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Peer victimization and suicidal thoughts and behaviors in depressed adolescents

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Abstract

Suicide is a leading cause of death among youth worldwide, and depressed adolescents are at a significantly elevated risk to report suicidal ideation, planning, and attempts. Peer victimization is a robust predictor of adolescent suicidal thoughts and behaviors (STBs), but little research has focused on why bullying leads to suicidal thoughts and behaviors. To address this empirical gap, we recruited 340 (246 female) depressed adolescents ages 13–19 ($M = 15.59$, $SD = 1.41$) within 48 hours of admission for acute psychiatric treatment. At the initial assessment, participants were administered clinical interviews characterizing psychopathology, nonsuicidal self-injury, and STBs (ideation, plans, and attempts). Further, they completed questionnaires assessing 3 forms of victimization (overt, relational, and reputational), recent risky behavior engagement, and psychiatric symptom severity. Controlling for internalizing symptoms and age, overt and reputational bullying were associated with more frequent past month suicide attempts, but not suicide ideation. Past month risky behavior engagement, but not NSSI, mediated the relation between victimization and attempts. However, sex differences revealed that this effect only held for males whereas bullying was directly associated with suicide attempts among females. In contrast, overt and relational bullying were non-linearly associated with suicide plans, and these relations were not mediated by risky behaviors or NSSI. Results highlight the complex network of factors that lead victimized adolescents to engage in STBs and may inform targeted suicide prevention and intervention programs.

Keywords

Adolescents; Suicide; Peer Victimization; Risky Behavior Engagement; Non-Suicidal Self-Injury

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Compliance with Ethical Standards

Ethical Approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent: Informed consent was obtained from all individual participants included in the study.

Conflict of Interest: The authors declare that they have no conflict of interest.

Suicide is a leading cause of death among youth worldwide (McLoughlin, Gould, & Malone, 2015). Rates of suicide ideation and attempts among adolescents are 12–17% and 4–8%, respectively (Kann et al. 2014; Nock et al. 2013), and these experiences markedly increase risk for suicide deaths (Finkelstein et al. 2015). Peer victimization, defined as intentional aggression enacted by a perpetrator more powerful than their victim (Olweus 2013), is a known contributor to suicide. Approximately 35% of adolescents report being bullied (Modecki et al. 2014), and these experiences are associated with 2- to 3-fold increased odds of suicide ideation and attempts (Holt et al. 2015). Despite these alarming statistics, little research has focused on why victimization contributes to suicidal thoughts and behaviors (STBs). Consequently, the present study tests behavioral mechanisms that may partially account for the relation between peer victimization and STBs among depressed adolescent inpatients, a population with especially high rates of suicide ideation, plans, and attempts (Stewart, Esposito, et al. 2017; Stewart et al. 2015;).

Peer Victimization and Adolescent Suicidal Thoughts and Behaviors

Peer victimization (i.e., bullying) is reliably linked to increased adolescent STBs, both concurrently and over time (Geoffroy et al. 2016; Wolke and Lereya 2015). Nonetheless, three unresolved issues pertinent to unpacking this association remain. First, it is unclear how peer victimization contributes to distinct forms of STBs, namely ideation, planning, and attempts, above the effect of concomitant psychiatric symptoms. Second, it is critical to disentangle the effects of bullying subtypes on suicide outcomes. Last, despite its reliability, the effect of bullying on STBs can be paradoxically small. Research bearing upon these issues is described below.

Adolescent suicide ideation, plans, and attempts differ in their prevalence, demographic and clinical correlates, and their association with future STBs (Nock et al. 2013; Ribeiro et al. 2016); it is therefore crucial to test the effect of bullying on each form of STBs separately. In most investigations of community adolescents, peer victimization is associated with both ideation and attempts (Liang, Flisher, & Lombard, 2007; Cui, Cheng, Xu, Chen, & Wang, 2011; Brunstein Klomek, Marrocco, Kleinman, Schonfeld, & Gould, 2007; Hepburn, Azrael, Molnar, & Miller, 2012; Schneider, O'Donnell, Stueve, & Coulter, 2012). However, some studies find that bullying is *only* associated with attempts, and not ideation or plans (Roh et al. 2015; Romero, Wiggs, Valencia, & Bauman, 2013), while others report the opposite pattern (Sampasa-Kanyinga, Roumeliotis, & Xu, 2014). These mixed findings may reflect the presence (or absence) of co-occurring psychiatric symptoms and whether or not studies control for their effects. Bullying increases an array of symptoms, including depression and anxiety (Wolke and Lereya 2015), and such symptoms are among the strongest correlates of suicidal thoughts, but are more weakly related to attempts (Nock et al. 2013). Therefore, controlling for internalizing symptoms could differentially impact relations between bullying and ideation versus attempts. To address this issue, this study recruited depressed psychiatric inpatients, who *all* possess common suicide risk factors (e.g., hospitalization, depression diagnosis) and controlled for individual differences in psychiatric symptom severity.

Peer victimization has most often been defined as a unitary construct in studies of adolescent suicide risk. However, theory and empirical data show discrete bullying subtypes (Wang, Iannotti, & Nansel, 2009; Olweus 2013; De Los Reyes and Prinstein 2004). Overt victimization involves being directly targeted with physical and/or verbal aggression (e.g., hitting, threats). In contrast, relational victimization (e.g., exclusion) uses the relationship to harm the target, and reputational victimization (e.g., gossiping) damages the victim's reputation among their peers. Direct (overt), but not indirect (relational, reputational), victimization is most consistently associated with suicide ideation (van der Wal, de Wit, & Hirasing, 2003; Bonanno and Hymel 2013; Dempsey, Haden, Goldman, Sivinski, & Wiens, 2011; Heilbron and Prinstein 2010), although two studies (Tsypes and Gibb 2015; Yen et al. 2014) found that both direct and indirect bullying predicted ideation. Studies of attempts are scarce and mixed—one study found that both direct and indirect bullying predicted attempts but not ideation (Roh et al. 2015), while another found a specific effect of overt victimization on attempts (Dempsey et al. 2011). In balance, the relation between subtypes of bullying and STBs warrants clarification, particularly in clinical samples, as this may inform suicide risk assessment and guide therapeutic interventions (e.g., assertiveness training for excluded youth). The present study tests the differential relations between overt, relational, and reputational bullying and suicide ideation, plans, and attempts among depressed adolescent inpatients.

The majority of studies to date have tested whether peer victimization directly, and linearly, leads to STBs using large, population-based cohorts; in these studies, effect sizes tend to be small (e.g., Hepburn et al. 2012; Bonanno and Hymel 2013; Yen et al. 2014). Given these modest direct relations, a separate but complementary possibility is that peer victimization is related to suicide risk partially due its associations with other maladaptive behaviors linked to suicide-related outcomes. Indeed, several studies using national and state-based Youth Risk Behavior Surveys have found that the effect of bullying may be mediated by externalizing behaviors (aggression, substance abuse, violence; Litwiller and Brausch 2013; Reed, Nugent, & Cooper, 2015). Although compelling, these studies are limited by single-item assessments of suicide-related outcomes that conflate ideation, plans, and attempts, and findings cannot be generalized to clinical populations who are at high risk for suicide. Alternatively, peer victimization is associated with non-suicidal self-injury (NSSI) in community samples (Giletta et al. 2015; Giletta, Scholte, Engels, Ciairano, & Prinstein, 2012; Hay and Meldrum 2010), and NSSI is an established risk factor for STBs (see Grandclerc, De Labrouhe, Spodenkiewicz, Lachal, & Moro, 2016). Therefore, it is conceivable that NSSI may partially account for the relation between bullying and STBs. In sum, it is critical to examine factors that may mediate the association between bullying and suicide, and prior research suggests that risky behavior engagement and NSSI are strong candidates.

Mediators of the Relation Between Victimization and Suicidal Thoughts and Behaviors

In light of escalating rates of peer victimization and STBs in youth (Nock et al. 2013; Modecki, Minchin, Harbaugh, Guerra, & Runions, 2014), it is essential to better understand

behavioral processes that may partially explain the relation between peer victimization and adolescent STBs. Based on the studies reviewed, risky behavior engagement and NSSI may increase the occurrence of suicide-related outcomes after being bullied. General Strain Theory (GST; Agnew 2001) proposes that strain—which results from any relationship or event wherein a person is not treated as they would like or experiences undesirable outcomes—pressures some adolescents to engage in deviant behavior to manage negative affect. GST has traditionally proposed that strain produces “externalizing” deviance, like aggression and criminal behavior. However, strained individuals also may use “internalizing” forms of deviance, such as NSSI (Hay and Meldrum 2010), to cope with their negative affect. Indeed, the most common function of NSSI behavior reported by adolescents is to escape aversive emotional or cognitive states (Nock, Prinstein, & Sterba, 2009).

Peer victimization is a salient source of strain particularly consequential to deviant behavior in adolescence (Agnew 2001). Consistent with GST, being bullied is associated with substance use, aggression, and violence (Litwiller and Brausch 2013; Reed et al. 2015) as well as NSSI (Giletta et al. 2012; Hay and Meldrum 2010; Giletta et al. 2015; Claes, Luyckx, Baetens, Van de Ven, & Witteman, 2015). Further, risky behaviors (Cooper, Agocha, & Sheldon, 2000) and NSSI (Klonsky 2007) modulate mood and acutely reduce negative affect in youth, and given the short-term relief they provide, may be positively reinforced, which in turn increases the likelihood that victimized adolescents use them to reduce future distress (e.g., Auerbach, Tsai, & Abela, 2010). This would ultimately strengthen the relation between being bullied and risky behavior engagement and NSSI.

The current study tests whether bullying is associated with risky behavior engagement and NSSI, and further, whether these behaviors mediate the relation between victimization and greater STBs. Consistent with our framework, the Interpersonal Theory of Suicide (ITS; Joiner 2005) proposes that repeated painful and provocative experiences like risky behaviors and NSSI may, over time, habituate adolescents to the pain and fear necessary to enact serious and lethal STBs. These painful, fear-inducing, and sometimes life-threatening behaviors may result in high-risk individuals dismissing the basic drive for self-preservation and increasing their willingness and capability to attempt suicide (Van Orden, Witte, Gordon, Bender, & Joiner, 2008). In line with the ITS, adults who report more painful and provocative events also exhibit: (a) greater pain tolerance and fearlessness of death (Bender, Gordon, Bresin, & Joiner, 2011) and (b) higher scores on measures of acquired suicide capability (Van Orden et al., 2008). Although the ITS has not been directly tested in youth, risky behaviors (e.g., Litwiller and Brausch 2013; Reed et al. 2015) and NSSI (e.g., Giletta et al. 2015; Grandclerc et al., 2016) are associated with suicide-related outcomes among adolescents, which supports our proposed mediation model.

Present Study

The primary goal of this study was to test the whether NSSI and risky behavior engagement mediate the relationship between peer victimization and STBs (see Figure 1). Based on extant theory and research, we propose the following framework. Consistent with GST, peer victimization leads some adolescents to engage in increased NSSI frequency and greater risky behavior engagement. Then, in line with the ITS, these painful and provocative

behaviors contribute to more frequent suicide-related outcomes as they build suicide capability. A multi-wave, prospective design is required to definitively test the temporal sequence of relations in this framework; nonetheless, examining this pattern of effects in a cross-sectional study provides a key, initial step prior to conducting time-intensive longitudinal research.

To address limitations of past work, we used a sample of depressed adolescent inpatients, controlled for concomitant psychiatric symptoms, measured multiple forms of victimization, and tested the influence of risky behavior engagement and NSSI simultaneously in our models. We tested the following *a priori* hypotheses. First, we hypothesized that overt, relational, and reputational victimization would all be associated with the frequency of suicide ideation, plans, and attempts in the month prior to hospitalization. Second, we predicted that all forms of victimization would be associated with risky behavior engagement and NSSI. Third, consistent with prior studies, we expected risky behaviors and NSSI to be significantly associated with suicide ideation, plans, and attempts. Fourth, we anticipated that risky behaviors and NSSI would jointly mediate the association between peer victimization and STBs. Given minimal research in this area, we made no specific hypotheses about the relative strength of effects through risky behaviors versus NSSI and did not make separate hypotheses regarding the effects of overt, relational, and reputational victimization. Last, given data showing sex and age differences in STBs (Nock et al. 2013) and peer victimization (Wang et al. 2009), exploratory analyses tested whether pathways in our model were moderated by these factors.

Method

Participants

Participants were 340 adolescents (246 female; 72.14%) recruited within 48 hours of admission to an acute psychiatric adolescent treatment program. Patients were admitted to this program for acute clinical concerns (e.g., severe self-injury), failure to thrive in outpatient treatment, and safety concerns (e.g., active suicidal thoughts). Participants were 13–19 years old ($M = 15.59$, $SD = 1.41$), and the majority ($n = 278$, 81.52%) was Caucasian. All adolescents met Diagnostic and Statistical Manual of Mental Disorders – Fourth Edition (DSM-IV-TR; American Psychiatric Association 2000) criteria for current MDD ($n = 277$, 81.47%) and/or Dysthymia ($n = 66$, 19.41%). Diagnoses were confirmed using the Mini International Neuropsychiatric Interview for children and adolescents (MINI-KID; Sheehan et al. 2010). Rates of Axis I diagnoses in the sample, stratified by sex, are provided in Online Resource 1, Table S1. Exclusion criteria included a current or past diagnosis any of the following: Bipolar Disorder I or II, a psychotic disorder, and pervasive developmental disorder. Of the 432 recruited participants, 70 (16.20%) did not meet diagnostic criteria for MDD or Dysthymia, 11 (2.55%) met one or more exclusionary criteria and a further 11 (2.55%) refused participation, leaving a final sample of 340 adolescents.

Instruments

Reliability data for questionnaire measures are provided in Table 1, while the psychometric properties of interview measures are described in text.

Mini International Neuropsychiatric Interview for children and adolescents

(MINI-KID; Sheehan et al. 2010)—The MINI-KID is a structured diagnostic interview that assesses current and past psychopathology in youth. Interviews were conducted by BA-level research assistants or graduate students who received 25 hours of training (e.g., didactics, mock-interviews, direct supervision) prior to interviewing live participants. Research has shown that the MINI-KID is a reliable tool for diagnosing psychopathology in outpatient (Sheehan et al., 2010) and inpatient (Stewart, Esposito, et al. 2017; Stewart et al. 2015) adolescent samples.

Self-Injurious Thoughts and Behaviors Interview (SITBI; Nock, Holmberg, Photos, & Michel, 2007)

—The SITBI is a structured clinical interview that assesses the presence, frequency and severity of suicidal thoughts and behaviors, as well as NSSI. Previous research has confirmed its concurrent validity (i.e., medium to large correlations with other measures of STBs) among adolescent inpatients (Nock et al. 2007). We measured 4 variables that focused on the frequency of thoughts and behaviors in the past month: (1) suicidal ideation (“How many days in the past month have you had thoughts of killing yourself”), (2) suicide plans (“How many days in the past month have you made a suicide plan”), (3) suicide attempts (“How many suicide attempts have you made in the past month”) and (4) NSSI (“How many times in the past month have you purposely hurt yourself without wanting to die”).

The SITBI has been used in several studies to assess suicide and NSSI among hospitalized adolescents (e.g., Stewart, Glenn, et al. 2017; van Alphen et al. 2016). It has demonstrated excellent inter-rater reliability (average $\kappa = .99$) and strong test-retest reliability (average $\kappa = .70$), as well as good agreement between parent and adolescent respondents on the presence of suicide-related outcomes and NSSI (Nock et al. 2007). Further, the SITBI has good convergence with other measures of suicide ideation, suicide attempts, and NSSI (average κ s = .54 – .87; Nock et al. 2007). Critically, using the SITBI allows the interviewer to clarify the meaning of constructs and correct misunderstandings that commonly arise from assessments that rely on brief questionnaire measures (e.g., Millner, Lee, & Nock, 2015).

Center for Epidemiologic Studies Depression Scale (CES-D; Radloff 1977)

—The CES-D is a 20-item self-report inventory capturing depressive symptom severity during the previous 2 weeks. Items are rated on a scale from 0 (*rarely or none of the time*) to 3 (*almost or all of the time*), and total scores range from 0 to 60. Higher total CES-D scores suggest more severe depressive symptoms.

Multidimensional Anxiety Scale for Children (MASC; March, Parker, Sullivan, Stallings, & Conners, 1997)

—The MASC is a 39-item questionnaire that measures current anxiety symptoms. Items are rated from 0 (*Never true about me*) to 3 (*Often true about me*) and total scores range from 0 to 117; higher scores indicate more severe anxiety.

Revised Peer Experiences Questionnaire (RPEQ; Prinstein, Boergers, & Vernberg, 2001)

—The RPEQ assesses self-reported experiences of peer victimization in the past year and includes the following subscales: Overt (3 items; e.g., “A teen chased me

like he or she was really trying to hurt me”), Relational (3 items; e.g., “A teen left me out of what they were doing”) and Reputational (3 items; e.g., “Another teen gossiped about me so that others would not like me”). On each subscale, higher scores indicate more frequent victimization.

Risky Behaviors Questionnaire for Adolescents (RBQ-A; Auerbach and Gardiner 2012)—The RBQ-A is a 20-item self-report questionnaire that measures the frequency of broad-based risky behaviors (e.g., substance use, aggression, rule-breaking) in the past month. We removed 1 item that assessed NSSI to avoid overlap with the SITBI. Adolescents are asked to rate items from 0 (*never*) to 4 (*always: 4 or more times per week*) and total scores ranged 0–76, with higher scores denoting greater risky behavior engagement.

Procedure

The Institutional Review Board approved this study, and treatment of participants was in accordance with the American Psychological Association ethical standards. Prior to participation, legal guardians and 18-year-old adolescents provided written, informed consent, and adolescents 13–17 years provided their assent. Within approximately 48 hours of hospital admission, participants completed structured interviews (MINI-KID, SITBI) and self-report measures (CES-D, MASC, RPEQ, RBQ-A) during a single laboratory session.

Data Analytic Overview

We tested several multiple mediation models that included continuous exposure variables (overt, relational, and reputational victimization), a continuous (risky behavior engagement) and a count (NSSI) mediator, and several count outcome variables (suicide ideation, plans, and attempts). We employed a causal mediation analysis approach developed under the counterfactual framework (Pearl 2001; Robins and Greenland 1992) that quantifies direct and indirect effects allowing for exposure-mediator interactions (Vanderweele and Vansteelandt 2009) and several generalized linear model specifications (Valeri and Vanderweele 2013; Vanderweele and Vansteelandt 2010; Imai, Keele, & Tingley, 2010). This approach is applicable to models with interactions and/or non-linearities, conditions that cannot be modeled with traditional mediation techniques.

Causal mediation analysis decomposes the total effect of the exposure (peer victimization) on the outcome (STBs) into the natural direct effect (NDE) and the natural indirect effect (NIE) through the hypothesized mediators. Causal direct and indirect effects are identified from observed data under the assumption of correct model specification as well as under the assumptions of: (i) no unmeasured confounding of the exposure-outcome relationship, (ii) no unmeasured confounding of the exposure-mediator relationship, (iii) no unmeasured confounding of the mediator-outcome relationship, and (iv) no confounders of the mediator-outcome relationship affected by the exposure (Pearl 2001). Estimates of NDEs and NIEs are derived from parameters estimated in a regression for the outcome (STBs) conditionally on exposure (peer victimization), mediators (NSSI and risky behavior engagement), and confounders, and in a regression for the mediator conditionally on the exposure and confounders.

In the present study, we estimate NDE as the change in the outcome (STBs) we would expect if the exposure (peer victimization) were set at one standard deviation (SD) above the mean versus mean levels, while the mediators are fixed at the level they would have taken with victimization at its mean. In contrast, the NIE is the effect of changes in peer victimization on STBs that operates through the mediators. Specifically, we estimate NIE as the average change in STBs if victimization were fixed at one SD above mean levels, but the mediators were changed from the values they would take if victimization was at mean levels to values they would take if victimization was one SD above the mean. The total effect—the sum of the NDE and NIE—represents how much STBs would change overall if victimization changed from mean levels to one SD above the mean.

Despite recent advances in counterfactual mediation software (Imai et al. 2010; Valeri and Vanderweele 2013), no program allows for count mediators in the context of multiple mediation analyses with non-continuous outcomes. We extended the work of Valeri and Vanderweele (2013) with count outcomes to allow for count mediators within a multiple mediation model. Further, we created a program in *R* (version 3.2.2) that automatically implements these analyses. We provide all equations used to derive reported estimates, as well as our *R* script (Online Resource 2 and 3, respectively). Our program fit linear models to continuous dependent variables (DVs; e.g., risky behaviors) and quasi-poisson models to count DVs (e.g., NSSI). We derived standard errors (*SEs*) for the NDE and NIE using the delta method, and these *SEs* were used to compute the 95% confidence intervals (95% CI) and *p*-values for these estimates.

Prior to testing mediation, we conducted a series of preliminary analyses that guided model identification. First, we identified potential demographic (age, sex, ethnicity) and clinical (depression and anxiety) confounders of the exposure-mediator, exposure-outcome, and mediator-outcome associations. Second, we tested the total effects of victimization on STBs, controlling for confounders and accounting for non-linear effects. Mediation models only were tested when there was a total effect of peer victimization on STBs. Third, we tested the associations between exposure variables and the mediators controlling for confounders and accounting for non-linear effects. Last, we tested associations between the mediators and outcomes, controlling for confounders and exposure effects, in outcome models where there was a significant total effect of victimization on STBs. Further, we tested *Mediator* $\times$ *Mediator* and *Exposure* $\times$ *Mediator* interactions in these models.

For each total effect, we estimated NDEs and NIEs of the exposure on the outcomes through the mediators. For models in which the NIE was statistically significant, we conducted follow-up single mediator analyses to determine which mediator was driving the effect using our *R* script. Finally, we assessed reproducibility by carrying out the same follow-up analyses with a published *R* package (*Causal Mediation Analysis* version 4.4.5; see Tingley, Yamamoto, Hirose, Keele, & Imai, 2014).

Results

Descriptive Statistics for Suicidal Thoughts, Suicide Attempts, and NSSI

In the month prior to the assessment, most adolescents ($n = 278$, 81.76%) reported suicide ideation, and nearly half ($n = 156$, 45.88%) reported making a suicide plan. The average number of days participants experienced ideation and made plans are summarized in Table 1. Seventy-five (22.06%) participants reported a suicide attempt in the past month, and medication overdose was the most common method employed in the most recent attempt ($n = 62$, 82.67%). Other suicide methods included stabbing oneself ($n = 11$, 14.67%), hanging ($n = 7$, 9.33%), poisoning ($n = 5$, 6.67%), suffocation ($n = 4$, 5.33%), jumping in front of a train or car ($n = 3$, 4.00%), and jumping from a height ($n = 1$, 1.33%).¹ Two hundred and four (60.00%) participants had at least one episode of NSSI in the month before hospitalization and most of these youth reported using more than one NSSI method in their lifetime ($n = 163$, 79.90%) and many used 4 or more methods ($n = 77$, 37.75%). The most common form of NSSI was cutting ($n = 192$, 94.12%), and other common methods included scraping one's skin ($n = 96$, 47.06%), hitting oneself ($n = 94$, 46.08%), skin picking ($n = 85$, 41.67%), and burning ($n = 67$, 32.84%).

Confounders

Bivariate associations among all study variables and descriptive statistics are summarized in Table 1. Younger age was associated with more frequent suicide plans and NSSI, but sex was not associated with past month STBs, $1.23 > t > -0.33$, $ps > .221$, NSSI, $b = 0.42$, $SE = 0.34$, $t(327) = 1.24$, $p = .214$, or risky behaviors, $t(332) = 0.21$, $p = .837$, $d = 0.03$. Further, non-White (versus White/Caucasian) ethnicity was not associated with STBs, $1.59 > t > -0.21$, $ps > .113$, NSSI, $b = 0.19$, $SE = 0.33$, $t(323) = 0.58$, $p = .564$, or risky behavior engagement, $t(328) = 0.88$, $p = .380$, $d = 0.13$.

Additionally, we tested continuous psychiatric symptoms, and not dichotomous diagnostic categories, as potential confounders as: (a) rates of mood and anxiety disorders were very high and thus these variables have far less meaningful variation than continuous symptoms and (b) focusing on recent, self-reported psychiatric symptoms allowed us to account for the effects of acute distress and/or mood on reporting of bullying, the mediators, and STBs. Greater depression severity was associated with all forms of peer victimization, past month suicide ideation and plans, as well as NSSI and risky behaviors. We regressed depression onto anxiety symptom scores and computed standardized residuals for anxiety. Residualized anxiety was not associated with STBs or NSSI, but greater anxiety was associated with lower risky behavior engagement. Therefore, age, depression, and residualized anxiety were included as confounders in causal mediation analyses.

Total Effects

We tested the shape of the association between our exposure variables and outcome variables using the generalized additive model (GAM) function from the *mgcv* R package

¹Values for methods employed sum to greater than 100% because adolescents could report more than one suicide method for their most recent attempt.

(version 1.8–12; Wood 2016). Plots of the dose-response relationship for the 9 models are presented in Online Resource 4 (Figure S1–S3). Next, we tested the strength of the linear and non-linear effects, controlling for confounders, in quasi-poisson regression models. In cases where higher-order terms (e.g., quadratic effects) were non-significant, they were removed.

Suicide ideation—GAM analyses indicated that the associations between overt, relational, and reputational victimization and ideation were quadratic, linear, and linear, respectively (Figure S1). However, in the overt victimization model, the quadratic term was non-significant ($p = .139$) and was therefore removed. Table 2 shows coefficients for these total effects models. In all cases, peer victimization was not associated with the frequency of past month suicide ideation after controlling for age, depression, and residualized anxiety (all $ps > .539$); therefore, we did not test any causal mediation models for suicide ideation.

Suicide plans—Associations between overt, relational, and reputational victimization and suicide plans were cubic, quadratic, and linear, respectively (Figure S2). For both overt and relational victimization, the non-linear terms were significant and were retained. We found evidence for significant total effects of overt and relational, but not reputational, victimization on the frequency of suicide plans in the past month (Table 2).

Suicide attempts—The associations between overt, relational, and reputational victimization and suicide attempts were quadratic, linear, and quadratic, respectively (Figure S3). However, the quadratic term for reputational victimization was non-significant ($p = .200$), and the quadratic term for overt victimization was small and marginally significant, $b = 0.02$, $SE = 0.01$, $t(318) = 1.97$, $p = .049$; both quadratic terms were therefore removed. We found significant total effects of overt and reputational victimization on past month attempts (Table 2).

Exposure-Mediator Associations

We tested that shape and strength of the associations between peer victimization and the mediators (NSSI, risky behaviors) by using GAM followed by a quasi-poisson regression models including the exposure variable and confounders. Plots of the dose-response relationship between each type of victimization and the mediators are given in Online Resource 4 (Figure S4–S5).

NSSI—GAM analyses showed that the associations between overt, relational, and reputational victimization and NSSI were linear, linear, and quadratic, respectively (Figure S4). However, the quadratic term for reputational victimization was non-significant ($p = .254$), and thus, only the linear term was retained. None of the 3 forms of peer victimization were significantly associated with past month NSSI frequency (Table 3).

Risky Behaviors—The associations between overt, relational, and reputational victimization and risky behavior engagement were quadratic, linear, and quadratic, respectively (Figure S5). The quadratic term for overt victimization was non-significant ($p = .223$), and it was small and marginally significant for reputational victimization, $b = -0.05$,

$SE = 0.02$, $t(313) = -2.14$, $p = .033$; therefore, only the linear terms were retained. All 3 forms of peer victimization were significantly associated with greater risky behavior engagement (Table 3).

Mediator-Outcome Associations

We tested both the strength of the association between the mediators and outcomes, as well as *Mediator* $\times$ *Mediator* and *Exposure* $\times$ *Mediator* interactions², in the following models: overt victimization predicting suicide plans, relational victimization predicting plans, overt victimization predicting suicide attempts, and reputational victimization predicting attempts. All models included confounders and non-linear exposure terms identified.

Suicide Plans—For overt victimization, when both mediators were included, NSSI was significantly associated with more frequent suicide plans, $b = 0.02$, $SE = 0.005$, $t(320) = 3.50$, $p < .001$, but risky behavior engagement was not ($p = .596$). Overt victimization remained associated with plans (quadratic: $b = 0.11$, $SE = 0.04$, $t[320] = 2.55$, $p = .011$; cubic: $b = -0.01$, $SE = 0.003$, $t[320] = -2.50$, $p = .013$), but the linear term was non-significant ($p = .420$).

For relational victimization, NSSI was associated with more frequent suicide plans, $b = 0.02$, $SE = 0.005$, $t(323) = 3.13$, $p = .002$, but risky behavior was not ($p = .608$). Further, relational victimization was significantly associated with suicide plans (quadratic term: $b = 0.03$, $SE = 0.01$, $t[323] = 3.28$, $p = .001$) although the linear term was non-significant ($p = .277$).

Suicide Attempts—For overt victimization, risky behavior engagement was uniquely associated with suicide attempts, $b = 0.05$, $SE = 0.02$, $t(318) = 2.86$, $p = .004$, but NSSI was not ($p = .242$). With both mediators in the model, overt victimization remained significantly associated with more frequent suicide attempts, $b = 0.17$, $SE = 0.04$, $t(318) = 4.47$, $p < .001$.

For reputational victimization, risky behavior engagement was again associated with past month attempts, $b = 0.07$, $SE = 0.02$, $t(318) = 4.27$, $p < .001$. However, neither NSSI ($p = .425$) nor reputational victimization ($p = .055$) were significant predictors in the model.

Mediation Analyses: Suicide Plans

Table 4 presents the NDE and NIE for all multiple mediation models. Given we tested hypotheses pertaining to 4 sets of NDEs and NIEs, the Bonferroni-corrected alpha was $p < .013$ for the multiple mediator analyses (no correction was used for follow-up analyses).

Overt Victimization—Both the NDE of overt victimization on suicide plans, and the NIE through NSSI and risky behaviors, were non-significant. These analyses estimated the NDE and NIE based on a change from mean levels of the exposure to one SD above the mean. However, the exposure-outcome association was non-linear, and consequently, we estimated the NDE and NIE using alternative values of overt victimization, guided by Figure S2a. For a change in overt victimization from the minimum to the 75th percentile, the NDE was non-

²We did not find strong evidence to include interaction terms in any of our mediation models. Results from these analyses are presented in Online Resource 1, Table S2 and S3.

significant, *point estimate* (*pe*) = -0.46, *SE* = 0.41, 95% CI [-1.25, 0.34], *p* = .262. In contrast, for a change from the 75th percentile to the 97.72nd percentile (3 SD above the mean), the NDE was significant, *pe* = 7.51, *SE* = 3.25, 95% CI [1.14, 13.87], *p* = .021; greater overt victimization was associated with more frequent suicide plans. Finally, for changes in overt victimization between the 97.72nd percentile and the maximum, the NDE was non-significant, *pe* = -3.83, *SE* = 4.06, 95% CI [-11.78, 0.52], *p* = .345 and corresponding NIEs were all non-significant (*ps* > .614).

Relational victimization—When the NDE and NIE were estimated based on a change in relational victimization from mean levels to one SD above the mean, both were non-significant (Table 4). Given the association between relational victimization and suicide plans was U-shaped (Figure S2b), we tested the NDE and NIE at the low and high ends of the distribution of reputational victimization scores. For a change from the minimum value to the 25th percentile, the NDE of reputational victimization on suicide plans was significant, *pe* = -1.29, *SE* = 0.65, 95% CI [-2.56, -0.02], *p* = .046; greater reputational victimization was associated with less frequent suicide plans (not through mediators) in this range. In contrast, for a change from the 75th percentile to the maximum value, the NDE was again significant, *pe* = 2.62, *SE* = 1.23, 95% CI [0.22, 5.03], *p* = .032, but in this case, reputational victimization was associated with more frequent suicide plans. The NIEs were non-significant in both ranges (*ps* > .751).

Mediation Analyses: Suicide Attempts

Overt victimization—In the mediation analysis, both the NDE of overt victimization on suicide attempts and the NIE through NSSI and risky behavior engagement were significant (Table 4). More than one quarter (26.5%) of the effect of overt victimization was through the mediators. Overt victimization was associated with greater risky behavior engagement, which was in turn related to more frequent attempts. In contrast, overt victimization was not associated with NSSI, nor was NSSI related to past month suicide attempts. We next tested the NIEs of overt victimization on attempts through NSSI and risky behaviors separately. Both the NDE of overt victimization on suicide attempts and the NIE through risky behaviors alone were significant (Table 4); risky behaviors accounted for 26.8% of the effect of the exposure on the outcome variable. Overt victimization, *b* = 0.17, *SE* = 0.04, *t*(326) = 4.67, *p* < .001, and risky behaviors, *b* = 0.05, *SE* = 0.02, *t*(326) = 3.02, *p* = .003, were uniquely associated with more past month suicide attempts in the outcome model. Results using the Tingley et al. (2014) *R* package replicated these findings (Table 4). For the NSSI model, the NDE of overt victimization was again significant, but the NIE was non-significant (Table 4). In the outcome model, overt victimization was uniquely associated with attempts, *b* = 0.22, *SE* = 0.03, *t*(318) = 6.45, *p* < .001, but NSSI was not, *b* = 0.01, *SE* = 0.01, *t*(318) = 1.34, *p* = .182.

Reputational victimization—The NIE of reputational victimization on suicide attempts through NSSI and risky behaviors was significant and the mediators explained 43.0% of the effect; however, the NDE was non-significant (Table 4). Reputational victimization was associated with more risky behavior engagement, which in turn was associated with more frequent suicide attempts. However, NSSI was not associated with reputational victimization

in the mediator model, nor with attempts in the outcome model. In single mediator follow-up analyses, the NDE of reputational victimization on attempts was significant, as was the NIE through risky behavior engagement (Table 4). Risky behavior engagement accounted for 39.5% of the effect of the exposure on the outcome. In the outcome model, both reputational victimization, $b = 0.08$, $SE = 0.03$, $t(326) = 2.28$, $p = .024$, and risky behaviors, $b = 0.07$, $SE = 0.02$, $t(326) = 4.37$, $p < .001$, were associated with attempts. Results using the Tingley et al. (2014) *R* package replicated these findings (Table 4). For the NSSI model, the NDE of reputational victimization on suicide attempts was significant, but the NIE was non-significant (Table 4). In the outcome model, reputational victimization was associated with more frequent attempts, $b = 0.11$, $SE = 0.04$, $t(318) = 3.00$, $p = .003$, but NSSI was not ($p = .280$).

Exploratory Analyses: Moderation by Age and Sex

Age did not moderate any relations in the model (all $ps > .095$), and thus, the mediation effects we report were invariant across participant age. In contrast, in the overt victimization outcome model, the effect of risky behavior engagement on suicide attempts was moderated by sex, $b = -0.08$, $SE = 0.03$, $t(316) = -2.63$, $p = .009$; specifically, risky behavior was associated with more frequent past month suicide attempts among boys, $b = 0.10$, $SE = 0.03$, $t(316) = 3.76$, $p < .001$, but not among girls, $b = 0.02$, $SE = 0.02$, $t(316) = 1.02$, $p = .309$. A similar pattern emerged in the reputational victimization outcome model—sex moderated the effect of risky behavior on attempts, $b = -0.12$, $SE = 0.03$, $t(316) = -3.94$, $p < .001$, such that risky behavior engagement was associated with attempts among boys, $b = 0.15$, $SE = 0.02$, $t(316) = 6.18$, $p < .001$, but not girls, $b = 0.03$, $SE = 0.02$, $t(316) = 1.48$, $p = .140$. No other relations in the models were moderated by sex ($ps > .184$).

We re-ran our mediation models for attempts stratifying analyses by sex. In these models, the NDE of overt victimization on attempts was significant among girls, $pe = 0.13$, $SE = 0.04$, 95% CI [0.06, 0.21], $p < .001$, but not among boys, $pe = 0.05$, $SE = 0.04$, 95% CI [-0.03, 0.17], $p = .259$. In contrast, the NIE of overt victimization on attempts through risky behavior and NSSI was significant among boys, $pe = 0.07$, $SE = 0.03$, 95% CI [0.01, 0.14], $p = .026$, but not girls, $pe = 0.01$, $SE = 0.02$, 95% CI [-0.02, 0.04]. The NDE of reputational victimization on attempts was also significant among girls, $pe = 0.11$, $SE = 0.05$, 95% CI [0.02, 0.21], $p = .024$, but not boys, $pe = 0.02$, $SE = 0.06$, 95% CI [-0.09, 0.13]. The corresponding NIE was non-significant among girls, $pe = 0.03$, $SE = 0.02$, [-0.01, 0.06], but approached statistical significance in boys, $pe = 0.05$, $SE = 0.03$, 95% CI [-0.01, 0.10], $p = .088$.

Discussion

Peer victimization is a common (Modecki et al. 2014) and a well-established contributor to adolescent suicide risk (Wolke and Lereya 2015; Holt et al. 2015). Nonetheless, limited research has examined mechanisms that potentiate this association, particularly among adolescent inpatients, a group at high risk for STBs. We tested whether the impact of peer victimization on STBs occurred through its intermediate effects on risky behavior engagement and NSSI. Four principal findings emerged. First, whereas overt and

reputational victimization were associated suicide attempts, overt and relational bullying were associated with plans. No form of bullying was related to suicide ideation above and beyond current symptom severity. Second, all forms of victimization were associated with risky behaviors, but none were associated with NSSI after accounting for current symptomatology. Third, risky behaviors, but not NSSI, mediated the link between overt and reputational bullying and suicide attempts; there were no significant mediation effects for suicide plans. Last, the direct effects of overt and reputational victimization on attempts were strongest for females while the indirect effects through risky behavior engagement were strongest among males. Together these findings advance knowledge on mechanisms that may explain the connection between bullying and suicide among adolescents.

Peer Victimization and Adolescent Suicidal Thoughts and Behaviors

Investigations testing the direct relation between victimization and STBs typically use community samples and do not account for concomitant psychiatric symptoms. These studies find that bullying is associated with both suicide ideation and attempts (Brunstein Klomek et al. 2007; Cui et al. 2011; Hepburn et al. 2012; Liang et al. 2007; Schneider et al. 2012). In contrast, we found that overt and reputational bullying were associated with more frequent attempts, but not ideation, controlling for internalizing symptoms. This pattern is in line with two previous studies, one that recruited outpatients and controlled for psychiatric symptoms (Roh et al. 2015) and another that controlled for depression (Romero et al. 2013). Thus, bullying may only be linked to more frequent suicidal ideation insofar as it increases internalizing symptoms; indeed, depression mediates the relation between bullying and ideation among community adolescents (Sampasa-Kanyinga et al. 2014; Hay and Meldrum 2010). In contrast, the direct relation between bullying and attempts may be larger, particularly among psychiatric samples, and independent of symptom severity. As only one-third of adolescent suicide ideators transition to make an attempt (Nock et al. 2013), it is essential to identify factors implicated in this transition. Our results show that particular forms of bullying are associated with suicide attempts, specifically, and thus, could be involved in triggering suicidal actions in vulnerable youth.

Prior research has found that direct, but not indirect, peer victimization is associated with adolescent STBs (cf. Tsypes and Gibb 2015; Yen et al. 2014; Dempsey et al. 2011). Conversely, our findings implicate both overt (physically harm or threats) and reputational (gossip and/or rumors) bullying in attempts. This discrepancy may be due to our use of an older sample than most previous research—indirect bullying becomes increasingly complex and subtle in late adolescence (Crick, Casas, & Nelson, 2002) and is more common than direct victimization during this developmental period (Wang et al. 2009). Alternatively, there is substantial co-occurrence among bullying subtypes, and being the victim of multiple forms of victimization is strongly linked to negative psychological outcomes (Wang, Iannotti, Luk, & Nansel, 2010). Many of our adolescent inpatients may have experienced *all* forms of victimization; therefore, the relation of overt and reputational victimization to suicide attempts may reflect a nonspecific effect of being bullied in some manner on more frequent attempts. Nonetheless, unpacking the unique and additive effects of different forms of victimization is critical for guiding interventions.

Although complex human behaviors, like suicide, may be poorly represented in linear models (Ehlers 1995), research on correlates of STBs rarely tests non-linear relations. To address this issue, we explicitly tested curvilinear relations between bullying and STBs. Our results showed that overt victimization only was related to suicide plans at relatively high levels; this might have occurred because most participants reported no overt victimization, and thus, the top quartile of the distribution was comprised of those who experienced *any amount* of overt bullying. This finding may reflect the association of the presence (versus absence) of these experiences with suicide plans. The association between relational victimization and plans was U-shaped and may have been driven by the covariance of relational victimization and adolescents' close friendships. At low levels, relational victimization may be linked to with more close friendships, as these ties could generate opportunities to be excluded. The inverse effect of relational bullying on suicide plans in this range may be a product of a protective effect of social support on STBs. In contrast, at high levels, the damaging effects of relational bullying with respect to increased suicide plans may outweigh the benefits of added social support.

Clarifying the Role of Risky Behaviors and NSSI

General Strain Theory (GST; Agnew 2001) posits that some adolescents use deviant behavior as a means of coping with situations in which they are mistreated. In line with GST, we found that all types of victimization were associated with engaging in risky behaviors (e.g., substance use, physical fights, and unsafe sex). Our results extend findings from community adolescent samples that consistently demonstrate a link between bullying and maladaptive externalizing behaviors (e.g., Litwiller and Brausch 2013; Reed et al. 2015) to high-risk psychiatric inpatients. Further, risky behaviors were associated with more frequent suicide attempts, and mediated the relation between victimization (overt and reputational) and attempts. Thus, our results suggest that risky behavior engagement may potentiate the effect of peer victimization on suicidal behaviors. The ITS (Joiner 2005) asserts that risky behaviors increase suicide risk by reducing fearfulness and bolstering pain tolerance, thereby building suicide capability. This hypothesis has been supported in adults (Bender et al. 2011; Van Orden et al. 2008), and the present study provides preliminary evidence for a downward extension of the ITS to adolescents. Clarifying factors that contribute to suicidal behaviors among youth is critical as adolescent suicide attempts predict persistent psychiatric and psychosocial problems, including suicide deaths in adulthood (Finkelstein et al. 2015).

In mediation analyses in the suicide attempt models, the direct effect of reputational victimization was non-significant, and smaller, than the direct effect of overt victimization; conversely, the indirect effect of reputational victimization via risky behavior engagement was larger than the corresponding estimate for overt bullying. Adapting the ITS framework (Joiner 2005), overt bullying may directly heighten suicide risk, irrespective of risky behaviors, because being hit, kicked, and/or threatened builds one's capability to enact lethal self-harm in and of itself. In contrast, reputational victimization (i.e., negative rumors, gossip) may increase suicidal desire, which stems from the combination of *perceived burdensomeness* (i.e., loneliness and lack of reciprocal care) and *thwarted belongingness* (i.e., self-loathing and perceived liability to others). Conceivably, reputational bullying

contributes to these constructs by conveying a clear message that the target does not belong among their peers. However, suicidal desire is not a sufficient precursor to a serious suicide attempt—one must still possess the capability for these acts. Our results suggest that the relation between reputational bullying and more frequent attempts may be partly explained by the association between reputational bullying and risky behaviors, which have been linked greater suicide capability (Bender et al. 2011; Van Orden et al. 2008). To evaluate these possibilities, future longitudinal research should test more elaborate pathways from bullying to adolescent suicide attempts incorporating ITS constructs like perceived burdensomeness, thwarted belongingness, and their interaction.

Contrary to hypotheses, we found no significant associations between bullying and NSSI; consequently, NSSI did not mediate the relation between victimization and STBs. Although several studies have found that bullying is linked to greater NSSI (Giletta et al. 2012; Giletta et al. 2015), this relation may be driven by the effect of bullying on greater depression (Claes et al. 2015). Our results support this possibility, as we found no association between bullying and NSSI among depressed adolescents when we controlled for depression severity. Furthermore, the frequency of adolescents' NSSI behavior in the month prior to hospitalization was not associated with suicide attempts in the same period of time. NSSI frequency is a strong predictor of suicide attempts in community (Grandclerc et al., 2016) and outpatient (Asarnow et al. 2011) samples, but, as our findings corroborate, not among inpatients (Nock, Joiner, Gordon, Lloyd-Richardson, & Prinstein, 2006; Prinstein et al. 2008). The chronic NSSI that typifies adolescent inpatients (Nock et al. 2006; Stewart, Esposito, et al. 2017) may be unrelated to risk for suicide attempts. Indeed, Whitlock and Knox (2007) found that the association between lifetime NSSI and STBs peaks at moderate NSSI frequency and is weaker at higher frequencies. Alternatively, other NSSI characteristics, such as method (e.g., cutting; scratching) or function (e.g., escape aversive emotions) may be more relevant to predicting attempts among inpatients (e.g., Stewart, Esposito, et al. 2017). Given inconsistencies regarding the link between NSSI and attempts in adolescents, further research is warranted.

Although NSSI did not mediate the effect of bullying on any form of STBs, it was bivariately associated with suicide ideation and plans, and the latter effect was robust to controlling for age, depression, and anxiety. Despite the necessary non-suicidal intention behind NSSI, our findings replicate a well-established relation between these behaviors and suicidal ideation (see Grandclerc et al. 2016). In contrast, few studies have examined the link between NSSI and adolescent suicide plans, independent of ideation (cf. Zetterqvist, Lundh, & Svedin, 2013). The way NSSI contributes to suicide plans, and vice versa, may be especially apposite to suicide risk, as plans predict suicide deaths among adult ideators (Joiner et al. 2003). Further, NSSI is linked to unremitting suicide ideation, as well as attempts, within 2 years of psychiatric hospitalization among adolescents (Prinstein et al. 2008). Given the overlap between NSSI and suicide plans, and their association with future suicide attempts and deaths, assessing and monitoring these clinical features among adolescent inpatients may be valuable for managing risk post-discharge.

Age and Sex Moderation Effects

Rates of STBs are higher in mid-to-late, compared to early, adolescence (Nock et al. 2013), and the prevalence of all forms of peer victimization is highest in childhood, reducing steadily through adolescence (Wang et al. 2009). Nonetheless, the associations between bullying and STBs in this study were invariant across age. Therefore, although bullying becomes less common and shifts from more explicit (e.g., pushing, name-calling) to covert (e.g., subtle exclusion; Crick et al. 2002) behaviors, its toxicity with respect to suicide risk may not change over development. To date, school anti-bullying programs have focused on children and early adolescents (Evans, Fraser, & Cotter, 2014); although it is sensible to target bullying when these behaviors first emerge, generating bullying interventions tailored to high school students may help attenuate STBs at a developmental stage where suicidal thoughts and behaviors surge.

The direct effects of overt and reputational victimization on suicide attempts were specific to females. This is consistent with studies finding that peer victimization prospectively predicts greater suicide ideation (Heilbron and Prinstein 2010; Tsypes and Gibb 2015) and higher odds of suicide attempts (Brunstein Klomek et al. 2009) among females but not males. Our findings may be a function of sex differences in peer relationship processes. Compared to boys, girls are more interpersonally sensitive and concerned about social approval, experience more interpersonal stress and report more distress following negative peer events (see Rose and Rudolph 2006). In contrast, among boys, peer victimization was only related to attempts indirectly through risky behavior engagement, and this differential pattern in males versus females is in line with the ITS. Specifically, the ITS proposes that females encounter more risk factors that increase thwarted belongingness and perceived burdensomeness, which may account for higher rates of suicide ideation and attempts in girls and women compared to males. In contrast, males may be more likely to develop acquired capability for suicide due to greater average tolerance of pain and fear and more exposure to events that desensitize them to self-harm (Joiner 2005). Indeed, male adolescents engage in more general risky behavior than females (Auerbach et al. 2010), and there may be sex differences in how these behaviors contribute to suicide. For instance, male adolescents are more likely to engage in suicidal behavior while intoxicated than females (Rowan 2001). Future research is needed to replicate our results, and to probe potential sex differences in the specific *types* of risky behavior (e.g., physical fights versus truancy) that may contribute to adolescent STBs.

Limitations

Our findings should be considered in light of the following limitations. First, and most notably, a statistical assumption of mediation analyses is that the exposure (i.e., peer victimization) and mediators (i.e., NSSI, risky behavior) precede the outcome (e.g., suicide attempts) in time (MacKinnon, Fairchild, & Fritz, 2007). Our data were cross-sectional, and even though bullying was assessed in a period (past year) that preceded the mediators and outcome variables (past month), our data cannot definitively ascertain that peer victimization contributed to later STBs (see Kraemer et al. 1997 for a discussion). Further, the SITBI assessed both NSSI (mediator) and STBs (outcomes) in the past month, but this interview does not collect fine-grained information on the relative timing of NSSI behaviors relative to

STBs. Thus, STB outcomes may have preceded NSSI behaviors in some cases. Although the framework we tested is theoretically and empirically motivated, alternative, complementary patterns of relations among study constructs are also plausible. For instance, adolescents who engage in risky behaviors (e.g., substance use, risky sex) may be ostracized from other youth and bullied as a result. Similarly, adolescents who make suicide attempts may be the target of social exclusion following their attempt. Multi-wave, prospective research including repeated assessments of peer victimization, proposed behavioral mediators, and suicide-related outcomes are needed to confirm the pattern of relations proposed in this study (Figure 1).

Second, our cross-sectional data did not allow us to parse phenomenological distinctions between risky behaviors and suicide attempts. It is possible that some attempts function as a form of risky behavior, and thus may lie on a continuum with these behaviors; future prospective research that separates these constructs in time could help clarify this issue. Third, we relied on a self-report measure of peer victimization; although bullying questionnaires show moderate convergence with peer nominations (De Los Reyes and Prinstein 2004; Olweus 2013), sociometric assessments of peer status and/or observer (e.g., peer, parent) reports would extend our results. Relatedly, we did not consider participants' own bullying perpetration in analyses, nor did we assess bullying chronicity (i.e., beyond past year); both bully-victims (Holt et al. 2015) and chronically bullied youth (Geoffroy et al. 2016) are at heightened risk for STBs. Last, causal mediation analyses assume no unmeasured confounding variables affecting model paths (Pearl 2001). Although meeting this assumption is not feasible in most research, the addition of other plausible mediators and/or moderators (e.g., thwarted belongingness; acquired suicide capability) may have improved model fit.

Conclusions

The current study tested two behavioral mechanisms—risky behavior engagement and NSSI—underlying the relation between peer victimization and STBs. Risky behavior engagement, but not NSSI, mediated the association between two forms of bullying and suicide attempts; this indirect effect was strongest among boys, whereas girls showed a stronger direct effect of bullying on attempts. Bullying was also associated with suicide plans, but relations were curvilinear, with victimization only predicting increased planning severe levels. Unlike attempts, relations between bullying and plans were not mediated by risky behavior engagement or NSSI. These results highlight the complex network of factors that may be implicated in how being bullied heightens suicide risk. Further elucidating mechanisms that explain *how* and *for whom* stressful experiences contribute to STBs will provide key points of entry for prevention efforts and targeted clinical interventions.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.

Directed acyclic graph illustrating the direct and indirect associations quantified in causal mediation analyses. Specifically, the model estimates the joint indirect effects of the exposure variables (A; overt, relational, and reputational victimization) on the outcomes (Y; suicide ideation, plans, and attempts) through two mediators: risky behavior engagement (M_1) and non-suicidal self-injury (M_2). Included in the model are measured confounders (C) of the exposure-outcome, mediator-outcome and exposure-mediator associations.

Table 1

Bivariate associations among study variables

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Past Month Attempts	--	.33***	.25	.15	.49***	.46***	.13	.40**	.08	-.11	-.19
2. Past Month Plans		--	.80***	.24***	.19	.34***	.24*	.23*	.57***	-.02	-.32**
3. Past Month Ideation			--	.12***	.04	.09+	.09+	.09+	.36***	.05	-.04
4. Past Month NSSI				--	.36***	.12	.10	.24+	.54***	-.19	-.36**
5. Risky Behaviors					--	.35***	.15**	.33***	.22***	-.19***	.06
6. Overt Victimization						--	.38***	.54***	.15**	.03	-.11*
7. Relational Victimization							--	.58***	.30***	.24	-.11*
8. Reputational Victimization								--	.23***	.17**	-.15**
9. Depression Symptoms									--	.00	-.03
10. Anxiety Symptoms ^a										--	-.11+
11. Age											--
Mean	75 ^b	2.56	11.28	5.36	7.22	4.18	7.99	6.76	35.29	62.06	15.59
Standard Deviation	22.06 ^b	5.35	10.46	12.32	6.31	2.07	3.32	3.70	13.06	17.42	1.41
Cronbach's Alpha	--	--	--	--	.76	.82	.84	.92	.93	.91	--

Note

+ $p < .07$;* $p < .05$;** $p < .01$;*** $p < .001$

Associations involving suicidal and self-injurious thoughts and behaviors are standardized betas coefficients derived from quasi-poisson regressions. Associations among continuous variables (risky behaviors, victimization, psychiatric symptoms, and age) are Pearson product-moment correlation coefficients. NSSI = Non-suicidal self-injury.

^aStandardized residuals computed by regressing depression symptoms on anxiety symptoms.

^bValues represent the number and percentage of adolescents who made at least one past month suicide attempt

Total effects models for peer victimization (overt, relational, reputational) and past month suicidal thoughts and behaviors (ideation, plans, and attempts)

Table 2

Suicide Ideation			Suicide Plans			Suicide Attempts		
<i>b</i> (<i>SE</i>)	<i>t</i>		<i>b</i> (<i>SE</i>)	<i>t</i>		<i>b</i> (<i>SE</i>)	<i>t</i>	
Exposure: Overt Victimization								
Overt	0.01 (0.02)		0.54	-0.10 (0.11)	-0.87	0.22 (0.03)	6.51***	
Overt Square	--		--	0.10 (0.04)	2.33*	--	--	
Overt Cube	--		--	-0.01 (0.003)	-2.24*	--	--	
Age	-0.02 (0.04)		-0.46	-0.22 (0.08)	-2.85**	-0.12 (0.09)	-1.43	
Anxiety	0.05 (0.05)		1.02	-0.08 (0.11)	-0.77	-0.18 (0.11)	-1.59	
Depression	0.03 (0.004)		6.46***	0.04 (0.01)	3.84***	-0.002 (0.01)	-0.26	
Exposure: Relational Victimization								
Relational	-0.01 (0.02)		-0.54	-0.03 (0.04)	-0.95	0.04 (0.05)	0.98	
Relational Square	--		--	0.02 (0.01)	3.13**	--	--	
Age	-0.03 (0.04)		-0.71	-0.26 (0.08)	-3.33***	-0.16 (0.10)	-1.57	
Anxiety	-0.06 (0.05)		1.12	-0.06 (0.11)	-0.53	-0.18 (0.14)	-1.29	
Depression	0.03 (0.005)		6.26***	0.04 (0.01)	3.94***	0.002 (0.01)	0.13	
Exposure: Reputational Victimization								
Reputational	-0.002 (-0.01)		-0.12	0.02 (0.03)	0.77	0.11 (0.04)	3.08**	
Age	-0.03 (0.04)		0.44	-0.23 (0.08)	-2.96**	-0.13 (0.09)	-1.40	
Anxiety	0.05 (0.05)		1.00	-0.08 (0.11)	-0.70	-0.24 (0.13)	-1.80	
Depression	0.03 (0.004)		6.31***	0.04 (0.01)	4.05***	-0.004 (0.01)	-0.41	

Note.

* $p < .05$;** $p < .01$;*** $p < .001$.*b* = regression coefficient; *SE* = Standard Error; *t* = *t*-value; Square = Quadratic Term; Cube = Cubic Term.

Table 3

Relations between peer victimization and proposed mediators

	NSSI		Risky Behaviors	
	<i>b</i> (<i>SE</i>)	<i>t</i>	<i>b</i> (<i>SE</i>)	<i>t</i>
Exposure: Overt Victimization				
Overt	−0.005 (0.05)	−0.11	1.07 (0.16)	6.88 ***
Age	−0.23 (0.08)	−2.88 **	0.41 (0.23)	1.81
Anxiety	−0.16 (0.11)	−1.46	−1.22 (0.32)	−3.87 ***
Depression	0.05 (0.01)	4.96 ***	0.09 (0.02)	3.78 ***
Exposure: Relational Victimization				
Relational	−0.01 (0.04)	−0.32	0.31 (0.11)	2.84 **
Age	−0.28 (0.08)	−3.45 ***	0.23 (0.24)	0.34
Anxiety	−0.24 (0.11)	−2.15 *	−1.45 (0.34)	−4.21 ***
Depression	0.05 (0.01)	4.10 ***	0.09 (0.03)	3.19 **
Exposure: Reputational Victimization				
Reputational	0.03 (0.03)	1.00	0.60 (0.09)	6.49 ***
Age	−0.20 (0.08)	−2.51 *	0.39 (0.23)	1.68
Anxiety	−0.17 (0.11)	−1.52	−1.51 (0.33)	−4.62 ***
Depression	0.05 (0.01)	4.55 ***	0.07 (0.03)	2.66 **

Note.

*
 $p < .05$;**
 $p < .01$;***
 $p < .001$. b = regression coefficient; SE = Standard Error; t = t -value; NSSI = Non-suicidal self-injury.

Table 4

Mediation models for suicide plans and attempts

Natural Direct Effect			Natural Indirect Effect		
<i>pe</i> (<i>SE</i>)	95% CI	<i>p</i>	<i>pe</i> (<i>SE</i>)	95% CI	<i>p</i>
Multiple Mediator Analyses^a					
<i>Outcome: Suicide Plans</i>					
Overt	0.35 (0.26)	.167	−0.15, 0.85	−0.04 (0.08)	.621
Relational	0.27 (0.19)	.155	−0.10, 0.65	0.01 (0.03)	.759
<i>Outcome: Suicide Attempts</i>					
Overt	0.10 (0.02)	<.001	0.05, 0.15	0.04 (0.01)	.009
Reputational	0.07 (0.04)	.074	−0.01, 0.15	0.05 (0.02)	<.001
Single Mediator Analyses					
<i>Exposure: Overt Victimization, Outcome: Suicide Attempts</i>					
NSSI	0.13 (0.02)	<.001	0.09, 0.18	<0.001 (0.002)	.942
Risky Behavior	0.10 (0.02)	<.001	0.05, 0.15	0.04 (0.01)	.006
<i>Exposure: Reputational Victimization, Outcome: Suicide Attempts</i>					
NSSI	0.13 (0.05)	.009	0.03, 0.22	0.002 (0.003)	.455
Risky Behavior	0.08 (0.04)	.036	0.01, 0.16	0.05 (0.02)	<.001
Reproducibility Analyses: Tingley et al. (2014) Package^b					
<i>Exposure: Overt Victimization, Outcome: Suicide Attempts</i>					
NSSI ^c					
Risky Behavior	0.11	<.001	0.04, 0.20	0.03	.02
<i>Exposure: Reputational Victimization, Outcome: Suicide Attempts</i>					
NSSI					
Risky Behavior	0.10	.02	0.02, 0.19	0.05	.02

Note. *pe* = point estimate; *SE* = standard error; NSSI = Non-suicidal self-injury.

^aThe Bonferroni-adjusted alpha was set at $p < .013$ for multiple mediator analyses.

^bThe Tingley et al. (2014) Package uses bootstrapped confidence intervals and thus, no standard errors were generated. Further, package restricts exact *p*-values to two decimal places.

^cNatural direct and indirect effects of victimization on suicide attempts through NSSI could not be computed with the Tingley et al. (2014) R Package because it does not allow count mediators.