The Role of Interpersonal Conflict and Perceived Social Support in Nonsuicidal Self-Injury in Daily Life

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Abstract

Although accumulating microlongitudinal research has examined emotion regulatory models of nonsuicidal self-injury (NSSI), few studies have examined how interpersonal contingencies influence daily NSSI behavior. Participants with repeated NSSI ($N = 60$) provided daily ratings of perceived social support, interpersonal conflict, and NSSI urges and behaviors for 14 days. Consistent with interpersonal models of NSSI, we hypothesized that participants would be more likely to engage in NSSI on days when they experienced high levels of interpersonal conflict, that NSSI acts that were revealed to others would be followed by desirable interpersonal changes (i.e., greater support, less conflict), and that these interpersonal changes would, in turn, predict stronger NSSI urges and more frequent NSSI behavior. Consistent with hypotheses, daily conflict was associated with stronger same-day NSSI urges and greater likelihood of NSSI acts. Perceived support increased following NSSI acts that had been revealed to others, but not unrevealed NSSI acts. This perceived support was, in turn, associated with a stronger NSSI urges and greater likelihood of engaging in NSSI on the following day. Moreover, participants whose NSSI was revealed to others engaged in more total NSSI acts during the diary period than those whose NSSI was not revealed to others. Inconsistent with hypotheses, interpersonal conflict did not decrease following NSSI, regardless of whether or not these acts were revealed to others. Together, these results provide preliminary support for interpersonal reinforcement models of NSSI and highlight the importance of expanding research in this area to include interpersonal contingencies that may influence this behavior.

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Keywords

self-harm; social support; experience sampling; daily diary; reinforcement

Nonsuicidal self-injury (NSSI), defined as the deliberate, direct destruction of body tissue without suicidal intent and for purposes not socially sanctioned (International Society for the Study of Self-Injury, 2007), is associated with negative emotional, interpersonal, and physical consequences (e.g., Conterio & Lader, 1998; Favazza, 1998; Turner, Chapman, & Gratz, 2014), including suicidal behavior (e.g., Hamza, Stewart, & Willoughby, 2012) and accidental death. A central question in NSSI research is why some individuals engage in this behavior repeatedly despite these negative consequences. Prominent theories suggest that whereas undesirable consequences of NSSI (e.g., shame, stigma, infection) may occur hours, days, or weeks following NSSI, the immediate relief from aversive emotions provided by NSSI is negatively reinforcing, maintaining ongoing engagement in the behavior (Chapman, Gratz, & Brown, 2006). Microlongitudinal research methods, such as ecological momentary assessment and daily diary paradigms, have played an important role in testing these theories, providing evidence that individuals with a history of NSSI report greater daily negative affect than those without an NSSI history (Bresin, 2014; Victor & Klonsky, 2014) and that specific negative emotional states increase prior to NSSI behavior and decrease in the hours following NSSI (e.g., Armey, Crowther, & Miller, 2011; Snir, Rafaeli, Gadassi, Berenson, & Downey, 2015). Microlongitudinal studies have also identified several individual characteristics that may increase the likelihood of engaging in NSSI, including affective lability (Anestis et al., 2012; Selby, Franklin, Carson-Wong, & Rizvi, 2013), rumination (Selby et al., 2013), impulsivity (Bresin, Carter, & Gordon, 2013), and the combination of high rumination and low emotion differentiation (Zaki, Coifman, Rafaeli, Berenson, & Downey, 2013). Together, these studies highlight the importance of emotion regulation and other individual difference characteristics in NSSI behavior.

Although this research represents a clinically relevant advance, few microlongitudinal studies to date have examined interpersonal contingencies that may influence NSSI, despite theoretical support for the relevance of such factors to NSSI risk (Nock, 2008; Prinstein, Guerry, Browne, & Rancourt, 2009). Developed to complement psychological models of NSSI, interpersonal models of NSSI propose two important relationships between the interpersonal context and NSSI. First, interpersonal models posit that negative interpersonal events often serve as precipitants to NSSI behavior (Prinstein et al., 2009). Indeed, cross-sectional studies find that people who have engaged in NSSI often report that stressors such as conflict, loss, rejection, and separation preceded their NSSI behavior (Rosen, Walsh, & Rode, 1990; Shaw Welch & Linehan, 2002). Second, interpersonal models suggest that NSSI may, at times, be reinforced by desired changes in the interpersonal environment, such as increases in desired behaviors (e.g., support, caretaking, compliance with requests) and reductions in unwanted or aversive behaviors (e.g., demands, requests; Nock & Prinstein, 2004, 2005; Klonsky, 2007). Consistent with this hypothesis, cross-sectional studies show that many people who engage in NSSI report doing so in the service of interpersonal functions (Brown, Comtois, & Linehan, 2002; Nock & Prinstein, 2004; Turner, Chapman, & Layden, 2012). From an anthropological perspective, NSSI may thus be viewed as a signal

of distress that is enacted when less costly or intense behaviors fail to meet interpersonal needs, either because of poor signal quality, timing, or strength, or insufficiently responsive environments (Nock, 2008). An important limitation, however, is that so far much of the data that has been used to test interpersonal models has been drawn from retrospective or cross-sectional studies, limiting our ability to examine how NSSI interacts with interpersonal events in real time.

To our knowledge, only a few microlongitudinal studies have examined the interpersonal contingencies that surround NSSI behavior. Although one study suggested that NSSI thoughts often occurred when adolescents were with peers and felt rejected by others (Nock, Prinstein, & Sterba, 2009), the associations between interpersonal conflict and NSSI have not yet been directly tested. Several studies have shown that participants rarely explicitly endorse interpersonal functions as motivations for NSSI during microlongitudinal studies (Nock et al., 2009; Selby et al., 2013; Snir et al., 2015), though it is unclear whether this is due to a low prominence or prevalence of these motivations, or to shame and stigma associated with endorsing interpersonal motives, which are often viewed negatively (e.g., as "manipulative" or "needy"). Notwithstanding, even if the individual did not *intend* to evoke responses from other people, desirable interpersonal consequences following the behavior would be expected to increase the likelihood of future NSSI and contribute to its maintenance (Linehan, 1993). Thus, it is essential to examine these functions using methods other than explicit self-report. Responding to this need, Snir and colleagues (2015) examined changes in specific emotions surrounding NSSI acts to provide an indirect assessment of possible motivations for NSSI. The results of this study revealed that feelings of perceived rejection/isolation rose in the hours preceding NSSI and decreased following NSSI (Snir et al., 2015). Given that the same pattern was not observed for noninterpersonally oriented emotions (i.e., general negative affect, self-devaluation), the authors proposed that these findings provide indirect support for a communicative function of NSSI, wherein feelings of rejection and isolation are reduced due to increases in the availability or perception of support from others. Further research is needed to test this proposal and the precise interrelations of NSSI behavior and changes in support.

An important presupposition in interpersonal reinforcement models is that people in the individual's interpersonal environment must be aware of at least some instances of this behavior, and modify their behavior in response (e.g., offering greater support, reducing unwanted demands). Although microlongitudinal research suggests that most acts of NSSI occur when an individual is alone (Nock et al., 2009), cross-sectional research shows that most people who engage in NSSI report that at least one other person knows that they have engaged in this behavior (Heath, Ross, Toste, Charlebois, & Nedecheva, 2009; Whitlock, Eckenrode, & Silverman, 2006). Research examining interpersonal reactions to NSSI, however, has largely focused on negative reactions to this behavior (Deiter & Pearlman, 1998; Favazza, 1998), with few studies examining positive or desired interpersonal consequences of NSSI. Moreover, although one longitudinal study found that NSSI (but not other maladaptive behaviors) was associated with increased closeness in adolescents' relationships with their fathers over 1 year (Hilt, Nock, Lloyd-Richardson, & Prinstein, 2008), the more immediate interpersonal sequelae of NSSI remain unknown.

Aims and Hypotheses

Just as intensive, microlongitudinal methods have advanced our understanding of the emotional contingencies surrounding NSSI, a critical next step in research on NSSI is to apply these methods to examining interpersonal contingencies that may also influence NSSI. In particular, this study examined three associations suggested by interpersonal models of NSSI: (a) that NSSI is more likely to occur on days when participants experienced high levels of interpersonal conflict; (b) that NSSI is, in some cases, be followed by desired interpersonal changes; and (c) that these interpersonal changes must increase the likelihood of future NSSI (Nock, 2008; Prinstein et al., 2009). To this end, we used a prospective (2-week) daily diary design to examine these associations in young adults with recent, repeated NSSI. We expected that there would be a positive, within-day association between interpersonal conflict and NSSI urges and probability of NSSI behavior, even after controlling for negative affect (Hypothesis 1). Consistent with interpersonal reinforcement models of NSSI, we expected that only NSSI acts that were revealed to others would be followed by desired changes in the interpersonal environment. Specifically, we hypothesized that NSSI acts that were revealed to others would be associated with next-day increases in perceived support and decreases in conflict (Hypothesis 2). We also examined the prospective associations between perceived support and conflict following revealed NSSI and subsequent propensity to engage in NSSI. We hypothesized that perceived support the day following a revealed act of NSSI would be positively associated with next-day NSSI urges and NSSI acts, whereas perceived support the day following unrevealed NSSI (or days without NSSI) would be unrelated to next-day NSSI urges or acts (Hypothesis 3a). Similarly, we expected that decreases in conflict following revealed NSSI acts would be associated with greater next-day NSSI urges and greater likelihood of NSSI acts (Hypothesis 3b). Finally, we hypothesized that individuals who engaged in NSSI that was revealed to others during the 2-week diary period would report more frequent NSSI during the 2-week monitoring period, than individuals who engaged in only unrevealed NSSI during this period (Hypothesis 4).

Method

Participants

Adults (aged 18 to 35) with recent, repeated NSSI were eligible to participate in this study. The final sample ($N = 60$) averaged 23.25 years of age ($SD = 4.25$). The majority of participants were female (85%) and had completed some or all of a postsecondary degree (74%). Just over half of the participants were in a romantic relationship at the time of the study (58%), but most were not married or cohabiting (80%). Participants identified as White (53%), East Asian (18%), Southeast Asian (8%), Native Canadian (3%), Black or African Canadian (2%), Hispanic or Latino/a (2%), and other ethnicity (8%; ethnicity not reported for n = 3 participants). With respect to sexual orientation, 58% were heterosexual, 25% were bisexual, 6% were gay or lesbian, 5% were pansexual, and the remaining 6% reported another orientation. Participants met criteria for an average of 3.87 lifetime psychiatric disorders ($SD = 2.84$, range = 0 to 11) and 2.03 current disorders ($SD = 1.99$, range = 0 to 10; see Table 1 for further information on the prevalence of current and lifetime

diagnoses for this sample). Despite being a community sample, 80% of participants reported a history of psychiatric treatment and 40.4% reported the current use of psychotropic medications. The mean Global Assessment of Functioning score of participants was 64.71 (SD = 9.72, range = 40 to 90), indicating that, on average, psychiatric symptoms resulted in mild to moderate impairment within this sample.

Assessment of participants' NSSI histories via the Deliberate Self-Harm Inventory (Gratz, 2001) revealed that the most frequent NSSI methods included cutting or carving the skin (85%), self-hitting or banging head (68%), burning (38%) and scratching (33%). The median number of lifetime NSSI acts was 206 (SD = 571.05, range = 15 to 3009), and the median number of NSSI methods used was six (SD = 2.48, range = 1 to 12). The median number of days since participants' last engagement in NSSI was 32 (SD = 78.27, range = 0 to 298). Nearly half of the participants (48%) had engaged in NSSI within 30 days of study participation, and 40% had engaged in NSSI during the 2 weeks prior to study participation. Nearly all of the participants (n = 57 participants; 95%) reported that someone knew about their history of NSSI, including friends (n = 41 participants, 68%), therapists or doctors (n = 36 participants, 60%), family members (n = 35 participants, 58%), and romantic partners (n = 32 participants, 53%). The source of this knowledge was reported to be voluntary disclosure by the participant (n = 32 participants, 53%), unintentional discovery by others (n = 19 participants, 32%), or direct witnessing by others (n = 3 participants, 5%; n = 3 did not report how NSSI was revealed). Of the participants who reported that someone knew about their NSSI history, an average of 11.04 other people were aware of the self-injury (SD = 10.63, range = 1 to 45).

Procedures

Recruitment, screening, and diagnostic assessment—Participants were recruited using online advertisements on community web-sites (e.g., craigslist.org) and flyers posted in stores and community spaces near university campuses and mental health clinics. Interested participants (n = 585) completed an initial online survey, which included the question, "Have you ever deliberately hurt yourself physically, such as by cutting, scratching or burning yourself, but without intending to kill yourself?" to determine whether they had a history of NSSI. Of the 384 participants who were aged 18–35 with either 10 lifetime episodes of NSSI or no history of NSSI, 361 were scheduled for an in-person diagnostic interview, 232 completed the interviews, and 60 met the current study inclusion criteria (i.e., 10 lifetime episodes of NSSI; one NSSI episode in the past year; thoughts or urges for NSSI in the past 2 weeks; regular access to the Internet to complete online surveys).

Because co-occurring psychiatric diagnoses are common among persons engaging in NSSI (Selby, Bender, Gordon, Nock, & Joiner, 2012), we limited exclusion criteria to conditions that could interfere with the diary protocol, including current psychotic disorders, mania, or substance dependence. Graduate and undergraduate research assistants trained by the first and last author assessed potential participants using the Structured Clinical Interview for *DSM–IV* Axis I Disorders (First, Spitzer, Gibbon, & Williams, 1996) and the Diagnostic Interview for *DSM–IV* Personality Disorders (Zanarini, Frankenburg, Chauncey, & Gunderson, 1987). During the interview session, participants also completed the Deliberate

Self-Harm Inventory (Gratz, 2001), a 17-item questionnaire measure of the frequency, duration, and medical severity of 17 methods of NSSI ($\alpha = .87$ for the current study). This assessment session took approximately 2 to 4 hr, and participants were paid $30.

To ensure fidelity and reliability of assessment ratings, all assessors met monthly to review codings, resolve disagreements, and prevent interviewer/rater drift. In addition, the first author reviewed and coded audio-recordings of a randomly selected subset of diagnostic interviews (8% of the 232 interviews conducted for this study). Resulting interrater reliabilities for the diagnostic categories were in the "good" to "substantial" agreement range (average $\kappa = .62$; Landis & Koch, 1977; absolute rates of rater agreement = 80–100%).

Daily diary procedures—Diaries were completed over 14 days. Although end of day reports were expected to adequately capture some outcomes (i.e., presence or absence of NSSI thoughts and acts, see Nock et al., 2009), we expected other phenomena of interest to fluctuate throughout the day (e.g., NSSI urges, mood, interpersonal conflict, perceived support). To increase the reliability and validity of the data, we used a modified day reconstruction method to characterize these phenomena (Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004). This method allows respondents to complete a single daily report at the end of the day during which they are prompted to retrospectively report on different "episodes" within the day. For this study, participants rated NSSI urges, mood, conflict and perceived support separately within three predefined periods each day: morning (defined as the period between first waking up and noon), afternoon (defined as noon to 6 p.m.), and evening (defined as 6 p.m. until the diary entry). Although collecting three retrospective (end of day) reports introduces possible limitations associated with recall biases when compared with more frequent experience sampling procedures, the day reconstruction method remains preferable to collecting a single daily aggregated rating, as it allows participants to capture variability in phenomena that fluctuate within each day. Moreover, the day reconstruction method reduces participant burden and may therefore improve compliance with daily monitoring procedures (Kahneman et al., 2004).

Each evening at 5 p.m., the study coordinator emailed participants a link and password to access the online questionnaires. Questionnaires were administered using Remark Web Survey 5, a software package allowing for online question branching, time/date stamping, and data storage on a secure server. Participants were encouraged to complete the diaries as close to bedtime as possible. Participants who did not complete the previous evening's diary were emailed in the morning and given until 11 a.m. to complete the entry. To ensure that acts of NSSI were not missed, participants were asked to report any NSSI events that took place after the previous evening's diary had been submitted but before the participant went to sleep. Questions were branched so that participants only responded to relevant items (e.g., if they had no contact with their parents, they were not required to rate the quality of parental support). Participants received $45 per week if they completed at least five of seven entries or $60 if they completed all seven entries, for a total compensation between $0 (<5 entries completed per week) and $120 (all 14 entries completed).

Diary Compliance

Participants completed 735 out of the possible 840 diary entries, with an average of 12.10 entries per person (SD = 3.39, range = 1 to 15). Rates of diary compliance were not related to age, $t(58)$ = .08, p = .56), gender, $t(58)$ = −.84, p = .40, or diagnoses: mood, anxiety, or substance use disorders, ts(15.97–58) = −.84–1.52, ps = .12–.56. NSSI acts were reported by 31 participants on a total of 90 days, consistent with rates of NSSI observed in previous microlongitudinal studies (Armey et al., 2011; Nock et al., 2009; Selby et al., 2013; Snir et al., 2015). NSSI observed during the diary period included self-cutting (n = 18 NSSI acts), scratching (n = 32 NSSI acts), hitting (n = 17 NSSI acts), biting (n = 5 NSSI acts), and "other" self-injury (n = 17 NSSI acts, e.g., reopening old wounds or sticking oneself with sharp objects such that bleeding occurred; n = 7[1]).

Measures

Engagement in NSSI—NSSI acts were assessed with the dichotomously rated (yes/no) item, "Did you engage in nonsuicidal self-injury today?" Previous items defined NSSI as, "injuring yourself without intending to die." Participants who endorsed NSSI acts were asked what NSSI method they had used, whether anyone knew about the NSSI (and, if so, who and how they had come to learn about the NSSI), and to rate the perceived impact of NSSI on their emotions and relationships (Nock et al., 2009).

NSSI urges—The five-item Alexian Brothers Urges to Self-Injure Scale (Washburn, Juzwin, Styer, & Aldridge, 2010) was used to assess NSSI urges within each of the three periods (morning, afternoon, evening). Items on the Alexian Brothers Urges to Self-Injure Scale are rated from 0 to 6 and assess the frequency of NSSI thoughts, strength of NSSI urges, time spent thinking about NSSI, difficulty resisting urges, and overall experience of NSSI urges within each period (e.g., "This morning . . . how much time did you spend thinking about injuring yourself or about how you want to injure yourself?"). The five items were summed to yield a total score ranging from 0 (*no urge to engage in NSSI*) to 29 (*extremely high urges to engage in NSSI*) for each period. The three total scores were then averaged to create a daily urges score.

Perceived social support—The Goldsmith Social Support Scale (Goldsmith, McDermott, & Alexander, 2000) uses 12 adjective pairs to assess perceptions of support (e.g., "My romantic partner was . . . *helpful— unhelpful*, *selfish— generous*). Participants provided ratings for three potential sources of support: romantic partners, parents, and peers. Ratings were only provided if the participant first endorsed having had contact (either in person or remotely, e.g., via text message, email, phone call) with that source of support during each daily period (morning, afternoon, evening). Daily support scores were then averaged across nonmissing reports, providing an average daily perceived support score ranging from 1 (*very unsupportive*) to 7 (*very supportive*).

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[1]The precise NSSI method was not available for 10 acts of NSSI reported by participants in response to an item assessing "other" NSSI methods, and method was not reported for one act of NSSI.

Interpersonal conflict—The 17-item Test of Negative Social Exchange (Ruehlman & Karoly, 1991) assessed whether participants had experienced negative interpersonal interactions. Whereas the original measure uses a Likert-type scale to assess degree of conflict over the past month, we used a checklist (present/absent) to better characterize the expected frequency of conflict within each time period (morning, afternoon, evening). The Test of Negative Social Exchange assesses four types of conflict: hostile/impatient (e.g., someone losing his or her temper, yelling at, or becoming angry with the participant), insensitive (e.g., someone taking the participant for granted, ignoring the participants' wishes or needs), interfering (e.g., distracting the participant when he or she was doing something important), and ridiculing (e.g., making fun of, laughing at or gossiping about the participant) interactions. These scales were moderately to highly correlated in the present study, and thus were collapsed into a single total score (γs = .16 to .81, four of six >.50). The 17 items were therefore summed within period and then averaged across periods, creating an average daily conflict score ranging from 0 (*no conflict*) to 17 (*high conflict*).

Negative affect—The Multidimensional Mood Questionnaire (Wilhelm & Schoebi, 2007) consists of six bipolar items assessing three aspects of mood: valence (*content—discontent, well—unwell*), calmness (*relaxed—tense, agitated—calm*), and energetic arousal (*tired—awake, full of energy—without energy*). Given that negative valence/high arousal emotions such as anger and hostility are particularly relevant to daily acts of NSSI (Armey et al., 2011; Claes, Klonsky, Muehlenkamp, Kuppens, & Vandereycken, 2010), we created a composite daily Negative Affect score by creating within-person standardized (*z*) scores indicating average daily Valence and Calmness scores across the three diary periods, and then taking the mean of these two *z*-scored variables to create a composite score. Thus, scores >0 indicate more negatively valenced and higher arousal affect. Previous microlongitudinal research suggests that the Valence and Calmness subscales are correlated between and within persons (Wilhelm & Schoebi, 2007); moreover, these scales were strongly correlated in our data (average within-person correlation: r = .60), supporting the use of this composite score.

Data Analytic Plan

Primary analyses used two-level multilevel models in HLM 7.01 software (Bryk, Raudenbush, & Congdon, 2010). All multilevel analyses used random effects models to allow variability in the intercept and slope. Time was included in all of the models, and was uncentered and modeled as 0 at the intercept and then the number of days from baseline to completion of each diary entry. Dichotomous predictors (i.e., presence/absence of NSSI) were dummy-coded and uncentered, continuous Level 1 predictors (i.e., perceived support, conflict) were standardized (as *z* scores) within each person, and continuous Level 2 predictors (e.g., number of Axis I disorders) were grand-mean centered.

To test our first hypothesis, we examined the within-day associations between daily conflict on Day$_T$ and NSSI urges or acts on Day$_T$, controlling for daily negative affect. Because NSSI acts were assessed dichotomously (present/absent), we used hierarchical generalized linear models (HGLMs) with a Bernoulli distribution and logit link function to derive a

multilevel logistic regression for this outcome. The resulting HGLM coefficients can be interpreted as the log odds of the outcome for the unit-specific model. For example,

Level 1

$$\text{Prob}(NSSI_{Tij}=1|\beta_j)=\varphi_{ij}$$
$$\log[\varphi_{ij}/(1-\varphi_{ij})]=\eta_{ij}$$
$$\eta_{ij}=\beta_{0j}+\beta_{1j}*(Time_T)+\beta_{2i}(Affect_T)+\beta_{3i}(Conflict_T)$$

Level 2

$$\begin{aligned}\beta_{0i} &=\gamma_{00}+\gamma_{01}(\text{Covariate})+r_{0i}\\\beta_{1i} &=\gamma_{10}=\gamma_{11}+r_{1i}\\\beta_{2i} &=\gamma_{20}+\gamma_{21}+r_{2i}\\\beta_{3i} &=\gamma_{30}+\gamma_{31}+r_{3i}\end{aligned}$$

To test the second hypothesis, we computed two dummy-coded variables to indicate the presence of any NSSI acts that had been revealed to others (no revealed NSSI = 0) and the presence of any unrevealed NSSI acts (no unrevealed NSSI = 0). These dummy variables were entered as Level 1 predictors of support or conflict on Day_{T+1}, taking into account the Level 1 effects of time, the autocorrelation of the dependent variable from Day_T to Day_{T+1}, and any Level 2 covariates. The full sample was included in these analyses, to maximize power. For example,

Level 1

$$\text{Support}_{T+1}=\beta_{0i}+\beta(Time_{T+1})+\beta_{2i}(Support_T)$$
$$+\beta_{3i}(Revealed\_NSSI_T)+\beta_{4i}(Unrevealed\_NSSI_T)+e_{ti}$$

Level 2

$$\begin{aligned}\beta_{0i} &=\gamma_{00}(Covariate)+r_{0i}\\\beta_{1i} &=\gamma_{10}+r_{1i}\\\beta_{2i} &=\gamma_{20}+r_{2i}\\\beta_{3i} &=\gamma_{30}+r_{3i}\\\beta_{4i} &=\gamma_{40}+r_{4i}\end{aligned}$$

To test our third hypothesis, we created coefficients representing interpersonal events (perceived support or conflict) following each type of NSSI by multiplying support or conflict on Day_T by three dummy-coded variables characterizing NSSI behavior on the previous day (revealed NSSI, unrevealed NSSI, or no NSSI on Day_{T-1}). These coefficients were then entered as Level 1 predictors of NSSI urges on Day_{T+1}, controlling for the Level 1 effects of time, NSSI urges on Day_T and the effect of support at Day_{T-1}. For example,

Level 1

$$\text{Urges}_{T+1} = \beta_{0i} + \beta_{1i}(Time_{T+1}) + \beta_{2i}(Urges_T) + \beta_{3i}(Support_{T-1})$$
$$+ \beta_{4i}(Support_T * Revealed\_NSSI_{T-1})$$
$$+ \beta_{5i}(Support_T * Unrevealed\_NSSI_{T-1})$$
$$+ \beta_{6j}(Support_T * NoNSSI_{T-1})$$

Level 2

$$\beta_{0i} = \gamma_{00}(Covariate) + r_{0i}$$
$$\beta_{1i} = \gamma_{10} + r_{1i}$$
$$\beta_{2i} = \gamma_{20} + r_{2i}$$
$$\beta_{3i} = \gamma_{30} + r_{3i}$$
$$\beta_{4i} = \gamma_{40} + r_{4i}$$
$$\beta_{5i} = \gamma_{50} + r_{5i}$$
$$\beta_{6i} = \gamma_{60} + r_{6i}$$

Similarly, we modeled perceived support or conflict as Level 1 predictors of the probability of next-day NSSI acts using HGLM models. To test our fourth hypothesis, we divided the sample into two groups: those with any acts of revealed NSSI during the diary period and those with only unrevealed NSSI acts during the diary period. We then used an independent-samples *t* test to examine differences in total NSSI frequency during the 2-week diary period.

Results

Reliability, Data Inspection, and Missing Data

To examine reliability of the diary measures, we used equations provided in Kashdan et al. (2013) to calculate the reliability at the period-level (adjusting for differences among days and people) from the three-level unconditional means models, with items nested within periods nested within people. Coefficients, which can be interpreted as functionally equivalent to Cronbach's alpha, suggested adequate reliability (.72 to .91) for each of the study measures (see Table 2). The intraclass correlation coefficients of the continuously distributed variables fell between .41 and .56 (see Table 2), indicating that between-person processes account for roughly half of the total variance in each variable and that multilevel models were appropriate for these data.

Descriptive information for the primary study variables is presented in Table 2. With respect to data outliers, visual inspection of the Q-Q plots and individual slopes for NSSI urges identified two univariate outliers. These were replaced with the next valid value, which resulted in a more acceptable distribution (skew = 1.45, kurtosis = 1.69). Multivariate inspection did not reveal any significant outliers among the independent variables (Mahalanobis' D_2s > 1.88, ps > .003). Finally, Little's (1988) missing completely at random test supported the assumption that the data were missing at random, $\chi^2(170) = 170.77$, $p = .48$, validating the use of multilevel models with maximum likelihood estimation.

Covariates for Multilevel Models

Prior to conducting the primary analyses, we modeled several potential Level 2 covariates, including gender, age, number of current and lifetime psychiatric disorders (other than personality disorders), and the presence of a mood disorder, anxiety disorder, or borderline personality disorder, as moderators of the intercept for the dependent variables: perceived support, conflict, NSSI urges, and NSSI acts. Female gender was significantly associated with perceived support ($\gamma = -.09$, $p = .04$) and NSSI urges ($\gamma = -.08$ $p = .004$), and lifetime psychiatric disorders were significantly associated with perceived support ($\gamma = -.03$, $p = .02$). Significant covariates were included in subsequent models.

Disclosures of Daily NSSI Acts

Descriptive data revealed that the majority of the 90 NSSI acts that occurred during the 2-week monitoring period were not revealed to others ($n = 63$, 70%). Ten participants reported a total of 27 NSSI acts that were revealed, almost exclusively to romantic partners (93%, $n = 25$ of 27 total acts). These 10 participants did not differ from the remainder of the sample with respect to age, $t(58) = 0.04$, $p = .97$, gender, $\chi^2(1) = 2.12$, $p = .15$, ethnicity, $\chi^2(8) = 7.22$, $p = .51$, sexual orientation, $\chi^2(1) = 0.81$, $p = .37$, presence of a current anxiety disorder, $\chi^2(1) = 3.03$, $p = .08$, mood disorder, $\chi^2(1) = 0.75$, $p = .79$ or borderline personality disorder, $\chi^2(1) = 0.07$, $p = .79$, diagnosis. When asked how other(s) had learned of the NSSI act, these participants reported that: someone was with them when they engaged in the behavior ($n = 14$ acts, 52% of the 27 acts that had been revealed), they had told someone about it ($n = 8$ acts, 30%), or someone had unintentionally found out about it ($n = 4$ acts, 15%). Whereas cutting ($n = 16$ acts of cutting were not revealed, of 18 total) was rarely revealed, more than half of the episodes of other types of NSSI were revealed to others (self-scratching: $n = 17$ revealed of 32 acts total; self-biting $n = 5$ revealed of 5 acts total; self-hitting $n = 9$ revealed of 17 acts total; other NSSI such as severe skin-picking $n = 16$ revealed of 17 acts total), resulting in a significant difference in proportion of acts that were revealed to others as a function of NSSI method, $\chi^2(4) = 16.84$, $p = .002$. The majority of participants who engaged in NSSI during the diary period reported that their NSSI acts had a "neutral or no effect" on their relationships. This was true regardless of whether the NSSI was revealed (80% of revealed NSSI acts were rated as having "no effect or a neutral effect" on relationships) or not (91% of unrevealed NSSI acts were rated as having "no effect or a neutral effect" on relationships, $z = -1.62$, $p = .11$).

Hypothesis 1: Conflict Predicts Same-Day NSSI

Consistent with Hypothesis 1, conflict was positively and independently associated with same-day NSSI urges ($\gamma = .60$, $SE = .15$), $t(58) = 3.88$, $p < .001$, and likelihood of engaging in NSSI (odds ratio [OR] = 1.28, 95% confidence interval [CI] of OR [1.13, 1.46]), $t(58) = 3.88$, $p < .001$, after controlling for average daily negative affect.

Hypothesis 2: Increased Support and Reduced Conflict Follow Revealed Acts of NSSI

Consistent with Hypothesis 2, NSSI acts that were revealed to others were followed by increased perceived social support the following day ($p = .02$, see Table 3), whereas unrevealed NSSI acts were not ($p = .87$). Inconsistent with this hypothesis, however, NSSI

acts were not significantly associated with changes in interpersonal conflict the following day, regardless of whether they had been revealed ($p = .79$) or not ($p = .62$, see Table 3).

Hypothesis 3: Perceived Support Is Positively Associated With NSSI Urges and Acts When It Follows Revealed NSSI

Consistent with Hypothesis 3, perceived support following revealed NSSI was positively associated with subsequent (next-day) NSSI urges ($p = .002$), whereas perceived support following unrevealed NSSI was negatively associated with subsequent urges ($p = .14$; see Table 4). Moreover, perceived support that followed revealed NSSI acts was associated with a greater likelihood of engaging in NSSI the following day ($p < .001$, see Table 4). Finally, supplementary analyses showed a significant relationship between perceived support and next-day NSSI acts only among participants who had revealed at least one act of NSSI during the diary period ($OR = 1.73$, 95% CI of OR [1.07, 2.80]), $t(57) = 2.27$, $p = .03$, compared to those with only unrevealed NSSI ($OR = 0.93$, 95% CI of OR [0.82, 1.06]), $t(57) = -1.12$, $p = .27$. Because analyses examining Hypothesis 2 revealed no significant association between NSSI acts and next-day interpersonal conflict, we did not examine the association of interpersonal conflict with next-day NSSI urges or acts.

Hypothesis 4: NSSI That Has the Potential for Social Reinforcement Is Associated With More Frequent NSSI

Consistent with Hypothesis 4, participants who had revealed at least one act of NSSI during the diary period, and thus had experienced possible interpersonal reinforcement of NSSI, reported more frequent NSSI during the 2-week monitoring period ($M = 4.20$, $SD = 4.00$) than participants with only unrevealed NSSI ($M = 2.00$, $SD = 1.47$), $t(32) = -2.38$, $p = .02$.

Discussion

This study used a daily diary to examine interpersonal contingencies that influence daily variability in NSSI behavior. Specifically, we tested three tenets of interpersonal models of NSSI: (a) that people report greater NSSI urges and are more likely to engage in NSSI on days when they experience high levels of interpersonal conflict, (b) that NSSI that is revealed to others is followed by desirable changes in the interpersonal environment, and (c) that these changes increase the likelihood of subsequent NSSI behavior. Overall, results were partially consistent with our hypotheses. Consistent with cross-sectional work showing an association between interpersonal stressors and NSSI, our results found a positive within-day association between conflict and NSSI urges and acts. Moreover, consistent with interpersonal reinforcement models of NSSI, perceived support was found to increase following NSSI that was revealed to others, and this support, in turn, was associated with increased NSSI urges and greater likelihood of engaging in NSSI the next day. Furthermore, participants whose NSSI was revealed to others during the 2-week diary period engaged in more frequent NSSI during this period, compared to those whose NSSI was not revealed to others. Inconsistent with hypotheses, however, we did not find that interpersonal conflict decreased following acts of NSSI. Nonetheless, findings are consistent with models of NSSI suggesting that this behavior may occur in response to ruptures in relationships, and may

sometimes serve to mobilize support and bolster interpersonal affiliation (Nock, 2008; Prinstein et al., 2009).

There are a number of caveats to consider in interpreting these findings. First, the within-day association of conflict and NSSI does not imply that conflict elicited NSSI behavior; a more frequent assessment schedule is needed to tease apart the temporal sequencing of these events, and to rule out possible confounding factors that could explain this relationship. Second, it is important to note that only approximately one third of the NSSI acts observed during this study were revealed to others, and these acts were reported by a limited subset of participants. Thus, it would be a mistake to assume that interpersonal reinforcement accounts for the majority of NSSI acts, or that interpersonal contingencies are relevant for everyone who engages in NSSI. Moreover, the presence of desired interpersonal changes should not be assumed to exclude the influence of other possible sources of reinforcement, nor should reinforcement contingencies be assumed to imply explicit motivation or a deliberate desire or intention to influence others. Indeed, not only is NSSI likely multifactorial and influenced by a variety of intrapersonal, interpersonal, and environmental contingencies (Nock & Prinstein, 2004, 2005; Prinstein et al., 2009), some of the factors that influence and reinforce NSSI likely operate outside of an individual's awareness (Nisbett & Wilson, 1977; see also Gratz, Chapman, Dixon-Gordon, & Tull, 2015). Nonetheless, the results of this study add to a growing body of literature investigating factors that may maintain NSSI.

In particular, our findings, although preliminary, emphasize the importance of expanding the scope of NSSI research to include interpersonal contingencies that influence this behavior. Previous research suggests that interpersonal events may serve as both antecedents (e.g., Herpertz, 1995; Shaw Welch & Linehan, 2002) and reinforcers (Hilt et al., 2008) of NSSI. Results of this study provide preliminary support for both of these proposed associations. More frequent assessment schedules (e.g., multiple reports per day, or passive continuous monitoring) in future research would allow for an even more fine-grained examination of the dynamic associations of interpersonal events and NSSI, and may help clarify the sequencing of these associations. Further understanding of the scope of intrapersonal and interpersonal contingencies surrounding NSSI could highlight key opportunities to interrupt the behavioral chains that lead to NSSI behavior and promote its repetition. Moreover, examining the longer-term consequences of NSSI disclosures (e.g., weeks or months later) is necessary to improve our understanding of the role of interpersonal consequences in the continuation or desistance of this behavior.

Due to the clinical prevalence of NSSI, it is important to consider how this study may inform assessment and treatment. First, our results suggest that daily acts of NSSI were typically *not* voluntarily disclosed to others. It is therefore important for clinicians to systematically assess for NSSI over the course of treatment, and not to assume that clients will voluntarily reveal recent NSSI acts. Second, our results suggest that individuals who engage in NSSI may not be aware of the interpersonal effects of their NSSI. For instance, whereas previous studies have shown that people rarely explicitly endorse interpersonal motives for NSSI in daily life (Nock et al., 2009; Selby et al., 2013; Snir et al., 2015), indirect probing of the interpersonal sequelae of NSSI revealed that NSSI is sometimes followed by improvements

in perceived relationship quality, at least for those acts that were revealed to others. Helping clients to identify and understand the possible consequences of NSSI and the ways in which these consequences may influence subsequent engagement in this behavior may aid in efforts to decrease NSSI. Additionally, increasing awareness of the positive or potentially reinforcing consequences of NSSI help clients identify more adaptive behaviors that could serve similar functions (e.g., alternate signals of distress that could similarly promote support from others). Indeed, these types of problem-solving strategies are often incorporated into psychosocial treatments for NSSI (see Turner, Austin, & Chapman, 2014). In this vein, these findings point to the potential utility of incorporating an interpersonal focus into treatments for NSSI, through individual or group social skills training or family or couples interventions.

This study has a number of limitations that warrant consideration. The decision to collect a single daily report versus multiple reports per day, although well-suited to examining the next-day associations that were the focus of this study, did not allow us to examine temporal sequences within each day. We made this decision for two primary reasons: (a) Many of the phenomena of interest were expected to be adequately captured via a single daily report (e.g., presence or absence of NSSI acts), and (b) the use of a less burdensome monitoring procedure was expected to improve participant compliance, and, thus data quality. Nonetheless, phenomena that fluctuate rapidly (e.g., emotions during and following social interactions) may be better captured using more frequent or continuous monitoring schedules, such as ambulatory physiological assessment or passive acoustic monitoring. Given the challenges associated with implementing these methods, we believe that the results of the present study are valuable in guiding hypotheses that can be tested using more frequent sampling strategies.

Additionally, there are a number of limitations associated with the inclusion criteria and sample selection strategy used in this study. Inclusion criteria were selected to be similar to previous microlongitudinal investigations of NSSI (e.g., Armey et al., 2011; Nock et al., 2009; Selby et al., 2013) and to capture individuals with current struggles with NSSI. Nonetheless, consistent with most previous studies, only a subset of participants engaged in NSSI during the diary period, and even fewer report NSSI acts that were revealed to others. Replication is necessary to substantiate the robustness of the results supporting Hypotheses 2 and 3, in particular. Although the number of participants engaging in NSSI and the number of NSSI acts observed during this study are comparable to previous microlongitudinal work (Armey et al., 2011; Nock et al., 2009; Selby et al., 2013; Snir et al., 2015), it is likely that more stringent inclusion criteria (e.g., requiring NSSI acts within the 2 weeks prior to study participation) would have resulted in higher rates of NSSI acts and, thus, improved power for some analyses. Moreover, our inclusion criteria focused on NSSI in general, rather than a particular form of NSSI. As a result, the methods of NSSI observed in this study frequently included minor forms of NSSI, such as self-scratching and biting (Lloyd-Richardson, Perrine, Dierker, & Kelley, 2007). Given that the interpersonal sequelae of NSSI may differ depending on the method of NSSI (e.g., cutting may elicit more intense responses from other, relative to minor NSSI), future research examining NSSI method as a moderator of the relations between NSSI and interpersonal support and conflict is needed. Likewise, given that other microlongitudinal studies have found similarly high rates of minor NSSI during

daily monitoring periods (even among samples with high rates of baseline cutting behaviors; Armey et al., 2011; Selby et al., 2013), future research should investigate the contingencies that influence the choice of different NSSI methods. Finally, although we did not have sufficient power to examine how interpersonal sequelae vary depending on *how* NSSI is revealed (e.g., whether it is voluntarily disclosed vs. discovered unintentionally), this is an important question for future research. Taken together, these limitations underscore the need for replication of these findings in larger and more diverse samples, including groups who were not well represented in this study (e.g., male self-injurers). Furthermore, although most participants reported a history of psychiatric treatment, participants were not sampled from a clinical setting and current psychiatric treatment beyond psychotropic medication use was not assessed. Thus, the extent to which these results are applicable to outpatient or other clinical populations needs to be examined.

Additional limitations involve the study's measurement strategy. First, given that this study relied exclusively on participant self-report, interpersonal changes following NSSI were assessed from the perspective of the participants only. Future research should therefore consider how other indices of social support (e.g., informant reports of support provided to the participant) relate to daily NSSI. Furthermore, NSSI acts were assessed with a single yes/no question. Although previous microlongitudinal work suggests that NSSI typically occurs on average one to three times total per week (Armey et al., 2011; Nock et al., 2009), it is possible that some days may have involved multiple instances of NSSI, which would not have been captured using the present assessment strategy. Finally, the current study was limited in its ability to examine how reactions to NSSI may differ depending on relationship type, as NSSI acts were almost exclusively revealed to romantic partners. Given previous findings that the interpersonal sequelae of NSSI vary by relationship (i.e., leading to closer relationships between adolescents and their fathers, but not mothers; Hilt et al., 2008), future research should investigate possible differences in more immediate sequelae depending on the source of support.

Despite these limitations, this study represents an important step in testing prominent interpersonal models of NSSI and clarifying the role of interpersonal factors in NSSI behavior. Furthermore, this study underscores the utility of microlongitudinal designs to investigate other psychological and interpersonal factors that may inform our understanding of NSSI as it occurs in people's everyday lives. Expanding this research to include factors that precipitate, buffer against, and reinforce NSSI will provide a more complete picture of why people engage in this behavior, how to prevent it, and how to improve clinical interventions focused on treating this behavior.

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General Scientific Summary

Interpersonal conflict and support are proposed to play a role in triggering and maintaining NSSI behavior. The results of this study support the notion that people are more likely to engage in NSSI when they experience high levels of conflict with other people. Further, the results suggest that NSSI is sometimes followed by increases in perceived support, which can in some cases make future NSSI more likely.

Table 1

Diagnostic Characteristics of the Sample

	Current (%)	Lifetime (%)
Mood disorders	23.3	80.0
Major depressive disorder	13.3	66.7
Bipolar disorder	3.3	13.3
Dysthymia	8.3	8.3
Anxiety disorders	55.0	68.3
Social phobia	20.0	25.0
Specific phobia	16.7	25.0
Generalized anxiety disorder	15.0	16.7
Panic disorder	13.3	18.3
Agoraphobia without panic	1.7	6.7
Posttraumatic stress disorder	13.3	16.7
Obsessive compulsive disorder	10.0	13.3
Psychotic disorders	1.7	3.3
Substance use disorders	6.7	51.7
Alcohol abuse	3.3	25.0
Alcohol dependence	1.7	33.3
Substance abuse	1.7	13.3
Substance dependence	.0	21.7
Personality disorders	40.0	—
Paranoid personality	5.0	—
Avoidant personality	26.7	—
Dependent personality	3.3	—
Obsessive compulsive personality	8.3	—
Borderline personality	26.7	—
Antisocial personality	6.7	—

Note. Current disorders were defined as having met *DSM-IV* diagnostic criteria within the past month. Personality disorders were counted as "current" if they had been present for the past 2 years. Lifetime personality disorders are not reported because these disorders were only assessed within the past 2 years.

Table 2

Descriptive Statistics for Primary Study Variables Prior to Centering

Continuous	*N* days	Min.	Max.	*M*	*SD*	Skew	Kurtosis	ICC	Reliability
NSSI urges	732	.00	21.67	3.54	4.58	1.45	1.69	.41	.88
Perceived social support	691	1.00	7.00	4.75	1.15	−.04	−.11	.56	.91
Conflict	732	.00	16.00	1.39	2.18	2.40	7.21	.49	.72
Negative affect	731	−2.95	2.88	.00	.86	.08	−.05	.46	.89

Dichotomous	*N* days	*n* Endorsed	% Endorsed	Skew	Kurtosis				
NSSI acts	735	90	12.2	2.31	3.34	—	—		

Note. Min. = minimum; Max. = maximum; ICC = intraclass correlation coefficient; NSSI = nonsuicidal self-injury. ICC and reliability are not reported for NSSI acts, as these were assessed using a single, dichotomous item.

Table 3

Perceived Support and Interpersonal Conflict Following Revealed Versus Unrevealed NSSI Acts

	Predicting next-day support: Fixed effects			Predicting next-day conflict: Fixed effects		
	γ	SE	t	γ	SE	t
Intercept	4.74	.25	19.03 ***	1.61	.25	6.32 ***
Revealed NSSI	.41	.18	2.33 *	.09	.33	.27
Unrevealed NSSI	.02	.11	.16	−.13	.27	−.49
	Random effects			Random effects		
	Est.	SD	χ^2	Est.	SD	χ^2
Intercept	.83	.91	25.19 ***	2.98	1.73	16.50 **
Revealed NSSI	.25	.50	5.39	.67	.82	3.73
Unrevealed NSSI	.02	.14	3.44	.26	.51	.83

Note. NSSI = nonsuicidal self-injury.

*
$p < .05$.

**
$p < .01$.

***
$p < .001$.

Table 4

Next-Day NSSI Urges and Acts Following Contingent and Noncontingent Support

| | Predicting next-day urges | | | Predicting next-day acts | | |
| | Fixed effects | | | Fixed effects | | |
	γ	SE	t	OR	95% CI of OR	t
Intercept	1.74	.85	2.04*	.19	[.14, .27]	−10.40***
Support (revealed NSSI)	3.19	.98	3.26**	6.87	[3.47, 13.58]	5.66***
Support (unrevealed NSSI)	−1.05	.71	−1.49	.73	[.34, 1.54]	−.86
Support (no NSSI)	−.12	.15	.79	1.05	[.94, 1.17]	.83

| | Random effects | | | Random effects | | |
	Est.	SD	χ^2	Est.	SD	χ^2
Intercept	7.97	2.82	2.97	2.08	1.44	7.47
Support (revealed NSSI)	4.46	2.11	2.33	2.81	1.68	10.45*
Support (unrevealed NSSI)	3.19	1.79	7.58	2.12	1.46	5.45
Support (no NSSI)	.10	.31	7.95*	.09	.30	.45

Note. NSSI = nonsuicidal self-injury; *OR* = odds ratio; CI = confidence interval.

*
$p < .05.$

**
$p < .01.$

***
$p < .001.$