Journal of Adolescent Health 57 (2015) 305–312

ELSEVIER

JOURNAL OF ADOLESCENT HEALTH

www.jahonline.org

Original article

Longitudinal Associations Between Cybervictimization and Mental Health Among U.S. Adolescents

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Article history: Received September 30, 2014; Accepted May 15, 2015
Keywords: Cyberbullying; Victimization; Anxiety; Bullying; Harassment; Longitudinal; Internet; Depression

A B S T R A C T

Purpose: An emerging body of literature suggests that victims of bullying report detrimental mental health outcomes, such as depression and anxiety. The purpose of this study was to explore the relationship between cybervictimization, depression, and anxiety among school-aged youth over a 3-year time frame.
Methods: Students in Grades 6 through 12 at the initial wave of the study responded to survey items designed to assess their online experiences, including cybervictimization and self-reported depression and anxiety at three separate time points, over a 3-year period. In total, 559 school-aged youth participated in the study.
Results: Results suggest a reciprocal relationship between cybervictimization and depression and cybervictimization and anxiety. More specifically, depression at Time 1 predicted cybervictimization at Time 2, depression at Time 2 predicted cybervictimization at Time 3, and cybervictimization at Time 1 predicted depression at Time 3. Additionally, cybervictimization at Time 1 predicted anxiety at Time 2, cybervictimization at Time 2 predicted anxiety at Time 3, and anxiety at Time 1 predicted cybervictimization at Time 2.
Conclusions: Based on the findings from this study, cybervictimization, depression, and anxiety seem to have a reciprocal relationship. Therefore, educational and mental health professionals should consider interventions that address adolescents' online experiences, while supporting mental health and social and emotional learning.

IMPLICATIONS AND CONTRIBUTION

A reciprocal relationship exists between cybervictimization and mental health outcomes over time. Given the increasing prevalence of cybervictimization and its relationship to depression and anxiety, interventions should target both mental health and bullying prevention.

In an era of evolving technology, where youth have always experienced a world with Internet access, students are engaging in electronic activities for communication, socialization, leisure, and knowledge acquisition. Although these advancements in technology have transformed the social milieu, affording students immediate access to information and potentially increasing intellectual capacity [1], they have also established a precedent for perpetual "connectedness." For example, 95% of adolescents have access to the Internet [2], with electronic media exposure eclipsing 10 hours per day [3]. Although the benefits to these advancements cannot be disputed [4], perpetual "connectedness" may set the stage for increased risk of cybervictimization.

We draw on Hinduja and Patchin's (2009) definition of cyberbullying victimization as "willful and repeated harm inflicted through the use of computers, cell phones, and other electronic devices" ([5], pp 5) and recognize experiences that may occur only once (i.e., online harassment). Drawing parallels with traditional bullying literature, cyberbullying may include an

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1054-139X/
http://dx.doi.org/10.1016/j.jadohealth.2015.05.002

imbalance of power, where individuals cannot easily defend themselves [6], which may be attributed to the technological aptitude of the aggressor [6]. Cyberbullying can also include several topographies of behaviors [7] and manifest through diverse contexts [6]. Given the breadth of avenues for cybervictimization and high rates of electronic media consumption, it is conceivable that long-term exposure to cyberbullying is related to negative psychosocial outcomes.

Traditional versus cyberbullying and mental health

Given the advancing landscape of technology and media consumption among youth, we initially examine the relationship between depression and cybervictimization through a traditional bullying lens. Kaltiala-Heino et al. [8] suggested that students who experienced frequent victimization were 4.2 times more likely to report depression than students who are not victimized. These findings suggest that students who experience moderate to high levels of traditional victimization report higher levels of depression [9–11]. Ttofi et al. [12] conducted a meta-analysis examining victimization and depression and determined that victims of school bullying were 1.74 times more likely to report depression during subsequent time points. However, in a 4-year longitudinal study, Klomek et al. [13] determined that students who are directly involved in bullying without comorbid serious depression or current suicidal ideation were significantly less likely to report depression and suicide ideation over time than students who began the study as perpetrators, victims, or bully-victims with comorbid depression or current suicidal ideation.

Cross-sectional cyberbullying studies have revealed that excessive Internet use is related to detrimental psychosocial symptoms [14,15], and students who experience cybervictimization report higher levels of depression than students who have not experienced cyberbullying [16,17]. Therefore, an overlap between mental health outcomes associated with traditional victimization and cybervictimization exists; yet, an emerging body of literature also suggests that these forms of victimization may diverge. Bonanno and Hymel [18] suggest that involvement in cyberbullying, either as a perpetrator or as a victim, uniquely predicted depression and suicidal ideation above traditional bullying involvement. Schneider et al. [19] reported that students who only experience traditional victimization, cybervictimization, and both forms of victimization are 2.31, 3.26, and 5.64 times more likely to report depression than students who are not victimized respectively. Moreover, Gini and Espelage [20] reported that cybervictimization was more strongly associated with suicidal ideation than traditional forms of bullying.

Similar to depression, an empirical link between anxiety and victimization has been established. Depression and anxiety are common outcomes related to traditional victimization [21], and comorbidity is common [22]. Theoretical models suggest that comorbidity may be attributed to overlap in definitions, may represent a single construct, reciprocity between the constructs, population stratification, or a fundamental link between predictive factors [23]. Cummings et al. [23] "maintain that anxiety and depression are separate but meaningfully related constructs" (pp 823), where they propose a multiple pathways model that suggests comorbidity may exist in a subset of individuals that maintain parallel antecedents for both depression and anxiety; but, in other subsets of individuals, comorbidity may develop due to the reciprocity of depression and anxiety. This development may be attributed to a combination of social/environmental, biological, and behavioral risk factors. Antisocial or adverse interactions with peers, including victimization, may serve as a social/environmental risk factor for anxiety [11,24].

The social and environmental factors associated with physical environments may deviate from the purview of online environments. For example, there is a perception of anonymity in online environments [25]; yet, the perpetual "connectedness" transcends physical and electronic boundaries, where cyberbullying may result in immediate repetition through electronic distribution to large subsets of peers [26]. To illustrate this point, Dempsey et al. [26] determined that cybervictimization was a distinctly different construct from traditional and relational victimization, and increased levels of cybervictimization was associated with escalated rates of social anxiety, but not depression.

Are mental health problems antecedents or consequences of cybervictimization?

A small number of longitudinal studies of cyberbullying show associations with poor mental health, substance use, and problem behavior [27,28]. A central question these studies attempt to answer is whether youth that exhibit depressive symptoms go into online spaces or behave in ways that make them more susceptible to experiencing cybervictimization or is depression a consequence of these experiences [29]. For example, longitudinal study by Gamez-Guadix et al. [27] explores associations between cybervictimization, depression, substance use, and problematic Internet use. They found that victimization at Time 1 predicted depression and problematic Internet use at Time 2. In addition, increased levels of depressed mood and substance use at Time 1 predicted more victimization at Time 2. However, additional time points may be needed to fully understand the temporal sequence of cybervictimization and mental health outcomes.

The present study

The present study was designed to directly address these gaps in the literature by exploring the longitudinal relationship between cybervictimization and depression and anxiety, where anxiety and depression were examined as separate constructs, guided by the following research questions. What is the predictive relationship between cybervictimization and depression and cybervictimization and anxiety over time?

Methods

Population

The sample for the present study was derived from a federally funded, longitudinal study designed to explore the online experiences adolescents, with an a priori emphasis on racial and ethnic diversity. The sample includes 559 students that participated in the study over three waves of data collection, with 251 males (44.9%) and 308 females (55.1%) from 12 Midwestern schools in Grades 6 (17.5%), 7 (15.0%), 8 (17.2%), 9 (13.1%), 10 (22.7%), 11 (10.7%), and 12 (3.8%) during the initial administration of the study. The racial breakdown includes 183 (32.7%) African-American, 180 (32.2%) Caucasian, 96 (17.2%) Latino/a, 44 (7.9%) biracial, 36 (6.4%) Asian or Asian American, 12 (2.1%) Native American, and 8 (1.4%) "other." The participation rate averaged

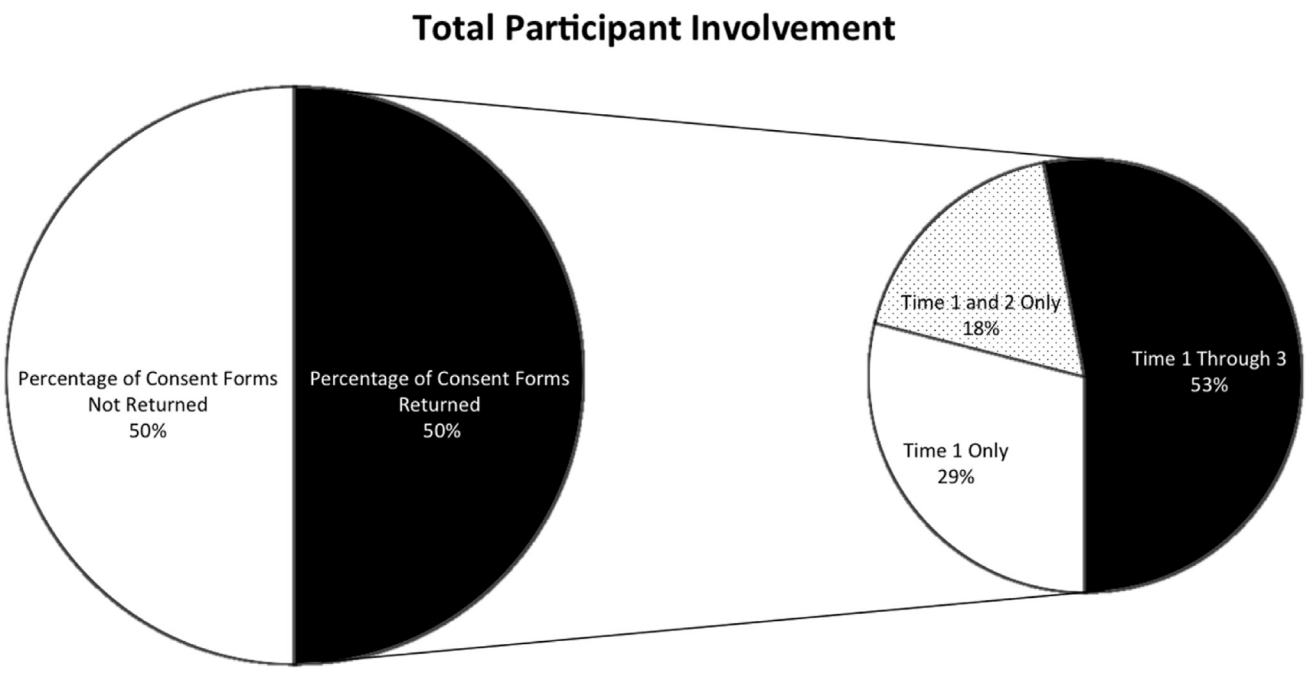

Figure 1. Total sampling distribution over three time points.

49.8%, with a retention rate of 71% from Time 1 to Time 2 and 74% from Time 2 to Time 3 (see Figure 1).

Procedure

Respondents were recruited in collaboration with school administrators, where research assistants gave a 10-minute presentation to selected classes and distributed approximately 150 parental consent forms per school, which were available in English and Spanish. Care was taken to ensure students were representative of the general population of each school, including a range of socioeconomic status backgrounds, technical and cognitive abilities, and racial-ethnic groups. On a prearranged date, researchers returned to each school to administer surveys via Web link to students who returned the affirmative parental consent forms. During administration, research assistants were present to inform students of confidentiality, explain terms, and troubleshoot any technical difficulties. Surveys were completed at three separate time points over the duration of the study, and each subsequent survey administration was completed between 10 to 12 months after the previous administration. On completion or termination of the survey, all students were provided with online counseling and safety resources. The institutional review board of the principal investigator's institution approved all procedures, and all necessary approvals were acquired from partner schools and school boards.

Measures

Cybervictimization. The six-item Online Bullying and Harassment subscale from the Online Victimization Scale [30] was used to measure respondents' experiences with cybervictimization. To assess the longitudinal experiences of cybervictimization, respondents were asked to "choose how many times these things happened to you online in the *last year*." The cybervictimization items included "People have said mean or rude things about the way that I talk (write) online," "People have posted mean or rude things about me on the Internet," "I have been harassed or bothered online because of something that happened at school," "I have been embarrassed or humiliated online," "I have been bullied (repeated name calling or harassment) online," and "People have said mean or rude things about how I look, act, or dress online." Response options included "0 = Never," "1 = Once," "2 = A Few Times a Year," "3 = A Few Times a Month," and "4 = Almost Daily."

The Online Victimization Scale [30] was validated in a two-phase confirmatory factor analysis with a diverse sample of adolescents in Grades 9 through 12. In Phase 1, the four factor model (i.e., online bullying and harassment, online sexual victimization, individual online racial discrimination, vicarious online racial discrimination) demonstrated acceptable model fit; $\chi^2_{(186)} = 556.709$, root mean square error of approximation (RMSEA) = .096, Tucker-Lewis Index (TLI) = .916, comparative fit index (CFI) = .927, Incremental Fit Index (IFI) = .927. In the second phase, an additional confirmatory factor analysis was conducted with a separate diverse sample to demonstrate consistency across samples. In this phase, the four factor model mirrored the previous phase and demonstrated acceptable model fit ($\chi^2_{(183)} = 570.303$, RMSEA = .087, TLI = .930, CFI = .939, IFI = .939). To demonstrate generalizability to the current sample, a confirmatory factor analysis was conducted for the current sample, where the Bullying and Harassment subscale of the Online Victimization Scale [30] maintained acceptable model fit; $\chi^2_{(15)} = 36.596$, RMSEA = .051 (.030; .072), TLI = .987, CFI = .995, IFI = .995. Cronbach's alpha for the present study was .84, .90, and .92 for time points 1 through 3, respectively.

Depression. A 12-item version of the Center for Epidemiologic Studies Depression Scale was used to measure adolescents' depressive symptoms [31]. Sample items include "I felt I was just as good as other people" and "I had crying spells". Response

Table 1
Correlations, means, and standard deviations among the latent constructs

Construct	CV1	CV2	CV3	DEP1	DEP2	DEP3	ANX1	ANX2	ANX3
CV1	1.00								
CV2	.39*	1.00							
CV3	.29*	.55*	1.00						
Dep1	.35*	.26*	.23*	1.00					
Dep2	.20*	.35*	.27*	.50*	1.00				
Dep3	.26*	.27*	.38*	.48*	.52*	1.00			
Anx1	.27*	.20*	.18*	.45*	.31*	.29*	1.00		
Anx2	.15*	.31*	.19*	.26*	.46*	.29*	.30*	1.00	
Anx3	.12*	.16*	.27*	.26*	.32*	.54*	.35*	.30*	1.00
Means	.24	.47	.60	.85	.88	.89	.72	.74	.82
Standard deviation	.53	.76	.85	.48	.49	.51	.83	.90	.99
% End (n)	53.5 (299)	53.3 (298)	59.4 (332)	98.6 (551)	99.1 (554)	98.0 (548)	67.3 (376)	64.6 (361)	62.6 (350)
High end (*n*)	7.2 (40)	18.4 (103)	24.3 (136)	17.0 (95)	18.6 (104)	22.2 (124)	18.6 (104)	19.0 (106)	22.7 (127)

*Significant at the .01 level.
% End represents individuals who affirmed at least one item on the scale, and high end represents the percentage or respondents who were at least one standard deviation above the pooled mean and standard deviation. Pooled means and standard deviations for cybervictimization = .45, .56; depression = .87, .36; and anxiety = .76, .66, respectively.
Anx = anxiety, number represents the time point of administration; CV = cybervictimization; Dep = depression.

options ranged from "0 = Rarely or none of the time" to "3 = Most or all of the time." To establish generalizability to the current sample, a confirmatory factor analysis was conducted for the current sample, where the 12-item version of the Center for Epidemiologic Studies Depression Scale [31] demonstrated acceptable model fit; $\chi^2_{(15)} = 32.570$, RMSEA = .046 (.024; .067), TLI = .978, CFI = .991, IFI = .991. Cronbach's alpha for the present study was .71, .73, and .77 for time points 1 through 3, respectively.

Anxiety. Anxiety was assessed using four items from the tension subscale of the Profile of Mood States-Adolescents [32]. Participants were asked to describe the extent that they felt each of the following: "panicky," "anxious," "worried," and "nervous." Responses ranged from "0 = Not at all" to "4 = Extremely." To establish generalizability to the current sample, a confirmatory factor analysis was conducted for the current sample, where the tension subscale of the Profile of Mood States-Adolescents [32] demonstrated acceptable model fit; $\chi^2_{(15)} = 19.684$, RMSEA = .024 (.000; .049), TLI = .996, CFI = .998, IFI = .998. Cronbach's alpha for the present study was .84, .90, and .92 for time points 1 through 3, respectively.

Missing data

To address the issue of missing data, a multiple imputation procedure was executed using SPSS version 21 (IBM Corp., Armonk, NY) through the fully conditional specification Markov Chain Monte Carlo maximum likelihood algorithm. Overall, 10 fully imputed datasets were computed at the item level by time of administration [33] and aggregated to create one parsimonious dataset [34]. Respondents were retained if they completed at least two time points of administration on each of the three constructs, and missing data were treated as Missing Completely at Random. A missing values analysis was conducted before imputation, and it was determined that the mean level of missingness by item was 3.85% in Time 1, 1.61% in Time 2, and 3.37% in Time 3. Although Luengo et al. [35] reported that missingness below 5% is manageable; the multiple imputation procedure was used to create a parsimonious dataset that was the best possible representation of the data.

Analytic procedures

Longitudinal structural equation modeling was used to explore the longitudinal effects of cybervictimization on depression and anxiety. The approach was appropriate for the data structure because structural equation modeling allows the exploration of similarities and differences of latent constructs over time, while simultaneously controlling for measurement error [34]. To ensure appropriate data fit, a measurement model was established with freely estimated parameters. Because the scales have been subject to several factor analytic procedures, and it was the a priori decision to test the structural models, the freely estimated measurement model served as the foundation for all subsequent structural models. Once the measurement model was fit, separate structural models were constructed for depression and anxiety by cybervictimization over time.

To establish the measurement and structural models, an item-to-construct balancing procedure was conducted to create parcels for cybervictimization, depression, and anxiety [34]. Parcels represent aggregate-level indicators to establish a just-identified model (i.e., a model with one unique solution), and this method was used because the focus of the study was on the construct, not item-level indicators. To establish the parcels, separate exploratory factor analytic procedures were conducted by construct, and the three highest loadings were used to anchor the parcels, and the next highest loadings were added to the anchors in inverse order [34].

After the data were imputed, and the parcels were created, both the freely estimated and longitudinal structural models were constructed using SPSS AMOS version 22 (IBM Corp.). Once all the nonsignificant paths were trimmed from the original structural model to establish the final structural model, the χ^2 difference test was used to determine if model fit was impacted by the removal of the paths. Model fit was evaluated through χ^2, RMSEA, TLI, and CFI. RMSEA scores below .08 and TLI and CFI scores greater than .90 are considered acceptable.

Results

Associations between the constructs revealed that each time point of cybervictimization was positively associated with each time point of depression, ranging from $r = .20^{**}$ to $r = .38^{**}$, and anxiety, ranging from $r = .12^{**}$ to $r = .27^{**}$ (see Table 1). In addition to the associations, basic descriptives were assessed. Percentages of respondents who endorsed each scale (i.e., affirmed at least one item on the scale) were calculated, where 53.5% endorsed at

Table 2
Loadings, intercepts, estimated latent variance, unique residuals, and squared multiple correlations for estimated measurement model for cybervictimization, depression, and anxiety

Scale	λ	τ	λ^a	θ	R^2
CV Time 1					
Parcel 1	1.00	.29 (.03)	.88	.08 (.01)	.78
Parcel 2	.82 (.04)	.20 (.02)	.81	.10 (.01)	.66
Parcel 3	.90 (.04)	.22 (.02)	.82	.11 (.01)	.68
CV Time 2					
Parcel 1	1.00	.44 (.03)	.90	.11 (.01)	.81
Parcel 2	.90 (.03)	.43 (.03)	.87	.13 (.01)	.76
Parcel 3	1.04 (.04)	.49 (.04)	.89	.15 (.01)	.79
CV Time 3					
Parcel 1	1.00	.55 (.04)	.92	.11 (.01)	.85
Parcel 2	.93 (.03)	.56 (.03)	.91	.11 (.01)	.83
Parcel 3	1.04 (.03)	.63 (.04)	.91	.14 (.01)	.83
Dep Time 1					
Parcel 1	1.00	.92 (.03)	.38	.29 (.02)	.15
Parcel 2	2.39 (.29)	.89 (.03)	.89	.08 (.02)	.79
Parcel 3	2.07 (.23)	.71 (.03)	.77	.14 (.02)	.60
Dep Time 2					
Parcel 1	1.00	.95 (.03)	.31	.32 (.02)	.09
Parcel 2	2.84 (.40)	.92 (.03)	.87	.08 (.02)	.76
Parcel 3	2.63 (.38)	.73 (.03)	.76	.16 (.02)	.58
Dep Time 3					
Parcel 1	1.00	.97 (.03)	.38	.33 (.02)	.15
Parcel 2	2.28 (.26)	.95 (.03)	.92	.05 (.02)	.85
Parcel 3	2.20 (.24)	.76 (.03)	.81	.14 (.02)	.66
Anx Time 1					
Parcel 1	1.00	.87 (.04)	.86	.32 (.02)	.74
Parcel 2	1.06 (.06)	.73 (.05)	.80	.41 (.04)	.64
Parcel 3	.67 (.04)	.42 (.03)	.70	.32 (.02)	.48
Anx Time 2					
Parcel 1	1.00	.89 (.04)	.85	.31 (.02)	.72
Parcel 2	1.08 (.06)	.77 (.05)	.83	.38 (.04)	.68
Parcel 3	.73 (.04)	.42 (.04)	.74	.28 (.03)	.55
Anx Time 3					
Parcel 1	1.00	.94 (.05)	.94	.13 (.03)	.88
Parcel 2	1.04 (.04)	.92 (.05)	.85	.41 (.04)	.72
Parcel 3	.71 (.03)	.51 (.04)	.77	.34 (.02)	.60

Anx = anxiety; CV = cybervictimization; Dep = depression; R^2 = squared multiple correlation; λ = loading estimates (standard error); τ = intercept estimates; λ^a = standardized loadings-common metric completely standardized; θ = residual (standard error).

least one item on the cybervictimization scale at Time 1, compared with 59.4% at Time 3; 98.6% endorsed at least one item on the depression scale at Time 1, compared with 98.0% at Time 3; and 67.3% endorsed at least one item on the anxiety scale at Time 1, compared with 62.6% at Time 3. High endorsement for each scale was calculated by establishing a pooled mean score (i.e., total mean score for all time points) and standard deviation and defining high endorsement by one standard deviation above the pooled mean score by time point. For cybervictimization, 7.2% reported high cybervictimization at Time 1, 18.4% at Time 2, and 24.3% at Time 3. Depression and anxiety followed a similar pattern with 17.0% at Time 1, 18.6% at Time 2, and 22.2% at Time 3 for depression and 18.6% at Time 1, 19.0% at Time 2, and 22.7% at Time 3 for anxiety (see Table 1).

Table 3
Fit indices for final measurement model, comparative independence model, fully estimated structural model, and final trimmed structural model for cybervictimization and depression and cybervictimization and anxiety

Model	χ^2	*df*	*p*	RMSEA	90% RMSEA CI	CFI	TLI
Measurement model for cybervictimization and depression							
Final CFA	265.00	108	.000	.05	.04–.06	.97	.96
Independence model	6,174.75	153	.000	.27	.26–.27	.00	.00
Fully estimated model	510.66	125	.000	.07	.07–.08	.94	.92
Final model	514.08	128	.000	.07	.07–.08	.94	.92
Measurement model for cybervictimization and anxiety							
Strong CFA	197.61	108	.000	.04	.03–.05	.99	.98
Independence model	6,763.78	153	.000	.28	.27–.28	.00	.00
Fully estimated model	361.06	125	.000	.06	.05–.07	.96	.96
Final model	362.96	128	.000	.06	.05–.06	.96	.96

CFA = confirmatory factor analysis; CFI = comparative fit index; RMSEA = root mean square error of approximation; 90% RMSEA CI = 90% confidence intervals for root mean square error of approximation; TLI = Tucker-Lewis Index.

Table 4
β Weights and *z*-scores for the final structural model for cybervictimization and depression and cybervictimization and anxiety

Construct	*B* (standard error)	*z*-Score	β
Structural model for cybervictimization and depression			
Auto-regressive paths: cybervictimization			
CV1–CV2	.60 (.06)	10.06**	.45
CV2–CV3	.60 (.05)	12.89**	.53
Auto-regressive paths: depression			
Dep1–Dep2	.65 (.06)	11.66**	.63
Dep2–Dep3	.67 (.06)	11.97**	.63
Cross-lagged paths: cybervictimization and depression			
CV1–Dep3	.15 (.04)	3.56**	.15
Dep1–CV2	.30 (.06)	4.75**	.21
Dep2–CV3	.21 (.06)	3.34**	.14
Structural model for cybervictimization and anxiety			
Auto-regressive paths: cybervictimization			
CV1–CV2	.63 (.06)	10.50**	.47
CV2–CV3	.66 (.05)	14.09**	.58
Auto-regressive paths: anxiety			
Anx1–Anx2	.38 (.06)	6.74**	.35
Anx2–Anx3	.37 (.06)	6.57**	.32
Cross-lagged paths: cybervictimization and anxiety			
Anx1–CV2	.20 (.06)	3.51**	.15
CV1–Anx2	.11 (.05)	2.12*	.10
CV2–Anx3	.10 (.04)	2.19*	.10

*Significant at the .05 level, ** Significant at the .01 level.
Anx = anxiety; number represents the time point of administration; CV = cybervictimization; Dep = depression.

Measurement and structural models

Depression. To establish preliminary model fit, a freely estimated measurement model (i.e., no specified parameter restrictions) was established for cybervictimization and depression. Loadings by parcels ranged from λ = .81 to λ = .92 for cybervictimization and λ = .31 to λ = .92 for depression (see Table 2). In addition to the acceptable parcel loadings, the measurement model represented a close fit of the data; $\chi^2_{(108)} = 265.00$, $p < .001$, RMSEA = .05, TLI = .96, CFI = .97 (see Table 3).

The full structural model, including all autoregressive (i.e., path from one construct to the same construct at a subsequent time point) and cross-lagged (i.e., path from one construct to a different construct at a subsequent time point) paths represented an acceptable fit of the data; $\chi^2_{(125)} = 510.66$, RMSEA = .07, TLI = .92, CFI = .94. After the initial fit of the structural model, all nonsignificant paths were sequentially removed resulting in an acceptable fitting model; $\chi^2_{(128)} = 514.08$, RMSEA = .07, TLI = .92, CFI = .94. To establish invariance between the models, the χ^2 difference test was employed, and it was determined that there were nonsignificant differences between the models ($\Delta\chi^2_{(3)} = 3.42$, $p > .05$), suggesting that the removal of the nonsignificant paths was tenable (see Table 3).

The final structural model included both autoregressive and cross-lagged paths (see Table 4). The autoregressive paths for

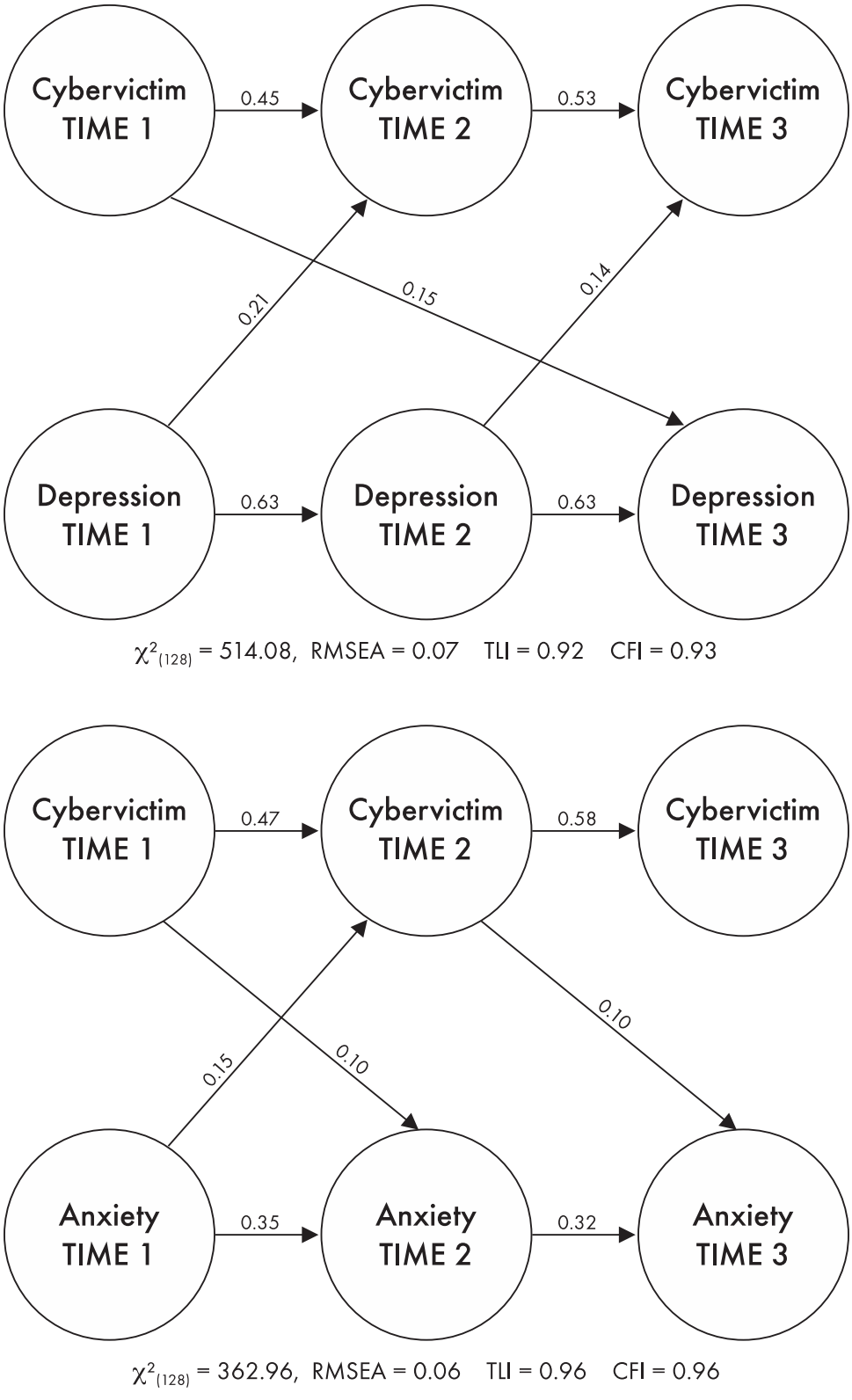

Figure 2. Structural models for cybervictimization and depression (top) and cybervictimization and anxiety (bottom).

cybervictimization were retained for Time 1 to Time 2 ($\beta = .45$) and Time 2 to Time 3 ($\beta = .53$) and for depression for Time 1 to Time 2 ($\beta = .63$) and Time 2 to Time 3 ($\beta = .63$). Significant cross-lagged paths included depression at Time 1 to cybervictimization at Time 2 ($\beta = .21$), depression at Time 2 to cybervictimization at Time 3 ($\beta = .14$), and cybervictimization at Time 1 to depression at Time 3 ($\beta = .15$). Figure 2 represents the final structural model for cybervictimization and depression.

Anxiety. To establish preliminary model fit, a freely estimated measurement model was established for cybervictimization and anxiety. Loadings by parcels ranged from $\lambda = .81$ to $\lambda = .92$ for cybervictimization and $\lambda = .70$ to $\lambda = .94$ for anxiety (see Table 2). In addition to the acceptable parcel loadings, the measurement model represented a close fit of the data; $\chi^2_{(108)} = 197.61$, $p < .001$, RMSEA = .04, TLI = .98, CFI = .99 (see Table 3).

The full structural model, including all autoregressive and cross-lagged paths represented an acceptable fit of the data; $\chi^2_{(125)} = 361.06$, RMSEA = .06, TLI = .96, CFI = .96. Following the initial fit of the structural model, all nonsignificant paths were sequentially removed resulting in an acceptable fitting model; $\chi^2_{(128)} = 362.96$, RMSEA = .06, TLI = .96, CFI = .96. To establish invariance between the models, the χ^2 difference test was employed, and it was determined that there were nonsignificant differences between the models ($\Delta\chi^2_{(3)} = 1.90$, $p > .05$), suggesting that the removal of the nonsignificant paths was tenable (see Table 3).

The final structural model included both autoregressive and cross-lagged paths (see Table 4). The autoregressive paths for cybervictimization were retained for Time 1 to Time 2 ($\beta = .47$) and Time 2 to Time 3 ($\beta = .58$) and for anxiety for Time 1 to Time 2 ($\beta = .35$) and Time 2 to Time 3 ($\beta = .32$). Significant cross-lagged paths included cybervictimization at Time 1 to anxiety at Time 2 ($\beta = .10$), cybervictimization at Time 2 to anxiety at Time 3 ($\beta = .10$), and anxiety at Time 1 to cybervictimization at Time 2 ($\beta = .15$). Figure 2 represents the final structural model for cybervictimization and anxiety.

Discussion

The present study examined the predictive relationship between cybervictimization and depression and anxiety over time. This study was designed to directly evaluate depression and anxiety as independent constructs and their unique relationship to cyberbullying. As anticipated, associations between cybervictimization and depression and anxiety were significant for each time point of administration [18,20]. Additionally, the measurement model demonstrated that cybervictimization, depression, and anxiety were stable over time.

Autoregressive paths

Positive autoregressive paths were found for cybervictimization, where the level of cybervictimization at one time point was predictive of subsequent time points, after controlling for the levels at previous time points, suggesting that cybervictimization increased over time. Although few studies have examined cybervictimization over time, in a cross-sectional analysis, Rose et al. [36] used the Bullying and Harassment subscale of the Online Victimization Scale [30] to evaluate prevalence rates of cybervictimization among a diverse sample (n = 14,508) of adolescents in Grades 6 through 12 and determined that approximately 47% of adolescents endorse at least one item on the subscale, with 12% reporting high levels of cybervictimization. Although these findings are similar to the present study, Tokunga [37] argued that extant cyberbullying research demonstrates a curvilinear relationship, where prevalence levels peak during seventh and eighth grade. Although this postulation supports traditional victimization literature [38], it also demonstrates the necessity of evaluating cybervictimization over time. However, it should be noted that the present study was situated by time of administration, not grade level, which suggests that the number of students who experienced cybervictimization increased over each subsequent time point (1 year apart).

Similar positive autoregressive paths were found for depression and anxiety, with levels of depression and anxiety at one time point predicting increased levels of depression and anxiety at subsequent time points. Because the scales used to assess depression and anxiety for the present study are psychometric proxies for a construct of interest and not a diagnostic tool for depression or anxiety diagnosis, we cannot postulate on psychiatric diagnoses. However, based on Cummings et al. [23] multiple pathways model, it is conceivable that if depression and/or anxiety go undiagnosed and without intervention, adolescence are unlikely to independently resolve these complications.

Depression, anxiety, and cybervictimization

Cross-sectional studies suggest that increased levels of traditional victimization [9–11] and cybervictimization [16,17] are associated with higher levels of depression. Viewing this relationship through a cross-sectional lens suggests that this relationship is directly linear, where victimization is predicting depression [37]. Tokunaga et al. [37] argued that cyberbullying should be viewed through a nonrecursive (i.e., bidirectional) lens, where the ongoing process of cyberbullying is cyclical.

The present study adds credibility to the nonrecursive model, where findings suggest that cybervictimization and depression represent a reciprocal relationship, and students who reported high depression at Time 1 and Time 2 reported higher levels of cybervictimization at Time 2 and Time 3, respectively and respondents who reported higher levels of cybervictimization at Time 1 reported higher levels of depression at Time 3. These findings parallel traditional bullying literature that suggest students who report depressive symptoms are more likely to experience subsequent victimization [10,39] because they may appear more vulnerable [21,40]. However, this study suggests that vulnerability may extend to online contexts.

In contrast to the findings with depression, we found students reporting higher levels of cybervictimization at Time 1 and Time 2 reported higher levels of anxiety at Time 2 and Time 3 and participants who reported more anxiety at Time 1 reported higher levels of cybervictimization at Time 2. It may be the case that students developed a toolkit for managing symptoms of anxiety over time, and thus no relationship was found between Time 1 and Time 3, as was the case with depression. For example, Tynes et al. [41] found that ethnic identity moderated the association between race-based cybervictimization and anxiety but not for depression.

Limitations and future research

Although this study addressed notable gaps in the literature, it is not without limitation. First, data were examined by wave of

administration, so implications for grade and/or age could not be established. Second, demographic variables were not included in the models, limiting the generalizability of the findings. Third, this study did not account for Internet access, time online, or online activities, which may further the understanding of the relationship between cyberbullying, depression, and anxiety. Given these limitations, future research should examine these relationships while accounting for potential mitigating factors, such as age, demographics, and frequency of Internet use.

Implications and contributions

This study demonstrated the reciprocal relationship between cybervictimization and mental health outcomes over time. Given the increasing prevalence of cybervictimization over time and the reciprocity between cybervictimization and depression and anxiety, educational stakeholders must attend to the mental health and bully prevention policies. More specifically, bullying prevention legislation should include provisions and guidance for schools to address and reduce cybervictimization among adolescents. Additionally, educational stakeholders should implement multitiered systems of support that include universal and targeted interventions that specifically address online experiences and safety while supporting the mental health of school-aged youth through social and emotional learning and skill development.

Funding Sources

This work was supported by the Eunice Kennedy Shriver National Institute of Child Health & Human Development of the National Institute of Health under Award Number R01HD061584.

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