022) were negatively predictive. Exposure to deprivation-based adverse childhood experiences (β=-0.881, S.E.=0.381, p=0.021) was negatively predictive of slope and negatively predictive of the quadratic term (β=-0.262, S.E.=0.119, p=0.028).

Discussion

Researchers have found high prevalence rates of electronic dating violence in cross-sectional studies (Peskin et al., 2017), but little is known about the patterns of specific electronic dating violence domains across time (Caridade et al., 2019). This study provides insight into adolescent experiences of three unique domains of electronic dating violence (electronic harassment, electronic coercion, electronic monitoring), and provides evidence that the sequence

of these behaviors change in non-linear ways between age 12 to 18. In addition to providing longitudinal information to the field of electronic dating violence that largely utilizes cross-sectional studies, the present study expands existing longitudinal evaluations of electronic dating violence whereby researchers have used forms of linear models to examine risk over time (Y. Lu et al., 2018), and thus have not been able to evaluate pinnacles of risk (Temple et al., 2016b). General trends across the three domains show that the experience of electronic dating violence begins in pre-adolescence, increases substantially until roughly 10th grade (age 16), and then begins to decline.

The finding of change in risk across time until an inflection point is an important step to better understand the experience of electronic dating violence and supports other researcher findings of an age-curve in physical forms of dating violence (W. L. Johnson et al., 2015). Unlike in-person forms of dating violence, electronic domains appear to peak slightly earlier, around 10th or 11th grade. This earlier peak may reflect how electronics are utilized in early and mid-adolescence before individuals have geographic autonomy (i.e., being able to legally drive on their own) and physically appear a bit older (i.e., can take public transit without much adult questioning) and may be allowed by parents to be out with less supervision and checking up.

Though there is growing consensus that electronic dating violence is unique relative to in-person forms of dating violence (Peskin et al., 2017), in longitudinal studies many researchers have examined generalized electronic dating violence (Y. Lu et al., 2018) as opposed to specific domains of electronic dating violence. Yet, researchers have found evidence of differential patterns of engagement by specific type of electronic dating violence (Thulin, Heinze, Kernsmith, et al., 2020). Examining the curves by individual domain of electronic dating violence reveals notable differences in patterns by domain of electronic dating violence. In the

present study, electronic harassment was the most pervasive form of electronic dating violence engagement, with 17% - 39% of youth reporting exposure in the prior year. Based on the growth curve, risk of this behavior increased sharply between 7th and 10th grade, plateauing between 10th and 11th, and then falling. The next most common form was electronic coercion, with 12% - 39% of participants reporting engagement in electronic coercion in the prior year. As compared to electronic harassment, electronic coercion had a slower increase in early adolescent years (6th-9th grade), but rose more sharply between 9th and 11th grades before declining. Similar to electronic harassment, electronic monitoring (reported by 6% - 28% of participants in the past year) increased around 7th grade, but this increase persisted until an inflection point at 11th grade where risk of behavior began to decrease.

The differences in the increase and peak of electronic dating violence domains may reflect differences in the mechanisms through which electronic harassment, coercion and monitoring occur. Harassment may be more similar to cyberbullying that often begins in mid to late childhood, which may influence the earlier increase in electronic harassment in dating relationships (Kowalski et al., 2019). Social Learning Theory may help explain the early emergence of electronic monitoring. As the majority of adults share passwords within their romantic relationships, youth may begin to engage in electronic monitoring behaviors earlier due to seeing adults in their lives sharing passwords with a romantic partner and thus view it as normative in a relationship (Lenhart & Duggan, 2014). The relatively later trend observed in electronic coercion (as compared with electronic harassment and monitoring) may be in part be explained by Identity Theory, which includes the emergence and exploration of sexuality. Unlike monitoring or harassment, electronic coercion is the attempt to elicit sexual text, pictures or videos, which may be influenced by hormonal changes and increasing experiences of dating

behaviors that typically occur in mid to late adolescence (Abma & Martinez, 2017). The differences in these mechanisms highlight the unique nature of each domain of electronic dating violence.

Factors Predicting Levels of Electronic Dating Violence

In addition to providing evidence of non-linear risk, this study also provides novel findings of risk and protective factors that predict the intercept, slope and quadratic term of each model. One factor that was consistently predictive across domain of electronic dating violence for the older cohort was greater engagement in dating behaviors, which include behaviors such as holding hands, kissing and oral sex. Greater engagement in dating behaviors was also a significant risk factor for electronic harassment and electronic coercion engagement in the younger cohort. These findings supplement evidence that earlier engagement in dating behaviors is associated with greater risk of in-person forms of dating violence (Capaldi et al., 2012). Another major predictor across age and specific electronic dating violence domains was exposure to threat-based adverse childhood experiences, which was positively predictive of younger and older youth reports of electronic harassment and coercion and younger youth reports of electronic monitoring. This compliments existing longitudinal findings of a positive association between exposure to adverse childhood experiences and in-person domains of violence (Heinze et al., 2021), and expands on these findings by exploring explicit exposure type (i.e., threat versus deprivation) (Hawkins et al., 2021). In this study, participants who experienced threat-based adverse experiences such as exposure to physical violence or witnessing parental intimate partner violence were more likely to engage in electronic dating violence behaviors, which supports the application of Social Learning Theory within the study of dating violence. However, this finding also supports existing work that provides preliminary

evidence of the need to evaluate adverse childhood experiences with more nuance (Hawkins et al., 2021).

Several of the protective factors were significantly associated with multiple electronic dating violence behaviors, but varied by cohort. Across the three electronic dating violence domains, greater parental monitoring of participants in the younger cohort (6th-9th grade) was significantly protective against engagement in all three domains. However, parental monitoring was not a significant predictor of engagement in any of the three domains in the older cohort (9th-12th grade). This may be related to Identity Theory and the change that individuals experience across adolescence whereby they become more autonomous and have less influence from caregivers or other adults, and thus monitoring from a parent is less influential to prevent electronic dating violence in older adolescence (Claes, 2018).

The increase in autonomy through adolescence may also help explain why social support was found to be a protective factor against engagement in electronic harassment and monitoring in the older cohort, but was not a significant predictor of behaviors in the younger cohort. Interpreting the difference in friend influence through a Life Course Theory and Identity Theory framework, the form, role and influence of friends in the life of an individual changes throughout adolescence (Santos & Vaughn, 2018). In early adolescence, relationships may be based more upon overlapping activities, interests, and geographic location whereby individuals are less autonomous as to where they are and have less development of individual identity (Claes, 2018). In late adolescence, the physical appearance of adulthood, advancement in cognition, and increase in autonomy both socially and emotionally result in mid- and late-adolescents having more flexibility in where they spend their time and with whom. Additionally, older youth tend to have fewer but closer friendships than younger youth, who are more likely to be friends with a

broader set of peers. Another important age-related difference found in the present study was the association of electronic monitoring with gender; for the younger cohort, being male was positively associated with electronic monitoring. This association flipped by the time participants were slightly older adolescents, whereby females were more likely to report electronic monitoring. This change by age and gender might be due to displacement, where experiences of more direct forms of violence (i.e., harassment which is negatively associated with being male, although not at a significant level) could lead to more covert forms (i.e., monitoring) (Walters & Espelage, 2020). Alternatively, it may be that monitoring increases for females with age due to increases in more intimate relationships where jealousy or non-monogamous behavior may increase. More research into why younger boys and older girls monitoring is needed to understand this phenomena.

Though originally conceptualized as protective factors, parental knowledge of accounts and knowledge of password to their child's accounts were positively associated with younger cohort participant engagement in electronic monitoring and older cohort participant engagement in electronic coercion. This suggests that in order for parental involvement in their child's electronic use to be effective, there has to be active engagement (such as monitoring) as compared with passive knowledge (i.e., of passwords or accounts). Future work might evaluate the interaction of passive and active forms of parenting of youth's electronic use, and at what point in development these influences are most beneficial to adolescents.

Factors Predicting Changes in Electronic Dating Violence

Overall, variables that were significant predictors of slope were predictive of the quadratic term in the opposite direction – in other words, if a factor was positively predictive of slope, it would be negatively predictive of the quadratic term, and vice versa. The factors

consistently predictive of slope and quadratic terms were not always consistent between cohorts; for example, though dating behaviors were predictive of the intercept for both cohorts for all three forms of electronic dating violence, this pattern does not persist for the slope and quadratic term by cohort for each electronic dating violence behavior. This finding adds nuance to existing findings that earlier dating and engagement in greater dating behaviors is predictive of where an individual starts out at in their trajectory, but has less influence over the long-term change in trajectory than other risk or protective factors.

Another pattern to note is that while factors that significantly predicted the slope and quadratic were usually also significantly predictive of the intercept term, this was not always the case. For example, in the younger cohort, drug use did not predict the intercept term for electronic harassment, but did predict the slope (negatively) and quadratic term. A negative prediction of the slope and a positive prediction of the quadratic term indicates that those who did engage in drugs in early adolescence were often slower to begin engaging in harassment, but that once they did begin to engage in it, their risk increased more quickly than those who did not engage in drug use. A similar pattern is noted for the older cohort who are exposed to deprivation-based adverse childhood experiences (e.g., emotional neglect, parental incarceration). While deprivation-based adverse childhood experiences were not predictive of the intercept, those who experienced deprivation-based adverse childhood experiences were slower to engage in electronic monitoring, but once they did engage, their risk increased much more quickly. Despite being slower to engage, it may be that once youth who are exposed to these risk factors do begin to engage, the frequency is substantially greater than peers who are not exposed to these risk factors.

Threat-based adverse childhood experiences (e.g., witnessing parental intimate partner violence, experiencing physical abuse) are important predictive exposures for the slope and quadratic term for electronic harassment and coercion in the older cohort. Threat-based adverse childhood experiences are largely composed of active violent behaviors, such as child physical abuse, emotional abuse, or witnessing parental intimate partner violence (Hawkins et al., 2021). Electronic harassment and coercion are two forms of direct, confrontational engagement, either through direct harassment or using pressure or threats to coerce a partner to share graphic images (Thulin, Heinze, Kernsmith, et al., 2020). Threat-based adverse childhood experiences inform the trajectory of overt forms of electronic dating violence (i.e., harassment, coercion) but is not predictive of a form of electronic dating violence that is more covert in nature (i.e., monitoring). This has important implications for understanding the mechanisms of overt versus covert forms of dating violence. The application of Social Learning Theory to this finding helps contextualize why individuals who are exposed to threat-based experiences then repeat these behaviors in their own interpersonal interactions during adolescence. For those engaging in electronic monitoring, it may be that interactions that are less confrontational but potentially harmful to family dynamics, such as manipulation of one parent by another for a given outcome, would be predictive of electronic monitoring. Deprivation-based adverse experiences influence engagement in social situations and attachment style in relationships, but may not have direct influence on overt violent behaviors (Müller et al., 2019),. The finding of the present study provides additional support for the need to understand active threat-based exposures versus deprivation-based exposures, and their implication on adolescent development.

Limitations

Though providing novel information, this study is not without limitation. First, the sample in this study is composed of two cohorts that are followed over four years. While both cohorts represent similar populations who likely have similar contextual exposures, it is not the exact same sample. A single cohort followed across the entirety of adolescence would allow the growth curves to be estimated across the entire period. However, finding similar rates of engagement at ninth grade (i.e., the fourth wave report of the younger cohort matches up to the first wave report of the older cohort) suggests that these samples have comparable rates of exposure. Second, the present study focuses on between-person trajectories as opposed to within-person trajectories. A future direction could include evaluating time-varying covariates such as how social support at specific ages in a youth's life may differentially influence engagement in electronic dating violence. Finally, the present study does not account for in-person domains of dating violence (e.g., physical dating violence, sexual dating violence). Though in-person behaviors are less common than electronic dating violence, researchers have found evidence that electronic and in-person domains overlap (Thulin, Heinze, Kernsmith, et al., 2020). The results of this study however do not represent all exposure to dating violence given the absence of in-person domains, nor should they be interpreted in this way. However, the exclusive focus on electronic dating violence domains holds value in unpacking a set of unique domains of risk exposure that are very pervasive but have less longitudinal empirical findings.

Conclusion

Electronic dating violence is common during adolescence and poses acute and long-term risks for wellbeing. Yet, few researchers have evaluated non-linear trajectories of specific domains of electronic dating violence and the protective and risk factors that may predict

trajectories. In the present study, the risk of engaging in electronic dating violence during adolescence changes non-linearly across time. That is, in general, electronic dating violence increases from early adolescence until a peak around 10th or 11th grade, when electronic dating violence tends to decrease, though there are unique patterns by specific domain of electronic dating violence. Risk factors associated with electronic dating violence, such as exposure to threat-based adverse childhood experiences including physical abuse (as opposed to deprivation-based experiences, such as neglect) and earlier engagement in dating behaviors increase the long-term and relative consistency of risk. Protective factors such as parental monitoring decreases the risk but seems to only have a protective influence at developmentally-specific periods (i.e., during early adolescence, but not in later adolescence). The findings of the present study further the understanding of the patterns of risk of specific domains of electronic dating violence across adolescence, and provide potential factors that could contribute to the risk of or protection against electronic dating violence engagement.

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Chapter 3 Longitudinal Effects of Electronic Dating Violence on Depressive Symptoms and Delinquent Behaviors across Adolescence

During adolescence (youth age 12-18), the risk of experiencing internalizing (e.g., depressive symptoms) or externalizing (e.g., delinquent behaviors) problems is high. A substantial proportion of adolescents (youth age 12-18) are at risk for experiencing depressive symptoms and engaging in delinquent behaviors including fighting, stealing, and use of alcohol or drugs. Nationally, one in ten adolescents will report depression, though this statistic appears to be on the rise (Avenevoli et al., 2015; W. Lu, 2019). In a different nationally representative study, researchers found a mean of 40.6 delinquent behaviors and 8.8 substance use disorders per 100 youth aged 12-17 (Grucza et al., 2018). Depression and engagement in delinquent behaviors represent acute and long-term risk of poor health (e.g., depression in adulthood) and economic (e.g., failure to complete secondary school, unemployment) outcomes for youth (Clayborne et al., 2019; D. Johnson et al., 2018). Though researchers find evidence that family-level factors (such as adverse childhood experiences) predict depressive symptoms and delinquency (Elmore & Crouch, 2020), there is growing evidence that exposure to teen dating violence is also associated with a greater likelihood of depressive symptoms and delinquent behaviors such as engaging in peer violence and substance use. One limitation of the current literature is that many studies focus only on in-person forms of dating violence. While in-person forms are important to understand, there is need to understand the effect electronic dating violence (EDV), given that it is one of the most prevalent forms, affecting three in four adolescents (Ellyson et al., 2021; Thulin, Heinze, Kernsmith, et al., 2020).

Electronic Teen Dating Violence

Electronic forms of teen dating violence (EDV) are a pervasive risk for both male and female youth, though there are likely gendered patterns that influence engagement of EDV (Reed et al., 2017; Zweig et al., 2014). Researchers of a nationally representative study found that 76.1% of individuals report engagement (victimization and/or perpetration) in EDV during adolescence (in this study defined as age 11-17) (Ellyson et al., 2021). A growing set of empirical evidence supports that, similar to in-person forms of teen dating violence (Choi et al., 2017), youth often experience the co-occurrence of victimization and perpetration of electronic dating violence, also known as electronic dating violence engagement (Caridade & Braga, 2020; Cutbush et al., 2021; Temple et al., 2016a; Thulin, Heinze, Kernsmith, et al., 2020). Electronic forms of dating violence are qualitatively different from in-person forms (i.e., physical, sexual, in-person verbal/psychological) in several ways. First, EDV is not geographically confined (Stonard et al., 2017). Second, disengagement techniques like blocking or unfollowing one account does not guarantee a perpetrator will not create new accounts that, at times, misrepresent the identity of the account holder (Paat & Markham, 2021; Stonard, 2020). Third, it is possible to engage in EDV at a very high frequency in a short time frame, and at times of day that are traditionally private (i.e., before bed, first thing in the morning) (Stonard et al., 2017). Finally, EDV affords the ability to mass share private messages, audio, photos or videos, and it is nearly impossible to fully remove this information once it has been shared electronically (Paat & Markham, 2021; Papacharissi, 2014). Given the qualitative differences in experiences of EDV relative to in-person forms of violence, researchers have a growing interest in possible negative health outcomes related to EDV (Cava, Tomás, et al., 2020; Y. Lu et al., 2018; Van Ouytsel et al., 2017; Zweig et al., 2014).

EDV and Depressive Symptoms

Findings on the effect of EDV on depressive symptoms are mixed. Several researchers find an association between exposure to EDV and poorer depressive symptoms in cross-sectional research (Cava, Tomás, et al., 2020; Y. Lu et al., 2018; Zweig et al., 2014). While some researchers find evidence that the effect of EDV on depressive symptoms is compounded by concurrent in-person victimization (Gracia-Leiva et al., 2020), others find that cross-sectional associations between EDV and poor depressive symptoms were no longer significant when accounting for in-person forms of violence (Duerksen & Woodin, 2019; Weingarten et al., 2018). Further, while some researchers identified an association between EDV and depressive symptoms when using a cross-sectional design, they find that this association was not significant when utilizing a longitudinal design (Y. Lu et al., 2018).

Several overarching limitations of existing studies on EDV and depressive symptoms might explain some of the mixed findings. First, the majority of existing studies are cross-sectional, and thus the directionality of association is not possible to evaluate. Second, many of these studies evaluate the effect of EDV on depressive symptoms in samples of youth in late adolescence (e.g., age 14-17) or emerging adulthood (e.g., 18-23). Yet initial exposure and the subsequent pinnacle of EDV appears to occur much earlier, in late childhood or early to mid-adolescence (e.g., initial exposures have been reported at age 11) (Ellyson et al., 2021; Thulin et al., 2021). Studying the effects of electronic violence on mental health outcomes may be most pressing in early- and mid-adolescence (i.e., age 12-15), as the risk of electronic violence increases and peaks. Finally, most studies do not delineate between various forms of EDV. This is problematic given that various domains of EDV have slightly different trajectories (Thulin et al., 2021) and are qualitatively unique from one another (Cava, Buelga, et al., 2020; Ellyson et

al., 2021; Thulin, Heinze, Kernsmith, et al., 2020). Evaluating the effect of unique domains of EDV on mental health may provide important nuance to the effect of various forms of EDV on mental health outcomes.

EDV and Delinquency

While depressive symptoms are important to understand, researchers argue that measures of depression are differential by gender with a bias towards internalizing depressive symptoms. In a systematic review, researchers find that men who experience negative mental health outcomes such as depressive symptoms, may be more likely to express them as externalizing behaviors such as drug or alcohol use (Cavanagh et al., 2017). This is problematic as externalizing behaviors are typically not included in depression screeners. Researchers find that male and female youth are at high risk of engagement in EDV (Ellyson et al., 2021). As such, evaluating delinquency as a negative outcome relative to a risk exposure such as EDV is important in better understanding the effect of EDV on outcomes for female and male youth.

Delinquency as an outcome is important to understand relative to the effects of EDV for both females and males. Of the little research has been conducted on the association between EDV and delinquency (Caridade et al., 2019), researchers find associations between EDV exposure and greater delinquency (Van Ouytsel et al., 2017; Zweig et al., 2013), though engagement may be differential by gender (Zweig et al., 2013). In another study, researchers find that EDV is associated with greater episodic heavy drinking for both genders, and with greater frequency of alcohol use for males (Van Ouytsel et al., 2016). In a fourth study, perpetration of EDV was associated with bullying perpetration (Peskin et al., 2017). Similar to the limitation in the research on EDV and mental health outcomes, research that exists on EDV and delinquency has largely been cross-sectional, which limits the ability to evaluate directionality. Additionally,

delinquent behaviors often increase with age; though the peak in delinquent behaviors is later than EDV behaviors, it may be that EDV is an important risk factor for delinquent behavior. As evidence of the association between EDV and delinquency is growing, less is known about the longitudinal effects of EDV on delinquent behaviors. This is likely important given increases in delinquent behavior across time and the importance of identifying this behavior early on. Finally, existing literature often measures EDV as a single construct, and at this time, little is known about the influence of unique domains of EDV on delinquent behaviors.

Adverse Childhood Experiences

Greater exposure to adverse childhood experiences (ACEs) increases the risk of electronic dating violence (Smith-Darden et al., 2017), depressive symptoms (Elmore & Crouch, 2020), and delinquency (Dube et al., 2006). Recently, researchers have recently advocated for greater nuance in the evaluation of adverse childhood experiences, such as the division of threat-based (i.e., exposure to violence) versus deprivation-based (i.e., neglect) (Hawkins et al., 2021) experiences. This delineation may be particularly important for dating violence given the conceptualization that exposure to threatening experiences may increase externalizing behaviors such as violence perpetration (Heinze et al., 2021) while deprivation-based experiences may be influential of internalizing behaviors (Tanzer et al., 2021). The relationship between depressive symptoms, delinquency and EDV may be confounded if adverse childhood experiences are not accounted for.

Present Study

The present study fills several gaps in the literature by evaluating the longitudinal effect of three unique domains of EDV (electronic harassment, electronic coercion, and electronic monitoring) on mental health and delinquency outcomes. This study provides information on

both the longitudinal effect over time of EDV exposure as well as adding nuance by evaluating the effect of qualitatively unique domains of EDV. As data are drawn from two cohorts representing 6th-9th grade and 9th-12th grade, I am able to evaluate the effect of specific domains of EDV on depression and delinquency throughout adolescence (i.e., age 12-18). Finally, I will account for the potential interaction of age and gender, in-person forms of teen dating violence and exposure to threat- and deprivation-based adverse childhood experiences (ACEs).

Methods

Study Design, Data Sources, and Study Population

Data for the present study are drawn from the longitudinal Strengthening Healthy Adolescent Relationships and Environments (SHARE) study. In the broader study, data were collected annually for four years from 1,236 youth composing two cohorts. The younger cohort of youth (n=588) were in 6th grade (average age of youth was 12 years old) at the first wave of data collection, while the older cohort of youth (n=648) were in 9th grade (average age of youth was 15 years old) at the commencement of the study. Youth were sampled from within schools. Schools were selected based on a risk-index composite score that was created using publicly available data on income levels of a given local school district, housing, and crime (see Kernsmith et al., 2018 for more details). Two local school districts at each level of risk (low-, medium-, high-) were recruited, and all middle and high schools in the identified districts were invited to participate for a total of 13 schools. Information about the study was sent home to parents via USPS. Study materials including a project overview as well as consent documents provided parents an opportunity to decline their child's participation by contacting the study team (i.e., passive consent). Prior to data collection, youth assent was obtained by explaining the study, the voluntary nature of the study, and that participants had the option to withdraw from the

study at any time without penalty. Data collection occurred during one school hour at each wave. Survey administration was conducted in a mutually agreed upon time and location and care was taken to spread youth out to provide privacy in responding to the pencil-paper questionnaires on topics including their interactions with romantic partners, friends and their families. All participating youth were made aware of a Certificate of Confidentiality obtained through the Centers for Disease Control and Prevention. The Institutional Review Board for both participating universities and the funding agency approved the data collection protocols.

Measures

Depressive Symptoms. The first primary outcome was depressive symptoms adapted from the K6 (Kessler et al., 2002) with an item added on anger created by the original SHARE study PIs, as depression commonly manifests as anger among young males (Genuchi, 2015). Seven items assessed depressive symptoms at each wave of data collection (alpha range across the waves: 0.85 –0.88). Youth reported how often they had felt a particular way in the prior four weeks on a 5-point frequency scale from "None of the time" (0) to "All of the time" (4). Feelings included nervousness, hopelessness and anger. A mean of depressive symptoms was calculated for each wave of data collection.

Delinquent Behaviors. The second primary outcome was delinquent behaviors using a version of the scale used in the National Youth Survey (C. A. Anderson & Dill, 2000; Elliot et al., 1985). The scale was shortened to eliminate questions on violent behavior that were measured in other scales. Youth reported how many times in the past year they had engaged with 34 deviant behaviors, including vandalism of property, stealing, and using substances including alcohol and drugs. Youth responded on a frequency Likert-scale from "never" (0) to "10 or more times" (4). A factor analysis of items identified substantial cross-loading of one item (cheating on school

tests), and thus the item was removed. A mean across the remaining 33 items was calculated for each wave of data collection.

Electronic Dating Violence Engagement. EDV engagement representing perpetration and victimization was measured using three sub-domains: electronic monitoring, electronic coercion, and electronic harassment. Items were adapted from Safe Dates (Foshee et al., 1996) and psychometric evaluation resulting in the three domains was conducted elsewhere (Thulin et al., 2020).

Electronic Harassment. Electronic harassment dating violence was measured using twelve items (α range: 0.82 – 0.90), representing six items on victimization and six identical items but from the role of perpetration. Items including spreading rumors about a partner through electronic means including networking sites like Facebook. Youth reported frequency of engagement from "Never" (0) to "10+ times" (4) in the prior year. A sum across perpetration and victimization was calculated for each wave.

Electronic Coercion. Electronic coercion dating violence was measured by six items (α range: 0.75 – 0.84), three for perpetration and three for victimization. Youth reported the frequency from "Never" (0) to "10+ times" (4) they had experienced or perpetrated coercive actions, such as pressuring a partner to send nude or sexy photos. A sum across perpetration and victimization was calculated for each wave.

Electronic Monitoring. Engagement with electronic monitoring was evaluated with four items (α range: 0.79-0.81), two for victimization and two for perpetration. Youth reported the frequency with which they had experienced (victimization) or perpetrated reading texts, emails or instant messages when they/their partner did not want them to and demanding passwords to

electronic communication or networking sites in the past year from "Never" (0) to "10+ times" (4). A sum across perpetration and victimization was calculated for each wave.

Verbal Dating Violence Engagement. Verbal dating violence engagement was measured with ten items (α range: 0.86 – 0.87), five for victimization and five for perpetration (Foshee et al., 1996). Youth first reported on frequency of victimization then on perpetration, from "Never" (0) to "10+ times" (4) in the prior year. Violence included threatening to cheat on a partner, calling the other person names, and swearing at one's partner. A sum across victimization and perpetration was calculated for each wave.

Physical Dating Violence Engagement. Physical dating violence was assessed with 30 items on physical forms of dating violence (α range: 0.94 – 0.97), 15 for victimization and 15 for perpetration (Foshee et al., 1996). Youth first reported how often in the prior year they had experienced the given action (victimization), and then how often in the prior year they had perpetrated the given action, from "Never" (0) to "10+ times" (4). Actions included scratching, slapping, biting and hitting, among others. A sum across perpetration and victimization was calculated for each wave.

Sexual Dating Violence Engagement. Sexual physical violence was defined by four behaviors (α range: 0.72 to 0.87) (Foshee et al., 1996), and youth reported the frequency in the past year from "Never" (0) to "10+ times" (4) first on victimization then on perpetration. Actions included insisting on sexual activity when a partner did not want to. A sum across perpetration and victimization was calculated for each wave.

Adverse Childhood Experiences. Adverse Childhood Experiences (ACEs) (Felitti et al., 1998) were evaluated at the first wave of data collection. ACEs were modeled based on deprivation or threat, in line with recent advances in conceptualization of ACEs (Hawkins et al., 2021). Threat-

based ACEs included emotional violence, physical violence, sexual violence, witnessing parental intimate partner violence, and witnessing parental alcohol or drug use. Deprivation ACEs included neglect, having a parent commit suicide, or having a parent who was incarcerated. Youth were asked to indicate if at any time in their life the event or experience had occurred (1) or not (0). If the youth reported any activity within a given experience, they received a 1 for that experience; no report received 0. A sum across ACEs was then calculated, ranging from 0 to 5 for threat-based ACEs and 0 to 3 for deprivation-based ACEs.

Gender and Cohort. Gender was self-reported during the first wave of data collection as male (1) or female (0). Age was represented by cohort, with those in the younger cohort being followed from 6th-9th grade (average age span 12-15 years) and the older cohort being followed from 9th-12th grade (average age span 15-18 years). A categorical variable representing all four combinations of gender and age was created, with younger females being the referent.

Statistical Analysis

First, descriptive analyses were used to review data distributions. Next, multi-level models were used to evaluate depressive symptoms and delinquent behavior outcomes by exposure to electronic harassment, electronic coercion, and electronic monitoring, while accounting for verbal dating violence, physical dating violence, sexual dating violence, exposure to threat-based ACEs, exposure to deprivation-based ACEs, and gender across all four waves of data collection. Models were stratified by cohort, and each wave of data corresponds to the youth of each cohort being one year older (i.e., younger cohort at wave 1 was on average 12 years old, at wave 2 13 years old, at wave 3 14 years old, etc.). Multi-level models were used to account for the potentially correlated nature of the repeated measures observations in this data (Raudenbush & Bryk, 2001; Singer & Willett, 2003). Analyses were conducted in Stata 15.0.

Study Population

Of the 588 younger cohort, 526 (89.5%) endorsed dating violence exposure and all

necessary covariates, while 592 (91.4%) of the 648 of the older cohort had dating violence

exposure data and all necessary covariates. Of the younger cohort who are not included in the

analyses (n=62), 30 (48.4%) are not included because they indicated not dating at any point

while the others were missing data on one or more covariates. Of the 56 youth from the older

cohort not included in analyses, 28 (50.0%) were not included because they indicated not dating

at any point while the others were missing data on one or more covariates. Those not included in

analysis were not differential in terms of the socio-demographic variables of gender (χ^2=2.64,

df=1, p=0.104) and cohort (χ^2=1.29, df=1, p=0.256) (measured at Wave 1) or depression

(t=0.734, df=1222, p=0.463) but were less likely to report delinquent behaviors at baseline

(t=2.891, df=1229, p=0.004). Demographics of the sample are presented in Table 8.

Table 8. Sample Demographics, Study 2

Sample Demographics

	Younger Cohort, 6th-9th Grade (12-15 years old)	Older Cohort, 9th-12th Grade (15-18 years old)
Sample size	526	592
Sex	*n(%)*	*n(%)*
Male	251 (47.7%)	277 (46.8%)
Female	275 (52.3%)	315 (53.2%)
Race		
White	291 (55.3%)	402 (62.0%)
Black	91 (17.3%)	104 (17.6%)
Multi-Racial	49 (9.3%)	64 (10.8%)
Other	54 (10.3%)	43 (7.3%)
Missing	41 (7.8%)	12 (2.0%)

Descriptive Statistics

Over the four waves, average report of depression ranged from 0.923 (standard deviation = 0.798) to 1.068 (standard deviation = 0.911) for the younger cohort, and 1.124 (standard deviation = 0.811) to 1.352 (standard deviation = 0.922) for the older cohort (Table 9). Delinquency behaviors ranged from 0.14 (standard deviation = 0.30) to 0.19 (standard deviation = 0.39) for the younger cohort, and from 0.29 (standard deviation = 0.38) to 0.31 (standard deviation = 0.37) in the older cohort. Over the four waves, average report of engagement with electronic harassment ranged from 0.80 (standard deviation = 2.81) to 1.97 (standard deviation = 4.94) in the younger cohort, and 1.78 (standard deviation = 3.94) to 2.26 (standard deviation = 4.26) for the older cohort. Average report of electronic coercion ranged from 0.42 (standard deviation = 1.52) to 1.32 (standard deviation = 3.16) for the younger cohort, and 1.47 (standard deviation = 2.93) to 1.98 (standard deviation = 3.55) for the older cohort. Average report of electronic monitoring ranged from 0.19 (standard deviation = 0.91) to 0.61 (standard deviation = 1.93) in the younger cohort and 0.84 (standard deviation = 2.22) to 1.15 (standard deviation = 2.56) in the older cohort. For engagement with verbal dating violence, average report ranged from 2.61 (standard deviation = 4.84) to 5.07 (standard deviation = 7.22) for the younger cohort, and 5.79 (standard deviation = 7.24) to 7.20 (standard deviation = 7.69) for the older cohort. Across the four waves, average report of physical dating violence ranged from 1.52 (standard deviation = 7.40) to 3.75 (standard deviation = 12.13) for the younger cohort, and 3.69 (standard deviation = 9.50) to 5.46 (standard deviation = 12.84) for the older cohort. For average sexual violence by wave ranged from 0.20 (standard deviation = 1.12) to 0.44 (standard deviation = 2.07) in the younger cohort and 0.56 (standard deviation = 1.99) to 0.85 (standard deviation = 2.83) for the older cohort. For the time-invariant variables of threat-based ACEs and deprivation-based ACEs, at baseline the younger cohort reported an average of 0.82 (standard deviation =

1.18) threat-based and 0.25 (standard deviation = 0.57) deprivation-based ACEs. The older

cohort reported an average 1.39 (standard deviation = 1.47) threat-based and 0.29 (standard

deviation = 0.67) deprivation-based ACEs.

Table 9. Descriptive Statistics of Depression, Delinquency, Electronic Harassment, Electronic Coercion, Electronic Monitoring, Verbal Physical and Sexual Dating Violence

Descriptive Statistics of Depression, Delinquency, Electronic Harassment, Electronic Coercion, Electronic Monitoring, Verbal Physical and Sexual Dating Violence		
	Younger Cohort, 6th-9th Grade (12-15 years old)	Older Cohort, 9th-12th Grade (15-18 years old)
	mean(std)	*mean(std)*
Time-Varying Variables		
Depressive Symptoms, Wave 1	0.92(0.80)	1.30(0.88)
Depressive Symptoms, Wave 2	0.95(0.84)	1.35(0.92)
Depressive Symptoms, Wave 3	1.02(0.91)	1.23(0.86)
Depressive Symptoms, Wave 4	1.07(0.89)	1.12(0.81)
Delinquent Behaviors, Wave 1	0.14(0.30)	0.29(0.38)
Delinquent Behaviors, Wave 2	0.18(0.34)	0.31(0.39)
Delinquent Behaviors, Wave 3	0.18(0.30)	0.29(0.40)
Delinquent Behaviors, Wave 4	0.19(0.39)	0.31(0.37)
Electronic Harassment, Wave 1	0.80(2.81)	1.78(3.94)
Electronic Harassment, Wave 2	1.13(3.64)	2.26(4.41)
Electronic Harassment, Wave 3	1.31(2.95)	2.18(4.26)
Electronic Harassment, Wave 4	1.97(4.94)	1.98(4.49)
Electronic Coercion, Wave 1	0.42(1.52)	1.47(2.93)
Electronic Coercion, Wave 2	0.67(2.01)	1.98(3.55)
Electronic Coercion, Wave 3	0.98(2.79)	1.61(3.11)
Electronic Coercion, Wave 4	1.32(3.16)	1.74(3.66)
Electronic Monitoring, Wave 1	0.19(0.91)	0.84(2.22)
Electronic Monitoring, Wave 2	0.20(0.86)	1.01(2.43)
Electronic Monitoring, Wave 3	0.44(1.47)	1.12(2.48)
Electronic Monitoring, Wave 4	0.61(1.93)	1.15(2.56)
Verbal Dating Violence, Wave 1	2.61(4.84)	5.79(7.24)
Verbal Dating Violence, Wave 2	2.93(5.14)	6.72(7.73)
Verbal Dating Violence, Wave 3	3.69(5.36)	7.20(7.69)
Verbal Dating Violence, Wave 4	5.07(7.22)	6.40(7.26)
Physical Dating Violence, Wave 1	2.80(8.38)	5.46(12.84)
Physical Dating Violence, Wave 2	1.52(7.40)	4.69(11.44)
Physical Dating Violence, Wave 3	2.55(7.74)	3.69(9.50)
Physical Dating Violence, Wave 4	3.75(12.13)	3.83(11.80)
Sexual Dating Violence, Wave 1	0.23(1.54)	0.56(1.99)
Sexual Dating Violence, Wave 2	0.30(2.32)	0.81(2.60)

	0.20(1.12)	0.78(2.20)
Sexual Dating Violence, Wave 3	0.20(1.12)	0.78(2.20)
Sexual Dating Violence, Wave 4	0.44(2.07)	0.85(2.83)
Time-Invariant Variables		
Threat-based ACEs, Wave 1	0.82(1.18)	1.39(1.47)
Deprivation-based ACEs, Wave 1	0.25(0.57)	0.29(0.67)

Influences on Depressive Symptoms over Adolescence

Depressive symptoms over adolescence was predicted by multiple factors (Table 10). Higher exposure to electronic coercion was predictive of increased depression (β=0.0150, S.E.=0.0064, p=0.018), as was higher exposure to verbal dating violence (β=0.0222, S.E.=0.0029, p<0.001) and physical dating violence (β=0.0042, S.E.=0.0020, p=0.038). Threat-based ACEs (β=0.1257, S.E.=0.0189, p<0.001) were also predictive of greater report of depressive symptoms. The other age by gender categories significantly differed from one another, highlighting important differences by age within gender. For instance, younger males (β=-0.2916, S.E.=0.0610, p<0.001) and older males (β=-0.2490, S.E.=0.0597, p<0.001) reported less depression while older females reported more (β=0.1693, S.E.=0.0577, p=0.003) as compared with younger females (referent – see superscript a for more details). Finally, individual differences (i.e., random effects for intercept) were significant (β=0.2592, S.E.=0.0199, p<0.001).

Table 10. Effect of EDV Domain on Depressive Symptoms across Adolescence, Multi-level Model

Effect of EDV Domain on Depressive Symptoms across Adolescence, Multi-level Model

	Beta	S.E.	p-value
Dating Violence Domains			
Electronic Harassment	0.0044	0.0050	p=0.385
Electronic Coercion	0.0150	0.0064	p=0.018
Electronic Monitoring	-0.0100	0.0100	p=0.303
Verbal Dating Violence	0.0222	0.0029	p<0.001
Physical Dating Violence	0.0042	0.0020	p=0.038
Sexual Dating Violence	-0.0025	0.0093	p=0.789

Covariates			
Threat ACEs	0.1241	0.0190	p<0.001
Deprivation ACEs	0.0273	0.0408	p=0.503
Female, Younger Cohort (Referent)[a]	--	--	--
Male, Younger Cohort	-0.2916	0.0610	p<0.001
Female, Older Cohort	0.1693	0.0577	p=0.003
Male, Older Cohort	-0.2490	0.0597	p<0.001
multi-level			
id	0.2592	0.0199	p<0.001

[a]When analyzed using younger males as the referent, younger females and older females were more likely to report depressive symptoms. When older females were the referent, younger females, younger males, and older males were less likely to report depressive symptoms. When older males were used as the referent, younger females and older females were all more likely to report depressive symptoms.

Influences on Delinquency over Adolescence

Throughout adolescence, delinquency is influenced by multiple factors (Table 11). Increased exposure to electronic coercion (β=0.0073, S.E.=0.0025, p=0.004) and electronic monitoring (β=0.0077, S.E.=0.0038, p=0.045) were both predictive of more delinquency across adolescence. All three forms of in-person dating violence were also significant (verbal: β=0.0114, S.E.=0.0011, p<0.001; physical: β=0.0040, S.E.=0.0008, p<0.001; sexual: β=0.0161, S.E.=0.0036, p<0.001). Exposure to threat-based (β=0.0407, S.E.=0.0075, p<0.001) and deprivation-based ACEs (β=0.0426, S.E.=0.0161, p=0.008) were both predictive of delinquency as well. As compared with younger females, younger males (β=0.0725, S.E.=0.0241, p=0.003) and older males (β=0.1543, S.E.=0.0236, p<0.001) were substantially more likely to report delinquency, but there is only a marginal difference by age for females. However, for males, older males are at the greatest risk, which is emerges when changing the referent to younger males (see superscript b, in Table 11). Individual differences (i.e., random effects for intercept) were significant in this model as well (β=0.0409, S.E.=0.0032, p<0.001).

Table 11. Effect of EDV Domain on Delinquent Behaviors across Adolescence, Multi-level Model

Effect of EDV Domain on Delinquent Behaviors across Adolescence, Multi-level Model

	Beta	S.E.	p-value
Dating Violence Domains			
Electronic Harassment	0.0008	0.0020	p=0.682
Electronic Coercion	0.0073	0.0025	p=0.004
Electronic Monitoring	0.0077	0.0038	p=0.045
Verbal Dating Violence	0.0114	0.0011	p<0.001
Physical Dating Violence	0.0040	0.0008	p<0.001
Sexual Dating Violence	0.0161	0.0036	p<0.001
Covariates			
Threat ACEs	0.0407	0.0075	p<0.001
Deprivation ACEs	0.0426	0.0161	p=0.008
Female, Younger Cohort (Referent)[b]	--	--	--
Male, Younger Cohort	0.0725	0.0241	p=0.003
Female, Older Cohort	0.0422	0.0229	p=0.065
Male, Older Cohort	0.1543	0.0236	p<0.001
multi-level			
id	0.0409	0.0032	p<0.001

[b]When older males are the referent, all other categories are less likely to report delinquency, though younger males are most like older males, followed by older females. Younger females are least likely to report delinquency as compared with older males.

Discussion

The present study provides novel information on the longitudinal effects of domains of electronic dating violence (electronic harassment, electronic coercion, and electronic monitoring) on depressive symptoms and delinquency across adolescence while accounting for in-person domains of dating violence, and ACEs. By delineating the effects of in-person verbal, physical and sexual dating violence with unique electronic domains, I was able to better understand the influence of specific domains of violence on depressive symptoms and delinquent behaviors across adolescence. Additionally, the present study supports the delineation of threat-based and

deprivation-based ACEs (Hawkins et al., 2021). Though parsimony in research is ideal for model building, over-simplification of certain behaviors negates the ability to effectively screen, intervene and develop preventative programs to reduce risk overall. In other words, the specific types of violence likely have different mechanisms through which they affect individuals and populations. The findings from the present study support the importance in evaluating specific domains of violence exposure relative to health and behavioral outcomes.

The present findings also support the importance of studying the existence and effects of electronic dating violence throughout adolescence, given that the emergence (Ellyson et al., 2021) and pinnacle of this type of behavior appears to occur in mid-adolescence (Thulin et al., 2021). Additionally, the findings of that combinations of age and gender are predictive of both depressive symptoms and delinquent behaviors extends findings from cross-sectional studies on the relationship between dating violence and worse health and behavioral outcomes (Reed et al., 2017; Zweig et al., 2014). Based on the findings on both depression and delinquency, it is clear that violence delivered through communication (in-person and electronically) is an important risk factor in adolescence. Or more colloquially, sticks and stones can break bones and online actions and words written can very much hurt.

Predicting Depressive Symptoms and the Role of Electronic Coercion

In addition to expanding existing cross-sectional research findings on the association between electronic dating violence and depression (Cava, Tomás, et al., 2020), the present findings expand the existing literature base on the relationship between EDV and depressive symptoms that has often been evaluated in emerging adulthood (Y. Lu et al., 2018; Tennant et al., 2015). In the present study, electronic dating violence engagement was predictive, but only for the domain of electronic coercion. Differential effects by domain of EDV support researcher

postulation that there are unique and qualitatively different forms of EDV that need to be conceptualized and evaluated to better understand these behaviors (Cava, Buelga, et al., 2020; Thulin, Heinze, Kernsmith, et al., 2020). What makes electronic coercion more influential on depressive symptoms as compared with harassment or coercion is not entirely clear. Harassing or manipulative behaviors like those in electronic harassment or electronic monitoring may have less of an effect because they are not entirely novel interpersonal experiences. Harassment or manipulation may be present in earlier inter-personal relationships in the family or with peers (i.e., bullying, sibling relationships) and thus a youth may have individual experience with such behaviors that they can draw from and apply within their dating lives. While coercion may also be present in earlier relationships, electronic coercion is qualitatively unique from harassment or monitoring in that it is sexual in nature. It may be that the sexual nature of electronic coercion is particularly influential given the importance of identity formation during adolescence, including sexuality (Erikson, 1968). Other forms of negative experiences around initial and early sexual experiences have been shown to have negative long term consequences for mental and physical health (Fergusson et al., 2013; Sprecher et al., 2019). Whereas the intention behind sexual coercion may be less nefarious than adult perpetrated technology-assisted child sexual abuse and exploitation (legally often termed child pornography), the findings of the present study expand the field's understanding of the detrimental effects of electronically facilitated sexual coercion when they occur between peers even when controlling for in-person forms of abuse (Joleby et al., 2020).

The Role of Electronic Dating Violence on Delinquent Outcomes

In the present study, both electronic coercion and electronic monitoring were predictive of greater delinquency, even when accounting for engagement in in-person verbal, physical and

sexual violence and threat-based and neglect-based ACEs. The finding that engagement in EDV is a substantial and important risk factor of delinquent behaviors in adolescence expands on similar research in a population of emerging adults (Sargent et al., 2016). This is particularly important given that EDV behaviors emerge and potentially peak during adolescence (Ellyson et al., 2021; Thulin et al., 2021). Additionally, given researcher findings that electronic coercion and electronic monitoring are relatively common, with up to 4 in 10 youth reporting engagement in the prior year, it is clear that this is a prominent risk behavior during adolescence. That both forms are relatively prevalent and predictive of delinquency supports the importance of early detection and intervention, particularly for boys given the finding of gendered effects. As far less research on the effect of EDV on externalizing behaviors such as delinquency exist (Caridade & Braga, 2020), the present study is an important addition.

Though I hypothesized that all three forms of electronic dating violence would be predictive of delinquency, electronic harassment was not predictive. This finding is surprising given that researchers have previously found that greater engagement in in-person psychological (in this study called verbal violence) violence predicts poorer delinquent behaviors such as peer aggression (Orpinas et al., 2012). Electronic harassment is a form of abuse that is similar to verbal/psychological violence (but conducted online) – the finding in the present study that it is not predictive of delinquency may be explained by the perceived normativity of using electronics to harass others (Stonard, 2020), across multiple social relationships, including dating partners, friends, unknown peers, and adults (Thulin & Heinze, Under Review). This may also be supported by the finding that electronic harassment is more common than electronic coercion and monitoring, with researchers finding between 17-40% of adolescents (age 12-18) report electronic harassment in the prior year (Thulin et al., 2021). It may be that increased perceived

normativity somewhat reduces the effect this form of violence. However, given cases of extreme harassment leading to negative outcomes include suicide (Taylor, 2019), further research on normativity relative to severity of exposure is necessary to better understand the effect of electronic harassment on health and wellbeing outcomes.

Limitations

This study provides novel information; however, it is not without limitations. First, the study is a cohort design drawn from a sample of southeast Michigan youth, and thus is not nationally representative. Youth in the present study are from urban and peri-urban settings; it may be that youth in rural settings have different types of exposures that may be important, particularly for EDV, which is not limited in terms of physical distance. Second, despite evaluating three unique forms of electronic dating violence, the present study reflects a larger challenge currently present in the field; the lack of a unified and clearly understood set of constructs that define electronic (also called cyber) forms of abuse (Rocha-Silva et al., 2021). However, the only way to solve this issue is to continue to use nuanced measurement of EDV constructs to understand qualitative differences and quantitative differential effects on behavior. Finally, the present model does not account for the effects of polyvictimization. Overlap between electronic and in-person domains of dating violence has been found by researchers (Thulin, Heinze, Kernsmith, et al., 2020). Understanding the effect of polyvictimization across domains of dating violence would be a useful future direction. The present study does not address polyvictimization, but rather I aim to understand the unique effect of specific domains of EDV while controlling for in-person violence. This is an important contribution to show the longitudinal effects of EDV on health and behavioral outcomes.

Conclusion

Electronic dating violence engagement is predictive of worse depressive symptoms and greater delinquency, but nuance exists by domain of electronic dating violence engagement. Greater electronic coercion is predictive of depressive symptoms across adolescence, particularly for older females, while electronic coercion and electronic monitoring predict greater engagement in delinquent behaviors, particularly for younger and older males. That domains of EDV predict depressive symptoms and delinquency across adolescence while accounting for in-person domains of dating violence (i.e., verbal, physical, and sexual) and adverse childhood experiences adds clarity to previously mixed findings on the effects of EDV on outcomes. This study adds nuance to existing mixed findings, and upholds the need to used nuanced evaluation of electronic dating violence exposures (i.e., to study unique contribution of electronic dating violence domains) to better understand their influence on health and behavioral outcomes across adolescence. Additionally, this information can be used to inform future intervention work and stresses the importance of addressing electronic forms of dating violence in addition to in-person forms in prevention and intervention programs.

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Chapter 4 Identifying Predictors of Adolescent Electronic Dating Violence Harassment, Coercion and Monitoring: An Applied Machine Learning Approach

Electronic dating violence (EDV), defined as abuse perpetrated through electronic or technical means, is a pervasive problem in adolescence (*Preventing Teen Dating Violence*, 2020) with three in four youth reporting exposure by age 16 (Ellyson et al., 2021). Unlike in-person violence, domains of EDV are unique in that they are not geographically contained (Stonard et al., 2017), the frequency of engagement (i.e., victimization and/or perpetration of EDV) can be extraordinarily high (Stonard et al., 2017), and that harm can be perpetrated in a wide-spread manner with a single click of a button (Paat & Markham, 2021), which can be particularly threatening when done to evoke retaliation (Stonard, 2020). Though EDV is often evaluated as a single construct, recently researchers have advocated and provided preliminary evidence that there are multiple domains of EDV (Cava, Buelga, et al., 2020; Thulin et al., 2021), such as electronic monitoring, harassment, and coercion (Thulin, Heinze, Kernsmith, et al., 2020).

While electronic harassment, electronic coercion and electronic monitoring share similarities (e.g., all are not geographically contained, all are possible to engage in through electronics), important differences in prevalence (Thulin et al., 2021), trajectory of domains, and effects on health and behavioral outcomes (Thulin, Kusunoki, et al., Under Review) suggest that these forms are individually distinct from one another. Researchers of a systematic review noted that given the infancy of the field of EDV, there is much work to be done to fully flush out clear conceptualizations, definitions and mechanisms of EDV, including possible predictors (Rocha-Silva et al., 2021). Conceptualizing, defining, and investigating the mechanisms through which

specific types of EDV occur (e.g., what factors are associated with each domain of EDV) is very important as risk factors may differ by domain of EDV. Information on the nuance would be important for tailored intervention work. Alternatively, finding similarities in predictors across various domains of EDV could help inform the most cost-effective factors that interventions might focus on to reduce this type of behavior across multiple domains of EDV. Adding nuance to our understanding of EDV domains includes evaluating a wider set of potential factors that may help predict each domain of EDV. This can be achieved by applying analytic techniques from other fields (e.g., such as machine learning techniques from computational science and electric engineering), which could provide novel insights into accounting for variations of experience in adolescence.

Established Risk Factors and EDV

Risk factors used in multiple studies and found to be consistently predictive of EDV can be considered typical predictors. One factor is substance use (drug and alcohol use), which is associated with greater risk of EDV (Bennett et al., 2011; Y. Lu et al., 2018; Rocha-Silva et al., 2021). Another typical predictor is delinquency (Caridade et al., 2019; Sargent et al., 2016; Van Ouytsel et al., 2017; Zweig et al., 2014). While many researchers have found that delinquent behaviors are predictive of EDV (Caridade et al., 2019; Sargent et al., 2016; Zweig et al., 2014), variations of measurement tools results in different types of behaviors being captured by the indices and thus it is not clear about what specific delinquent behaviors are associated with EDV. Additionally, some tools include substance use (e.g., the Honest Conduct Scale used in Sargent et al., 2016) which begs the question of whether substance use items are overly contributing unique variance and association with EDV. Identifying which specific delinquent behaviors are

associated with EDV while also accounting for various types of substance use would provide important information for future intervention work.

Adverse childhood experiences (ACEs) are another major risk factor that is typically evaluated and was identified by researchers of one meta-analysis to be one of the most predictive constructs of EDV (Caridade & Braga, 2020). Though often used as a singular additive construct, recently researchers have advocated for the differentiation between threat-based and deprivation-based ACEs (Hawkins et al., 2021). Threat-based ACEs (e.g., physical abuse, witnessing parental intimate partner violence) have been found by one set of researchers to be particularly predictive of EDV domains (Thulin et al., 2021). While typical risk factors (e.g., substance use, delinquency, threat-based/deprivation-based ACEs) are important to account for, it is not entirely clear how each individual exposure underlying the various constructs may be particularly risky. Given heterogeneity in EDV engagement, it could be helpful to know if specific events or behaviors within these typical risk constructs are strongly predictive of EDV. Moreover, developmental timing influences EDV domains and should be accounted for by age to better tailor future screening and intervention work (Thulin et al., 2021).

Innocuous to Risky: Highly Prevalent Exposures Specific to Adolescent Development

Whereas high-risk factors like substance use (which are not as common but highly predictive of EDV) account for a subset of youth who engage in EDV, there is another set of youth who engage in EDV and experience other more subtle risk factors. For these youth, the major risk factors may not be the most important to capture; instead, it may be that exposures that are slightly more normative during adolescence and which can be innocuous at certain levels of exposure but become risky at higher levels may be important to account for variance. In an attempt to expand our understanding of risk factors of electronic harassment, electronic coercion,

and electronic monitoring, it is worth considering how pervasive yet heterogenous EDV

engagement is in adolescence and what is considered normative.

Technology use and availability is ubiquitous in contemporary adolescent life, and has

resulted in substantial changes in how youth utilize their time and how interactions occur.

Whereas around 60% of youth regularly read books, magazines or newspapers in the 1970's,

around 15% of adolescents in 8th,10th and 12th grade regularly read these media sources (Twenge

et al., 2019). Even as compared with adolescents in 2006, those in 2016 spend an hour less per

day watching television; instead, youth have increased utilization of the internet, data and smart

phones for entertainment and connection, with modern 12th graders spending a collective six

hours a day between texting, time online, social media and gaming. Though children are exposed

to electronics from a very early age, having ownership of a device and thus at least some privacy

in use is occurring from preadolescence, with half of youth owning a smart phone by age 11

(Lucero et al., 2014). Access and availability continue to increase throughout adolescence, and

by age 19 over 90% own a smart phone. Social engagement through technology is highly

normative throughout adolescence, with researchers of a study utilizing nationally representative

data finding that 75%-80% of adolescents use social media sites to connect with friends almost

every day (Twenge et al., 2019). Technology is thus commonplace in contemporary adolescent

interpersonal relationships, including romantic relationships. Three in four youth interact with

their partner by posting on their social media page and 92% of youth regularly engage with their

romantic partner through text messages (Lenhart & Page, 2015). While there is some evidence

that engaging in positive messaging through text can promote romantic satisfaction (Juhasz &

Bradford, 2016; Luo & Tuney, 2015), or help couples stay connected when physically separate

(Chien & Hassenzahl, 2020; Juhasz & Bradford, 2016), technology as a resource can go from

beneficial in a relationship to problematic when utilized in unhealthy ways, including behaviors such as control, coercion and aggression (Cava, Buelga, et al., 2020; Kernsmith et al., 2018; Zweig et al., 2013). Though technology use in interpersonal relationships is normative in contemporary adolescent life, there may be a tipping point where technology use goes from innocuous and beneficial to problematic and predictive of aggressive online engagement including EDV.

To capture a wider set of constructs that may be associated with EDV domains, I must contextualize youth exposure within adolescent development and the unique and novel experience of dating[1] that is inherent in this period. Adolescence is the developmental period when most individuals have their first experiences of dating (Zimmer-Gembeck, 2002). Debut of dating during adolescence is due to several influences such as biological changes and subjective norms reflecting social expectations of dating during adolescence that are common particularly in the US (Collins & Steinberg, 2007). Due to inexperience, youth will test out various strategies and approaches of romantic engagement with another individual as they gain their initial exposures to dating (Jackson et al., 2001). Some of these strategies such as approaching someone the youth already knows well to date are statistically normal (i.e., reported by a strong majority of youth, 88%) and conceptually can be considered as logical and likely non-problematic. However, youth also try out other behaviors that are less likely to be entirely innocuous and could be "at best, inappropriate, and at worst, abusive" (p 320, Helm et al., 2017).

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[1] For this overview, dating is presented as occurring between two individuals and does not speak to polyandrous relationships – it is also notable that the majority of dating research (both adolescent developmental dating and dating violence) is highly skewed to examining heterosexual dating behaviors.

Some dating behaviors can be considered under certain contexts innocuous, and perhaps even typical, normative, or beneficial to the relationship, such as the sending of notes or doing unrequested favors (Williams & Frieze, 2005). However, when behaviors become overly frequent and persistently enacted, they may transition from innocuous and beneficial for a relationship to damaging to the relationship and potentially traumatic for one or both parties. An example would be keeping tabs on a partner. While knowing a partner's general schedule may be a sign of support and interest, monitoring-type behaviors can be a form of stalking. While the phenomena of monitoring and showing up in in-person settings has been referred to as the continuum of stalking-type behaviors (Helm et al., 2017; Spitzberg et al., 2004; Williams & Frieze, 2005), there is a wider set of behaviors that exist on a continuum of safe and beneficial in a relationship to unsafe and harmful to one or both individuals in a relationship, and should be studied in relation to electronic harassment, coercion and monitoring.

In addition to dating behaviors, there are other behaviors that reflect hormonal and social sexual development during adolescence, are widespread, and at some level can be considered a normative experience but could potentially become risky. Pornography use is pretty widespread in adolescence (Peter & Valkenburg, 2016) and in adult samples (less research exists in adolescent samples) has been found to be beneficial for stress relief, sexual curiosity and self-exploration (Bőthe et al., 2021). However, other researchers have found that it increases loneliness (Yoder et al., 2005) and for adolescents may be particularly harmful (Peter & Valkenburg, 2009) given the tendency for individuals with less sexual experience to compare themselves more with the heightened physique of actors, subsequent bodily responses, and sexual scenes portrayed in pornography which are not realistic of the average body and interaction (Morrison et al., 2007). Additionally, other researchers have cautioned that violence

is often portrayed in pornography, and that higher levels of use may result in changes to perceptions of appropriate behavior between intimate partners and lead to greater risk of violence (Foubert et al., 2019) though these claims are refuted by other authors (Watson & Smith, 2012). Despite the mixed literature, that the vast majority of pornography now exists online may in some ways reinforce the feeling that online spaces are not as real as in-person ones, and that violence portrayed in these spaces is in some way more normative, acceptable, and less harmful (Stonard, 2020) and may increase likelihood to engage in violence in electronic spaces with romantic partners. Given that pornography use is prevalent, may increase risk of worse outcomes, and is often consumed in online spaces, investigating the association between pornography use and electronic harassment, coercion and monitoring may be important.

Finally, there are some interactions that are normative and reflect important relationship dynamics between parents (or more broadly, primary caregivers) and youth (Collins & Steinberg, 2007) and importantly, have been found as important predictors of EDV (Thulin et al., 2021). Adolescence marks an important developmental period for physical and social autonomy, and a period where it is normative for individuals to make greater strides towards independence in their day-to-day lives from their primary caregivers (Collins & Steinberg, 2007). However, as adolescents are trying out steps towards independence, there is a back and forth between autonomy and parental advice that is helpful in the reflection on actions and experiences, and ultimately learning of skills. Both youth and parents are agents of these interactions, but as parents are in a position of greater power, decision-making, and responsibility for youth, their monitoring is critical to evaluate. Within EDV research, parental monitoring appears to be an effective factor in reducing risk of EDV engagement, but only when it is active monitoring (as opposed to more passive monitoring like knowing of the existence of an account but not

checking in with their youth about their use of it) and only during earlier adolescence (Thulin et al., 2021). It may be that certain parental monitoring behaviors are particularly helpful, and given their normativity and prevalence during adolescent development, should be considered when studying EDV domains at specific ages.

Why Evaluate Individual Items as Opposed to Scales: Prioritizing Criterion over Construct Validity

The existence and ubiquity of electronics in adolescent life is relatively novel and definitions, measurements, and thus findings related to EDV differ greatly reflecting that the field is still very much in an exploratory phase to understand this new type of exposure that humans are experiencing (Rocha-Silva et al., 2021). While researchers have evaluated potential factors associated with EDV generally and specific domains of EDV such as harassment, coercion and monitoring, most researchers study multi-item indices composed of multiple indicators (Caridade et al., 2019). An alternative approach that has not been widely used is to employ robust analytics (such as machine learning) to study individual item predictors. There are conceptual and analytic benefits to this approach. Given the infancy of the field, using individual items provides additional nuance that is helpful in thinking about the conceptual differences and potential risk factors associated with each unique domain. Analytically, correlations in items underlying scales are never 1.0 (which would suggest redundancy), and thus variability representing item uniqueness exists within constructs. By using individual items in models (as opposed to combining them into a scale or index), I can capitalize on item uniqueness and thus capture unique variability that predicts each EDV domain.

Researchers have raised concerns about the lack of theory guiding data-driven exploration. A promising compromise is to use theory to guide the selection of potential types of

exposures which then can be evaluated using data-driven exploration (Elragal & Klischewski, 2017). For example, given that EDV has been found to be normative quantitatively and qualitatively – quantitatively, three in four youth report EDV engagement (Ellyson et al., 2021), qualitatively, researchers have found that youth perceive the electronic space as one where interactions that would likely be perceived as not normative in the in-person space are normative in the electronic space (Stonard, 2020) – a wider set of variables that reflect other seemingly normal or common exposures that occur during the period of adolescence may be important to explore in addition to well established adolescent risk factors (e.g., drug or alcohol use). To use individual items from a wide set of typical and potentially more subtle risk factors, I must employ a different type of analytic tool which will not be as limited by power considerations as is seen in linear regression.

Machine learning penalized regression models have been used to study a variety of outcomes (Aheto et al., 2021; Haynos et al., 2021; Meehan et al., 2020), including to evaluate predictors of violence (Goldstick et al., 2017; Rosellini et al., 2017; Wang et al., 2020). Unlike linear regression models (e.g., GLM logistic regression models or non-linear partial likelihood models such as a Cox model), penalized models are particularly useful when wanting to evaluate a larger number of predictor variables which may be correlated and thus make OLS parameter estimation less reliable. Penalized models use regularization, which is a balance of attempting to account for more variance at the cost of increasing bias to minimize the total error of the model. What this means is that the more variables in the models, the more penalties are imposed; thus, the model shrinks coefficients that have smaller magnitudes towards zero, which decreases the overall error of the model. By capitalizing on the abilities of machine learning techniques to explore a wider set of variables, it is possible to prioritize criterion validity to provide clear

nuance in both typical and potentially more subtle exposures that cannot be identified when collapsing individual events or exposures into a broader multi-item scale or indices.

Current Study

Though researchers have evaluated several possible constructs that may be predictive of domains of EDV, few, if any, have examined how the individual items underlying the constructs relate to EDV. Additionally, though researchers have identified factors that represent major risk, little is known about exposures that are highly prevalent and considered more normative. The purpose of the present study is to 1.) explore a wider set of variables beyond the typically evaluated predictors, which may account for more variation and a greater proportion of youth exposure and 2.) use individual items (as opposed to scales) to better understand nuance in what is predictive of electronic harassment, electronic coercion, and electronic monitoring. Both of these aims will help expand our understanding of electronic harassment, electronic coercion, and electronic monitoring. Additionally, this information will provide insight into what specific exposures (as opposed to wider constructs) are most predictive of engagement with each domain, which could be critical for effective future intervention work.

Methods

Study Design, Data Sources, and Study Population

Data for the present study were drawn from the Strengthening Healthy Adolescent Relationships and Environments (SHARE) study. SHARE, a prospective longitudinal cohort study, followed two cohorts of youth starting in 6th and 9th graders for four years. Data were collected annually, between 2013-2016. Youth were recruited from six city school districts in southeast Michigan, representing high, medium and low socioeconomic and crime areas. Two school districts were selected for participation at each level of community risk (low, medium,

high). All middle and high schools in each local school district participated in the research (n=13 schools, total).

Within each school, the sample was selected using stratified random sampling by grade level (6th and 9th grade at Wave 1) and sex, with equal numbers recruited within each group. Demographic statistics are located in Table 12. At the first wave of data collection, 588 6th and 648 9th graders for a total of 1,236 youth were recruited into the study. The average age of the younger cohort at wave 1 was 12.0 years (standard deviation = 0.45 years) while the average age of the older cohort at wave 1 was 15.0 years (standard deviation = 0.56 years). The majority of youth were white (59.1%), followed by Black (17.4%) and multi-racial (10.5%). Similar to the first two empirical papers in this dissertation, just under one third of students were from a low (31.5%) or medium (29.1%) risk school district, with slightly more than one third of the sample coming from a high-risk school district (39.4%).

Table 12. Demographic Statistics, Study 3

Demographic Statistics

	Younger Cohort	Older Cohort
n	390	478
Male n(%)	181(46.4%)	223(46.7%)
Age in Years (Std)	12.0(0.45)	15.0(0.56)
School Risk Level n(%)		
Low	133(34.1%)	150(31.4%)
Medium	149(38.2%)	135(28.2%)
High	108(27.7%)	193(40.4%)

A passive parent consent procedure was used in the study. Parents had the opportunity to refuse consent for their child's participation by returning a written form or by calling or e-mailing the school or researchers, otherwise their child would be included in the study. Prior to survey administration, all students provided oral or written assent (depending on age) and were informed of their right to withdraw from the study at any time. Informed consent was obtained

from all individual participants in the study. Surveys were administered during the school day at a mutually agreed upon time and place and generally took one class period to complete. The written questionnaires were completed in a large group setting, with space between youth to protect privacy. A Certificate of Confidentiality was obtained through the Centers for Disease Control and Prevention. The Institutional Review Board for both participating universities and the funding agency approved the data collection protocols.

Measures

Electronic Dating Violence Engagement. Three domains of electronic dating violence engagement were evaluated: electronic harassment, electronic coercion, and electronic monitoring. For each item, youth reported how often they or their partner engaged in a given behavior, from "Never" (0) to "10+ times" (4) in the past year. A binary variable representing any report of each domain was created to represent engagement at any wave (1) or no report (0). All items are derived from the Safe Dates program (Foshee et al., 1996). In the case that youth had not dated in the prior year, they were classified as having no reported exposure.

Electronic Harassment. Twelve items were used to measure electronic harassment, six representing victimization and six representing perpetration. Items included spreading rumors about a partner through electronic means including networking sites like Facebook.

Electronic Coercion. Six items were used to evaluate electronic coercion, three representing victimization and six representing perpetration. Sample items include pressuring a partner to send nude or sexy photos.

Electronic Monitoring. Four items were used to measure electronic monitoring, two representing victimization, two representing perpetration. A sample item is demanding passwords to electronic communication or networking sites.

Predictor Variables.

The selected predictor variables were informed by existing literature, availability in the data, and missingness. 169 unique items representing typical predictors (i.e., substance use, delinquent behaviors, threat-based adverse childhood experiences, and deprivation-based adverse childhood experiences) and innocuous to problematic predictors (i.e., youth's use of technology in interpersonal communication, dating interactions, youth's use of pornography, and parental monitoring) were included in the penalized regression model. All predictor variables were assessed at the first wave of data collection representing 6th grade for the younger cohort and 9th grade for the older cohort.

Typical Predictors. Four typical predictors that have been used in multiple studies and found to be predictive of EDV are used in the present study: threat-based adverse childhood experiences, deprivation-based adverse childhood experiences, substance use, and delinquency.

Threat-Based Adverse Childhood Experiences. Threat-based ACEs were assessed using nine items corresponding to the adverse experiences of physical abuse, emotional abuse, sexual abuse, and caregiver intimate partner violence (Felitti et al., 1998). Youth reported if they had ever experienced the behavior at any point in their life (1) or not (0).

Deprivation-Based Adverse Childhood Experiences. Deprivation-based ACEs were assessed using nine items corresponding to the adverse experiences of neglect, caregiver substance use, caregiver mental illness, caregiver divorce and caregiver incarceration (Felitti et al., 1998). Youth reported if they had ever experienced the behavior at any point in their life (1) or not (0).

Delinquent Behaviors. Thirty delinquent behaviors were evaluated, including stealing, perpetrating violence against others (e.g., peers, parents), running away from home, and coercing

others for money or other things. Youth reported how often in the prior year they had done each item, from "Never" (0) to "10 or more times" (4).

Substance use. Four items were used to evaluate youth's substance use. Youth reported how often in the prior year they had done each item, from "Never" (0) to "10 or more times" (4). Substances inquired about were alcohol, marijuana, and other illegal drugs.

Innocuous to Problematic Predictors. Four innocuous to problematic predictors which are normative but can become problematic are used in the present study: youth's use of technology, dating interactions, youth's use of pornography, and perceived parental monitoring.

Youth's Use of Technology. Five items were used to measure use of technology. Youth reported the level to which they utilized five types of electronic means to communicate with their friends. Technological means included talking on a cell phone, text message, and social networking sites (such as Facebook, Twitter, REDDIT, etc.). Youth reported the frequency they utilized each means each day on a 6-point frequency scale, from "Never" (0) to "10 or more times per day" (5). In the case that the youth indicated they did not have that type of account, they were assigned a 0 having never used that form of electronic communication to talk to friends.

Dating Interactions. Dating interactions included 96 emotional, physical and sexual behaviors derived from the Safe Dates program (Foshee et al., 1996). Forty-eight items represented the action being done to the youth (and in the case of abusive actions, the youth being victimized), and 48 represented the action being done by the youth (and in the case of abusive actions, the youth being the perpetrator). Non-abusive items included "tried to understand the other person's feelings", and "went and did something else". Abusive items included "called other person names", "slapped them", and "used threats to make them have any

sexual activity". Youth reported how often the behavior had been done to them in the prior year, and then on how often they had done the behavior in the prior year, from "Never" (0) to "10+ times" (4).

Youth's Use of Pornography. Three items were used to evaluate youth's use of pornography. Youth reported the frequency of pornography in the prior year over three mediums: magazine, downloading from online, or watching pornographic videos. Youth responded to their use over the prior year on a 5-point frequency scale, from "Never" (0) to "More than 10 times a month" (5).

Perceived Parental Monitoring. Youth reported on 13 perceived parental monitoring behaviors. Behaviors included parents asking if a youth has completed their homework, parental knowledge of where a youth was when outside of the house, and if the family had clear rules about alcohol and drug use. Youth responded on a 4-point agreement scale of "NO!" (1), "no" (2), "yes" (3) and "YES!" (4).

Statistical Analysis

In the present study, I used a machine learning shrinkage approach (i.e., penalized regression model), meaning that covariates that provide less information are minimized in the model in order to identify items that provide more information. There are several types of penalized regression models, including Lasso, Ridge and elastic net. Ridge regression does not force any covariate coefficients to 0, even if the covariate provides minimal information (Aheto et al., 2021). In ridge regression, the sum of squared coefficients is penalized (Oleszak, 2019). Lasso regression forces covariates with smaller coefficients (i.e., that contribute less information) to 0 (Aheto et al., 2021). This represents the penalization of the sum of absolute values of the coefficients (Oleszak, 2019). Elastic net regression is the combination of Lasso and Ridge,

allowing some smaller coefficients to remain small while forcing the smallest to 0 (Aheto et al., 2021). In this dissertation, I opted for elastic net regression, as it has the benefits of ridge and lasso with more flexibility in the shrinkage approach (Zou & Hastie, 2005).

The elastic net method simultaneously performs variable selection and regularization, making it optimal. To adjust for amount of covariate shrinkage, penalized regression requires a specified lambda (i.e., the optimal point between the Ridge approach and the Lasso approach). The best lambda is that which minimizes the cross-validation prediction error rate. Lambda selection is determined using the automated function in R, cv.glmnet. The glmnet function in R also requires a specified alpha term. As elastic-net regression is being used, an alpha value of ~0.50 will be used (alpha values of 1 specify the lasso regression while alpha values specified at 0 imply ridge regression). With the optimal lambda and specified alpha, the final test model can be built to use test data to predict the binary outcome of engagement or no engagement by domain of EDV and age. Model accuracy will be determined in the test model, to check and see how accurately the model it classifies the observations (i.e., youth) into exposure or no exposure as compared with their observed (i.e., binary calculated) classification. Researchers evaluate elastic net model fit using AUC curves with final model AUC ranging from around 0.60 – 0.80 (Aheto et al., 2021; Meehan et al., 2020; Wang et al., 2020; Zuromski et al., 2020). Higher AUC statistics indicate that the model accounts for a greater proportion of data variance.

I took several steps to create the elastic net logistic regression model in the present study. First, I standardized all predictor variables. This was done as penalized regression models are highly sensitive to variations in scaling of measures. As penalized logistic regression can only

use complete data, analyses for the present study were restricted to complete case[2]. By cohort, the data were randomly split into a training set (75%) and a testing set (25%); the split of 75/25 matches another study on youth violence (Goldstick et al., 2017). To build the testing and training models, I used the glmnet package in R and carat package to select the optimal lambda from 10 possible lengths. I then created a model for each domain of electronic dating violence by cohort (total of 6 models) based on 75% of the sample, and then tested efficacy of the model with the remaining 25% of the sample. Model fit was assessed based on efficacy and AUC.

Results

Descriptive Statistics

There was no missing data for the outcome variables of electronic harassment, electronic coercion or electronic monitoring. For predictors, missingness by construct ranged from 0.0% to 11.89% of the total sample. For the construct of dating interaction, 5.83% (n=72) of youth were missing data for one or more item. For ACEs, 7.04% (n=87) of youth were missing data for one or more items. 7.12% of youth were missing data on parental monitoring. The highest amount of missingness was for delinquent behaviors, with 11.89% (n=147) missing data for one or more of the 34 items. 0.0% (n=0) of youth were missing data on communication with friends using technology. 3.64% (n=45) of youth were missing data on one or more items on pornography use. Across all constructs, 868 (70.23%) youth had complete data. By cohort, 66.3% of the younger cohort (n=390) and 73.8% (n=478) of the older cohort had complete data (χ^2=38.5, df=27,

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[2] In preliminary work for this study, a model representing exposure to any of the three electronic dating violence domains or no exposure was created. For each cohort two models were constructed: one with complete case data, and one with missing data imputed. Imputation was completed utilizing the mice package in R. Imputation was based on 5 iterations and 10 imputations. Missingness of variables did not appear to be at random, and as such imputation further exacerbated bias; thus, complete case analysis was utilized for all modeling presented in the present study.

p=0.071). In the younger cohort, 28.1% of youth (n=165) reported electronic harassment engagement at 6th grade, 24.2% reported electronic coercion engagement (n=142) and 15.5% reported electronic monitoring (n=91) at 6th grade. In the older cohort, 46.5% of youth reported engagement in electronic harassment (n=301), 43.4% reported engagement in electronic coercion (n=281) and 35.0% reported engagement in electronic monitoring (n=227) at 9th grade.

Elastic Net Regression: Predicting EDV Engagement at 6th Grade

Of the 390 younger cohort youth included in the present analyses, 273 youth were in the training set and 117 in the testing set. Due to selecting a specific seed, the same training and testing samples were used for all three models.

Electronic Harassment. The model for electronic harassment successfully predicted 72.6% of engagement at 6th grade in the testing sample. AUC was 0.576. Of the top ten items predicting electronic harassment in 6th grade, six items were drawn from dating interactions, three from technology use to communicate with friends, and one from pornography use (Table 13). The most predictive item was watching pornographic videos. The six items from the dating interactions construct included being hit by something besides a fist by a partner, the youth expecting to hear the worst, a partner explaining their feelings, the youth arguing strongly with their partner, the youth hitting their partner with something other than a fist, and the youth's partner saying nice or complementary things. The three technology use items were communicating with friends using social networking sites, communicating with friends using instant messages, and communicating with friends using email.

Electronic Coercion. The model for electronic coercion accurately predicted 75.2% of the youth engagement at 6th grade of the testing sample. AUC was 0.530. Seven of the top ten items predicting electronic coercion were drawn from dating interactions, two represented delinquency,

and one represented threat-based ACEs. The dating interactions included a partner pretending to not know what was going on, a partner trying to flatter the youth, a partner checking up on the youth over text or cell phone, a partner swearing at the youth, the youth explaining their feelings to their partner, a youth checking up on their partner over text or cell phone, and a partner trying to consider how the youth felt. The two items drawn from the construct of delinquency were cheating on school tests and stealing something worth more than $50. The threat-based ACE was a parent or other adult in the household swearing at the youth, insulting the youth, putting the youth down, or humiliating the youth.

Electronic Monitoring. The model for electronic monitoring accurately identified 84.6% of youth engagement at 6th grade in the testing sample. AUC was 0.609. Five of the top ten items were drawn from dating interactions, three from delinquency, one from technology use and one from deprivation-based ACEs. The five items from dating interactions were a partner bending the youth's fingers, the youth trying to consider how their partner thinks, the youth threatening to cheat on their partner, the youth trying to flatter their partner, and the youth explaining their feelings to their partner. The three delinquency items were drinking more than 5 alcoholic beverages on one occasion, stealing things worth between $5 and $50, and stealing something worth more than $50. The technology use item was communicating with friends using instant message. The deprivation-ACE was if a youth's parents were ever separated or divorced.

Table 13. Variables Most Predictive of Domains of EDV at 6th Grade

Variables Most Predictive of Domains of EDV at 6th Grade

Harassment		**Coercion**		**Monitoring**	
Label	*Co-efficient*	*Label*	*Co-efficient*	*Label*	*Co-efficient*
Watched pornographic videos	0.277	Pretended not to know what was going on?, victim	0.253	Drank more than 5 alcoholic beverages on one occasion.	0.776
Hit them/me with something besides a fist?, victim	0.212	Cheated on school tests?	0.196	Bent their/my fingers?, victim	0.398
Expected to hear the worst?, perpetrator	0.182	Tried to flatter other person?, victim	0.126	Tried to consider how the other person thinks?, perpetrator	0.326
Explained feelings?, victim	0.175	Checked up on them/me over text or cell	0.097	Threatened to cheat on you/them?, perpetrator	0.309

		phone (where they are, what they're doing, who they're with, etc.)?, victim			
Argued strongly?, perpetrator	0.154	Swore at the other person?, victim	0.089	Stolen (or tried to steal) things worth between $5 and $50?	0.240
communicated with friends using social networking sites such as Facebook, Twitter, REDDIT, etc.	0.132	Explained feelings?, perpetrator	0.063	Communicated with friends using instant message	0.209
communicated with friends using instant message	0.124	Checked up on them/me over text or cell phone (where they are, what they're	0.060	Tried to flatter other person?, perpetrator	0.171

Item	Value	Item	Value	Item	Value
		doing, who they're with, etc.)?, perpetrator			
Communicated with friends using email	0.124	Did a parent or other adult in the household often swear at you, insult you, put you down, or humiliate you?	0.043	Were your parents ever separated or divorced?	0.166
Hit them/me with something besides a fist?, perpetrator	0.119	Tried to consider how the other person thinks?, victim	0.032	Explained feelings?, perpetrator	0.152
Said nice or complimentary things?, victim	0.103	Stolen (or tried to steal) something worth more than $50?	0.025	Stolen (or tried to steal) something worth more than $50?	0.150

Elastic Net Regression: Predicting EDV Engagement at 9th Grade

In the older cohort, 334 youth were in the training set and 141 in the testing.

Electronic Harassment. The model accurately predicted 70.8% of electronic harassment outcomes engaged in by 9th grade youth. AUC was 0.69. Of the top 10 items predicting electronic harassment, six are drawn from dating interactions, two from delinquency, one from parental monitoring, and one from deprivation-ACEs. The dating interactions included a partner pretending to not know what was going on, a partner getting upset, the youth reporting that they had argued strongly with a partner, a partner insisting on sexual activity when the youth did not want to (but the partner not using physical force to elicit the activity), the youth reporting that they had tried to consider how their partner thought and the youth insisting on sexual activity when their partner did not want (but not using physical force to elicit the activity). The delinquency items that were most predictive were stealing (or trying to steal) things worth $5 or less and drinking more than 5 alcohol beverages on one occasion. The item from parental monitoring that was predictive of harassment was higher report that the youth would be caught if they drank alcohol without permission by a parent. The deprivation-ACE was the youth feeling like their family did not look out for one another, did not feel close to one another, and did not support one another.

Electronic Coercion. The model predicting electronic coercion engagement in 9th grade youth accurately predicted 69.2% of coercive outcomes. AUC was 0.66. Of the top ten items predicting electronic coercion, six are drawn from dating interactions, two from delinquency, one from pornography use, and one from deprivation-based ACEs (Table 14). The items drawn from dating interactions that were most predictive of electronic coercion were the youth trying to

consider how their partner thinks, a partner getting upset, a partner insisting on sexual activity when the youth did not want to (but the partner not using physical force to elicit the activity), a partner telling the youth they care about the youth's opinions and feelings, the youth pretending to not know what is going on, and the youth insisting on sexual activity (but not using physical force) when their partner did not want to. The two delinquency items that were found to be highly predictive of electronic coercion engagement were using alcohol beverages and hitting (or threatening to hit) other students. The items of downloading or looking at pictures of naked people online (pornography use) and feeling that your family does not look out for one another, does not feel close, or does not support one another (deprivation-based ACEs) were also highly predictive of electronic coercion engagement.

Electronic Monitoring. The model for the older cohort accurately predicted 79.2% of EDV outcomes. AUC was 0.71. Of the top ten items predicting electronic monitoring, seven are drawn from dating interactions, two from delinquency, and one from technology use. The seven items drawn from relationship interactions were the youth feeling clueless about what was going on in their relationship, the youth arguing strongly with their partner, the youth swearing at their partner, the youth's partner arguing with the youth strongly, the youth telling their partner that they care about the partner's opinions and feelings, the youth's partner telling the youth that they care about the youth's opinion and feelings, and the youth telling their partner that the partner could be replaced. The two items from delinquency were the youth using force to get money or things from other people (not including other students) and stealing or trying to steal things worth $5 or less. The item from technology use was using social networking sites to communicate with friends.

Table 14. Variables Most Predictive of Domains of EDV at 9th Grade

Variables Most Predictive of Domains of EDV at 9th Grade

Harassment		Coercion		Monitoring	
Label	*Co-efficient*	*Label*	*Co-efficient*	*Label*	*Co-efficient*
Insisted on sexual activity when they/I did not want to (but did not use physical force)?, perpetrator	0.17	Downloaded or looked at pictures of naked people online in the past year	0.06	Said that the other person could be replaced?, perp	0.05
Did you often feel that your family didn't look out for one another, feel close to one another, or support one another?	0.19	Insisted on sexual activity when they/I did not want to (but did not use physical force)?, perp	0.06	Said that they care about the other person's opinions/feelings?, victim	0.05

Drank more than 5 alcoholic beverages on one occasion.	0.19	Hit (or threatened to hit) other students?	0.08	Said that they care about the other person's opinions/feelings?, perp	0.07
Tried to consider how the other person thinks?, perpetrator	0.19	Was clueless about what was going on?, perpetrator	0.08	Argued strongly?, victim	0.08
Stolen (or tried to steal) things worth $5 or less?	0.22	Said that they care about the other person's opinions/feelings?, victim	0.08	Communicate with friends using social networking sites (such as Facebook, Twitter, REDDIT, etc.)	0.08
Insisted on sexual activity when they/I did not want to (but did not use physical force)?, victim	0.26	Did you often feel that your family didn't look out for one another, feel close to one another, or support one another?	0.09	Stolen (or tried to steal) things worth $5 or less?	0.08

	0.30	Insisted on sexual activity when they/I did not want to (but did not use physical force)?, victim	0.09	Used force to get money or things from other people (not students)?	0.09
Argued strongly?, perpetrator					
If you drank some beer or wine or liquor (for example, vodka, whiskey, or gin) without your parents' permission, would you be caught by your parents?	0.31		0.10	Swore at the other person?, perp	0.13
	0.38	Got upset?, victim Tried to consider how the other person thinks?, perpetrator	0.11	Argued strongly?, perpetrator	0.18
Got upset?, victim					

Pretended not to know what

was going   0.39   0.13   Was clueless about what   0.20

on?, victim   Used alcoholic beverages?   was going on?, perpetrator

Discussion

The present study fills a gap in the literature by identifying items that are most predictive of electronic harassment, electronic coercion, and electronic monitoring at age 12 (6th grade) and age 15 (9th grade). By utilizing a large number of individual items as opposed to scales, the findings of this study provide unique insight into what is most predictive of each domain of EDV at both ages. When comparing items across domains of EDV, some overlap exists but there is a lot of heterogeneity in predictors. Supporting researcher findings of differences between domains (Ellyson et al., 2021; Thulin et al., 2021; Thulin, Heinze, Kernsmith, et al., 2020), the top two items that were most predictive of each domain are not in the top ten items most predictive of either of the other two domains. Across domains at both ages, half or more of the top ten items represent specific dating interactions. While more obvious risky dating interactions like physical violence are present in those items, many of the dating interactions that are highly predictive are interactions that can be innocuous. The findings of both typical risk factors and more subtle risk factors supports the idea of broadening our conceptualization of potential risk factors – this broadening creates important opportunities where screenings and interventions could take place.

Innocuous to Problematic Predictors

Within the construct of dating interactions, both major and more innocuous behaviors appeared in the top ten items for all domain and age combinations. Interactions that are clearly problematic included specific physical (e.g., a partner or the youth hitting the other person with something besides a fist) and verbal (e.g., the youth threatening to cheat on a partner) dating violence behaviors at 6th grade and sexual (e.g., insisting on sexual activity when the partner or youth does not want to) and verbal (e.g., swearing at the other person) violent behaviors at 9th

grade. That sexual violence was not predictive at 6th grade but was at 9th grade may reflect changes in physiology and autonomy that naturally lead to more opportunities for intimate behaviors, which unfortunately also includes greater opportunities for sexual violence. What is potentially the most important finding is that the number of innocuous dating behaviors as compared with clearly negative behaviors is greater for every domain at both ages. For example, four of the six dating interactions that are most predictive of 6th grade EDV harassment are innocuous as compared with two that are clearly negative.

At face value, the innocuous dating behaviors are less risky and could even be positive in relationships depending on how they are used, such as saying nice or complimentary things or a partner explaining their feelings to the youth. Even items such as arguing strongly or expecting to hear the worst are not inherently negative; arguing strongly but respectfully could be positive in certain situations, while expecting to hear the worst could reflect a youth being perceptive and aware of other people's feelings beyond their own. However, these behaviors can become risky in some contexts – for example, always expecting to hear the worst and feeling that one always has to be perceptive and gauge where a partner is at could reflect being in a relationship with someone who has poor interpersonal interactions ranging from inability to effectively communicate one's feelings (which can be non-violent) to a partner who is manipulative, controlling and violent. Items like explaining feelings, trying to consider how the other person thinks, and a partner or the youth telling the other person that they care about the person's opinions and feelings could all be positive under certain circumstances or could reflect behaviors that are manipulative in nature (e.g., gaslighting) or coping strategies in unhealthy relationships. That the pattern of one or two clearly risky dating interactions and three to six dating behaviors that could reflect either healthy relating or unhealthy relating is present across all domains and

ages and that the majority of predictors for each domain for both ages are dating behaviors indicates the need for greater exploration of these behaviors that are not inherently violent but can become so under certain circumstances.

Another highly normative factor that was found to be predictive of EDV was interpersonal technology use – while the channel of communication used may be important (e.g., instant message versus email versus social networking site), popularity of channels changes very frequently both with the development of new channels to communicate through and due to wider norms or endorsements of a given channel (e.g., when model Kylie Jenner tweeted that she no longer used Snapchat, Snapchat stock lost $1.3 billion as users deleted their accounts) (Yurieff, 2018). As such, the important takeaway is that higher use of technology in interpersonal interactions in adolescence is highly predictive of EDV. It may be that online interactions feel less real or impactful when youth are perpetrating violent behaviors online, or that youth who use technology for more of their interpersonal communications see more interpersonal violent communications, and thus the normativity and perceived appropriateness of EDV behaviors increases (Stonard, 2020). Negative interactions is not the sole use of technology, and positive effects of technology should not be under stressed (Chien & Hassenzahl, 2020; Juhasz & Bradford, 2016); however, there may be important social cues and empathetic interactions that are harder to employ online as compared with in-person interactions. Given that adolescence is a prime developmental period for learning to employ and maintain social interactions autonomously, future research evaluating the need for adolescents to learn social interactions and empathy from in-person as opposed to online interactions may be an important next step.

Surprisingly, indicators of pornography use appeared only twice across domain and age: watching pornographic videos was predictive of EDV harassment at 6th grade (age 12), and

downloading or looking at pornographic images was predictive of EDV coercion at 9th grade (age 15). While partially supporting claims that pornography use in adolescence is problematic (Peter & Valkenburg, 2009), that only two indicators were present across all 60 potential indicators (i.e., 10 indicators for each of the three domains, for both ages) suggests that this is a less important risk factor to account for as compared with other highly normative behaviors which represented a greater proportion of the 60 potential indicators and appeared across domains and ages (e.g., innocuous dating behaviors or high use of technology for interpersonal interactions). However, the measures used for pornography use in the present study do not provide details on what types of pornography youth were viewing or using, and as such it is impossible to detangle the use of pornography demonstrating active consent and sex-positive images as compared with pornography that is more violent and coercive in nature. Rather, the important conclusion to draw from the present findings is that other innocuous behaviors are more widespread, and that interventions may be more successful and cost-effective by focusing on behaviors that appear more commonly as predictors.

Typical Predictors

Several typical risk factors investigated were found to be predictive of EDV. In the present study, alcohol use appears as a top predictor of EDV monitoring at 6th grade and EDV coercion at 9th grade, supporting other researcher findings (Y. Lu et al., 2018; Thulin et al., 2021; Zweig et al., 2014). Surprisingly, the typical risk factor of drug use was not a top predictor. Though both drug and alcohol use are obvious risk factors, alcohol use is more widespread than drug use (Johnston et al., 2014). It may be that drug use is not as useful of a prediction tool given that few youth engage relative to the high proportion of youth who engage in one or more EDV domain. This is not to negate that drug use is a major risk factor for worse health and behavioral

outcomes in adolescence, but rather it is not as useful indicator of the widespread risk behavior that is EDV as compared with risk factors that are also more widespread.

Several forms of delinquency also appeared several times across EDV domain in both ages, providing additional nuance to existing research which has found association between EDV and delinquency (Caridade et al., 2019; Sargent et al., 2016; Zweig et al., 2014). Whereas delinquency indexes often represent a wide range of problematic behavior, including interpersonal violence (i.e., hitting, slapping or pushing others), stealing, and/or cheating, the findings of the present study provide clarity on what delinquent interactions are most predictive of EDV. In particular, stealing appeared multiple times within and across domains and ages. The type of stealing ranged from items worth $5 and less up to items worth more than $50. Another form of delinquency that is more widespread was cheating on tests in school. While stealing or cheating on exams may seem minor in comparison to something like interpersonal violence, it may be an early indication of worse things to come. Additionally, by using individual items for all forms of delinquency (including substance use), I was able to account for individual item unique variance and show that delinquency is not being carried entirely by the inclusion of substances; rather, by examining a broader set of events that represent delinquency, I was able to extract more nuanced information about forms of delinquency that may be more innocuous but are highly useful in predicting EDV. These nuanced findings may be critical for future screening and intervention work.

Adverse childhood experiences appeared in two of the three domains for both 6th and 9th graders. For younger youth (6th graders, age 12), verbal violence in one's family and parents being divorced were most predictive. It may be that verbal violence in a family is correlated to parental divorce, and that exposure to verbal violence in childhood or pre-adolescence when

youth are still highly dependent on parents to learn interactive behavioral skills is an important risk factor. The deprivation-based ACE of youth feeling like their family members do not look out for one another, support one another, and that their family is not close appeared as a predictor of electronic harassment and coercion for the 9th graders. Not feeling supported, cared about, and close with family members may reflect unhealthy behaviors within one's family of origin. Youth may repeat unhealthy behaviors in other interpersonal relationships, such as their dating relationship. Additionally, the finding in the 9th graders may be partially explained by normative adolescent development at age 15, where youth are investing more time and effort in their interpersonal relationships outside of a family context but needing support and advice from parents as they navigate (Collins & Steinberg, 2007). Not feeling supported within one's family may result in youth investing more heavily in the relationships they are autonomously creating, including romantic relationships. If an adolescent has learned unhealthy ways to relate and needs to rely more heavily on relationships outside of their family, they may be at much higher risk for unhealthy or toxic dating experiences.

The use of individual items provides additional nuance to ACE exposures and expands the existing literature. That three of the four ACEs identified across the domains and ages represent deprivation-based ACEs is surprising, and contradicts prior longitudinal findings that threat-based ACEs were more predictive than deprivation-based ACEs (Thulin, Kusunoki, et al., Under Review). It also supports identifying and better understanding the different mechanisms through which deprivation-based and threat-based ACEs should be evaluated and measured (Hawkins et al., 2021). Finally, the findings of the present study give further support that ACE exposures are not equally influential, and that additive ACE measurement has severe limitations in understanding what risks are most problematic at a given age (McLennan et al., 2020).

Limitations

Though this study provides novel insights, it is not without limitation. First, though I reviewed the literature and attempted to include all available risk factors in the present dataset that can be considered typically predictive of EDV, there are potentially other factors that researchers may argue are typical and important to include. Future iterations of these types of analyses with datasets that have a greater number of constructs and are entirely complete (or have very low missingness) could ameliorate this limitation. However, this study provides novel and important information by examining a wider set of potential predictors and evaluating items to provide additional nuance that cannot be derived when using indices or scales in analyses. Second, I evaluated EDV in two cohorts – one representing 6th grade youth (average age ~12) and the other representing 9th grade youth (average age ~15). While the cross-sectional nature of the present study provides important insights into a wider set of predictors, it may be that the pattern of predictors changes discreetly, for example from year to year. Future work evaluating predictors at each year could help address this limitation. Next, our findings of behaviors that could in some settings be healthy but in other contexts be harmful reflects a need for greater expansion of work unpacking these murkier potential risk factors. This is particularly important given that adolescence is often the premier of dating interactions, and that physiological and social changes make dating a truly unique experience during this time period – youth are trying things out for the first time, and likely learning from the experiences they have. So it may be that youth are fundamentally at greater risk of engaging in murkier risk behaviors that can be innocuous in some contexts but riskier in others. Finally, the data used in the present study was drawn from one area of the Midwest, and thus does not represent all US youth. Future work with representative samples would be a strong addition to the empirical knowledge derived from the

present study. These limitations notwithstanding, the present study provides novel, compelling information that is relevant to a greater swath of youth who are at risk of EDV and thus could be used in future screening and intervention work.

Conclusion

Though researchers have identified constructs that are associated or predictive of future EDV engagement, the present study fills a gap by evaluating individual items of each construct to understand what specific exposures are most predictive of a given domain of EDV by age. Identifying which specific events or behaviors within the wider constructs typically used in EDV research (i.e., substance use, delinquency, threat-based ACEs, deprivation-based ACEs) are most predictive of EDV constructs could potentially be used in future behavioral interventions. However, the high prevalence rate of EDV may explain why some of the more destructive behaviors such as delinquency or exposure to ACEs are a smaller subset of the most predictive factors of each EDV domain across ages. The top predictors of EDV in both the younger and older cohorts were innocuous interactions including dating behaviors and greater use of online and electronic spaces. It may be that the key in lowering the prevalence of EDV in teens is to use educational interventions to change what is considered normative and reduce the social acceptability of behaviors that can become problematic. The findings of the present study identify the priority to address highly prevalent behaviors that can go from innocuous to problematic, and can be used to help inform future measurement, screening and intervention work.

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Chapter 5 Summarization, Implications, and Future Directions

Overview

In this dissertation, I provided novel information to the field of electronic dating violence (EDV), guided by three main aims. In the first empirical paper (Chapter 2), I provided novel information on the shape of trajectories of engagement (perpetration and/or victimization) in three domains of EDV (electronic harassment, electronic coercion, and electronic monitoring) across adolescence. In the second empirical paper (Chapter 3), I evaluated the effect of EDV engagement on depressive symptoms and delinquency across adolescence. In the third empirical paper (Chapter 4), I employed machine learning to evaluate a much larger set of potential predictors of EDV to identify the specific exposures that predict EDV engagement. These were important studies to conduct for three reasons. First, despite recent publications showing the pervasiveness of youth exposure to EDV (Caridade et al., 2019; Ellyson et al., 2021), existing studies had not yielded nuanced information examining the shape of EDV trajectories across time. Second, though supposition of effect on depressive symptoms (Cava, Tomás, et al., 2020; Y. Lu et al., 2018; Zweig et al., 2014) and delinquency behaviors (Peskin et al., 2017; Van Ouytsel et al., 2017; Zweig et al., 2013), little had been done to evaluate the temporal effect of EDV on depressive symptoms and delinquency across adolescence. Finally, though work has been done to determine what predicts engagement in specific domains of EDV (Ellyson et al., 2021; Thulin et al., 2021; Thulin, Heinze, Kernsmith, et al., 2020), none had identified specific events and behaviors from typical and subtle risk factors that are most predictive of EDV. Additionally, the work I present in this dissertation is notable in that all three empirical papers

evaluate EDV as three unique domains (electronic harassment, electronic coercion, electronic monitoring). This adds to existing theoretical and statistical findings, and provides additional support to understanding the unique effect of the specific domains of electronic harassment, electronic coercion and electronic monitoring. In the remainder of this final chapter, I discuss the substantial findings and their implications for screening, intervention, and programmatic efforts and identify several future directions that may be of importance to the field given my findings across the three empirical studies in this dissertation.

Empirical Study 1: "Electronic Teen Dating Violence Curves by Age"

In the first study of this dissertation, I provided novel and important information on the average trajectory of engagement in each domain of EDV (electronic harassment, electronic coercion, and electronic monitoring) across adolescence. This expands existing researcher findings of non-linear risk of in-person forms of dating violence across adolescence (W. L. Johnson et al., 2015; Sianko et al., 2019). Studying the trajectory of EDV domains was (and is) particularly important given the high level of access to technology (Lenhart & Duggan, 2014), the unique nature of electronic dating violence (Stonard, 2020), and postulation by researchers that electronic forms of violence are particularly salient during adolescence (Twenge et al., 2019).

The finding of a general trend of non-linear increase across early adolescence (ages 12-15) with a large increase until around age 16 for all domains of EDV is critical information that can be used to inform future screening and intervention work. These findings provide additional nuance to recent researcher reports of an average age of EDV engagement at age 16 (10th grade) (Ellyson et al., 2021). Knowing that risk of EDV engagement is present as early as age 12 provides reason for prevention work in late childhood or early adolescence. Prevention work in

late childhood or early adolescence that helps youth learn healthier interpersonal skills could lower the proportion of youth who experience EDV during adolescence.

I found that risk of engagement across all EDV domains increases substantially between early and mid-adolescence. This finding may support the identification of and intervention on EDV behaviors prior to age 16. Targeting youth at mid-adolescence may be particularly important given structural and social changes youth encounter at age 16. These changes include shifts in a set of social definitions (e.g., the changing of legal and social standing in society, for example at age 16 youth are legally able to obtain a driver's license and Federal laws no longer restrict the number of hours an individual can legally work) which can increase individual physical, social, and economic autonomy (Collins & Steinberg, 2007). This additional autonomy may result in mid to late adolescents spending more time in person with others, and may translate into in-person inappropriate or abusive behavior that was conducted online prior to age 16. While further research into the shifts in risk relative to changes in social definitions may help unpack the overlap between electronic and in-person dating violence interactions (Thulin, Heinze, Kernsmith, et al., 2020), that the highest risk of EDV occurs in mid-adolescence suggests that it is an important time period for EDV screening and intervention work.

In addition to identifying trajectories, in the first empirical study I evaluated what risk and protective factors predict an individuals' starting point (intercept), the rate of increase in risk (slope), and at what point rate changes (quadratic term). Several risk factors were salient across domain of electronic dating violence and age, leading to three important conclusions. First, threat-based adverse childhood experiences and greater engagement in dating behaviors are predictive of greater risk of electronic harassment and coercion across ages. My finding lends empirical support to re-conceptualizing how ACEs are operationalized (Hawkins et al., 2021). It

also may mean that for youth living in families where threatening actions take place, observed behaviors may translate into a greater risk of unhealthy behaviors in the youth's dating relationships, potentially through Social Learning Theory (Bandura & Watlers, 1977). It may be that youth who grow up in families with greater displays of abusive or threatening behavior between family members and towards the youth may enter into dating relationships earlier to gain additional social support and have less family support to help them navigate health and unhealthy dating behaviors, including EDV. I postulate that identifying youth who have been exposed to violence within their family of origin and who are found to engage in earlier dating (even if it is healthy) be identified, and ensure that resources on healthy relating are provided to them from an early age in an attempt to prevent unhealthy behaviors including EDV from occurring.

The second major conclusion I am able to draw from the factors predicting trajectories is on the protective effect of parental monitoring and social support at certain ages. At age 12, parental monitoring was protective against all three domains of electronic dating violence for youth trajectories between 12 and 15, but was not protective against worse EDV trajectories between 15 to 18. Additionally, the type of parental monitoring mattered, and I found that active monitoring was more influential than passive monitoring (e.g., knowing of accounts, but not actually checking them). Contrary to the age-trend of parental monitoring effectiveness, social support at age 15 was protective against worse EDV trajectories from 15 to 18 but was not protective against EDV trajectories between 12 and 15 (and was even a risk factor of electronic coercion for youth age 12 to 15). These two findings of age-specific protective effects show that my use of a developmental framework is likely important when studying EDV. Further, interventions aimed at EDV should take into account developmental differences in the influence

of certain interpersonal relationships. For example, based on the findings of this first empirical paper, I believe that interventions aimed at working with early adolescents could leverage parental influence by engaging parents (or caregivers, more broadly) in more monitoring behaviors. This would be most effective if caregivers were trained on active monitoring tools, including how to have effective conversations about electronic use, increasing skills around how to check youth's use of electronics, and providing space for youth to have conversations about online interactions and implications of certain interactions (such as electronic harassment) that youth may be seeing online. For older youth, it may be that interventions within schools or activities could leverage peer relationships by changing perceptive normativity and acceptability of problematic online interactions, including harassment, coercion and monitoring. That many youth perceive these behaviors as normative in the online space likely increases the risk of EDV engagement (Stonard, 2020). Engaging youth to change what is considered normative online may be a highly effective intervention strategy for older youth who are spending more time with peers and where social support is more influential than parental monitoring.

The first study of this dissertation provides novel and important insights into the experience of EDV in adolescence and enables me to postulate future potential directions for research. Given the finding of change in risk across time, I suggest future work focus on evaluating the effect of each domain of EDV on youth mental health and behavior outcomes, such as depressive symptoms and delinquent behavior. This would be important to understand given that depressive symptoms and delinquent behaviors can cause serious disruption to healthy physical, psychological and social development (Cavanagh et al., 2017; Clayborne et al., 2019; Esmaeelzadeh et al., 2018). Additionally, longitudinal exploration of the effect of EDV on depressive symptoms and delinquent behaviors could expand existing cross sectional findings of

association (Cava, Tomás, et al., 2020; Y. Lu et al., 2018; Peskin et al., 2017; Van Ouytsel et al., 2017; Zweig et al., 2014). A second direction for future work would be for researchers to test the effectiveness of active parental monitoring between age 12 and 15 to see if it reduces engagement in EDV in mid to late adolescence (when risk of EDV may be highest). Related to this second direction, testing interventions aimed at peer group perceived normativity of online behaviors could inform both intervention and prevention programs and ultimately decrease the risk of EDV in adolescence.

Empirical Study 2: "Longitudinal Effects of Electronic Dating Violence on Depressive Symptoms and Delinquent Behaviors across Adolescence"

In the second empirical study of this dissertation, I examined what effect each domain of EDV had on internalizing (depressive symptoms) and externalizing (delinquent behaviors) outcomes while accounting for the interaction of age and gender on both outcomes. The findings of my second empirical study expand existing cross-sectional findings of an association between EDV, depressive symptoms (Cava, Tomás, et al., 2020; Y. Lu et al., 2018; Zweig et al., 2014) and delinquent behaviors (Peskin et al., 2017; Van Ouytsel et al., 2016; Zweig et al., 2014). Additional nuance of the effect of EDV over time on depressive symptoms and delinquent behaviors while accounting for gender and age is important as it provides insight on the effect of EDV on both outcomes over time. This is important because depressive symptoms and delinquency often emerge during this adolescence, can co-occur, and can be differential in long term effect by gender (Dekker et al., 2007; Diamantopoulou et al., 2011).

From the findings of this study, I can suggest several important conclusions related to the effect of EDV on depressive symptoms and delinquency across adolescence. First, supporting researcher postulation of qualitative differences between domain of EDV (Ellyson et al., 2021;

Thulin et al., 2021; Thulin, Heinze, Kernsmith, et al., 2020), the effects on depressive symptoms and delinquency are differential by domain. For example, though electronic coercion and electronic monitoring were predictive of one or both outcomes, electronic harassment was not predictive for either outcome. Based on the findings of this study, it might seem logical to draw the conclusion that electronic harassment is not problematic. However, given evidence that extreme electronic harassment can lead to extremely negative outcomes, including suicide (Taylor, 2019), when I compare the results of the present study with other findings I draw two conclusions. First, I note that electronic harassment is the most pervasive form of EDV (as was found in the first empirical paper of this dissertation), and that it might seem to at least a proportion of youth as normative (Stonard, 2020). Researchers in other areas of interpersonal violence have found that increased perceptions of normativity of violence increase the occurrence of that domain of violence (Lansford & Dodge, 2008). Though perceived normative levels of violence may not have a direct effect on depressive symptoms or delinquent behaviors in adolescence, researchers find that perceived normativity in one domain of violence is likely to increase the occurrence of other domains of violence, a phenomena described in Cultural Spillover Theory (Baron et al., 1988; Lysova & Straus, 2019). Thus, even if electronic harassment does not have direct implications on depressive symptoms or delinquent behaviors, interventions should address electronic harassment given that it is the most pervasive form of EDV and based on Cultural Spillover Theory could increase the occurrence of other domains of EDV that do effect depressive symptoms and delinquent behaviors.

Interestingly, electronic coercion was the domain that predicted both depressive symptoms and delinquent behaviors, even when controlling for gender and age. This has two important implications, the first of which relates to gender, and the second of which relates to the

intersection of sexual development that is inherent in adolescence and the sexual nature of electronic coercion. For depressive symptoms, girls and particularly older girls were more likely to report depressive symptoms. While I initially expected that this translated into greater risk for girls than boys exposed to electronic coercion, I found that electronic coercion was also predictive of delinquent behaviors, particularly for males. This expands existing findings from a college-aged population that women felt more pressure and greater threats to send sexual content than men (Gassó et al., 2020), and shows that when considering overlap of perpetration and victimization, pressure to send illicit materials is detrimental to females and males.

The other major conclusion, which has implications for both prevention and intervention work, has to do with the overlap in sexual development that typically occurs during adolescence and the sexual nature of electronic coercion. Electronic coercion is qualitatively different from harassment and monitoring in that it is both explicitly sexual in nature and it is coercive; when this behavior is not coercive, it is often called sexting. Researchers have found that sexting increases the likelihood of sexual intercourse debut (which is not necessarily problematic) and female adolescent engagement in risky sexual behavior (which is obviously problematic) (Temple et al., 2012). This is true despite that a proportion of sexting is not coercive in nature (and thus much of sexting is not abusive). However, when the sharing of illicit material is in response to coercive tactics, it becomes a form of abuse. The detrimental effect of electronic coercion on both depressive symptoms and delinquency is likely informed at least in part by the normative formation of sexual identity that begins in adolescence (Erikson, 1968), and that initial sexual experiences can have critical and long lasting effects on health and wellbeing (Joleby et al., 2020). When initial exposures are abusive in nature, they can have longitudinal effects, such as those I found in this second empirical study. Sexual coercion also carries a unique form of re-

traumatization. Unlike physical copies of text, photos, or videos, electronic forms of communication (written or media) are almost impossible to remove from the web once shared. Researchers have found that the challenge in removing content online results in long term potential re-exposure and subsequent re- victimization (Stonard et al., 2014). Additionally, there are federal consequences of having or sharing explicit images or videos of individuals under age 18, even if the subject of the images or videos and the owner of those images or videos is the same person.

The two conclusions related to sexual coercion have important implications for prevention and intervention work. First, it is clear that electronic coercion has detrimental effects on outcomes for both male and female youth, and as such, interventions should engage males and females as victims and potential perpetrators of these coercive behaviors. Second is that unlike electronic harassment or monitoring, electronic coercion is predictive of both depressive and delinquent outcomes. Although less prevalent than harassment, the finding that it is detrimental for internalizing and externalizing outcomes suggests that it is critical to focus prevention work to reduce the risk of electornic coerion.

A future direction that is highlighted by the findings of the second empirical study is the need to understand overlap and potential poly-engagement of multiple domains of EDV over time. As highlighted by Cultural Spillover Theory, perceived normativity (which researchers have found to be common of EDV) increases occurrence not only of the domain that is perceived as normal, but also of other domains, even if they are not considered normative. Testing a conceptual model in which perceived normativity of one or more domains of EDV in late childhood leads to engagement of electronic harassment (the most prevalent form, even at age 12) in pre-adolescence or early-adolescence and subsequent exposure to electronic coercion or

monitoring may help explain the mechanisms through which youth engage in various domains. This would not only allow me to test the applicability of Cultural Spillover Theory to EDV work, but could also provide potential pathways for intervention. For example, I could test if increased parental monitoring between normativity and harassment reduces subsequent engagement in electronic coercion. I could also test pathways further along the developmental pathway such as between harassment and coercion, to see if an intervention which increased social support and decreased perceptions of normativity would reduce the risk of electronic coercion. The benefit of these types of interventions could be increasing the safety of dating relationships for youth and reducing the effect of EDV on depressive symptoms and delinquent behaviors.

Study 3: "Identifying What Most Predicts Electronic Dating Violence Harassment, Coercion, and Monitoring: an Applied Machine Learning Approach"

In the third and final empirical study of this dissertation, I employed a developmental framework to identify a wider set of possible predictors and used advanced analytic and computational skills to evaluate which specific events and behaviors were most predictive of electronic harassment, electronic coercion and electronic monitoring. Predictors included both known and typically used risk factors (i.e., substance use, delinquency, and adverse childhood experiences) and factors that are more subtle but due to their prevalence and potential to be innocuous or risky (i.e., frequency of technology use in communication, dating behaviors including innocuous and violent interactions, youth's use of pornography, and youth's perception of parental monitoring). In addition to examining the wider set of constructs, in this study I prioritized evaluating individual items instead of indices or scales. While criterion validity over construct validity can be problematic, I compromised between the two by using theory to guide the overall constructs selected to be included in the model and then used data-driven analytics to

identify what was most predictive. This type of approach was beneficial for two reasons. First, I was able to investigate specific events or behaviors that were most predictive of each domain of EDV. Second, I was able to identify which factors were consistently risky across domains and which were unique predictors of the given domain without entirely sacrificing theoretically informed analytics. My findings from this third empirical paper allow me to draw several conclusions that could provide important information for future screening, prevention and intervention work.

First, I found several predictors that appear in two or three domains, such as forms of deprivation-based ACEs and greater frequency of technology use in interpersonal communication. The implication of the predictors that appear across multiple domains is that they could be leveraged to inform future screening tools. As mentioned earlier in this chapter, while the trajectories and effects of the three domains support that they are distinct from one another, the potential for overlap of domains or perceived normativity of one domain leading to engagement in other domains is high. Having a small number of items that can accurately predict two or more domains that could be used as a short screening tool could help to identify youth who are at greater risk of one or more domains of EDV engagement. A new screening tool could also be tested for longitudinal efficacy using similar machine learning method as the one used in the third empirical paper – this has been done by researchers to create screeners for other areas of violence research (Goldstick et al., 2017).

The next important contribution is the finding that many of the indicators of each domain were unique. Though this lessens the ease of creating a concise screening tool for all three domains, it reinforces prior qualitative and empirical findings that support distinction of each domain (Thulin et al., 2021; Thulin, Heinze, Kernsmith, et al., 2020; Thulin, Kusunoki, et al.,

Under Review). In addition to providing support that the domains are distinct, by evaluating both typical risk factors (such as alcohol use) and behaviors that are more normative and thus subtle risk factors (e.g., can be innocuous under certain contexts but risky under others) I've been able to explore a wider set of behaviors that could be screened for or, perhaps more importantly, could be modifiable behaviors that interventions could target. These specific behaviors could be incorporated within the earlier proposed conceptual model, which provides the benefit of additional pathways where interventions can occur.

I also found it notable that in addition to examining a wider set of variables and thus potential opportunities for intervention, the subtle variables selected are influenced by developmental changes during adolescence and could provide opportunities for prevention work. One example is that I included a wide set of dating behaviors, ranging from beneficial actions such as "asking questions to understand what the other person was trying to say" to clearly risky actions such as "slapping them". Because dating behaviors often premier during adolescence, youth have little to no romantic experiences of their own upon which to draw (Zimmer-Gembeck, 2002). They thus often end up testing out a variety of behaviors to see what is conducive to their target dating outcome (Jackson et al., 2001). The implication of the novel experience of dating, the existence of a variety of behaviors that range from clearly beneficial to clearly risk including subtle risk behaviors which can be beneficial under certain circumstances or risky in other circumstances, and that many of these subtle factors predict EDV engagement, is a potential opportunity for future prevention work. Prevention strategies that do not focus exclusively on obviously problematic or violent behaviors (such as physical violence like slapping), but also include skills on positive relating in relationships could help more youth engage in the positive side of some of these subtle behaviors and understand and avoid using

these subtle behaviors in ways that are detrimental and that may lead to engaging in violent forms of interactions in the online space. This may be particularly important given the finding that non-violent technology use was highly predictive of EDV – learning to interact in electronic spaces in non-violent ways may have important implications for a host of interpersonal interactions. Additionally, given that dating begins early (as do EDV behaviors), it may make sense that prevention strategies employ a developmental approach and holistically address interpersonal interactions both in-person and online to reduce the risk of EDV engagement.

Conclusion

In the present dissertation, I expanded the field of EDV research through three main aims. First, I found that electronic dating violence is a prominent problem. Risk increases quadratically during adolescence, with rapid increase occurring in mid-adolescence. I found that both risk and protective factors predicted the average starting point (intercept), rate of increase (slope), and inflection points (quadratic term), which may reflect developmental changes in autonomy and shifts in the magnitude of peer influence that are distinct features of adolescence. The findings of the first empirical paper suggest that screening and intervention work during mid-adolescence may capture and thus serve the greatest number of youth who are engaging in EDV. In my second empirical paper, I found that domains of EDV have longitudinal effects on depressive and delinquent behaviors. The implications of this second study stress the need for interventions for EDV engagement, and potential prevention work to avoid the negative effects that EDV has on depressive symptoms and delinquent behaviors. Further, though the most prevalent form of EDV did not have a direct effect on depressive symptoms and delinquency, a future direction is to apply Cultural Spillover Theory which postulates that normativity of a given domain of violence increases not only the prevalence of that domain, but the prevalence of other domains of

violence, even if they are not socially normative. The testing of a conceptual model would potentially provide multiple pathways for intervention. Finally, in the third empirical paper, I evaluated both typical and more subtle factors that become highly normative during adolescent development to understand what individual events or behaviors are most predictive of each domain of EDV. The findings from the third empirical study have several broader implications. First, finding several predictors across multiple domains of EDV provides an opportunity for the future development of a screener for any domain of EDV. Secondly, that many of the predictors were predictive of only one domain further emphasizes the distinct nature of each domain of EDV. Third and finally, that many of the unique predictors were more subtle forms of risk that become highly normative during adolescence is an opportunity to develop preventative programs that address both obviously risky behaviors (like the use of physical violence in dating relationships) as well as behaviors that are more subtle and could potentially be leveraged by preventative programming to be used in ways that are beneficial and not harmful within youth dating relationships.

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