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Peer Socialization of Non-Suicidal Self-Injury in Adolescents' Close Friendships

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Abstract
Non-suicidal self-injury (NSSI), or self-harming behavior without intent to die (Nock *Current Directions in Psychological Science, 18,* 78–83, 2009), is associated with distress and impairment across domains, including increased risk for suicidality (Kiekens et al. *Journal of Affective Disorders, 239,* 171–179, 2018). In adolescence, prevalence of NSSI is high (Swannell et al. *Suicide and Life-threatening Behavior, 44,* 273–303, 2014), and peer influence regarding NSSI is thought to be strong (Brechwald and Prinstein *Journal of Research on Adolescence, 21,* 166–79, 2011). Although concern regarding "clusters" of NSSI has long been documented, peer socialization of NSSI in adolescence is understudied. This paper tests peer influence on NSSI frequency within adolescent friendship dyads. Emotion regulation difficulties and friendship quality were evaluated as factors that may influence susceptibility to peer influence effects. Adolescents ($N = 196$, *M age* = 15.68, 69.9% female, 87.6% White) nested within 93 friendship dyads reported on their own NSSI frequency, difficulties in emotion regulation, and friendship quality at three time points spaced 3 months apart. Cross-lagged Actor-Partner Interdependence Models examined peer influence effects over time. Friends' Time 1 frequency of NSSI uniquely predicted adolescents' own NSSI frequency over 3 and 6 months, controlling for initial similarity among friends as well as individual risk factors for NSSI. Peer influence effects were strongest in adolescents with higher levels of emotion regulation difficulty but did not vary as a function of friendship quality. Friends' NSSI frequency is a significant and unique predictor of increases in adolescents' own NSSI frequency over time. Implications for interventions that leverage the important developmental context of peer relationships are discussed.

Keywords Nonsuicidal self-injury · Peer influence · Socialization · Adolescence · Friendships

Non-suicidal self-injury (NSSI) has received increased attention in recent decades, given high prevalence rates and its association with suicidality (e.g., Kiekens et al. 2018; Muehlenkamp and Gutierrez 2007). Adolescents are at particular risk, experiencing higher rates of NSSI than at any other period in the lifespan (Swannell et al. 2014). There is growing interest in interpersonal factors, such as peer influence, that impact both risk for and exacerbation of NSSI (Nock 2009). Despite documentation of NSSI clusters (e.g., Taiminen et al. 1998), direct tests of NSSI socialization are lacking (see Jarvi et al. 2013). What is more, little is known about how third factors that create risk for NSSI may impact socialization susceptibility.

Addressing limitations of past studies, the current research used a longitudinal design and both adolescents' and friends' reports of NSSI to test socialization in friendship dyads over three and 6 months. Dyadic analyses addressed the nested data and isolated socialization effects above and beyond the impact of selection. Emotion regulation and friendship quality were examined as factors that may help to explain and/or enhance NSSI socialization among friends.

Non-Suicidal Self-Injury in Adolescence

NSSI [self-harming behavior(s) without intent to die; Nock 2009] can include cutting, scratching, hitting, burning, or inserting objects under the skin. Most individuals who self-injure use multiple methods and self-injure more than once a week (e.g., Klonsky 2011; Nock and Mendes 2008; Nock and Prinstein 2004). Adolescence is a critical developmental period for NSSI, as onset typically occurs during this time (e.g., Gandhi et al. 2018). Community

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prevalence rates are disproportionately higher in adolescence (17.2%) than in adulthood (5.5%; Swannell et al. 2014), with higher rates in clinical settings (25.7–82%; e.g., Mäkikyrö et al. 2004; Nock and Prinstein 2004). Adolescents who engage in NSSI have greater internalizing, externalizing, substance use, and personality pathology compared with adolescents who do not (Monto et al. 2018; Nock et al. 2006). Adolescent NSSI also is associated with greater suicidal ideation and past and future suicide attempts (e.g., Monto et al. 2018; Muehlenkamp and Gutierrez 2007; Nock et al. 2006).

Current theories posit that NSSI serves both intrapersonal and interpersonal functions (e.g., Nock 2009; Nock and Prinstein 2004). Intrapersonally, NSSI may be one way adolescents regulate negative affect through negative reinforcement processes. Interpersonally, NSSI may provide social reinforcement by intensely communicating distress, strengthening affiliations, or aggressing against others (Nock 2008). Indeed, the most commonly reported reason for NSSI is to regulate negative emotion, and another major function is clearly social (Taylor et al. 2018). Interpersonal factors are understudied as compared to intrapersonal factors. Discussion of social influences began, and has persisted in part, due to observations of NSSI "clusters" in inpatient settings (e.g., Lofthouse and Katz 2009; Matthews 1968; Taiminen et al. 1998). Scholars conceptualized these groupings from the perspective of social learning theory (Nock 2009; Whitlock et al. 2009; Zelkowitz et al. 2017), suggesting that individuals may observe others' NSSI and proceed to self-injure themselves.

Studies do indicate that knowing someone who engages in NSSI is a risk factor for NSSI. A majority of adolescents or young adults who self-injure know a peer who does as well (Claes et al. 2010 Heath et al. 2009). Other studies report that some adolescents get the idea to engage in NSSI from a peer (e.g., Deliberto and Nock 2008), perhaps because they talk about NSSI, share methods, encourage one another, and/or engage in NSSI together (e.g., Curtis 2017; Fisher et al. 2017 Heath et al. 2009; Nock et al. 2009).

Peer Influence in NSSI

Most studies of social influences in NSSI discuss the existence of contagion, or the "spread" of NSSI behavior from one individual to another. While precise definitions of contagion are lacking, peer influence likely encompasses more than mere exposure to another who self-injures. Peer influence involves both selection and socialization (Kandel 1978). Selection refers to the fact that individuals tend to befriend others to whom they are similar (e.g., Mercken et al. 2011). By contrast, socialization, refers to the notion that friends become more similar to one another over time, which most accurately approximates what has been described as contagion[1] (Heilbron and Prinstein 2008). Directly testing socialization requires a longitudinal design, a large sample with sufficient variability in behavior, both adolescent and peer/friend reports of behavior, and statistics that account for the interdependency of nested data and that simultaneously test selection and socialization. Many studies that reference NSSI socialization are limited in one or more of these regards (see Jarvi et al. 2013).

Four studies of adolescent NSSI have addressed some of these limitations in testing selection and/or socialization of NSSI behavior. Two examined socialization effects longitudinally but relied on adolescents' reports of friends' behavior. Hasking and colleagues (Hasking et al. 2013) tested whether knowing a friend who engages in NSSI predicted onset and severity of adolescents' own NSSI over 12 months. Knowing a friend who engaged in NSSI predicted later onset (but not severity) of adolescents' NSSI, but only under conditions of adolescents' own high levels of stress (facilitated socialization) or past thoughts about NSSI (mitigated socialization). In Prinstein et al. (2010)'s Study 2 of female adolescent inpatients, girls' perceptions of their friends' NSSI behaviors were correlated with their own NSSI behavior and predicted the frequency of their own NSSI behaviors over 18 months. It is not known whether the friendships in these studies were current or reciprocal, or whether friends engaged in NSSI, precluding clear understanding of whether socialization occurred. As Heilbron and Prinstein (2008) discussed, correlations between adolescents' behavior and perceptions of friends' behavior can be exponentially greater than correlations between adolescents' and friends' actual behaviors (see also Kandel 1996).

Two other studies used adolescents' and friends' reports of NSSI. You and colleagues (You et al. 2013) tested selection and socialization within adolescents' reciprocal, school-based friendships over 6 months. Although no selection effect was found, friends' NSSI status predicted adolescents' later NSSI status (but not frequency), evidencing socialization. Study 1 of Prinstein et al. (2010) assessed NSSI in sixth- to eighth-grade adolescents' school-based friendships over 12 months, finding support for socialization of NSSI frequency in girls and in sixth graders.

These studies have added to our understanding of NSSI socialization in adolescence, but unanswered questions remain. As adolescents have influential friendships outside of school (Ueno 2005) and highly-distressed friends may not attend school (Freudenberg and Ruglis 2007), studying

[1] In line with current recommendations for language around peer influence, the term contagion is used here only in historical context, and the term socialization is used throughout to reflect efforts to destigmatize individuals struggling with NSSI (see Hasking and Boyes 2018).

adolescents' closest friendships whether in or out of school is important. Further, only two studies tested for both selection and socialization (Prinstein et al. 2010 Study 2; You et al. 2013), and no studies employed dyadic data analyses or statistically isolated socialization by controlling for selection. These analytic considerations are important, as socialization estimates may be inflated when selection is not controlled (Kenny et al. 2006).

It also is unclear whether other (e.g., "third") variables could explain peer influence. Such variables are important to include in empirical tests of socialization to ensure that effects remain after controlling for known NSSI predictors. Socialization does persist after controlling for depressive symptoms and impulsive behavior (Prinstein et al. 2010; You et al. 2013), but other risk factors remain untested. Relatedly, third variables may help explain susceptibility to socialization. Although important discussion has taken place on susceptibility (e.g., Heilbron and Prinstein 2008), few studies have tested moderators of NSSI socialization. As noted, Hasking and colleagues (Hasking et al. 2013) found that high life stress enhanced socialization but past NSSI cognitions mitigated socialization. Prinstein and colleagues (Prinstein et al. 2010) found that socialization occurred only in girls' friendships (Study 1 and Study 2) and in younger adolescents' friendships (Study 1).

Two unexplored areas of potential confound or susceptibility involve emotion regulation difficulties and friendship quality. Theory conceptualizes NSSI as a maladaptive emotion regulation strategy (e.g., Hasking et al. 2017; Nock and Prinstein 2004, 2005), and empirical evidence has amassed to support that adolescents who self-injure have high emotional reactivity and significant regulation difficulties (e.g., Nock and Mendes 2008; Nock et al. 2008; Zelkowitz et al. 2017). Yet no studies have examined whether socialization persists above and beyond risk for NSSI created by adolescents' emotion regulation deficits. It is possible that socialization may be driven in part by emotion regulation difficulties, or, alternately, these difficulties may render adolescents particularly vulnerable to peer influence and may amplify observed NSSI socialization effects.

Research further suggests that poor quality relationships may create risk for NSSI. Most proximal triggers for NSSI are interpersonal (Whitlock et al. 2006), and individuals with NSSI more frequently report rejection (Nock et al. 2009), lower quality relationships (Claes et al. 2010), and less social support (Heath et al. 2009; Tatnell et al. 2014) than individuals who do not self-injure. As such, negative friendship quality may be a risk factor that, if unaccounted for, may drive socialization effects. Negative friendship quality also could exacerbate NSSI socialization effects when they occur.

Interestingly, *positive* friendship quality has been studied as an amplifier for socialization of adolescent depressive symptoms. Socialization of depressive symptoms is stronger within friendships high in qualities like intimacy and caring (Schwartz-Mette and Smith 2018; Stevens and Prinstein 2005). Youth with high-quality friendships spend more time together, potentially offering more opportunity for influence. The idea that particularly close friendships may drive peer influence in NSSI has been used to explain the often observed gender difference in NSSI favoring females (e.g., Bresin and Schoenleber 2015 Mäkikyrö et al. 2004; Monto et al. 2018; Sornberger et al. 2012), as girls' friendships tend to be characterized by high levels of intimacy with and emotional reliance upon friends (see Rose and Rudolph 2006).

The Current Study

The current study addressed limitations of past research in testing the socialization of NSSI frequency. Whether friends' initial NSSI frequency predicted later increases in adolescents' own NSSI frequency was considered. In a community-based, longitudinal sample of adolescent friends, both adolescents' and friends' reports of NSSI were obtained, and dyadic data analyses simultaneously tested selection and socialization. Adolescents chose their closest friend, allowing for testing of socialization within what they considered their most influential friendship. Additionally, the current study incorporated three assessments, allowing testing of socialization over 3 months (a shorter time period than has been previously studied) and 6 months (a timeframe comparable to some past studies of peer influence effects). It was expected that the socialization effect for NSSI frequency would emerge over both 3 and 6 month intervals.

The current study also tested the influence of relevant third variables, emotion regulation difficulties and friendship qualities, to evaluate whether known risk factors for NSSI may drive socialization or, rather, exacerbate socialization risk. It was hypothesized that adolescents' emotion regulation difficulties would amplify socialization effects should they emerge. Regarding the friendship qualities, two possibilities were considered. On one hand, negative quality may exacerbate socialization of NSSI should it emerge above and beyond the influence of poor relationship functioning. On the other hand, positive qualities may also amplify socialization effects by creating close contexts in which adolescents are at greater vulnerability to peer influence. Gender and age differences in each of the relations also were explored.

Method

Participants

Adolescents aged 13 to 18 were recruited from the rural, surrounding communities of a mid-sized public university in

New England. Recruited (target) adolescents ($n = 93$) participated with a same-gender friend, resulting in a total sample of 186 participants (M *age* = 15.68, $SD = 1.49$; 69.9% female) nested in 93 dyads. Participants' racial and ethnic identities were representative of the community population: 87.6% White, 4.3% Black/African American, 3.2% Asian/Pacific Islander, 1.6% American Indian/Alaskan Native, 3.2% Hispanic or Latino(a).[2]

Procedure

All procedures were reviewed and approved by the [institution redacted] Institutional Review Board. The study was advertised to community adolescents as a project aimed at understanding the impacts of friendships on mental health. Invitations were distributed via social media, public posting, and local school and community events. Inclusion criteria were participant age and the ability to identify a same-gender friend within 2 years of their age. Interested youth or parent(s)/guardian(s) contacted the research team for more information. Parental consent was obtained for each minor participant prior to initiating study procedures. Dyads were then scheduled to attend a lab session. Participants aged 18 years provided consent, and all minor participants provided assent. Adolescents and friends next completed self-report measures of NSSI frequency, emotion regulation difficulties, and friendship quality on computers in separate rooms. Dyads also participated in additional laboratory tasks not relevant to the current study. Three and 6 months after the lab visit, adolescents and friends completed follow-up self-reports online. Participants received $40 for the lab visit and $10 for each follow-up.

Missing Data and Data Imputation

Of the 186 participants who completed the Time 1 assessment, 140 (75.3%) completed Time 2, and 110 (59.1%) completed Time 3. Retention was similar to rates reported in past longitudinal studies of NSSI (see Boergers and Spirito 2003). Representative analyses tested whether the 103 youth who completed three assessments differed from the 37 who completed only Time 1 and Time 2, the seven who completed only Time 1 and Time 3, or the 39 who completed only Time 1. One-way ANOVAs indicated that these groups did not differ with regard to Time 1 levels of NSSI [$F(3, 182) = 0.57$, $p = 0.64$], regulation difficulties [$F(3, 181) = 1.97$, $p = 0.12$], positive quality [$F(3, 179) = 0.52$, $p = 0.67$], or negative quality [$F(3, 182) = 2.18$, $p = 0.09$]. A chi-square independence test indicated that groups did not differ in Time 1 reported friendship status [$\chi^2(6) = 6.20$, $p = 0.40$)]. Little's test indicated data were missing completely at random (MCAR), $\chi^2(117) = 103.75$, $p = 0.80$. As imputing missing data is preferable to listwise or pairwise deletion when data are MCAR (Widaman 2006), a multiple imputation procedure was used to impute missing data in Mplus, and the full sample of 186 participants was retained.

Measures

Demographics and Friendship Status At Time 1, participants reported their age, gender identity, racial and ethnic identities, and friendship status (i.e., whether the friend with whom they attended the lab session was a best friend, close friend, just a friend, or not a friend).

NSSI Frequency Participants completed a seven-item measure assessing frequency of engagement in NSSI adapted from the measure used by Prinstein and colleagues (Prinstein et al. 2008). Items at each time point assessed the past-year frequency at which participants engaged in any type of NSSI ["*How often have you harmed or hurt your body on purpose (for example, cutting or burning your skin, hitting yourself, or pulling out your hair) without wanting to die?*"] and four specific types of NSSI: cutting, hitting, pulling hair out, and burning one's own skin. Two items allowed participants to describe and rate the past-year frequency of other methods (e.g., "banging head", "biting myself", "stabbing self"). Each item was rated on a 5-point Likert scale for frequency over the past year including 0 (*Never*), 1 (*Less than 5 times*), 2 (*5–10 times*), 3 (*1-2x times/month*) 4 (*1-2x/week*) and 5 (*Once a day*). Participants' NSSI scores were the highest reported past-year frequency of any type of NSSI at each time point.

Emotion Regulation Difficulties The Difficulties in Emotion Regulation Scale (DERS; Gratz and Roemer 2004) is a 36-item questionnaire assessing the degree to which individuals struggle to regulate emotion (e.g., *I experience my emotions as overwhelming and out of control*). Although the DERS was originally developed for adults, research has established its psychometric properties for use with adolescents (e.g., Weinberg and Klonsky 2009). Participants rated each item on a scale ranging from 1 (*Almost never*) to 5 (*Almost always*). Item scores were summed to yield a total score with higher scores reflecting greater difficulties ($\alpha = 0.96$).

Friendship Quality Participants completed the revised Friendship Quality Questionnaire (FQQ; Rose 2002; revision of Parker and Asher 1993). Twenty five items assessed negative and positive aspects of the friendship with their specific friend. Three items assessed negative friendship quality from the original FQQ. Three FQQ items also assessed each of five positive qualities (validation, help and guidance, conflict resolution, companionship and recreation, intimate exchange), and seven additional items assessed emotional

[2] Percentages do not sum to 100 as some participants identified as more than one race and/or ethnicity or did not respond to this item.

closeness (Bukowski et al. 1994 Camarena et al. 1990). Items were rated on a scale ranging from 1 (*Not at all true*) to 5 (*Really true*). A negative friendship quality score was computed by taking the mean of the responses to the three negative items ($\alpha = 0.86$), and a positive friendship quality score was computed by taking the mean of the responses to the 22 positive items ($\alpha = 0.92$).

Non-Independence of Data and Analytical Approach

Data from each participant were nested within dyads and thus not independent. Intraclass correlation coefficients (ICC) indicated that adolescents and friends were moderately similar with regard to NSSI (Time 1 ICC = 0.24, $p < 0.0001$; Time 2 ICC = 0.20, $p < 0.01$; Time 3 ICC = 0.33, $p < 0.0001$) and regulation difficulties (ICC = 0.20, $p < 0.01$). Friends were highly similar with regard to Time 1 negative quality (ICC = 0.67, $p < 0.0001$) and Time 1 positive friendship quality (ICC = 0.57, $p < 0.0001$). Techniques for handling the dependent data were employed. Specifically, a cross-lagged Actor-Partner Interdependence Model (APIM; Garcia et al. 2015; Kenny 1996) was used to estimate influences of the target adolescent (actor effect) and friend (partner or socialization effect) on adolescents' outcomes, while controlling for initial similarity between friends (selection). A random intercept and fixed main and interaction effects were estimated for each APIM using maximum likelihood estimation with robust standard errors in Mplus (Muthén & Muthén, 1998–2017). All variables were measured at Level 1 (individual level), except gender identity, which was a Level 2 variable. Model fit was assessed using chi-square, root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the Tucker-Lewis index (TLI), with smaller values of chi-square and RMSEA and larger values of CFI and TLI indicating better fit (Byrne 2010; Hu and Bentler 1999). An adjusted Bonferroni correction of 0.01, based on number of tests and average correlation among parameters in each model (see Smith and Cribbie 2013), was applied to all significance tests in the current study.

Results

Descriptive Statistics and Correlations

Adolescents reported that the friend who participated with them was a best (69.9%), close (25.8%), or good (4.3%) friend. See Table 1 for descriptive statistics and bivariate correlations among study variables. Although mean levels of NSSI frequency in the whole sample were low, a sizeable minority reported engaging in NSSI at each time point (Time 1: 27.4%, Time 2: 27%, Time 3: 28%), and moderate stability over time was observed. See Table 2 for information on frequencies by type of NSSI reported. Participants reported moderate levels of emotion regulation difficulties. As is typical in friendship studies (e.g., Chow et al. 2013), levels of negative quality were low and positive friendship quality was high. NSSI frequency at each time point was positively correlated with emotion regulation difficulties but was not correlated with positive or negative quality. Emotion regulation difficulties were associated with lower positive friendship quality but were not correlated with negative quality.

Mean-Level Gender and Age Differences

A series of multilevel models tested whether mean levels of variables varied by gender or age.[3] Separate models were tested in which each variable was predicted by gender or age. The gender effect was significant in predicting Time 1 emotion regulation [Standardized Parameter Estimate (SPE) = −0.43, $p < 0.01$], with girls reporting greater difficulty ($M = 2.38$, $SD = 0.77$) than boys ($M = 2.07$, $SD = 0.64$). Similarly, girls reported higher Time 1 positive quality ($M = 4.26$, $SD = 0.48$) compared to boys ($M = 3.87$, $SD = 0.66$), SPE = −0.43, $p < 0.0001$. No gender differences emerged for NSSI or negative quality; no age differences emerged for any variable.

Socialization of NSSI

A cross-lagged APIM was tested to examine the influence of friends' NSSI frequency on target adolescents' own NSSI frequency over 6 months (see Fig. 1). Adolescents' Time 2 NSSI scores were predicted from their own Time 1 NSSI scores, and their Time 3 NSSI scores were predicted from their Time 2 NSSI scores (within-person stability; actor effects). Adolescents' Time 2 and Time 3 NSSI scores also were predicted from their friends' Time 1 and Time 2 NSSI scores, respectively (socialization; partner effects). Initial similarity between friends (covariance between adolescents' and friends' Time 1 NSSI; selection effect) was controlled. The model had excellent fit [$\chi^2(14) = 11.80$, $p = 0.62$, RMSEA = 0.00, CFI = 1.00, TLI = 1.01]. Adolescents and friends were similar with regard to Time 1 NSSI (COV = 0.24; $p < 0.01$; 95% CI: 0.13, 0.36). The actor effects from Time 1 NSSI to Time 2 NSSI (SPE = 0.45; $p < 0.0001$; 95% CI: 0.39, 0.51) and from Time 2 NSSI to Time 3 NSSI (SPE = 0.63; $p < 0.0001$; 95% CI: 0.52, 0.74) were significant, indicating

[3] Three participants selected a non-binary gender identity. In each case, they were the friend of a target adolescent who reported a gender identity of either female or male. Given that target adolescents recruited a friend of their same gender, gender was treated as a Level 2 variable. The pattern of results was identical including these dyads (and using the gender identity reported by the target adolescent in each case as the Level 2 gender variable) and excluding these dyads. As such, all three dyads were retained for study analyses. The sample was stratified by age into two groups: younger adolescents (13–15 years, $n = 80$) and older adolescents (16–19 years, $n = 106$).

Table 1 Descriptive statistics and correlations

	M(SD)	1.	2.	3.	4.	5.	6.
Variable							
1. Time 1 NSSI	0.51(1.02)	–					
2. Time 2 NSSI	0.36(0.82)	0.53****	–				
3. Time 3 NSSI	0.42(0.94)	0.54****	0.74****	–			
4. Time 1 emotion regulation difficulties	2.28(0.75)	0.44****	0.39****	0.34****	–		
5. Time 1 positive friendship quality	4.41(0.57)	−0.07	0.00	0.07	−0.16*	–	
6. Time 1 negative friendship quality	1.62(0.81)	0.10	0.12	0.10	0.05	−0.12	–

*$p < 0.05$ ****$p < 0.0001$

moderate within-person stability over time. The partner effects were significant from Time 1 to Time 2 (SPE = 0.29; $p < 0.0001$; 95% CI: 0.22, 0.36) and from Time 2 to Time 3 (SPE = 0.20; $p \leq 0.01$; 95% CI: 0.07, 0.33) over and above initial similarity and within-person stability, indicating socialization of NSSI frequency within friendship dyads over time.

Multiple group comparisons next tested whether the model varied by gender or age. An unconstrained model in which all parameters varied by gender or age was compared to a series of increasingly constrained models including the structural weights (structural weights constrained to be equal across gender or age), structural covariances (covariances also constrained), and structural residuals (all parameters constrained) models. The most parsimonious model that did not differ from the unconstrained model for gender was the structural residuals model [$\Delta\chi^2(17) = 22.80$, $p = 0.16$], indicating that no aspect of the model differed by gender. The structural weights model best fit the data for age [$\Delta\chi^2(8) = 7.08$, $p = 0.53$], indicating that actor and partner effects were equivalent for younger and older adolescents.

Moderation of NSSI Socialization Effects

Analyses further tested whether the socialization of NSSI frequency was driven or moderated by adolescents' emotion regulation difficulties or by friendship qualities. These models were identical to the initial cross-lagged model except that the main effect of the moderator and the interaction between friends' Time 1 NSSI scores and the moderator were added as predictors of adolescents' Time 2 and Time 3 NSSI scores. Significant interactions were explored using a Johnson-Neyman procedure (see Aiken et al. 1991). In cases of significant interaction effects, simple slopes were tested, and plots of the values of the adjusted NSSI socialization effect across continuous values of the moderator were created.

A model first tested whether socialization of NSSI frequency was driven or enhanced by adolescents' difficulties with emotion regulation. Model fit was excellent [$\chi^2(21) = 21.06$, $p = 0.46$, RMSEA = 0.00, CFI = 1.00, TLI = 1.00]. Adolescents' Time 1 NSSI (SPE = 0.32, $p < 0.0001$; 95% CI: 0.18, 0.45), friends' Time 1 NSSI (SPE = 0.28, $p < 0.0001$; 95% CI: 0.18, 0.37), and adolescents' Time 1 emotion regulation difficulties (SPE = 0.20, $p < 0.01$; 95% CI: 0.09, 0.32) each uniquely predicted adolescents' Time 2 NSSI, controlling for friends' similarity. The interaction of friends' Time 1 NSSI and adolescents' Time 1 emotion regulation difficulties also was significant (SPE = 0.20, $p < 0.01$; 95% CI: 0.08, 0.32). Simple slopes of the socialization effect were calculated at low (−2 *SD*) and high (+ 2 *SD*) levels of difficulty. The socialization effect was not significant at low levels (SPE = 0.19, $p = 0.20$; 95% CI: −0.05, 0.43) but was significant at high levels (SPE = 0.78, $p < 0.0001$; 95% CI: 0.56, 0.99). See Fig. 2 for the 3-month NSSI socialization effect plotted across continuous values of emotion regulation difficulties.

Table 2 Prevalence and forms of NSSI reported

	% of participants reporting any NSSI	% reporting cutting	% reporting hitting	% reporting hair pulling	% reporting burning	% reporting other types
Variable						
1. Time 1 NSSI	27.4%	28%	32%	12%	< 1%	23%
2. Time 2 NSSI	27%	35%	38%	13%	< 1%	13%
3. Time 3 NSSI	28%	33%	33%	13%	< 1%	7%

Percentages for form represent the proportion of participants reporting any NSSI at each time point. These percentages do not sum to 100 as some participants reported engaging in more than one form of NSSI, and some participants reported the frequency of NSSI without specifying the form

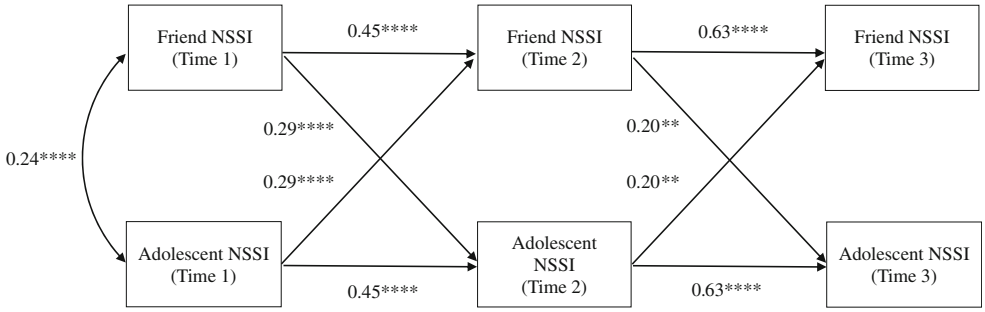

Fig. 1 Basic NSSI contagion model over 6 months. The Time 1 to Time 2 and Time 2 to Time 3 intervals were 3 months. $^{**}p < 0.01$. $^{****}p < 0.0001$. Actor and partner effects for adolescents and friends are identical, as per the constraints of the Actor Partner Interdependence Model for indistinguishable dyads (Kenny et al. 2006)

Adolescents' Time 2 NSSI (SPE = 0.59, $p < 0.0001$; 95% CI: 0.47, 0.72), friends' Time 2 NSSI (SPE = 0.23, $p < 0.01$; 95% CI: 0.11, 0.35) also uniquely predicted increases in adolescents' NSSI frequency at Time 3. However, neither the main effect of adolescents' Time 1 emotion regulation difficulties (SPE = 0.05, $p = 0.33$; 95% CI: −0.04, 0.15) nor the interaction of friends' Time 1 NSSI and adolescents' Time 1 emotion regulation difficulties (SPE = 0.08, $p = 0.17$; 95% CI: −0.02, 0.17) was significant in predicting adolescents' NSSI at 6 months. Multiple group comparisons tested whether this model varied by gender or age. The structural residuals model best fit the data for gender [$\Delta\chi^2(29) = 28.48$, $p = 0.49$], indicating no variability in the model by gender. The structural weights model best fit the data for age [$\Delta\chi^2(14) = 22.03$, $p = 0.08$], indicating that actor, partner, and moderation effects did not vary as a function of age grouping.

With regard to friendship qualities, a model next tested whether negative friendship quality drove or moderated socialization of NSSI frequency. Fit was acceptable [$\chi^2(21) = 33.05$, $p = 0.05$, RMSEA = 0.06, CFI = 0.96, TLI = 0.94]. Actor effects (Time 1 to Time 2 SPE = 0.44; $p < 0.0001$; 95% CI: 0.34, 0.54; Time 2 to Time 3 SPE = 0.62; $p < 0.0001$; 95% CI: 0.50, 0.74) and partner effects (Time 1 to Time 2 SPE = 0.27; $p < 0.0001$; 95% CI: 0.18, 0.36; Time 2 to Time 3 SPE = 0.24; $p < 0.01$; 95% CI: 0.11, 0.37) were significant. However neither the main effects of negative friendship quality on Time 2 NSSI (SPE = 0.04; $p = 0.56$; 95% CI: −0.07, 0.13) or Time 3 NSSI (SPE = 0.01; $p = 0.89$; 95% CI: −0.09, 0.10), nor the interactions predicting Time 2 NSSI (SPE = 0.07; $p = 0.33$; 95% CI: −0.05, 0.20) or Time 3 NSSI (SPE = 0.06; $p = 0.22$; 95% CI: −0.02, 0.14) were significant. The structural residuals model best fit the data for gender [$\Delta\chi^2(29) = 33.09$, $p = 0.27$],

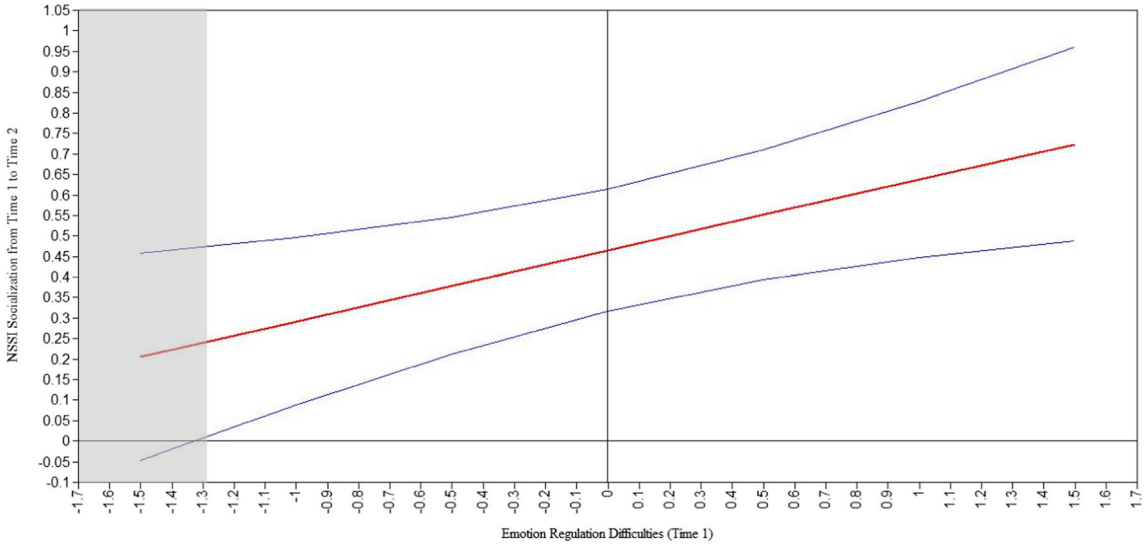

Fig. 2 NSSI contagion effect from Time 1 to Time 2 plotted against across continuous values of adolescents' Time 1 emotion regulation difficulties. The x-axis represents centered values of emotion regulation difficulties at Time 1. The y-axis represents the NSSI contagion effect from Time 1 to Time 2 (3 months). Top and bottom (curved) lines represent 95% confidence interval. Non-shaded area includes regions of significance

and the structural weights model best fit the data for age [$\Delta\chi^2(16) = 25.34$, $p = 0.06$].

A model then tested whether positive quality drove or moderated NSSI socialization. Model fit was acceptable [$\chi^2(21) = 35.48$, $p = 0.03$, RMSEA = 0.06, CFI = 0.95, TLI = 0.93]. Similar to the negative quality model, partner effects (Time 1 to Time 2 SPE = 0.31; $p < 0.0001$; 95% CI: 0.21, 0.40; Time 2 to Time 3 SPE = 0.24; $p < 0.01$; 95% CI: 0.11, 0.36) were significant, controlling for actor effects (Time 1 to Time 2 SPE = 0.43; $p < 0.0001$; 95% CI: 0.33, 0.54; Time 2 to Time 3 SPE = 0.63; $p < 0.0001$; 95% CI: 0.52, 0.75). However, positive friendship quality did not impact adolescents' Time 2 NSSI (SPE = −0.02; $p = 0.66$; 95% CI: −0.11, 06) or Time 3 NSSI (SPE = 0.06; $p = 0.07$; 95% CI: −0.01, 0.12), and the interaction was not significant in predicting Time 2 NSSI (SPE = −0.02; $p = 0.79$; 95% CI: −0.13, 0.10) or Time 3 NSSI (SPE = −0.03; $p = 0.41$; 95% CI: −0.07, 0.02). Regarding group comparisons, the structural weights model best fit the data for gender [$\Delta\chi^2(16) = 15.10$, $p = 0.52$] and age [$\Delta\chi^2(16) = 17.05$, $p = 0.38$]. Taken together, results suggest that NSSI socialization persists over and above, but does not differ as a function of, friendship quality, and these socialization effects were not moderated by gender or by age.

Discussion

The current research finds empirical evidence for socialization of NSSI frequency within adolescent friendship dyads. This work contributes to the existing literature on NSSI contagion in adolescence by offering new data from a study designed to extend the efforts of past studies. Specifically, the study utilized a longitudinal design, adolescents' and friends' reports of NSSI frequency, and a community sample that included variability in NSSI behaviors and that enabled youths' participation with their closest same-gender friend. Additionally, the current study employed dyadic data analyses, accounting for the interdependency in the nested data and allowing for isolation of socialization effects above and beyond selection effects.

The frequency of friends' initial NSSI behaviors significantly predicted increased frequency of adolescents' own NSSI behavior across time. This effect was moderate in size and held after controlling for the observed selection effect, which suggested that friends are moderately similar to one another with regard to initial levels of NSSI frequency, and the strong within-person stability of adolescents' NSSI frequency over time. Only one past study of NSSI socialization utilized both adolescents' and friends' reports of NSSI behavior (You et al. 2013). Interestingly, the selection and socialization effects were stronger in the current study than in the previous investigation (2013). As youth in the current study were able to select among all friends, as opposed to from only school-based friends, it may be the case that peer influence effects are amplified in youths' closest relationships. These results suggest that friends' influence in the exacerbation of NSSI over time is present and an important area of empirical inquiry.

Also noteworthy is that socialization was present after only 3 months and continued across 6 months. No past studies had examined socialization in friendships in time periods shorter than 6 months. That socialization was present over such a relatively short period of time has implications for our understanding of the potency of peer influence, namely that peer influence effects may be quick to onset and may not wane with time. Future research examining the very beginning stages of friendship formation and following dyads over time may allow for more precise isolation of the window of time in which initial socialization occurs and better estimates of the strength of selection effects. In light of findings from inpatient samples in which youth previously unknown to one another were thought to quickly experience socialization (e.g., Ghaziuddin et al. 1992; Taiminen et al. 1998), it may be a concerningly rapid process.

Another major contribution of the current study is the examination of known individual risk factors for NSSI in the context of socialization effects. Few studies to date had examined potential third variables that may drive socialization (Prinstein et al. 2010; You et al. 2013) or, alternately, those that may moderate risk for socialization (Hasking et al. 2013; Prinstein et al. 2010). The current study tested three such variables that had direct theoretical relevance to NSSI risk and that previously not been examined in the context of NSSI contagion: emotion regulation difficulties, negative friendship quality, and positive friendship quality.

Emotion regulation difficulties are known to predict NSSI, with a primary reason for self-injury being to regulate negative affect. The significant bivariate association between emotion regulation deficits and NSSI in the current study underscores this notion. Current data also suggest, however, that taking into account both intrapersonal vulnerabilities, such as difficulties in emotion regulation, and peer influence may better illuminate pathways to NSSI risk. Specifically, the socialization effect persisted significantly above the influence of adolescents' own deficits in emotion regulation, and effects were amplified for adolescents with higher levels of emotion regulation difficulties. The combination of adolescents' trouble navigating negative affect and their proximity to friends who engage in NSSI to cope may reflect an especially attractive pathway to increased NSSI behavior. Future research that clarifies the specific nature of adolescents' emotion regulation difficulties (e.g., Hasking et al. 2017; Madjar et al. 2019) may provide an even more nuanced picture of vulnerability to peer socialization.

With regard to friendship quality, socialization effects persisted over and above the influence of negative friendship quality and did not vary as a function of the level of negative quality within the friendship. Although interpersonal conflict

and stress are known NSSI risk factors, it could be that friendships in the current study were not particularly conflictual, given that adolescents voluntarily participated with their closest friends. For youth in very low quality relationships or for youth without close friends, however, interpersonal problems may be stronger predictors of increased NSSI over time and may operate outside of contagion effects.

Socialization also persisted despite the level of positive quality in friendships. Specifically, positive quality, neither on its own nor in concert with friends' initial NSSI frequency, impacted increases in adolescents' NSSI frequency over time. As such, having a high quality friendship does not appear to protect adolescents against experiencing socialization or impact the strength of socialization when it occurs, underscoring the notion that NSSI socialization could occur in friendships of high and low quality. This result is in contrast to past studies of depression socialization suggesting that high quality friendships are a context in which peer socialization is more likely to occur (Schwartz-Mette and Smith 2018). Given that co-rumination, the excessive discussion of problems and focus on negative affect, is one mechanism of depression socialization (Schwartz-Mette and Rose 2012), depressive symptoms may be socialized more readily in this highly intimate context. Socialization of NSSI, on the other hand, may not require intense emotional closeness and may more simply reflect adolescents trying new coping behaviors that appear effective for their friends.

It was somewhat surprising that few gender differences emerged. Similar to past research, females reported higher levels of emotion regulation problems (Neumann et al. 2011) and positive friendship quality (see Rose and Rudolph 2006) than did males. Although some past studies found a gender difference in NSSI favoring females, this finding does not always emerge (see Bresin and Schoenleber 2015 for meta-analysis) and also was not observed here. Context may play a role, as observed gender differences in NSSI tend to be larger in clinical settings than in community settings (Bresin and Schoenleber 2015). Future research should test whether gender differences may depend, in part, on the context of investigation and population studied. What is more, no gender or age differences in NSSI socialization or moderation of socialization were found. Given that only one past study examined gender and age differences in NSSI socialization (Prinstein et al. 2010) and that the current sample size was smaller, this is an important direction for further inquiry. Research with larger samples may illuminate gender- or age-specific vulnerabilities to socialization, if they exist.

Although the current study adds to our understanding of NSSI socialization within adolescents' friendships, its limitations point to important future directions. The NSSI measure used in the current study was a brief snapshot of NSSI frequency. Use of more extensive measures of NSSI (e.g., SITBI; Nock et al. 2007) could enable testing of whether NSSI socialization processes differ as a function of nuanced characteristics of the behavior. The current sample also was not diverse with regard to gender, racial, or ethnic identities. It is not known whether adolescent NSSI differs as a function of these identities, and future studies with more diverse samples would be better able to address these questions.

The current study did not directly test mechanisms of NSSI contagion, and it will be important for future research to elucidate the mechanisms by which NSSI is socialized within adolescent friendships. Previous studies suggest that individuals may hear or talk about NSSI with friends and even may engage in NSSI together with friends (Glenn and Klonsky 2009; Heath et al. 2009; Zelkowitz et al. 2017), but no studies to date speak directly to the nature of specific mechanisms. Clarifying mechanisms of NSSI socialization will enable the confirmation and/or extension of existing recommendations (e.g., Richardson et al. 2012) for impeding socialization in those in close contact with self-injuring adolescents.

It may be that existing intrapersonal vulnerability creates a fertile context in which the idea of NSSI is planted. Like any shared idea or activity among friends, NSSI may bring friends together in a non-judgmental context in which adolescents feel less shame or guilt regarding their NSSI behavior, which then may reinforce NSSI in both individuals over time. Given its short-term effectiveness as an emotion regulation strategy (Nock 2009), it may not take much more than the aforementioned sequence of events to socialize NSSI. Yet it remains to be seen whether more active interpersonal processes characteristic of dyadic friendships, such as co-rumination (Rose 2002), which is implicated in depression socialization (Schwartz-Mette and Rose 2012; Schwartz-Mette and Smith 2018), may reflect other ways in which NSSI is socialized. What is more, it is not known whether socialization of NSSI occurs outside of dyadic friendships and across adolescents' broader peer groups. Studies assessing youths' larger social networks may illuminate differential pathways for peer socialization depending on the context.

Future research with larger samples could allow for more in-depth analysis of subgroups, such as how peer influence impacts the onset of NSSI behavior in those without NSSI history or history of other mental illness. Such studies could further employ latent class analysis to study peer influence processes in those adolescents who experience onset, increase in, decrease in, or remittance of NSSI over time. Additionally, existing research on peer socialization has tested only linear trajectories, and studies with larger samples and more frequent assessment could test for the possibility of nonlinear trajectories in peer influence (e.g., using growth curve modeling). Future research also could assess whether adolescents sought treatment to identify sensitive periods for peer influence and, if treatment was received, the impact of intervention.

Despite the need for further inquiry, the current research has implications for intervening with youth who engage in

NSSI. The observed prevalence and stability of NSSI suggest that a sizeable proportion of community adolescents are struggling. In contrast to youth in clinical samples, many youth presumably were not receiving treatment, despite these clear concerns. Moreover, results underscore that friends of youth who self-injure are at risk. This stresses the importance of attending not only to youth who engage in NSSI but also to their friends. This is in contrast to a suggestion from Hasking and colleagues (Hasking et al. 2013) that having a close circle of friends may protect against NSSI, even if the friends engage in NSSI. Of course, the companionship and support afforded youth by close friendships is generally positive for adjustment (Parker and Asher 1993). On the other hand, friendships may exacerbate NSSI, should contagion be at play.

Adolescents who self-injure clearly need intervention to equip them with adaptive coping skills with which they can regulate difficult emotions and manage social stress. Friends of adolescents who self-injure warrant clinical attention as well, particularly if they exhibit emotion regulation vulnerabilities. What is more, there exists the optimistic possibility that friendships could be a context in which positive behaviors could be socialized. If friends see one another effectively managing stress, they may be more likely to do so as well. Along with indicated interventions, school-based prevention (e.g., Gillham et al. 2012) focused on acquisition of adaptive regulation tools may represent a convenient approach to addressing risk for NSSI at a community level. Such programs not only promote the use of adaptive techniques to regulate mood and behavior, they directly target some factors known to enhance vulnerability to the development of NSSI as well as peer socialization, such as difficulties in emotion regulation.

Compliance with Ethical Standards

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

Ethical Approval All study procedures were approved by the University of Maine Institutional Review Board (reference #2015-10-01).

Informed Consent Informed parental consent and child assent were obtained for all participants in this study.

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