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Christina M. Sellers

Antonia Díaz-Valdés

Andrew C. Porter

Catherine R. Glenn
Old Dominion University, cglenn@odu.edu

Adam Bryant Miller

See next page for additional authors

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Nonsuicidal Self-injury, Suicide Planning, and Suicide Attempts Among High-risk Adolescents Prior to Psychiatric Hospitalization

Christina M. Sellers[1,2], **Antonia Díaz-Valdés**[3], **Andrew C. Porter**[4], **Catherine R. Glenn**[4,5,6], **Adam Bryant Miller**[7], **Adeline Wyman Battalen**[1], **Kimberly H. McManama O'Brien**[1,8]

[1]Department of Psychiatry, Boston Children's Hospital, Boston, MA 02115, US

[2]School of Social Work, College of Social Science, Policy, and Practice (CSSPP), Simmons University, Boston, MA 02115, US

[3]Faculty of Humanities, Society and Health Research Center, Universidad Mayor, 7750000 Santiago, Chile

[4]Department of Psychology, University of Rochester, Rochester, NY 14627, US

[5]Department of Psychiatry, University of Rochester Medical Center, Rochester, NY 14627, US

[6]Department of Psychology, Old Dominion University, Norfolk, VA 23529, US

[7]Department of Psychology and Neurosciences, The University of North Carolina At Chapel Hill, Chapel Hill, NC 27599 Raleigh, US

[8]Department of Psychiatry, Harvard Medical School, Boston, MA 02115, US

Abstract

The purpose of this study was to understand the trajectories of nonsuicidal self-injury (NSSI) and suicide plans (SP) in the 90 days prior to inpatient hospitalization, understand the role of NSSI and SP in predicting suicide attempts (SA) on a given day, and to test the interaction between NSSI and SP in predicting same-day SA. Participants included 69 adolescents (77% female, 65% white, 77% Non-Hispanic/Latinx, M_{age} = 15.77 SD_{age} = 1.00) from an inpatient psychiatric unit. Past 90 day NSSI, SP, and SA were measured using the Columbia Suicide Severity Rating Scale and Timeline Follow Back. First, mixed effect models were conducted to assess trajectories of NSSI and SP leading up to inpatient hospitalization. The odds of NSSI remained relatively stable prior to hospitalization (OR = 1.01, 95% CI [1.00,1.02]). The odds of SP increased in the 90 days prior to hospitalization (OR = 1.04, 95% CI [1.02,1.05]) with each day associated with a 4% increase

Christina M. Sellers Christina.Sellers@simmons.edu.

Authors Contributions Sellers, O'Brien, Glenn, and Porter conceived the study and determined the methodology. Díaz-Valdés conducted the study analyses with support from Miller. Sellers and Wyman Battalen collected all study data. All authors contributed to the first draft of the manuscript and all authors have approved the final manuscript.

Compliance with Ethical Standards

Conflicts of Interest The authors declare that they have no conflict of interest to report.

Ethical Approval All procedures performed in this study, involving human participants, were approved by the overseeing Institutional Review Board and in accordance with ethical standards.

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

in the odds of making a SP. Second, random effect models were conducted to predict the odds of same-day SA from NSSI and SP. When adolescents endorsed either NSSI (OR = 2.99, $p < .001$) or a SP (OR = 77.13, $p < .001$) there was elevated odds of same-day SA. However, the presence of both NSSI and SP on a given day did not increase risk of SA on that same day. For this high-risk clinical sample of suicidal adolescents who drink alcohol, odds of SP increased in the days leading up to psychiatric hospitalization, but NSSI remained stable. On days when adolescents reported NSSI or SP, they had an increased odds of same-day SA. These results underscore the importance of frequent monitoring of NSSI and SP among high-risk adolescents who drink alcohol to prevent suicide attempts.

Introduction

Suicidal and nonsuicidal self-injurious behaviors are persistent public health problems affecting adolescents across the United States. The period of adolescence is marked by increased prevalence rates of both suicidal and nonsuicidal self-injurious behaviors, particularly among high-risk clinical samples (Brown & Plener, 2017; Oquendo & Mann, 2008). Among inpatient adolescents specifically, 47.5% reported a suicide attempt (SA), 53.6% reported a suicide plan (SP) (Prinstein et al., 2008), and 67.9% reported non-suicidal self-injury (NSSI) (Guerry & Prinstein, 2009). Despite mounting knowledge of risk factors for SA, predicting if and when an adolescent will attempt suicide remains difficult. Two of the most robust predictors of a future SA include engaging in NSSI (Muehlenkamp & Brausch, 2014; Ribeiro et al., 2016; Tang et al., 2011; Wichstrom, 2009) and making a SP (Joiner et al., 2003; Nock et al., 2008).

NSSI as a Risk Factor for Suicidal Behavior

The association between nonsuicidal and suicidal behavior is complex. Nonsuicidal and suicidal behaviors are distinct in a variety of ways including the level of suicidal intent, prevalence, frequency, and potential lethality (Glenn et al., 2017; Muehlenkamp, 2014). Specifically, when adolescents engage in NSSI, compared to suicidal behaviors, there is no intent to end one's life as the behavior involves deliberate injury to the self for reasons other than suicide (Hamza & Willoughby, 2015; Nock, 2009). With suicidal behavior, adolescents engage in self-harm with the intent of ending their own life (Silverman et al., 2007). In addition, NSSI is more prevalent and frequent than suicidal behavior in adolescents (Prinstein et al., 2008). Lastly, compared to NSSI, SAs tend to have higher potential medical lethality and more frequently require medical intervention (Grandclerc et al., 2016).

Despite unique distinctions between nonsuicidal and suicidal behaviors, there is significant overlap between the two classes of behaviors. Research has consistently demonstrated that NSSI is a robust risk factor for suicidal behavior (Tang et al., 2011; Wichstrom, 2009). For instance, a recent meta-analysis found that almost half (47.8%) of participants endorsing self-injury made a future SA (Ribeiro et al., 2016). Muehlenkamp and Brausch (2014) found that among young adults, engaging in NSSI within the past year was predictive of a past-year SA, and Asarnow and colleagues (2011) found NSSI to be one of the most robust predictors of a SA, above and beyond prior suicidal behavior. A number of contemporary suicide theories suggest that NSSI may increase risk for suicide by increasing the capability

for suicidal behavior (starting with the interpersonal theory of suicide [Joiner, 2003; Van Orden et al., 2010], and also included in the integrated motivational-volitional model of suicide [O'Connor & Kirtley, 2018] and the Three-Step Theory [Klonsky & May, 2015]). For instance, the interpersonal theory of suicide posits that NSSI increases risk for suicidal behavior by reducing an individual's fear of death and increasing tolerance for pain (Joiner, 2003; Van Orden et al., 2010).

Making the association between NSSI and suicidal behavior even more complex, emerging evidence suggests that NSSI can serve a function that protects against suicidal behavior (Brausch & Muehlenkamp, 2018). Given that NSSI most commonly serves to help alleviate individuals' negative emotional states (Brausch & Muehlenkamp, 2018; Klonsky et al., 2015; Nock & Prinstein, 2004; Taylor et al., 2018), engaging in NSSI may offer some short-term relief and temporarily delay a SA. Given the mixed findings, it is important to examine the trajectory of NSSI leading up to a SA in order to understand if NSSI confers risk for, or protects against, SA in the context of a suicidal crisis leading to inpatient hospitalization.

SP as a Risk Factor for SA

Suicide Planning (SP) is a robust risk factor for SA. SP is often understood as "a proposed method of carrying out a design that will lead to a potentially self-injurious outcome" (Silverman et al., 2007, p. 268). Research has demonstrated that the probability of a SA among individuals who have SP is 56% (Nock et al., 2008). This is substantially higher than the 15.4% of individuals with SI who have a SA without a SP (Nock et al., 2008). Research has also indicated that making a SP increases the odds of a SA, with one study citing that as SP increased, there was a 44% increase in the odds of a SA (Joiner et al., 2003). Joiner and colleagues (2003) also found that during participants' most severe experience of suicidality (i.e., ideation & plan), a SP was the only predictor of eventual death by suicide. These findings suggest that a SP, in addition to NSSI, is a key factor to predicting SA above and beyond the desire to die.

Purpose of Study

Although research has demonstrated both NSSI and SP as risk factors for SA, less is known about these associations over shorter and higher risk time periods, such as the period leading up to psychiatric hospitalization. No research, to our knowledge, has examined these relationships on a daily level prior to hospitalization in order to understand how a SP and NSSI on a given day may influence the odds of a SA on that same day. Understanding the trajectories of nonsuicidal and suicidal self-injurious behaviors among high-risk populations, and specifically among suicidal adolescents who drink alcohol, is necessary in order to identify potential intervention points. Suicidal adolescents who drink alcohol are one of the highest risk groups for suicide death. Research has consistently shown that alcohol use is a risk factor for suicide (Schilling et al., 2009) as alcohol use is associated with a disinhibition of behavior and greater impulsivity. Among suicidal adolescents, disinhibition and impulsivity while drinking can increase the chances of acting on suicidal thoughts (Schilling et al., 2009; Zhang & Wu, 2014). To this end, the present study focused on a sample at high risk for suicide and had three aims. The first aim was to test the trajectories

of NSSI and SP in the 90 days prior to inpatient hospitalization among adolescents. As distress increases, there is reason to believe that NSSI may also increase for those that use it as an emotion regulation strategy. This is based on the consistent findings in the literature that emotion regulation is one of the most common functions of NSSI (Brausch & Muehlenkamp, 2018). Separately, the literature indicates that NSSI increases risk for suicide attempts (Tang et al., 2011; Wichstrom, 2009), but the timeline in how this risk is conferred is unknown. Given that negative emotions increase in the days leading up to a suicide attempt (Bagge et al., 2017), there is reason to hypothesize that NSSI could be used more frequently during this time to cope with negative emotions. Although no other study has examined the 90 days prior to hospitalization in this particular group, we hypothesized that NSSI would increase leading up to hospitalization. Similarly, given the consistent research findings on suicide planning as a risk factor for suicide attempts, we hypothesized that SP would increase leading up to psychiatric hospitalization.

The second aim was to test whether NSSI and SP predicted SA on the same day and over time. We hypothesized that on days when individuals engaged in NSSI or made a SP, they would be at increased risk for a SA. The final aim was to test the interaction between NSSI and SP on SA on the same day and over time. We hypothesized that there would be a significant interaction between NSSI and SP on SA, such that when NSSI and SP occured together the risk of a SA would increase that same day and over time.

Methods

Participants

Data from this study come from the baseline assessments of two different randomized trials of a brief alcohol intervention among adolescents hospitalized for suicide risk (indicated by a SA, SP, or SI) with co-occurring alcohol use (all participants reported alcohol use at least once during the 90-days period: M_{days} = 7.02, SD = 8.80) (McManama O'Brien et al., 2017, 2018). Participants, aged 13–17 years, were recruited from an inpatient psychiatric unit of an urban hospital in the northeastern United States. The typical length of stay at this unit is 7–14 days and to warrant admission adolescents must have a DSM-5 diagnosis that severely impacts their ability to function and their level of risk requires close supervision. To be eligible for this study, participants must have endorsed SI, a SP, or a SA, and alcohol use, precipitating the hospitalization, and been able to speak and understand the English language. To determine eligibility, we conducted a chart review of new patients to the unit where we looked for the presence of these variables in unit questionnaires and medical records. Participants actively experiencing psychosis or in the custody of the state were excluded. The study was approved by the overseeing hospital's Institutional Review Board and all participants and their parents provided informed assent/consent. Participants received a $25 gift card.

The current study includes data from 69 participants (M_{age} = 15.7, SD = 1.0): 77% female, 65% White, and 77% Non-Hispanic/Latinx, who consumed alcohol at least once during the 90 days prior hospitalization (100%, n = 69) and endorsed either SI (100%, n = 69), SP (59.42%, n = 41) or SA (63.77%, n = 44) (see Table 1 for sample demographics).

Measures

Data for this study were collected via semi-structured interviews during the participants' inpatient psychiatric hospitalization. We collected data on SA, SP, and NSSI over the 90 days prior to inpatient hospitalization. We operationalized a SA as "a self-inflicted, potentially injurious behavior with a nonfatal outcome for which there is evidence (either explicit or implicit) of intent to die" (Silverman et al., 2007, p. 273) and a SP as "a proposed method of carrying out a design that will lead to a potentially self-injurious outcome" (Silverman et al., 2007, p. 268). For the purposes of this paper, we differentiated between nonsuicidal and suicidal self-injurious behaviors. Therefore, SP had to involve suicidal intent. In addition, we coded for SP on the day that the adolescent first made the plan or significantly modified their plan, rather than all days when SP was present, and in this paper we use the phrase "made a SP" in order to refer to this. An example of a significant modification to SP would be if an adolescent had planned to die by overdose and kept that plan for some time, then significantly developed/modified that plan by specifying which medications, how many, and when they would try to kill themselves. NSSI was operationalized as "a self-inflected, potentially injurious behavior for which there is evidence (either implicit or explicit) that the person did not intend to kill himself/herself (i.e., had no intent to die)" (Silverman et al., 2007, p. 272).

The Columbia-Suicide Severity Rating Scale (C-SSRS; Posner et al., 2011) was used to assess the presence of SA, SP, and NSSI. This was done by first asking participants if they experienced each of the items on the C-SSRS and then using a a modified version of the Timeline Follow Back Calendar (TLFB; Sobell & Sobell, 1995). Using the TLFB, we assessed frequency and days in which participants engaged in past 90-day SA, SP, and NSSI. This TLFB format has been used successfully in other studies to capture suicide-related data in their relation to substance use (McManama O'Brien et al., 2018; Sellers et al., 2021; Sellers et al., 2019) and prior studies have demonstrated good test–retest reliability for adolescents' self-report specifically for the prior 90 days with intra class correlations ranging from 0.83–0.92 (Levy et al., 2004). To obtain optimal recall of information, the TLFB uses a calendar format with temporal cues (e.g., birthdays, holidays, hospitalizations) to assist in recall of days when suicidal and nonsuicidal behaviors were present: presence of SA on any given day = 1; creation of a SP, or significant modifications of a SP, on a given day = 1; presence of NSSI on a given day = 1. The TLFB has yielded high test–retest reliability in prior studies (Martin-Willett et al., 2020; Linda C. Sobell & Sobell, 1992). Moreover, research has indicated reliability and validity of retrospective recall for NSSI and SP (Fox et al., 2020). Age and gender identity (0 = male, 1 = female; no participants identified as non-binary, transgender participants are coded with the gender they specified) were assessed and included in these analyses as control variables.

Analytic Approach

Data were analyzed with longitudinal modeling using Stata SE 15.1, with days nested within person. Individuals within our sample were independent of each other. We focused on how our measures changed over time. To test our first hypothesis, we estimated the trajectory of NSSI and SP on the 90 days prior to hospitalization through mixed effect models. We conducted *t*-test analyses to explore if the mean number of days adolescents reported

NSSI or SP differed by gender identity. These post-hoc analyses explored between-persons variability in NSSI and SP trajectories. To test our second hypothesis and explore the effect of NSSI and SP on SA, random effect models were conducted – the random and mixed effects were not significantly different, according to Haussman test ($p > 0.05$). All models were estimated using LaPlace method of integration, Bernoulli distribution, full maximum likelihood method of estimation and logit link function to take into account the distribution and nature of our main outcomes (Azevedo-Filho & Shachter, 1994; Kassahun et al., 2012; Kim et al., 2013). Unit-specific models were reported (Kim et al., 2013; Rabe-Hesketh & Skrondal, 2012). Finally, for our third hypothesis, we included an interaction term between NSSI and SP on SA in the random effect models. In our models, we controlled for age and gender identity separately; age was grand mean centered and all categorical vaiables were zero centered.

Results

Univariate Results

55% (n = 38) of adolescents endorsed NSSI on at least one day in the 90 days prior to hospitalization (see Table 1). NSSI was reported, on average, 10 out of the 90 days (11.08% of the time). During that same 90-day period, 59.42% (n = 41) of participants made a SP on at least one day and 63.77 (n = 44)% of participants had a SA on at least one day in the 90 days leading up to inpatient hospitalization. Finally, 25% of the participants of this study reported NSSI and SP on the same day at least once, and did so for an average of 1.43 days out of the 90 days.

Unconditional Models and Intraclass Correlations

Prior to testing hypotheses, an unconditional model was examined to calculate the intraclass correlation (ICC) of 0.32, indicating that about 32% of the variance in odds of attempting suicide was due to between-person differences.

Trajectories of NSSI and SP Leading to Hospitalization

The average odds of NSSI remained stable across the 90 days leading up to hospitalization (OR = 1.01, 95% CI [0.99, 1.02]). However, there was significant between-person variability in this trajectory ($\tau = 0.0002$, $p < 0.001$) (see Table 2). The average odds of SP increased significantly, though modestly, across the 90 days leading up to hospitalization (OR = 1.04, 95% CI [1.02,1.05]). Results indicate that for each day there was a 4% increase in the odds of making a SP. There was, also, significant between-person variability in this trajectory ($\tau = 0.0003$, $p < 0.001$).

Given the significant between-person variability in trajectories, we examined gender identity differences on NSSI and SP, separately, over the 90-days periods. The mean number of days reporting NSSI was higher for females than males (7.02 vs 1.18), but the mean difference was not significant ($t = -1.45$, $p = 0.15$). The mean number of days reporting a SP was higher for males than females (4.46 vs 2.15), but the mean difference was not significant ($t = 0.94$, $p = 0.35$).

Effects of NSSI and SP On Odds of Same-day SA

As depicted in Table 3, we first ran models with only time varying variables. Both NSSI (OR = 3.57, 95% CI [1.86,685]) and SP (OR = 61.02, 95% CI [27.01,137.83]) predicted elevated odds of same-day SA. NSSI and SP predicted 37% of SA. In a second model, we also tested the interaction between NSSI and SP in predicting same-day SA, which was not statistically significant (OR = 0.66, 95% CI [0.15, 2.91]). In other words, there was no additional effect on the odds of SA when both NSSI and SP occurred on the same day.

Our third model included time varying and time invarying variables to predict same-day SA. Females had significantly higher odds of SA compared to males (OR = 4.87, 95% CI [1.41, 16.86]). While the participant's age did not predict the odds of SA (OR = 1.15, 95% CI [0.73, 1.81]). The conditional main effects for NSSI and SP remained significant when controlling for time invariante predictors (ps < 0.001). This full model predicted 34% of SA variance, and presented the worsen fit compared to all other models (AIC = 686.61, BIC = 727.01).

The most parsimonious model (model 4) predicted about 35% of the SA variance. Both NSSI (OR = 3.51, 95% CI [1.84,6.68]) and SP (OR = 62.69, 95% CI [27.87,141.00]) predicted elevated odds of same-day SA, while controlling for gender identity (OR = 5.05, 95% CI [1.45, 17.58]). A participant who endorsed NSSI was 2.51 times more likely to attempt suicide compared to a participant who did not endorse NSSI on that given day. Additionally, a participant who endorsed SP was 61.69 times more likely to attempt suicide compared to a participant who did not endorse SP on a given day.

Discussion

This study investigated trajectories of NSSI and SP in the 90 days prior to inpatient hospitalization of suicidal adolescents who drink alcohol and aimed to understand the role of NSSI and SP in predicting SA. Results from this study partially supported our hypotheses. First, odds of SP, but not NSSI, increased modestly leading up to inpatient hospitalization, partially supporting our first hypothesis. Second, on days when youth engaged in either NSSI or SP, their odds of SA increased on that same day, supporting our second hypothesis. Third, the interaction between NSSI and SP was not significant. In other words, the presence of both NSSI and SP on a given day did not increase risk of SA on that same day, over and above when NSSI or SP occurred alone. However, the prevalence of adolescents who engaged in NSSI and SP on the same day was quite small, which limited our ability to draw conclusions from the findings related to our third aim.

Our findings indicated that the likelihood that an adolescent would make a SP increased in the 90 days leading up to psychiatric hospitalization. In practice, suicide risk assessments often involve gathering a detailed patient presentation of suicidality which includes inquiring about suicide ideation, planning, and other suicide-related behaviors (Jacobs et al., 2010). Our finding of modestly increasing likelihood of SP in the time leading up to hospitalization emphasizes that in addition to assessing for SP, it is important to assess how SP may change over time. This is particularly important as our findings indicated that the likelihood of SP and SA both increased over time for this group of suicidal adolescents who drink alcohol.

Given this study specifically assessed the development and/or modification of a suicide plan, more detail is needed to understand specifically how suicide plans develop or change over time.

Our most novel findings were related to NSSI. NSSI remained relatively stable over the 90 days prior to inpatient psychiatric hospitalization for suicide risk. Adolescents who engaged in NSSI at the beginning of the 90 days continued to engage in NSSI, and adolescents who did not engage in NSSI at the beginning did not increase the frequency of their NSSI leading up to their hospitalization. This may be because among youth with depression, NSSI tends to be relatively stable in nature (Barrocas et al., 2014), and is a distinctly different construct than SA in that there is no suicidal intent of the action itself. In addition, because NSSI serves to habituate the individual to pain via repeated exposure to physically painful experiences (Van Orden et al., 2010), a change in daily frequency over a three month period may not elevate the relative risk of SA, especially for those who may have been engaging in NSSI for months or even years prior. However, it is possible that our sample and methodology conflates these findings as our sample is of suicidal adolescents prior to psychiatric hospitalization, thus decreasing variability of suicidal and nonsuicidal experiences. Nevertheless, our findings imply that simply the presence of NSSI, regardless of change in frequency, confers risk for suicide attempts among high-risk adolescents.

On days when an adolescent engaged in NSSI or made a SP, their risk of SA also increased the same-day. This is consistent with prior research indicating NSSI (Tang et al., 2011; Wichstrom, 2009) and SP (Joiner et al., 2003) are robust risk factors for SA. Given the relationship between NSSI and SA, contemporary theories of suicide (Klonsky & May, 2015; O'Connor & Kirtley, 2018; Van Orden et al., 2010) have been used to help tease apart the functional duality of NSSI and SA. Although engaging in the act of NSSI may offer short-term relief and temporarily delay a SA, especially among persons experiencing emotion dysregulation, continued NSSI may not be an effective long-term strategy (Joiner et al., 2012). Therefore, it is possible that over time this function may no longer be effective and instead may have increased risk for suicide in our sample. Future research should consider examining the time course of NSSI and SA in order to establish at which point NSSI no longer reduces risk and instead increases risk (Brausch & Muehlenkamp, 2018; Burke et al., 2018).

Our findings extend prior research by focusing on the risk that NSSI and SP confer on SA on a given day, as opposed to simply over time. The potential elevation of risk of this relationship suggests the importance of practitioners' awareness of adolescents' ongoing NSSI and SP behaviors. Our finding that SP confers risk for SA on a given day supports current best clinical practices. Specifically, obtaining information that an adolescent has made a SP should signal to the practitioner that more stringent safety measures and perhaps a higher level of intervention and monitoring may be warranted. Although assessing SPs is best practice for all suicidal patients, this is particularly important given the high risk nature of the sample in this study. Research has established that alcohol use is a risk factor for suicide (Brausch & Muehlenkamp, 2018; Burke et al., 2018). Because adolescents who have a suicide plan and become intoxicated may be more likely to act on the plan due to the

disinhibition caused by alcohol (Bagge & Sher, 2008), timely identification of a new SP or alteration of an existing SP among these high risk individuals is evermore critical.

Inconsistent with our hypothesis, the interaction between NSSI and SP on SA was not significant. On days when youth engaged in both NSSI and SP, the odds of making a SA that same day did not change. It is important to recognize that this study looked specifically at the 90 days leading up to inpatient hospitalization of suicidal adolescents, and did not account for the temporal precedence of NSSI and SP on a given day, limiting our ability to examine daily causal effects. Additionally, given the small number of individuals who reported this co-occurrence, these results should be interpreted with caution. Despite the small sample and nonsignificant findings, it is possible that the two behaviors (planning and engaging in NSSI) do not add together to increase risk, but the presence of either alone is sufficient to warrant concern. Other literature indicates that NSSI emerges as a strong predictor of future suicidal behavior, however, comparatively fewer studies have examined suicide planning as a predictor variable. Thus, it is too early to make substantive conclusions. Nonetheless, these results are an important first step and these findings should be examined in larger studies.

Our findings should be interpreted with caution due to a small, homogenous sample of predominantly White females. Our sample consists of adolescents who were admitted to an inpatient psychiatric unit following a suicidal event who were at elevated suicide risk because they also endorsed past-month alcohol use. Consequently, our results are not generalizable to all suicidal adolescents. Rather, results should be applied to a high-risk clinical sample of suicidal adolescents who drink alcohol. Another limitation is that we retrospectively examined their suicidal and nonsuicidal self-injurious behavior leading up to the suicidal event. Although there is the possibility of recall bias given the use of self-report retrospective data, using self-report data allows us to share the experiences of participants from their perspective. Moreover, the use of a reliable and valid measure (the TLFB) helps to mitigate some of that risk. Prior research has demonstrated only *minimal* disparity between the TLFB and actual experiences and scholars have indicated that this may be influenced primarily by individual differnences in reporting (Donohue et al., 2004).

Similarly, our use of retrospective data and lack of temporal ordering of NSSI, SP, and SA on a given day limit our ability to make causal statements despite the longitudinal nature of the data. Despite these limitations, this study utilized recalled daily data to assess the relationship among distinct suicide-related variables on a fine-grained level. This is a strength of our study, as researchers frequently aggregate data which fails to allow for analysis of variability in the days leading up to a suicidal crisis. Future studies could extend research on suicidal and nonsuicidal self-injurious behavior by examining the temporal ordering of events as well as add variables related to emotion dysregulation, using advanced methodology such as ecological momentary assessment. Future studies could also examine longer time periods of the association between NSSI, SP, and SA.

With respect to clinical implications, by looking at daily changes over time in this study we can infer that when suicidal adolescents engage in NSSI or make a SP, they may be at particularly high risk of making a SA on that same day. This finding underscores the

importance of in-the-moment symptom monitoring and indicates the need to develop and test ecological momentary assessments and interventions (Kleiman et al., 2019). In addition, this research suggests how SP may increase over the short-term leading up to SA. However, SP is one of the least well studied constructs in the suicide field and we know even less about suicide planning among youth. Future research is needed to understand how formation of suicide plans or substantial changes to suicide plans may signal risk for SA.

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Data Availability

Data is available upon request.

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Table 1

Descriptive Statistics for Time-Invariant and Time-Varying Variables

Variables	***% (n) / M(SD)***	
Time-Invariant Variables		
Gender Identity		
Male	25% (17)	
Female	77% (52)	
Race		
White	65% (45)	
Non-White	35% (24)	
Ethnicity		
Hispanic/Latinx	23% (16)	
Non-Hispanic/Latinx	77% (53)	
Age	15.77 (1.00)	
Time-Varying Variables	*Between %*	*Within %*
Suicide Attempts	63.77% (44)	3.08% (2.77 days)
Suicide Planning	59.42% (41)	4.23% (3.81 days)
NSSI	55.07% (38)	11.08% (9.97 days)
SA, SP & NSSI	23.19% (16)	1.53% (1.38 days)
Alcohol Use	100% (69)	7.79% (7.01 days)

Table 2

Odds Ratios and 95% Confidence Intervals of the Mixed Effect Model for the Trajectory of NSSI and Suicide Planning

Variable	NSSI	SP
Day	1.01 [0.99, 1.02]	1.04*** [1.02, 1.05]
Var(Day)	0.0002 [0.002, 0.02]	0.003 [0.00016,0.009]

Nonsuicidal self-injury (NSSI); Suicide Plan (SP)

Table 3

Odds Ratios and 95% Confidence Intervals of the Mixed Effect Models of NSSI and Suicide Planning on Suicide Attempts (n = 69 nt = 6,207)

Variable	Model 1	Model 2	Model 3	Model 4
NSSI	3.57 *** [1.86, 6.85]	3.95 *** [1.89, 8.27]	3.51 *** [1.84, 6.69]	3.51 *** [1.84,6.68]
SP	61.02 *** [27.01,137.83]	67.90 *** [27.84, 165.57]	60.92 *** [26.97,137.62]	62.69 *** [27.87,141.00]
NSSI x SP		0.66 [0.15, 2.91]		
Gender Identity			4.87 * [1.41, 16.86]	5.05 * [1.45, 17.58]
Age			1.15 [0.73, 1.81]	
Intercept	0.003 *** [0.00, 0.01]	0.003 *** [0.00, 0.01]	0.001 *** [0.00, 0.00]	0.001 *** [0.00, 0.00]
AIC	690.22	691.92	686.61	684.95
BIC	717.16	725.59	727.01	718.62
ICC	0.37	0.36	0.34	0.35

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Confidence Intervals in Brackets. NSSI nonsuicidal self-injury