Suicide ideation in adolescents following inpatient hospitalization: Intensity and lability over six months of follow up

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Abstract

Understanding suicide ideation (SI) in adolescents, especially during the high risk time following hospitalization for a suicidal event, is a crucial component of improving risk assessment. Most studies rely on single assessments of SI, despite the potential for SI to vary considerably over time. The present study examined how indices of SI intensity (mean values) and lability (mean squared successive difference values) over a six-month period predict suicide attempts and self-harm, as well as how they relate to psychosocial risk factors and affective functioning, in a sample of 103 adolescents hospitalized for a suicide attempt or significant suicide ideation. Across the sample, SI intensity, but not lability, was associated with suicide attempts and nonsuicidal self-injury at six-month follow-up. SI intensity performed similarly to single time point SI assessments, and its relations were not moderated by SI lability. SI intensity was also associated with borderline personality disorder criteria and a history of sexual abuse. In contrast, SI lability was associated with greater negative affect intensity and lability. These findings suggest that intensity of SI may confer more risk post-hospitalization, and provide support for using these statistical methods to capture two distinct parameters of suicide ideation.

Keywords

suicide attempts; adolescents; suicide ideation; self-injury; affective intensity

Improving assessments of risk factors for suicide in adolescents is a critical public health priority. Suicide is the second leading cause of death in adolescents (CDC, 2014), and 8% of high school students engage in suicidal behavior, a quarter of which are severe enough to require medical attention (Kann et al., 2014). A broader group of adolescents (17%) engage in active, clinically significant suicide ideation (Kann et al., 2014). Suicide ideation (SI),

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defined as thoughts, images, and desires for death and/or death by suicide, is a risk factor for future suicide attempts (Lewinsohn, Rohde, & Seeley, 1996; Spirito & Esposito-Smythers, 2006) and death by suicide (Beck, Brown, Steer, Dahlsgaard, & Grisham, 1999). SI is also linked to non-suicidal self-injury (NSSI) (Guan, Fox, & Prinstein, 2012), which in turn may increase risk of engaging in more lethal suicidal behavior (Joiner et al., 2009).

Assessing SI is a central component of suicide risk assessment, in which clinicians ask patients about thoughts of death and thoughts of killing oneself. Despite numerous studies demonstrating increased suicide risk associated with endorsement of SI (Horwitz, Czyz, & King, 2015; Miranda, Ortin, Scott, & Shaffer, 2014), the majority of individuals who engage in SI do not attempt suicide (May & Klonsky, 2016). Improving our understanding of the relationship between SI and suicidal and self-injurious behaviors is essential to improve the ability to predict and prevent suicide and self-harm (Klonsky & May, 2013). This is particularly applicable to high risk clinical samples, such as adolescents following a suicide attempt and hospitalization, in which SI is highly prevalent, compared to general community samples in which the presence of SI may be more of a distinguishing risk factor. Thus, understanding what qualities of suicide ideation translate into heightened risk for suicide attempts is essential for clinicians.

Parameters of Suicide ideation: Intensity and Lability

Despite the primary role of suicide ideation in risk assessment, very little research to date has examined parameters of SI, such as intensity (severity of SI over time) and lability (the extent to which SI levels fluctuate over time). These parameters capture two theoretically orthogonal components of SI over time. For example, an individual with stable but moderate levels of SI and one with several spikes of very elevated but otherwise absent SI might have similar mean scores of SI intensity, but they would have very different lability scores (the stable individual with a low score and the spiking individual with a higher one, and an individual with constantly changing SI higher still).

When considering these patterns of SI and how they may or may not translate to suicidal behavior, clinicians may wonder whether persistently high and intense SI represents a particularly at-risk individual or whether rapidly changing and labile SI is more likely to spur impulsive, suicidal action. Prolonged, intense SI may, over time, deplete an individual's resources and reify thoughts of worthlessness and burdensomeness, and extended periods of suicidal planning, a component of active SI, may also increase an individual's capacity for suicidal behavior. In these ways, chronic, intense SI may elevate multiple risk factors described in the interpersonal-psychological theory of suicide (Joiner, 2005).

In contrast to mean levels of SI intensity, elevated lability represents more frequent and intense shifts in SI. This pattern of more variable SI may reflect greater affective reactivity or lability (Bowen, Balbuena, Peters, Leuschen-Mewis, & Baetz, 2014; Witte, Fitzpatrick, Warren, Schatschneider, & Schmidt, 2006). Evidence links affective instability to NSSI (Bresin, 2013; e.g. Peters, Baetz, Marwaha, Balbuena, & Bowen, 2016; Selby, Franklin, Carson-Wong, & Rizvi, 2013a) and suicidal behaviors (e.g. Fergusson, Woodward, & Horwood, 2000; Glenn, Bagge, & Osman, 2013; Yen et al., 2004), and suggests that suicidal

and self-harming behavior may function as attempts to regulate that distress (Armey, Crowther, & Miller, 2011; Zlotnick, Donaldson, Spirito, & Pearlstein, 1997).

Research on Parameters of Suicide ideation

Most studies rely on single assessments of SI using self-report questionnaires or interviews, which estimate the intensity or amount of SI during a specific time interval, but do not capture change or lability within that period. Some studies look at two or more time points, to predict changes over follow-up (Kovacs, Goldston, & Gatsonis, 1993; Mazza & Reynolds, 1998; Prinstein et al., 2008; Taylor, Gooding, Wood, Johnson, & Tarrier, 2011); however, these types of analyses are unable to characterize the nature of changes in SI beyond directional change between those assessments. Some of these studies do ask at a single time point about temporal aspects of SI, such as those using the Columbia Suicide Severity Rating Scale (C-SSRS; Posner et al., 2011), an interview including items asking about SI frequency ("Have you often thought about killing yourself?") and duration ("When you have these thoughts, how long do they last?"), in addition to rating SI severity. For example, in a community adolescent sample, SI frequency predicted future suicidal behavior, over and above history of suicidal behavior (Miranda et al., 2014). In adolescents and young adult psychiatric emergency room patients (approximately a third of whom were subsequently hospitalized), SI severity predicted future suicide attempts over and above past attempts and NSSI, and, among ideators, frequency of SI was a risk factor for future suicide attempts (Horwitz et al., 2015). However, the C-SSRS does not attempt to capture changeability of SI, nor do these studies track variability in C-SSRS ratings over time.

Several studies have utilized assessments across several time points to examine trajectories of SI in adolescents. One study examined SI in adolescents aged 13–17 years, following inpatient hospitalization for suicide attempts or acute SI using 4 time points (baseline, 3, 6, 12 months). The data fit three trajectories: high, chronic SI over the whole period, rapidly declining SI from high levels at hospitalization, and subclinical SI throughout (Czyz & King, 2014). Another study documented substantial within-person variability in SI in the same adolescent sample as the present study (ICC = .59) (Selby, Yen, & Spirito, 2013b), suggesting that a single index of SI may not adequately describe the phenomenon or provide all clinically relevant information.

While trajectory-modeling and growth-curve modeling approaches provide information about overarching directional change in SI over a period of time, they do not capture shorter-term fluctuations. Clinically, we observe that the course of suicide ideation can range from highly changeable and reactive (i.e., labile) to more chronic and persistent. Only one study to date has examined these parameters of SI and potential indicators of risk. Witte et al (2005) examined intensity, duration, and lability of SI in 108 college students who completed the Suicide Probability Scale (Cull & Gill, 1988) every day for 4 weeks. Only high lability of SI was significantly associated with previous suicide attempt (SA) status, suggesting that individuals who fluctuated the most in their SI were more prone to suicidal action. While this study provides initial evidence for the importance of considering other parameters of SI than intensity, it has several limitations. The study examined associations only with past suicide attempts, not as predictors of suicide attempts over a follow-up

period. The study was of college students; these parameters of SI have never been examined in either adolescents or in a high-risk population. The question remains for more high-risk adolescent groups: does chronicity/sustained intensity or lability confer greater risk factor for future suicide attempts and self-harming behaviors? Additionally, might these parameters interact, such that greater intensity of SI confers more risk depending on lability, or does greater lability confer risk only at certain levels of intensity?

Psychosocial Factors and Suicide ideation in Adolescents

Several environmental and temperamental factors confer risk for suicide ideation and may potentially affect SI lability. For example, childhood abuse can increase risk for both suicide attempts and suicide ideation (Enns et al., 2006), particularly sexual abuse (Fergusson et al., 2000; Molnar, Berkman, & Buka, 2001) and violent sexual or physical abuse (Joiner et al., 2007). Adolescents prone to heightened negative affectivity are also more prone to SI and suicidal behavior (Fergusson et al., 2000). Moreover, borderline personality disorder (BPD) may moderate SI stability; adolescents with BPD experienced greater fluctuations and reductions in SI over 6-month follow up from inpatient treatment (Selby & Yen, 2013). However, limited research has examined how psychosocial factors and affective functioning are associated with multiple domains of SI, specifically intensity and lability.

Present Study

The present study examined how, in a sample of adolescents, indices of SI intensity and lability over a six-month period following inpatient hospitalization predict suicidality and self-harming behaviors. These SI parameters were contrasted with more traditional, single-time point assessments of SI. The interaction between these parameters in predicting suicide and self-harming behavior was also modeled, with SI intensity expected to confer greater risk in the presence of increased lability. Additionally, associations between these SI parameters and several potential affective and psychosocial risk factors were examined, including several risk factors for suicidality (negative affectivity, childhood abuse), as well as factors that have been associated with less stable SI or shifts in SI (negative reactivity, borderline personality disorder).

Methods

Participants

A sample of 119 adolescents hospitalized for a suicide attempt or significant suicide ideation, regardless of psychiatric diagnoses, were enrolled in the study. All participants met hospital criteria for a psychiatric admission on the basis of elevated suicide risk, which typically required SI with a suicide plan. Adolescents who reported self-injury without suicidal intent were not eligible for inclusion in the study. Eligibility requirements also included fluency in English. Exclusion criteria included psychotic disorders or cognitive impairments that could affect reliability of interviews and self-reports. Participants were recruited from a psychiatric hospital in the northeast United States. Parental consent and adolescent assent were required to participate, and all procedures were approved by the Institutional Review Boards of both the hospital and university. Adolescents and parents

were each compensated for their time with $50 for both the initial interview and the six-month follow-up.

Of the 119 participants, 103 returned for follow-up sessions and were included in the present study. Of these, 66 (64.1%) were female, and 79.6% identified as White, 10.7% African American, 1.9% American Indian/Alaskan Native, and 6.8% other, with 16.5% endorsing Hispanic ethnicity. Age of the sample ranged from 13–18 years at the start of the study, with a mean of 15.30 years ($SD = 1.39$). In regard to housing and family, 78% lived with their biological mother and 34% with their biological father (29% with both biological mother and father), 24% with a stepparent, 9% lived with adoptive or foster parents, and 3% lived in a residential facility. The sample was socioeconomically diverse, with 32% of household incomes below $30,000 annually and 35% above $70,000 annually.

Procedure

All measures were administered at baseline, and SI was assessed with the LIFE follow up during 2- and 4- month phone check-ins, and at a six-month follow-up in-person session with both the LIFE and the SIQ. Weekly SI ratings were assigned using the time-line follow-back procedure, described below.

Measures

Baseline Interview Measures

Past History of Suicidal and Self-Harming Behaviors: The Schedule for Affective Disorders and Schizophrenia for School Aged Children – Present and Lifetime Versions (K-SADS-PL; Kaufman et al., 1997) was used to obtain demographic information, family history, and past history of suicidal and self-injurious behavior, as well as psychiatric diagnoses. Adolescent and caregiver participants were individually administered the K-SADS-PL, and consensus ratings using all available data were used to establish histories of suicidal and self-harming behaviors.

Borderline Personality Disorder: Diagnostic criteria of borderline personality disorder were assessed with the Childhood Interview for Borderline Personality Disorder (CI-BPD; Zanarini, 2003). The CI-BPD is the adolescent adaptation of the Diagnostic Interview for DSM–IV Personality Disorders (Zanarini, Frankenburg, Sickel, & Yong, 1996), a semi-structured diagnostic interview for the DSM–IV personality disorders. The nine individual criteria of BPD were coded as either present or absent, and total number of criteria endorsed and diagnostic status (BPD being indicated by the presence of at least five criteria) were coded. The CI-BPD has demonstrated good interrater reliability and validity and a single factor structure, suggesting the DSM-IV criteria also represent a diagnosis in adolescents (Sharp, Ha, Michonski, Venta, & Carbone, 2012). The kappa interrater reliability for BPD diagnosis in this sample was 0.82.

Childhood Abuse: Past history of childhood physical, sexual, and psychological abuse was assessed with the aforementioned K-SADS-PL (Kaufman et al., 1997).

Baseline Self-Report Measures

<u>Suicide ideation:</u> Participants' thoughts about during the prior month were assessed with
the 30-item Suicide ideation Questionnaire (SIQ; Reynolds, 1988). The SIQ was developed
to assess SI in adolescents based on field testing with over 2,400 participants. Responses
were on a 7-point Likert-type scale range from 0 (*I never had this thought*) to 6 (*almost
every day*). Excellent internal consistency and construct validity for the SIQ has been shown
in previous samples (Reynolds, 1988), and internal consistency was similarly high in the
present sample ($\alpha = 0.97$).

<u>Affect Intensity:</u> Participants' trait-level degree of affective responsiveness was assessed
with the 40-item Affect Intensity Measure (AIM; Larsen, Diener, & Cropanzano, 1987). It is
comprised of three subscales: Positive Affectivity, Negative Intensity, and Negative
Reactivity. Response options a Likert-style scale ranged from 1 (Never) to 6 (Almost
Always). The AIM has demonstrated strong test-retest reliability and adequate convergent
and discriminant validity in previous samples (Larsen et al., 1987), as well as excellent
internal consistency in the present study ($\alpha = .89$).

Follow-Up Measures

<u>Suicide ideation:</u> Participants' suicide ideation over time was assessed with the
Longitudinal Interval Baseline and Follow-Up Evaluation-Adolescent version (LIFE; Keller
et al., 1987). The LIFE is a semi-structured interview rating system for assessing the
longitudinal course of psychiatric disorders. The LIFE-Follow Up uses a timeline follow-
back method (described below) to examine the subsequent course of symptoms. This
procedure has demonstrated good interrater and test-retest reliabilities in another
longitudinal, naturalistic study (Warshaw, Dyck, Allsworth, Stout, & Keller, 2001; Warshaw,
Keller, & Stout, 1994), as well as strong interrater reliability for assessing SI within large
adolescent samples (Birmaher et al., 2009).

In conjunction with information from the KSADS-PL, baseline PSR scores were established
for each participant, utilizing a 6-point scale with scores assigned as 6 = *extremely intense*, 5
= *high*, 4 = *moderate*, 3 = *somewhat*, 2 = *minimal*, 1 = *not at all*. Follow-up assessments
were completed at 2, 4, and 6 months following hospitalization. Participants were asked the
following questions to determine their Psychiatric Status Ratings (PSR) for suicide ideation:

> "Sometimes when people are upset or feel bad they think about dying or even
> killing themselves. How often did you have these thoughts? When you had them,
> how long did they last—a few minutes, an hour or more, almost always? Did you
> have these thoughts throughout the past month or were there times when you did
> not have these thoughts? Do you have these thoughts now? Do you have a plan?
> What is it? Have you told anyone about these thoughts or plans?"

As part of the follow-up interviews, participants were asked to identify time anchors (e.g.,
life events, birthdays, holidays) in the preceding time interval to assist with recall of possible
change points in their level of suicide ideation. Participants were reminded of their previous
responses and asked whether changes have occurred during the past two months (or since
the last report if phone follow-up was not successful). Ratings are assigned for each week of

the follow-up interval. Kappas were conducted for baseline ratings by a second rater blind-scoring a randomly selected 10% of the baseline sample and were over .90 (Selby et al., 2013b).

SI was also re-assessed with SIQ at the 6-month in-person follow-up session.

Suicide Attempts: Sections of the KSADS-PL interview were repeated at the 6-month follow-up, including content covering suicidal behavior in the six-month period between hospitalization and follow-up assessment.

Non-Suicidal Self-Injury: NSSI was assessed at the 6-month follow-up using the Functional Assessment of Self-Mutilation (FASM; Lloyd, Kelley, & Hope, 1997), a self-report measure of the methods, frequency, and functions of NSSI. The FASM has demonstrated good reliability and validity in adolescent samples (Nock & Prinstein, 2004). The variable used in the present study was the presence of any NSSI during the follow-up period.

Data Analyses—Longitudinal SI was condensed into several indices from the PSR scores. First, PSR SI scores were centered at 3.5, the scale's midpoint, in order to create more meaningful scores and capture lability around this midpoint. Mean values across all time points were calculated to create an intensity score. Within-person suicidal lability was calculated using mean squared successive difference (MSSD; Neumann, Kent, & Bellinson, 1941). This method has demonstrated validity as index of lability in assessment of suicide ideation (Witte et al., 2005), as well as assessment of affect (Ebner-Priemer, Eid, Kleindienst, Stabenow, & Trull, 2009; Jahng, Wood, & Trull, 2008; Schoenleber et al., 2016). Initially, the difference in SI was calculated between each time point and the preceding one and the differences squared (i.e. $(X_i - X_{i-1})^2$), providing squared successive difference values for each time point beyond baseline. The mean of these squared difference values was then calculated for each participant.

Zero-order correlations were computed between all baseline and follow-up study variables, weekly SI intensity (mean), and SI lability. Spearman-Rank correlations were computed for any analyses involving zero-inflated variables. Pearson correlations were computed for all other associations.

To determine whether SI lability moderated the effect of SI intensity on follow-up suicide attempts (SA) and self-harming behaviors (NSSI), the cross-product of SI intensity and lability was computed and two hierarchical logistic regression analyses were run predicting SA and NSSI at 6 months. In each model, SI intensity and SI lability were entered in the first step. In the second step, the cross-product was added.

Results

Descriptive statistics for study variables are presented in Table 1. Follow-up PSR scores were obtained for 67.71% of the sample at approximately 2 months, 56.25% at approximately 4 months, and 83.33% at approximately 6 months, leading to an average period of recall of 15 weeks (3.70 months). PSR scores were obtained for an average total

period of 7.56 months (SD = 3.38). The distributions of BPD criteria, the AIM, and the SIQ at baseline fell within guidelines for normality (Estimate/SE of skew and kurtosis Tabachnick & Fidell, 2000). SI intensity and lability variables, as well as the SIQ at follow-up, demonstrated positive skew and were zero-inflated. Given that only 7.0% of the sample endorsed psychological abuse, this variable was not included in analyses. PSR score means across 2-month intervals, as well as at the initial week, are presented in Table 2. Across the full sample, mean PSR scores dropped from hospitalization through the end of the follow-up period. While this was true for both adolescents who attempted suicide during the follow-up period and those who did not, the suicide attempting group demonstrated more persistently elevated scores.

Parameters of SI and Suicidal and Self-Harming Behaviors

Correlations between SI dimensions and suicidal and self-harming behaviors are presented in Table 1. SI intensity and lability were not correlated, and SI intensity (but not lability) was strongly correlated with week 1 PSR scores. Both SI intensity and initial SI, but not SI lability, were associated with the SIQ at both time points. Additionally, SI intensity, but not lability, was significantly associated with suicide attempts at baseline and follow-up, as well as nonsuicidal self-injury at follow-up. Initial SI was correlated only with suicide attempts at follow-up. SI intensity performed similar to the SIQ: correlations between SI intensity and these variables were similar to those between the SIQ and the same variables.

Given that SI intensity, but not SI lability, was associated with suicide attempts and self-injurious behaviors at follow-up, we conducted two logistic regressions to better understand the effects of SI intensity on these follow-up risk behaviors. Logistic regression models were examined predicting each outcome at six-months from SI intensity, controlling for (1) history of that behavior at baseline and sex and (2) initial SI (see Table 2). SI intensity remained a significantly predictor of suicide attempts at follow-up when controlling for past history of suicide attempts at baseline. Adding initial SI in the second step of the model predicting suicide attempts did not predict additional variance. A one-point increase (on the 1 to 6 PSR scale) in mean levels of SI intensity across follow-up was associated with approximately double the risk of suicide attempts. SI intensity also predicted NSSI at follow-up over and above past history of NSSI at baseline. While initial SI predicted significant incremental variance in NSSI over and above NSSI history and sex, it did not remain a significant predictor once SI intensity was entered into the model. A one-point increase in SI intensity over follow-up was linked to an approximately 3.5-fold increase in the likelihood of engaging in NSSI during that period.

Moderation of SI Intensity by SI Lability

Results of hierarchical logistic regression models predicting suicide attempts and self-harm from the interaction of SI Intensity and Lability are presented in Table 3. The cross-product did not predict significant variance in the outcomes for either SA or NSSI at 6 months, suggesting that, contrary to hypotheses, lability did not moderate the effect of intensity on SA or NSSI.[1]

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[1]Results were not substantively changed by controlling for sex.

SI Parameters and Psychosocial Risk Factors

We also examined associations between SI indices and psychosocial risk factors. Only SI intensity and initial SI score were associated with a history of sexual abuse, and neither SI intensity nor lability was associated with BPD criteria. Both BPD criteria and a history of sexual abuse were associated with past suicide attempts; in addition, BPD criteria were associated with the SIQ at follow-up and both suicide attempts and NSSI at follow-up.

In contrast, SI lability, but not SI intensity or initial SI, was significantly associated with greater negative affect intensity and reactivity, as assessed by the AIM. The SIQ at baseline and follow-up was significantly associated with negative affect intensity, but not with negative affect reactivity. However, while negative affect intensity demonstrated small associations with past NSSI, neither negative affective intensity nor negative affective reactivity predicted suicide or NSSI outcomes. Positive affect intensity, while unrelated to any SI variables, was associated with fewer suicide attempts at follow-up (Yen et al., 2012).

In order to better understand the nature of the association between negative affect and SI lability, we decomposed the lability index into shifts toward improvement in SI and toward worsening SI. We were specifically interested in clinically significant changes, namely, changes between clinically elevated SI (PSR = 4–6) and absent or passive SI (PSR = 1–3). We coded number of shifts from elevated SI to low SI (improvement) and number of shifts from low SI to elevated SI (worsening). This count variable was then adjusted for the number of weeks adolescents were followed post hospitalization. SI improvement shifts were significantly associated with both negative affect intensity ($r = .27$, $p = .009$) and reactivity ($r = .31$, $p = .003$). SI worsening shifts were not associated with either negative affect intensity ($r = .05$, $p = .65$) or reactivity ($r = .09$; $p = .39$).

Discussion

In this sample of high-risk adolescents, SI intensity and lability over the 6 months following hospitalization were orthogonal parameters that functioned very differently. SI intensity, but not lability, was significantly associated with the occurrence of both suicide attempts and NSSI over the 6-month follow-up period, controlling for past history of suicide attempts and NSSI, as well as initial SI ratings. Contrary to hypotheses, this effect was not moderated by lability, suggesting that intense SI, regardless of whether shifts are occurring, may be most indicative of risk for suicidal or self-harming behaviors. Past sexual abuse also was linked to more intense SI.

SI intensity measured weekly was strongly associated with single time point assessments of SI. When compared to the SIQ, SI intensity demonstrated a similar pattern of associations with suicide and self-harming behaviors; however, when compared with the single initial PSR item, SI intensity demonstrated more robust and consistent associations with outcomes. This may reflect the tendency for repeated assessments to capture less error as well as to better capture a more severe and prolonged episode of SI. These findings have several clinical implications. Continuing to regularly assess SI following hospitalization may allow clinicians and care-takers to track persistence of SI and improve risk monitoring. Also, when assessing SI at a single time point in contexts where weekly check-ins may not be feasible

(such as schools or periodic psychiatric follow-up appointments), utilizing a measure such as the SIQ, rather than a single interview question, may better assess risk.

In contrast, SI lability was not associated with single-time point assessments of SI nor any suicide or self-injury outcomes. As expected, more worsening shifts in SI were associated with greater SI reported at follow-up. Neither worsening nor improving in SI were associated with suicide or self-harm outcomes. These findings suggest that while intensity of SI is a risk-factor for suicide and self-harm for high-risk adolescents, lability may not confer additional risk. SI lability was associated with increased negative affect intensity and reactivity; however, this did not appear translate into higher rates of suicidal behavior as theorized. Interestingly, the association between SI lability and negative affectivity appears to be driven primarily by shifts toward improvement. Adolescents with greater negative affect lability may have been more likely to be hospitalized due to a relatively brief suicidal episode. Their distress and related suicide ideation may also be more responsive to provided coping skills than more stable and persistent negative affect.

These results are in contrast with previous findings in a student sample that suggest lability to be the stronger predictor of past suicide attempts (Witte et al., 2005). Severity of the sample may affect the utility of SI lability in predicting suicidality. In a student or general sample where SI is typically low, greater SI lability may primarily confer greater risk for a shift from better functioning to an impulsive suicide attempt. In contrast, in a high-risk sample of adolescents, such as in the present study, the effects of lability seem to be more mixed. It is possible that for some, increased lability may signify a more fleeting suicidal event, while, for others, lability may drive relapse. This heterogeneity may negate or mask the effect of lability on the risk of attempting suicide and self-harm. Future studies should examine this index of SI as a risk factor across samples at a range of levels of suicidal severity and in different contexts (for example, in school settings with at-risk adolescents), as well as potential moderators of the relationship between SI lability and outcomes. Another possibility is that in a more severe sample, ranges of many variables are more constricted than in a general sample, potentially obscuring correlations and lessening the predictive value of general population risk factors. Testing whether variables that function as risk factors in general populations continue to predict outcomes in these more restricted samples is key for the clinicians providing care to these severe clinical groups.

The present study utilized one approach to capturing SI intensity and lability; future research in this area would benefit from utilizing additional approaches to this research question. Comparing these parameters with trajectory and growth curve-modeling approaches may provide further information about how different methods of quantifying SI over time perform. In particular, examining longitudinal data tracking both SI and specific dates of NSSI and suicidal behavior, would allow researchers to determine whether SI was stable or changing in the period immediately preceding the events. This would provide a more precise analysis of the nature of the SI precipitating suicidal events.

Limitations of the study include use of retrospective report of weekly ratings over past month(s), which requires adolescents to recall changes in their suicide ideation accurately. A related limitation was that some individuals did not complete all of the scheduled follow-up

assessments, resulting in longer periods of retrospective recall for some. We did not directly assess their confidence in these ratings, and there is potential for inaccurate reporting, which would be minimized in prospective designs. In addition, using more fine-grained assessments, such as daily diary or ecological momentary assessment approaches, may capture different aspects of SI lability. Future research delineating how these parameters of SI relate to suicide attempts and self-harm among adolescents, as well as factors that might explain individual differences in pathways between SI and risky behaviors, such as impulsivity, is critical for advancing the science and addressing this important public health issue. Additionally, while a strength of this study is the use of a clinical sample, it limits generalizability to broader community samples. Also, while sample demographics were reflective of the local inpatient populations, the majority of our sample was female and White, so future research should examine these indices of SI in more diverse samples as well as those with different gender and racial proportions to improve generalizability.

Acknowledgments

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Table 1

Descriptives (means and standard deviations or percentages) for and zero-order correlations between suicide ideation, suicidal and self-harming behaviors, psychosocial factors, and affect measures (N=103).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	M (SD)/%
1. SI Int	--															-.94 (1.31)
2. SI Lab	.10	--														.26 (.26)
3. SI T1	.74***	.15	--													3.41 (.16)
4. SIQ base	.36***	.17	.29**	--												92.38 (44.21)
5. SIQ 6-mo	.63***	.07	.32**	.29**	--											41.43 (44.12)
6. SA hx	-.07	.09	-.10	.07	-.02	--										60.4%
7. SA 6-mo	.40***	.02	.25*	.22*	.33**	.05	--									19.2%
8. NSSI hx	.04	.03	-.10	.29*	.19	.38***	-.05	--								76.7%
9. NSSI 6-mo	.40***	-.04	.16	.26*	.44***	.19	.24*	.38***	--							41.6%
10. BPD crit	.14	-.02	.04	.22*	.24*	.25**	.20*	.18	.21*	--						3.90 (2.23)
11. Sex ab	.37***	.11	.25*	.14	.15	.25*	.16	.04	.18	.09	--					26.7%
12. Phys ab	.03	.00	-.02	.07	.01	.13	-.09	.03	.03	.09	.06	--				14.0%
13. Pos Int	-.20	.01	-.09	-.14	-.10	.04	-.24*	-.10	-.13	.01	-.16	.14	--			3.12 (.85)
14. Neg Int	.15	.32**	.09	.34**	.24*	.18	-.05	.24**	.04	.04	-.01	.00	.26*	--		3.79 (.97)
15. Neg Rct	.09	.33**	.09	.13	.01	.13	-.14	.06	-.07	-.19	-.01	.15	.39***	.65***	--	3.82 (1.11)
16. Female	.11	.07	.03	.12	-.03	.16	.09	.11	.00	.21*	.07	-.05	.05	.25*	.24*	64.1%

*
$p<.05$;

**
$p<.01$;

***
$p<.001$

Note: Correlations are Spearman-Rank for associations containing variables 1, 2, and 5 (zero-inflated), and Pearson for all others. Means (M) and standard deviations (SD) are provided for continuous and dichotomous variables; percentages endorsed provided for dichotomous variables.

SI = Suicide ideation; Int = Intensity; Lab = Lability; T1 = initial SI; SIQ = Suicide Ideation Questionnaire; SA = Suicide Attempt; NSSI = Nonsuicidal Self-Injury; BPD crit = borderline personality disorder criteria; sex ab = sexual abuse; phys ab = physical abuse; psy ab = psychological abuse; Pos Int = Postive Affect intensity; Neg Int = Negative Affect intensity; Neg Rct = negative affect reactivity; Female = female sex. All assessments conducted at baseline (base) unless otherwise indicated (6-mo = 6-month follow-up).

Table 2

Raw suicide ideation intensity score means across eight week intervals over the study follow-up, for the full sample (N = 103) and for adolescents who engaged in a suicide attempt during the follow-up period (N = 19) and those who did not (N = 80).

	Total Sample Intensity Score	Suicide attempt during follow-up	No suicide attempt during follow-up
Week 1	3.42	4.21	3.18
1–8 weeks	3.09	3.97	2.85
9–16 weeks	2.59	3.89	2.31
17–24 weeks	2.36	3.45	2.14
25–32 weeks	2.11	3.11	1.87

Table 2

Logistic regression analyses predicting suicide attempt and non-suicidal self-injury at 6 months from mean suicide ideation intensity over 6-month period, over and above past behavior and initial suicide ideation intensity rating (N = 103).

Outcome	Predictors	Exp(B) (final)	95% CI	*p*-value	χ^2	χ^2
Suicide Attempt at 6 mo f/u	Sex	1.71	0.46 – 6.43	.444	1.79	
	SA baseline	1.22	0.36 – 4.10	.748		
	SI initial	0.95	0.58 – 1.55	.827	7.30	5.51*
	SI intensity	2.20**	1.26 – 3.85	<.001	15.78**	8.48**
NSSI at 6 mo f/u	Sex	0.60	0.22 – 1.76	.372	17.00***	
	NSSI baseline	22.97**	3.57 – 147.82	.001		
	SI initial	0.71	0.46 – 1.107	.130	21.64***	4.64*
	SI intensity	3.44***	1.78 – 6.65	<.001	40.66***	19.02***

Note 6 mo f/u = 6-month follow-up; SA = Suicide Attempt; SI = Suicide ideation; NSSI =non-suicidal self-injury

Table 3

Logistic regression analyses predicting suicide attempt and non-suicidal self-injury at 6 months from suicide ideation intensity moderated by suicide ideation lability (N = 103).

Outcome	Predictors	Exp(B) (final)	95% CI	p-value	χ^2	χ^2
Suicide Attempt at 6 mo f/u	SI intensity	2.19**	1.22 – 3.91	.008		
	SI lability	1.81	0.21 – 15.41	.585	16.78***	
	Int X Lab	1.17	0.16 – 8.42	.814	16.80**	0.02
NSSI at 6 mo f/u	SI intensity	1.70*	1.06 – 2.75	.029	18.17***	
	SI lability	1.97	0.21 – 18.89	.751		
	Int X Lab	2.91	0.44 – 19.38	.278	19.53***	1.36

Note 6 mo f/u = 6-month follow-up; SI = Suicide ideation; NSSI = non-suicidal self-injury; Int X Lab = cross-product of SI Intensity and SI Lability.