

# Trajectories of Suicide Ideation and Nonsuicidal Self-Injury Among Adolescents in Mainland China: Peer Predictors, Joint Development, and Risk for Suicide Attempts

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**Objective:** This study expanded knowledge about the development of suicide ideation and nonsuicidal self-injury (NSSI) among adolescents by investigating (a) peer experiences as predictors of trajectories of suicide ideation and NSSI, (b) the joint development of suicide ideation and NSSI, and (c) the risk for suicide attempts (SA) across joint trajectories of suicide ideation and NSSI. **Method:** At baseline, 565 tenth-grade Chinese adolescents (48.3% males) reported depressive symptoms and friend support. Moreover, peer victimization and friendships were assessed using a sociometric procedure. After baseline, participants completed measures of suicide ideation, NSSI, and SA every 3 months for 2 years. **Results:** Three similar trajectories of suicide ideation and NSSI were identified. After accounting for depressive symptoms, peer victimization differentiated adolescents in the high trajectory of suicide ideation and NSSI from those in the low and moderate trajectories of suicide ideation and NSSI, respectively. Friend support and friendlessness distinguished between the high and low and the moderate and low NSSI trajectories, respectively. Joint trajectory models revealed a strong overlap between the course of suicide ideation and NSSI: Adolescents in the chronically high suicide ideation trajectory were at the highest risk to follow a chronically high NSSI trajectory and vice versa. Finally, adolescents in the joint chronically high trajectory were approximately 5 times more likely to report SA than were their peers, above and beyond prior SA. **Conclusions:** Findings highlight the role of negative peer experiences as risk factors for NSSI and suicide ideation, which, in turn, can potentially increase risk for SA.

## What is the public health significance of this article?

This study suggests that peer victimization is a powerful antecedent of adolescent chronic engagement in nonsuicidal self-injury and suicide ideation, which in turn, conjointly, increase risk for suicide attempt. Therefore, adolescent history of peer victimization should be assessed and monitored in clinical and school settings.

**Keywords:** suicide ideation, nonsuicidal self-injury, trajectories, peer victimization, suicide attempt

Self-injurious thoughts and behaviors (SITBs) are a serious public health concern worldwide (Nock, Borges, et al., 2008). In adolescence, two particularly common types of SITBs include

suicide ideation, referring to thoughts of ending one's life, and nonsuicidal self-injury (NSSI), defined as the direct and deliberate destruction of one's body tissue without the intent to die (Nock,

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untimely death in June 2010 left him unable to complete analyses of these data.

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2010). Both suicide ideation and NSSI have their onset during adolescence, and cross-national data indicate that even in countries with very different cultural backgrounds, such as the United States and China, a similarly high number of youth report past-year episodes of suicide ideation (e.g., 15.8% in the United States, Center for Disease Control and Prevention [CDC], 2012; 17.4% in China, Cheng et al., 2009) and NSSI (e.g., 18% in the United States, Hankin & Abela, 2011; 15.5% in China, Tang et al., 2011; see also Muehlenkamp, Claes, Havertape, & Plener, 2012). Notably, suicide ideation and NSSI have been implicated as potential conjoint predictors of suicidal behaviors in recent theoretical work (Van Orden et al., 2010), suggesting that suicide attempts (SA) are preceded by the simultaneous development of a desire (i.e., “active” suicide ideation) and capability for suicide (i.e., a reduction in the innate human fear of death, developed through experiences such as NSSI).

Unfortunately, remarkably little is known about the longitudinal course of suicide ideation and NSSI across adolescence. Prior longitudinal work examining adolescent SITBs (e.g., Hankin & Abela, 2011; Heilbron & Prinstein, 2010) almost exclusively has employed 2-timepoint designs, thus offering limited insight into the heterogeneity in the course of suicide ideation and NSSI, as well as the antecedents of their development and maintenance. Identifying factors that place youth at risk for chronic suicide ideation and NSSI over time is particularly critical, given that their repeated occurrence—especially when simultaneous—may confer heightened risk for SA (Van Orden et al., 2010). This study used a multiwave prospective design (with follow-up assessments every 3 months to minimize recall biases) that allowed identification of distinct subgroups of adolescents who followed different suicide ideation and NSSI trajectories, as found in prior work (Barrocas, Giletta, Hankin, Prinstein, & Abela, 2015; Rueter, Holm, McGeorge, & Conger, 2008). Applying this approach, this study extends the extant literature on adolescent SITBs by examining (a) peer experiences as developmentally salient risk factors for distinguishing between different trajectory classes of suicide ideation and NSSI, (b) the co-occurrence of suicide ideation and NSSI over time (i.e., joint trajectories), and (c) the risk for SA across joint trajectories of suicide ideation and NSSI.

A large body of theoretical and empirical work has emphasized the role of stressful life events, in particular interpersonal stressors, as crucial proximal risk factors for the occurrence of SITBs (e.g., Davila & Daley, 2000). For example, according to the interpersonal theory of suicide (Joiner, 2005; Van Orden et al., 2010), interpersonal stressors (e.g., social rejection) may lead to suicide ideation by threatening individuals’ sense of belongingness. Similarly, interpersonal models of NSSI posit that negative interpersonal events precede NSSI, and that NSSI may serve as a maladaptive coping strategy to reduce stress and negative affect resulting from these experiences (Prinstein, Guerry, Browne, & Rancourt, 2009). Notably, adolescence is characterized by several developmental changes within the interpersonal domain, which increase adolescents’ exposure to interpersonal stressors (e.g., Hankin, Mermelstein, & Roesch, 2007; Rudolph & Hammen, 1999). In particular, consistent with a developmental perspective, peer experiences may represent salient stressors during adolescence (Rose & Rudolph, 2006), and therefore deserve particular attention when seeking to understand the development and maintenance of suicide ideation and NSSI.

In this regard, peer victimization may be a very potent stressor predicting adolescent SITBs. Although ample scientific and public attention has been directed to peer victimization as a potential risk factor for SITBs, most of the empirical work in this area has shown *concurrent* associations between peer victimization and both suicide ideation (e.g., Cui, Cheng, Xu, Chen, & Wang, 2011; for a review, see Kim & Leventhal, 2008) and NSSI (e.g., Giletta, Scholte, Engels, Ciairano, & Prinstein, 2012; Hilt, Cha, & Nolen-Hoeksema, 2008). Only recently have studies also demonstrated that peer victimization prospectively predicts suicide ideation (e.g., Heilbron & Prinstein, 2010; Winsper, Lereya, Zanarini, & Wolke, 2012), as well as NSSI (e.g., Fisher et al., 2012; Jutengren, Kerr, & Stattin, 2011; but see also Heilbron & Prinstein, 2010). Furthermore, not only may adolescents be exposed to stressful experiences within the broad peer group (e.g., peer victimization), but also (the lack of) dyadic peer relationships (e.g., friendships) may become sources of stress and thus pose risk for adolescent suicide ideation and NSSI. For instance, there is evidence to suggest that adolescents without friends are at greater risk for suicide ideation than their peers with friends (e.g., Cui et al., 2011; Bearman & Moody, 2004).

Although the presence of a close friend may generally be expected to reduce adolescents’ likelihood to develop SITBs, not all friendships may equally serve as protective factors. Peer relations research has documented that the positive effect of friends largely depends on certain friendship dimensions, such as the quality of the friendship and the characteristics of the friends (Hartup, 1996). Indeed, having poor quality friendships and problematic friends also represent stressful experiences and potentially may enhance adolescents’ risk for SITBs. In prior studies, unsupportive peer relationships in general, and friendships in particular, have been found to associate with and prospectively predict suicide ideation (e.g., Prinstein, Boergers, Spirito, Little, & Grapentine, 2000; Sun & Hui, 2007; for a review, see King & Merchant, 2008) and NSSI (Hankin & Abela, 2011). To a lesser extent, theoretical and empirical work also suggested that friends’ characteristics may influence adolescents’ SITBs. In this regard, drawing from social-learning theories (Bandura, 1977) and functional models of self-injury (Nock & Prinstein, 2004), it has been proposed that peer contagion may occur in relation to NSSI, given the social reinforcement and presumed rewards (e.g., gaining social attention) associated with engaging in these behaviors (see Heilbron & Prinstein, 2008). In line with this hypothesis, having friends who endorsed NSSI has been shown to increase adolescents’ risk for engaging in NSSI (Prinstein et al., 2010; You, Lin, Fu, & Leung, 2013).

Although existing evidence generally supports the role of different peer experiences as antecedents of NSSI and especially suicide ideation, a number of major shortcomings characterize prior work. First, studies using multi-informant methods (e.g., self- and peer report) are extremely rare. Nearly all prior studies have relied exclusively on self-report measures, and this approach enhances the risk of shared method variance. Because adolescents with high levels of internalizing problems (e.g., suicide ideation) tend to overestimate their involvement in negative peer relationships (e.g., De Los Reyes & Prinstein, 2004), the associations found in previous studies are likely to be inflated. Second, the independent role of different peer experiences has received relatively little attention. Indeed, past work has usually examined the

role of peers at either the group or dyadic level without simultaneously taking into account multiple dimensions of peer dynamics, such as friendships and peer victimization, although there is evidence that these different peer subtleties may have a different and specific impact on adolescent development (Parker, Rubin, Erath, Wojslawowicz, & Buskirk, 2006). Third, as noted earlier, most studies employed cross-sectional designs, and no prior work has used multiple assessments to investigate the effects of peer experiences on the latent trajectories of suicide ideation and NSSI.

Thus, the first aim of the present study was to overcome these limitations by employing a multiwave (i.e., 9 assessments) and multi-informant (i.e., self and peer-report measures) design to examine the unique predictive role of different peer experiences on adolescent trajectories of suicide ideation and NSSI (from Grade 10 to Grade 12). Adolescent peer experiences included peer victimization, friend support, and friendship type, as defined by two dimensions: (a) having (at least) 1 mutual friend and (b) the characteristics of the friends (i.e., whether friends engaged in NSSI). Notably, because depressive symptoms have been established as the strongest predictors of SITBs (e.g., Hankin & Abela, 2011; Prinstein et al., 2008), a key question was whether the effects of peer experiences on suicide ideation and NSSI would hold after taking the influence of adolescents' own depressive symptoms into account. Based on extant work (Barrocas et al., 2015; Rueter et al., 2008), three distinct trajectories of suicide ideation and NSSI were expected during this period of adolescence (i.e., low stable, moderate, and high stable trajectory). It was hypothesized that each of the peer experiences (i.e., peer victimization, friend support, and friendship type) would independently distinguish between different trajectories of both suicide ideation and NSSI, above and beyond depressive symptoms. Given the particularly stressful nature of peer victimization, it was hypothesized that peer victimization would confer specific risk for following a high trajectory of both suicide ideation and NSSI. When examining these associations, the moderating role of gender was also explored. Indeed, prior research, conducted mainly among adolescents from Western countries, suggests that peer experiences may more strongly predict suicide ideation and NSSI among females than males, given that: (a) females tend to be more reactive to peer related stressors (for a review, see Rose & Rudolph, 2006) and (b) peer experiences predict SITBs more strongly among females than males (e.g., Heilbron & Prinstein, 2010; Prinstein et al., 2010). Notably, however, fewer studies offered the opportunity to examine these gender differences in non-Western countries, such as China (for exceptions, see Cui et al., 2011; Sun & Hui, 2007).

The second aim of this study was to examine the co-occurrence of suicide ideation and NSSI over time. Although NSSI is defined in part by the absence of any explicit intent to die by suicide, evidence suggests that NSSI and suicide ideation often co-occur during adolescence (for a review, see Hamza, Stewart, & Willoughby, 2012). Yet, because of the paucity of longitudinal research, little is known about the codevelopment of suicide ideation and NSSI over time and especially about the relations between developmental trajectories of suicide ideation and NSSI. Notably, studying the joint development of suicide ideation and NSSI has the potential to offer important insight into the relation between nonsuicidal and suicidal behaviors (i.e., NSSI and SA). In this regard, two main perspectives have emerged in the literature (see

Hamza et al., 2012). Some researchers suggest that NSSI and SA are highly similar behaviors lying on the same continuum, with NSSI preceding the onset of SA and serving as a gateway for future SA (e.g., Stanley, Winchel, Molcho, Simeon, & Stanley, 1992). Conversely, other researchers emphasize that these are very distinct behaviors, with unique correlates, etiology, and functions (e.g., Nock, 2010). Examining whether discrete subgroups of adolescents could be empirically identified with a different course of NSSI and suicide ideation over time may contribute to addressing this open debate. Specifically, the existence of a subgroup of adolescents reporting a history of NSSI engagement in the absence of suicide ideation (e.g., moderate NSSI and low stable suicide ideation trajectory) would provide support for the latter perspective (Kapur, Cooper, O'Connor, & Hawton, 2013).

Furthermore, by examining the extent to which adolescents with stable high NSSI also show stable high suicide ideation, and vice versa, joint trajectory analyses likely convey important clinical information. Indeed, adolescents who report both chronic high suicide ideation and NSSI may be particularly at risk for engaging in SA. The interpersonal theory of suicide posits that repeated exposure to painful events, such as NSSI, may increase risk for SA through the development of the capability for suicide; yet, NSSI may not necessarily lead to SA among individuals without suicidal desire (i.e., "active" suicide ideation; Joiner, Ribeiro, & Silva, 2012). Although NSSI has been found to predict SA, both in the presence and absence of suicide ideation (see Hamza et al., 2012; Victor & Klonsky, 2014), no studies have investigated whether a history of chronic suicide ideation and NSSI is associated with heightened risk for SA, as would be expected based on the interpersonal theory of suicide (Joiner et al., 2012).

Thus, the final goal of this study was to examine how different joint trajectories of suicide ideation and NSSI were associated with SA risk. Based on prior cross-sectional studies (Hamza et al., 2012), a strong overlap was expected in the longitudinal trajectories of suicide ideation and NSSI, with the majority of adolescents following a low stable trajectory of both suicide ideation and NSSI and a small subgroup following a high stable trajectory of both suicide ideation and NSSI. Moreover, in line with the notion that NSSI can be clearly differentiated from suicidal behaviors, it was tentatively hypothesized that at least an additional small subgroup of adolescents showing a moderate trajectory of NSSI and a low stable history of suicide ideation would be identified. Finally, it was hypothesized that adolescents with chronically high levels of suicide ideation and NSSI would have the highest risk for SA compared with other adolescents following different joint trajectories.

To summarize, in the present study, a sample of adolescents was followed over a 2-year period with repeated assessments of SITBs (suicide ideation, NSSI, and SA), with the aims of investigating (a) the predictive effects of different peer experiences on latent trajectories of suicide ideation and NSSI, (b) the joint trajectories of suicide ideation and NSSI, and (c) the risk for SA among adolescents showing different joint developmental trajectories. Importantly, these aims were addressed in a sample of adolescents in mainland China. As such, this study further contributes to the existing literature on SITBs in at least two additional ways. First, although recent epidemiological data on SITBs in Chinese adolescents are lacking (for an exception, see Cheng et al., 2009), the high prevalence rates of suicide ideation and NSSI reported in

recent research (e.g., Tang et al., 2011; You et al., 2013) clearly indicate the fundamental need to study these phenomena in one of the world's largest populations. Second, this study offers the opportunity to apply theoretical perspectives that have been mainly used to understand SITBs in Western countries in a population of adolescents with a very different cultural background, therefore examining their cross-cultural validity. Notably, interpersonal models of SITBs (e.g., Davila & Daley, 2000; Prinstein et al., 2009) may be particularly relevant frameworks for understanding suicide ideation and NSSI development among Chinese adolescents. Indeed, the collectivistic culture predominant in China may further increase the relevance of interpersonal factors for the development and maintenance of suicide ideation and NSSI (e.g., Wong, Koo, Tran, Chiu, & Mok, 2011).

## Method

### Participants

Participants included 565 adolescents (48.3% males), enrolled in 10th grade at baseline ( $M_{age} = 16.03$  years,  $SD = 0.52$ ). Adolescents attended two schools in the Hunan province, mainland China, one located in the urban area of Changsha and the other in the rural area of Liuyang. Hunan ranks 23rd (10,336 Renminbi [RMB]) out of the 34 provinces in China in terms of annual gross domestic product, placing it well below the national provincial average ( $\mu = 29,719$  RMB;  $SD = 47,462$  RMB). At baseline, most adolescents (82.8%) reported living with both parents.

### Procedure

All students in 10th grade from the two schools were contacted to participate in the study. Consent forms were sent to all adolescents' parents, and approval to participate was received from more than 95% ( $n = 624$ ). All adolescents who received parental consent also gave consent to participate. At baseline, adolescents completed a questionnaire including self-report measures of depressive symptoms and friend support. Moreover, a sociometric procedure was used to assess adolescents' friendships and peer victimization. After baseline, participants completed eight waves of follow-up: regularly every 3 months for 2 years (i.e., 3, 6, 9, 12, 15, 18, 21, and 24 months post-baseline). At each follow-up assessment, adolescents completed measures of suicide ideation, NSSI, and SA.

Of the 624 adolescents who participated in the study, 7 (1.1%) did not complete any of the follow-up assessment and consequently were excluded from the final sample. Moreover, for all adolescents attending 1 of the 11 classes, friendship data were not available. Thus, these adolescents were also excluded from the analytic sample ( $n = 52$ ). Attrition analyses did not reveal significant differences between adolescents excluded because of missing friendship data and adolescents in the analytic sample on any of the study variables. Of the 565 adolescents in the analytic sample, approximately 84% and 95%, respectively, had complete data for seven and four out of eight waves of follow-up on both suicide ideation and NSSI variables.

To compare participants with and without missing data, Little's (1988) Missing Completely at Random (MCAR) test was conducted. Although the test was significant,  $\chi^2(713) = 1,341.37, p <$

.001, the normed  $\chi^2(\chi^2/df)$  of 1.88 justified the inclusion of adolescents with missing data in the analyses (Bollen, 1989). Missing data procedures are discussed (see Data Analytic Plan).

### Measures

A back-translation procedure was used to create the Chinese version of all study measures. First, original English versions were translated into Chinese by a bilingual translator from the Psychology Department at Second Xiangya Medical College of Central South University, Hunan. Subsequently, translated Chinese versions were back-translated into English by another bilingual translator from the Psychology Department at McGill University, Quebec. Finally, original versions were compared with the back-translation, and inconsistencies were resolved by both translators together. No items from any of the measures were removed or significantly altered during the translation process.

**Nonsuicidal self-injury (NSSI).** NSSI was assessed through a 5-item measure (Prinstein et al., 2008), in which each item referred to a specific NSSI method (i.e., cut/carved skin, burned skin, hit self, bit self, scrapped skin to draw blood). Participants were asked to report on a 5-point scale from 0 (*never*) to 4 (*almost every day*) how often they had engaged in each method without the intention to die during the previous three months. A global NSSI measure was computed by summing participants' answers to the 5 items (Cronbach's  $\alpha = .92-.97$ ), with higher scores indicating higher NSSI frequencies (possible range = 0–20). This measure has been previously used in studies with community and clinical adolescents, yielding evidence for good reliability and convergent validity (Giletta et al., 2012; Prinstein et al., 2008). For example, this measure has been reported to correlate highly with a commonly used single-item measure of NSSI ( $r = .69, p < .001$ ; Prinstein et al., 2008). Moreover, prior studies using this measure have yielded prevalence rates of NSSI that are highly comparable to those reported in other studies using different multi-item measures of NSSI (e.g., 24% vs. 28.4%; see Giletta et al., 2012 and Muehlenkamp et al., 2012, respectively).

**Suicide ideation.** Suicide ideation was assessed using a self-report measure composed of 8 items drawn from the Suicidal Ideation Questionnaire (SIQ; Reynolds, 1988) and the National Institute of Mental Health Diagnostic Interview Schedule for Children Version IV (NIMH DISC-IV; Shaffer, Fisher, Lucas, Dulcan, & Schwab-Stone, 2000). Example items include "I wish I were dead," and "I thought about how I would kill myself." These items were alternated with 7 filler items from the Reasons for Living scale (Linehan, Goodstein, Nielsen, & Chiles, 1983). At each follow-up point, adolescents were asked to indicate on a 5-point scale from 0 (*never*) to 4 (*almost every day*) how often they had had each of the suicidal thoughts in the previous 3 months. A total suicide ideation score was computed by summing adolescents' answers to the 8 items (Cronbach's  $\alpha = .91-.93$ ), with higher scores indicating higher frequencies of suicide ideation (possible range = 0–32). In support of its validity, this measure has been shown to correlate significantly with adolescent suicidal and nonsuicidal behaviors (e.g., SA, NSSI) and to be adequate for identifying adolescents with elevated levels of suicide ideation (Guan, Fox, & Prinstein, 2012).

**Suicide attempt (SA).** SA was measured using an item ("Have you ever tried to kill yourself [i.e., attempted suicide]?");

this item is used in the Suicidal Behavior Module of the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI; Kessler & Üstün, 2004). Adolescents were asked about SA during the previous year at the first follow-up point and during the previous 3 months at each of the subsequent seven follow-ups (i.e., 6–24 months post-baseline). This item is widely used to assess SA among adolescents (e.g., Klonsky, May, & Glenn, 2013) and also is included in the Youth Risk Behavior Survey (YRBS) conducted every 2 years by the Center for Disease Control and Prevention (CDC) to provide U.S. nationally representative data on adolescent health-risk behaviors. Prior work has provided support for the convergent and discriminant validity of this item among high school adolescents, by showing significant associations with other suicide items and measures of internalizing symptoms (May & Klonsky, 2011). In all the analyses, SA was used as a dummy coded variable distinguishing, at each assessment, adolescents who reported attempting suicide in the previous months from those who did not.

**Depressive symptoms.** Depressive symptoms were assessed with the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977). The CES-D is a 20-item self-report questionnaire designed to measure depressive symptoms in the general population. Participants were asked to indicate on a 4-point scale from 1 (*rarely or none of the time*) to 4 (*most or all of the time*) how often they had experienced each of the 20 symptoms (e.g., “I thought my life had been a failure,” “I felt sad,” “I had crying spells”) during the past week. A sum score across the 20 items was computed (Cronbach’s alpha = .85), with higher scores indicating higher depressive symptoms (possible range = 20–80). The CES-D has shown good psychometric properties, including, internal consistency, test–retest reliability, and validity (e.g., Roberts, Andrews, Lewinsohn, & Hops, 1990). This measure has been found to correlate moderately to highly with other self-reported measures of depressive symptoms (e.g., Children Depression Inventory [CDI], Doerfler, Felner, Rowilson, Raley, & Evans, 1988; Beck Depression Inventory [BDI]; Roberts, Lewinsohn, & Seeley, 1991) and to properly discriminate adolescents with and without depressive disorders (Yang, Soong, Kuo, Chang, & Chen, 2004). The CES-D has been widely used to assess depressive symptoms, including in culturally diverse samples of adolescents, such as Chinese adolescents (e.g., Greenberger, Chen, Tally, & Qi, 2000).

**Friend support.** Friend support was measured using the Social Support Scale for Children and Adolescents (SSSCA; Harter, 1985). The SSSCA is a 24-item measure assessing adolescent perception of social support from their close others, including parents, teachers, classmates, and friends. For the present study, the 6 items of the scale measuring social support from adolescents’ close friends were used. For each item, first, adolescents were presented with two statements (e.g., “Some kids have a close friend who they can tell problems to” BUT “Other kids don’t have a close friend who they can tell problems to”) and were instructed to decide which statement better described them. Subsequently, they were asked to indicate how true (*Really true for me* or *Sort of true for me*) was the statement they had selected. Thus, each item could range from 1 to 4. A total score of friend support was computed by summing adolescents’ answers to the 6 items (Cronbach’s alpha = .84), with higher scores indicating greater friend support (possible range = 6–24). This scale has been largely employed in previous studies to assess adolescent social support

(e.g., Prinstein, Boergers, & Vernberg, 2001) and has shown good validity and reliability (Harter, 1985). For instance, friend support as measured by the SSSCA correlated significantly with peer support assessed with different measures of social support (e.g., Survey of Children’s Social Support;  $r = .56, p < .01$ ; Dubow & Ullman, 1989).

**Peer victimization.** Peer victimization was assessed using a sociometric peer nomination procedure. Each adolescent was presented with a roster of all classmates and was asked to identify those who they thought were victims of aggression. Specifically, 2 items assessed overt victimization (“Who gets beat up, picked on, or teased by bullies?”, “Who gets threatened or hit by others, or has mean things said to them?”) and 2 items relational victimization (“Who gets left out of activities or ignored by others because one of their friends is mad at them?”, “Who gets gossiped about or has rumors told about them behind their backs?”, see Crick & Bigbee, 1998). To compute a measure of peer victimization, a sum of nominations received from all classmates was tallied for each adolescent and subsequently standardized within classrooms to account for differences in classroom size. Finally, a global measure of peer victimization was created by averaging across the standardized nominations received on each of the 4 items (Cronbach’s alpha = .81). Thus, higher scores indicate that adolescents were identified by more peers as a victim of peer aggression. In other words, this peer nomination procedure yielded a reputation-based measure of peer victimization (i.e., adolescent reputation among peers as a victim), rather than a measure of peer victimization frequency. Similar sociometric procedures are widely used to assess a variety of peer constructs, including peer victimization (e.g., Heilbron & Prinstein, 2010), and have been demonstrated to be highly reliable and valid methods (Coie & Dodge, 1983). For instance, in samples of adolescents, moderate associations between peer- and self-reported victimization provided support for the convergent validity of this measure (e.g., Crick & Bigbee, 1998; Graham & Juvenen, 1998). Moreover, peer-reported victimization has been shown to correlate with different developmental outcomes (e.g., loneliness, anxiety; Boivin & Hymel, 1997; Graham & Juvenen, 1998).

**Friendship type.** Friendship type was operationalized by distinguishing among adolescents without reciprocal friends, adolescents with reciprocal friends who did not engage in NSSI, and adolescents with reciprocal friends who engaged in NSSI. To create this variable, first adolescents were asked to nominate their best (i.e., closest) friends from a roster including all their classmates. An unlimited nomination procedure including both same- and cross-gender nominations was employed. On average, adolescents chose their friends from a pool of approximately 56 peers (classroom size ranged between 50 and 65 students), and each adolescent nominated about 5 friends ( $M = 4.71, SD = 3.85, range = 0–27$ ). Subsequently, friendship nominations were used to identify reciprocal friendships, those in which both peers mutually nominated as friends. Most adolescents (88%) were found to have at least one reciprocal friend, consistent with past research (Brendgen, Lamarche, Wanner, & Vitaro, 2010). Finally, adolescents with at least one reciprocal friend were further distinguished between those with at least one friend reporting at least one NSSI episode at the first follow-up wave and those for whom all friends did not report any engagement in NSSI. This procedure yielded the three friendship types (Table 1). A similar procedure has been

Table 1  
*Descriptives of Main Study Variables*

Variable	Males	Females	Total
Predictors at baseline (Grade 10)			
Depressive symptoms, <i>M (SD)</i>	32.21 (8.88)	32.54 (8.94)	32.38 (8.90)
Peer victimization, <i>M (SD)</i>	0.14 (.88) <sup>a</sup>	-0.12 (0.68) <sup>b</sup>	0.00 (0.79)
Friend support, <i>M (SD)</i>	15.31 (3.46)	15.18 (3.29)	15.24 (3.37)
Friendship type, <i>n (%)</i>			
No friends	49 (18.3%) <sup>a</sup>	18 (6.2%) <sup>b</sup>	67 (12.0%)
NSSI friends	92 (34.3%)	116 (40.0%)	208 (37.2%)
No NSSI friends	127 (47.4%)	156 (53.8%)	284 (50.8%)
NSSI, <i>M (SD)</i>			
3 months	1.26 (2.98)	0.74 (2.14)	0.99 (2.59)
6 months	0.99 (3.08)	0.70 (2.24)	0.83 (2.66)
9 months	1.20 (2.97) <sup>a</sup>	0.70 (2.31) <sup>b</sup>	0.94 (2.65)
12 months (Grade 11)	0.91 (2.92) <sup>a</sup>	0.40 (1.74) <sup>b</sup>	0.64 (2.38)
15 months	1.50 (3.70) <sup>a</sup>	0.52 (1.83) <sup>b</sup>	0.96 (2.87)
18 months	0.88 (2.98)	0.53 (2.07)	0.69 (2.54)
21 months	1.05 (3.12) <sup>a</sup>	0.47 (2.06) <sup>b</sup>	0.74 (2.62)
24 months (Grade 12)	1.11 (3.10) <sup>a</sup>	0.44 (1.88) <sup>b</sup>	0.75 (2.54)
Suicide ideation, <i>M (SD)</i>			
3 months	2.85 (5.27)	3.11 (4.81)	2.99 (5.04)
6 months	2.05 (4.69)	2.44 (4.86)	2.26 (4.78)
9 months	2.48 (4.83)	2.41 (4.44)	2.44 (4.63)
12 months (Grade 11)	2.19 (5.25)	1.75 (3.76)	1.96 (4.52)
15 months	3.04 (5.75)	2.06 (4.12)	2.50 (4.94)
18 months	1.88 (4.47)	1.69 (3.79)	1.78 (4.11)
21 months	2.17 (4.88)	1.65 (4.00)	1.89 (4.44)
24 months (Grade 12)	2.06 (4.63)	1.41 (3.25)	1.71 (3.96)
Suicide attempts, <i>n (%)</i>			
3 months	12 (5.0%)	19 (7.0%)	31 (6.1%)
6 months	8 (3.5%)	7 (2.7%)	15 (3.0%)
9 months	3 (1.3%)	7 (2.7%)	10 (2.0%)
12 months (Grade 11)	3 (1.4%)	4 (1.6%)	7 (1.5%)
15 months	4 (2.0%)	1 (0.4%)	5 (1.1%)
18 months	2 (1.0%)	4 (1.7%)	6 (1.4%)
21 months	1 (0.6%)	0	1 (0.2%)
24 months (Grade 12)	1 (0.6%)	1 (0.5%)	2 (0.5%)

*Note.* NSSI = nonsuicidal self-injury. Suicide attempts at 3 months post-baseline referred to the previous year. Suicide attempts assessed at each follow-up from 6 to 24 months post-baseline referred to the previous 3 months. <sup>a,b</sup> Different subscriptions indicate significant differences. Nonparametric tests (i.e., Mann-Whitney *U* tests) were used to compare means of NSSI, suicide ideation, and peer victimization by gender, because of the non-normal distribution of these variables. *T*-tests were used to compare means of depressive symptoms and friend support by gender.  $\chi^2$  tests were used to examine gender differences in friendship type (calculating adjusted standardized residuals) and suicide attempts.

previously used to examine the joint effect of friendship and friends' characteristics on adolescent depressive symptoms (Brendgen et al., 2010).

### Data Analytic Plan

Analyses were carried out in four main steps. First, group-based trajectory modeling (GBTM) was conducted to identify latent trajectories of NSSI and suicide ideation, separately. GBTM is a semiparametric method using a single outcome repeatedly measured over time to identify a finite number of subgroups of individuals showing a different developmental course (Nagin, 2005). In the unconditional models, the 8 timepoints of NSSI and suicide ideation measurement assessed between 3 and 24 months post-baseline were used as indicators to identify latent trajectories. A series of models, including both linear and quadratic terms, were estimated for both NSSI and suicide ideation separately, starting with a one-class model and incrementally incorporating additional

classes. Because of the non-normal distribution of NSSI and suicide ideation, resulting from most adolescents reporting no engagement in NSSI and suicide ideation, GBTMs were estimated using a censored-normal distribution to account for preponderance of zeros in the data (i.e., floor effect).

Five criteria were used to decide on the number of trajectories. The first three criteria included two commonly used indices of model fit, that is, the Bayesian Information Criterion (BIC; Schwarz, 1978) and the Lo-Mendell-Rubin ratio likelihood test (LMR-LRT; Lo, Mendell, & Rubin, 2001), and an index of classification accuracy, entropy (>0.70 indicates adequate classification accuracy; Nagin, 2005). The fourth and fifth criteria were the usefulness of the classes (i.e., each class should include at least 5% of participants; each class should not be a simple variation of another class; Muthén & Muthén, 2000) and the consistency of the identified classes with prior theoretical and empirical work (e.g., Barrocas et al., 2015; Brunner et al., 2007). Models were fitted

using 100 random perturbations of starting values to ensure replication of the best likelihood and avoid local maxima. Although we have previously identified latent trajectories of NSSI within the same sample of adolescents (see Barrocas et al., 2015), here we sought to replicate this unconditional model in a subset of participants from the original sample (i.e., 52 participants were excluded because of unavailable friendship data).

In the second step, conditional models were estimated separately for both NSSI and suicide ideation, in which covariates (i.e., peer experiences) were added to the best-fitting models previously identified (i.e., one-step approach). Note that, using this approach, covariates were introduced in the measurement model and therefore contributed to the model specification (i.e., formation of the trajectory classes). In these models, the probability of class membership was regressed on the baseline predictors to examine whether adolescents following different latent trajectories could be distinguished on the peer experiences measured at baseline. Specifically, a multinomial logistic regression was specified that allowed comparison of latent trajectories on each peer factor (i.e., peer victimization, friend support, and friendship type), while accounting for gender and depressive symptoms.

Third, the joint development of NSSI and suicide ideation over time was examined by estimating a joint trajectory model. The trajectory models identified for NSSI and suicide ideation were used as starting points to fit this model. Joint trajectory models yield two main sets of results, named as joint and conditional probabilities (Nagin & Tremblay, 2001). The joint probabilities reflect the proportion of adolescents following the different NSSI and suicide ideation trajectories. The conditional probabilities indicate the probability of adolescents to follow each trajectory of NSSI conditional on the trajectories of suicide ideation, and vice versa.

Participants with missing data on the outcome variables (i.e., suicide ideation and NSSI) were included in all GBMTs and full information maximum likelihood (FIML) estimation was used to handle missing values under the assumption of missing at random. However, because this approach does not allow missing values for covariates, conditional GBMTs were restricted to participants with complete data on the predictor variables. This was acceptable given that only 5% of participants had missing data on the predictors (Graham, 2009). All GBMTs were performed in M-plus version 6.0 (Muthén & Muthén, 1998–2010).

Finally, in the last step, adolescents were assigned to their most likely joint trajectory class based on their highest joint posterior probability and generalized estimating equations (GEEs) were used to examine the likelihood of reporting SA between 6 and 24 months post-baseline across joint trajectory classes. Note that assigning individuals to their most likely class is adequate when entropy is higher than .80 (Clark & Muthén, 2009). GEEs were employed to account for the overtime dependence in the repeated measures of SA. A first-order autoregressive structure was selected for the working correlation matrix (Wang & Carey, 2003) in which adjacent observations are assumed to be more highly correlated than nonadjacent ones, a common pattern for repeated measures data. A logistic specification was used with SA occurred between 6 and 24 months post-baseline as a binary outcome and the joint trajectory class and SA at 3 months post-baseline as independent variables. This allowed examining the effect of joint trajectory membership on SA above and beyond the effect of previous SA as

assessed at 3 months post-baseline. Because GEE models allow unbalanced data (i.e., different number of repeated observations in the outcome variable), all participants with available data on SA on at least one of the seven follow-ups between 6 and 24 months post-baseline were included in the analyses under the assumption of covariate-dependent missingness (i.e., missing data depend only on covariates).<sup>1</sup> GEEs yielded population average estimates and the associated odds ratio (ORs), which are interpretable as in traditional logistic regression model. All GEEs models were fitted in SPSS (version 21).

## Results

### Descriptive Analyses

Table 1 presents descriptive statistics for all study variables, in the total sample and separately by gender. For cross-cultural comparison purposes, means of NSSI and suicide ideation were compared with those reported in a prior study using the same measures in a sample of U.S. adolescents of similar age (see Guan et al., 2012).<sup>2</sup> Overall, suicide ideation frequency at the first assessment was found to be significantly higher in this sample ( $M = 2.99$ ,  $SD = 5.04$ ) than the one reported among U.S. adolescents ( $M = 1.30$ ,  $SD = 3.15$ ), Mann–Whitney  $U$  test  $p < .001$ . However, no significant differences were found when comparing NSSI frequency assessed at 3 months post-baseline in this sample ( $M = 0.99$ ,  $SD = 2.59$ ) with NSSI frequency reported previously among U.S. adolescents ( $M = 0.61$ ,  $SD = 1.19$ ), Mann–Whitney  $U$  test  $p = .32$ . Between 12% (at 12, 18, 21, and 24 months post-baseline) and 24% (at 3 months post-baseline) of adolescents reported that they had engaged in at least one NSSI episode across assessments, which is comparable to rates found in prior studies of adolescents from the United States and other countries (e.g., Muehlenkamp et al., 2012). Moreover, the 12-month prevalence of SA (6.1%) fell within the range of estimates previously found among 10th graders in epidemiological studies of U.S. adolescents (3.8%–8.2%; Taliaferro & Muehlenkamp, 2014 and CDC, 2012, respectively).

A higher proportion of males than females reported that they had engaged in at least one NSSI episode at 12, 15, 21, and 24 months post-baseline (all  $\chi^2$   $ps < .05$ ). Similarly, males also

<sup>1</sup> A minority of participants ( $n = 13$ ; 2.3%) had missing data on SA at all assessments between 6 and 24 months post-baseline and therefore could not be included in these analyses. Moreover, 56 participants (9.9%) had missing data on SA at 3 months post-baseline, mostly because of item nonresponse. Thus, multiple imputation was performed to generate 40 imputed data sets, including all study variables as covariates in the imputation process. Subsequently, all GEEs reported in the results' section also were fitted across the 40 data sets with imputed values on SA at 3 months post-baseline, and results were combined using Rubin's rule (Rubin, 1987). Results from these analyses were identical to those found among participants with complete data on SA at 3 months post-baseline. These results are available upon request to the first author.

<sup>2</sup> Note that in the study by Guan and colleagues (2012), a few differences existed in the way the measures of suicide ideation and NSSI were assessed and computed. That is, (a) items were scored on a 5-point scale ranging between 1 and 5, rather than 0 and 4; (b) total scores were computed by averaging, rather than summing, responses across items (c) the NSSI measure included an additional item (i.e., inserted objects under skin). Thus, to allow proper comparison with the measures used in the current study, suicide ideation and NSSI means were recalculated according to the criteria used herein.

reported higher frequency of NSSI engagement than females at 9, 12, 15, 21 (all Mann–Whitney  $U$  test  $ps < .05$ ), and 24 (Mann–Whitney  $U$  test  $p < .01$ ) months post-baseline. No gender differences were found in suicide ideation frequency and in the rates of SA. With regard to the predictor variables measured at baseline, gender differences were observed only in peer victimization, Mann–Whitney  $U$  test  $p < .001$ , and friendship type,  $\chi^2 p < .001$ . Specifically, compared with females, males had higher victimization scores and were more likely to be friendless (the adjusted standardized residual for the cell of friendless males was 4.4).

### Latent Trajectories of NSSI and Suicide Ideation

Table 2 presents the fit and accuracy indices for the GBTMs, including different numbers of latent trajectories of NSSI and suicide ideation. Based on these indices, the usefulness of the trajectory classes and prior theoretical and empirical work (e.g., Barrocas et al., 2015; Brunner et al., 2007), a three-class model was chosen for both NSSI and suicide ideation. The three NSSI and suicide ideation trajectory classes are represented in Figure 1. The first NSSI trajectory class (68.7%), labeled low NSSI, included adolescents with none or very few NSSI episodes from Grade 10 to 12 ( $b_{\text{linear}} = -3.40, p < .001$ ;  $b_{\text{quadratic}} = 0.32, p < .01$ ). The second trajectory class (26.3%) was composed of adolescents with moderate NSSI across the multiple assessments with a slight linear decline in NSSI frequency over time ( $b_{\text{linear}} = -1.40, p < .05$ ;  $b_{\text{quadratic}} = 0.09, p = .29$ ). The third trajectory class (5%) consisted of adolescents with high and stable NSSI engagement across the 2-year period ( $b_{\text{linear}} = 0.25, p = .83$ ;  $b_{\text{quadratic}} = -0.01, p = .96$ ). The three suicide ideation trajectory classes were highly similar to the NSSI trajectory classes. The first trajectory class (51.5%) included adolescents with no or very low levels of ideation over time ( $b_{\text{linear}} = -0.45, p < .05$ ), the second one (40.3%) included adolescents with moderate levels of suicide ideation declining from Grade 10 to 12 ( $b_{\text{linear}} = -0.54, p < .001$ ), and the third trajectory class (8.2%) consisted of adolescents with high and stable level of suicide ideation ( $b_{\text{linear}} = -0.15, p = .68$ ).

### Prediction of Latent Trajectories of NSSI and Suicide Ideation by Peer Experiences

Results from the conditional models are presented in Table 3 separately for NSSI and suicide ideation. Overall, conditional GBTMs supported the three-class solution identified in the unconditional models, for both NSSI and suicide ideation. With regard to NSSI, depressive symptoms predicted trajectory membership, with adolescents reporting higher depressive symptoms being more likely to follow the moderate and the high trajectory classes than the low one. Gender did not significantly predict NSSI trajectory membership.

After controlling for the effect of gender and depressive symptoms, all peer experiences significantly predicted trajectory membership of NSSI. Specifically, friendship type distinguished between the low and moderate trajectory classes. That is, compared with adolescents in the low trajectory class, adolescents in the moderate trajectory class were more likely to have no reciprocal friends than (a) reciprocal friends who never engaged in NSSI as well as (b) reciprocal friends who endorsed NSSI. However, no differences were observed between adolescents with reciprocal friends who did and did not engaged in NSSI. Friend support differentiated between the low and high trajectory, with adolescents in the low trajectory class reporting greater levels of friend support than adolescents in the high trajectory class. Finally, peer victimization differentiated the low from the high trajectory as well as the moderate from the high one. Adolescents in the high trajectory class had greater peer victimization scores at the baseline assessment than adolescents in the low and moderate trajectory classes. No significant interaction effects between gender and any of the peer factors on NSSI trajectory membership were observed.

With respect to suicide ideation, whereas no effects of gender were found, depressive symptoms significantly distinguished all three trajectory classes. That is, adolescents with high depressive symptoms were more likely to follow a moderate versus low trajectory and a high versus both low and moderate trajectories. After accounting for depressive symptoms, only peer victimization emerged to clearly predict suicide ideation trajectory class mem-

Table 2  
Fit and Accuracy Indices for Group-Based Trajectory Models of Nonsuicidal Self-Injury (NSSI) and Suicide Ideation

Classes	NSSI				Suicide ideation			
	Log likelihood	BIC	LMR-LRT	Entropy	Log likelihood	BIC	LMR-LRT	Entropy
1	-3,384.16	6,838.03			-7,052.61	14,174.88		
2	-3,129.43	6,353.91	<0.001	0.83	-6,674.43	13,443.86	<0.001	0.80
3	-3,097.64	6,315.68	0.07	0.75	-6,549.05	13,218.44	0.01	0.78
4	-3,077.93	6,301.60	0.16	0.77	-6,512.55	13,170.76	0.02	0.81
5	-3,066.69	6,304.48	0.16	0.80	-6,478.53	13,128.05	0.12	0.82

Note. BIC = Bayesian Information Criterion; LMR-LRT = Lo-Mendell-Rubin ratio likelihood test. For NSSI, the BIC decreased from a two- to a three-class solution, and the LMR-LRT indicated that the addition of a third class somewhat improved the model fit over a two-class solution. Moving from a three- to a four-class solution resulted in a more modest decrease in the BIC value and a nonsignificant LMR-LRT. Although the BIC supported a four-class solution, a three-class solution was consistent with theoretical expectations and prior empirical work (Barrocas et al., 2015; Brunner et al., 2007). For suicide ideation, in the one- to four-class solution, the BIC substantially decreased and the LMR-LRTs were all significant. However, a four- and five-class solutions both yielded two highly similar classes and a class including less than 1% of adolescents. For NSSI, a model with a quadratic term fit the data better than a linear model,  $\Delta\chi^2(3) = 9.05, p = .03$ , whereas a quadratic model did not improve the model fit for suicide ideation,  $\Delta\chi^2(3) = 3.02, p = .39$ . Therefore, for the subsequent analyses a model including a quadratic term was used for NSSI and a linear model for suicide ideation.



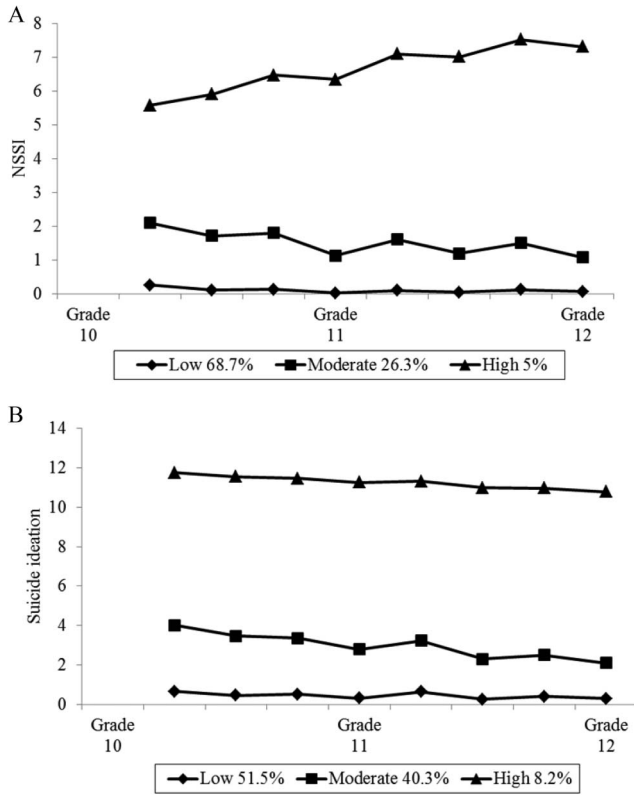


Figure 1. Trajectories of adolescent nonsuicidal self-injury (NSSI) (A) and suicide ideation (B) across eight follow-up assessments between Grade 10 and Grade 12.

bership. Adolescents with greater peer victimization were more likely to follow the high trajectory class than the low and the moderate trajectory classes. No significant effects of friend support and friendship type were found on trajectory membership of suicide ideation. Moreover, no significant gender moderation was revealed for any of the peer factors.

**Joint Trajectories of NSSI and Suicide Ideation**

Results from the joint trajectory model are presented in Table 4. As shown by the joint probabilities in the first part of Table 4, nine potential trajectory classes (3 × 3) characterized by different developmental patterns of NSSI and suicide ideation could be identified. The joint probabilities of NSSI and suicide ideation indicated that 60% of the adolescents followed a low trajectory class for both NSSI and suicide ideation, 26% were in the moderate trajectory for both NSSI and suicide ideation, and 6.5% belonged to the high NSSI and high suicide ideation trajectory class. Only a minority of adolescents was found to be in a different trajectory class for NSSI and suicide ideation. Specifically, 6.4% of participants belonged to the low NSSI and moderate suicide ideation trajectory; approximately 1% followed a moderate NSSI and low suicide ideation trajectory; and almost no adolescents (0.2%) were found to be in the moderate NSSI and high suicide ideation trajectory. No adolescent was identified in the remaining three trajectory classes. Classification accuracy of adolescents into joint trajectory classes was good (entropy = .87).

The second part of Table 4 reports the probabilities for adolescents to be in the suicide ideation trajectories conditional on the NSSI trajectories. Adolescents in the low NSSI trajectory class were most likely to be in the low suicide ideation trajectory class. Similarly, adolescents in the moderate NSSI trajectory class had the highest probability of classification in the moderate suicide ideation trajectory class. Finally, for adolescents in the high NSSI trajectory class, the probability of classification in the high suicide ideation trajectory class was equal to one.

A similar pattern was observed for the probabilities of NSSI trajectory classes given suicide ideation trajectory classes (see third part of Table 4). Adolescents in the low suicide ideation trajectory class were found to have the highest probability of classification in the low NSSI trajectory class; adolescents in the moderate suicide ideation trajectory class had the highest probability of classification in the moderate NSSI trajectory class; and those in the high suicide ideation trajectory class were most likely to be in the high NSSI trajectory class. Overall, results from the joint trajectory model showed a clear overlap between the trajec-

Table 3  
Baseline Predictors of Nonsuicidal Self-Injury (NSSI) and Suicide Ideation Latent Trajectories

Predictor	OR [95% CI]					
	NSSI			Suicide ideation		
	Moderate vs. Low	High vs. Low	High vs. Moderate	Moderate vs. Low	High vs. Low	High vs. Moderate
Gender	0.57 <sup>†</sup> [0.32, 1.03]	0.43 <sup>†</sup> [0.17, 1.05]	0.75 [0.26, 2.15]	1.17 [0.72, 1.91]	0.94 [0.43, 2.06]	0.80 [0.36, 1.77]
Depressive symptoms	1.06 <sup>***</sup> [1.03, 1.09]	1.09 <sup>***</sup> [1.04, 1.13]	1.02 [0.98, 1.07]	1.09 <sup>***</sup> [1.06, 1.12]	1.15 <sup>***</sup> [1.10, 1.19]	1.05 <sup>**</sup> [1.01, 1.09]
Peer victimization	1.23 [0.80, 1.89]	2.19 <sup>***</sup> [1.42, 3.39]	1.78 <sup>*</sup> [1.12, 2.84]	0.99 [0.68, 1.42]	1.71 <sup>***</sup> [1.19, 2.47]	1.74 <sup>**</sup> [1.18, 2.56]
Friend support	0.92 <sup>†</sup> [0.84, 1.01]	0.89 <sup>**</sup> [0.80, 0.99]	0.96 [0.85, 1.09]	0.99 [0.92, 1.06]	0.90 <sup>†</sup> [0.80, 1.02]	0.91 [0.81, 1.02]
Friendship type						
NSSI friends vs. no friends	0.46 <sup>*</sup> [0.21, 1.00]	0.75 [0.15, 3.70]	1.63 [0.31, 8.61]	1.01 [0.46, 2.20]	0.46 [0.14, 1.49]	0.45 [0.13, 1.53]
No NSSI friends vs. no friends	0.35 <sup>*</sup> [0.16, 0.76]	0.74 [0.17, 3.25]	2.09 [0.42, 10.37]	0.96 [0.44, 2.11]	0.58 [0.20, 1.66]	0.60 [0.19, 1.86]

Note. OR = odds ratio; CI = confidence interval. ORs with associated p values lower than .10 are indicated for reference only, but they are not discussed in the results section because they are not statistically significant.  
<sup>†</sup> p < .10. \* p < .05. \*\* p < .01. \*\*\* p < .001.

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Table 4  
*Joint and Conditional Probabilities of Nonsuicidal Self-Injury (NSSI) and Suicide Ideation*

NSSI	Suicide ideation		
	Low	Moderate	High
Joint probabilities of suicide ideation and NSSI			
Low	0.600	0.064	0
Moderate	0.009	0.260	0.002
High	0	0	0.065
Probabilities of suicide ideation conditional on NSSI			
Low	0.867	0.133	0
Moderate	0.045	0.940	0.015
High	0	0	1
Probabilities of NSSI conditional on suicide ideation			
Low	0.979	0.250	0
Moderate	0.021	0.750	0.056
High	0	0	0.944

tory classes of NSSI and suicide ideation, indicating that the developmental patterns of these phenomena strongly co-occur over time.

### Prediction of SA by Joint Trajectories of NSSI and Suicide Ideation

In a first set of analyses, a dichotomous variable was created differentiating adolescents who belonged to the high NSSI and high suicide ideation trajectory class from those who belonged to any other joint trajectory class. A 2 (joint trajectory membership)  $\times$  2 (SA at 3 months) cross-tabulation showed that, at 3 months post-baseline, the rate of SA in the previous year was significantly higher among adolescents in the high NSSI and high suicide ideation trajectory class (37.9%) than adolescents in the other joint trajectory classes (4.2%), Fisher's exact test  $p < .001$  (OR = 14.06, 95% confidence interval [CI] = [5.87, 33.67]). Moreover, a first GEE model revealed that, after controlling for SA assessed at 3 months post-baseline (OR = 6.14,  $p < .001$ , 95% CI = [2.59, 14.58]), membership in the high-high trajectory class was associated with an increased risk of reporting SA between 6 and 24 months post-baseline (OR = 5.01,  $p < .001$ , 95% CI = [2.03, 12.34]).

In a second GEE model, adolescents in the high-high trajectory class were compared with adolescents in each of the other joint trajectory classes. Notably, these analyses were limited only to the three joint trajectory classes with meaningful sample sizes (i.e., low-low, moderate-moderate, and high-high).<sup>3</sup> Results revealed that, after accounting for SA at 3 months post-baseline (OR = 2.58,  $p < .05$ , 95% CI = [1.17, 5.98]), membership in the high-high trajectory class was associated with a higher likelihood of reporting SA between 6 and 24 months relative to membership in both the other joint trajectory classes. Specifically, adolescents who belonged to the high-high trajectory class were approximately 40 times more likely to report SA compared with adolescents in the low-low trajectory class (OR = 40.88,  $p < .001$ , 95% CI = [10.25, 163.11]) and more than 2 times compared with adolescents in the moderate-moderate trajectory class (OR = 2.34,  $p < .05$ , 95% CI = [1.05, 5.22]).

### Discussion

Despite the theoretical and clinical importance of understanding the longitudinal course of SITBs during adolescence, empirical work in this area has been largely lacking. To address this research gap, the present multiwave study identified trajectory classes of suicide ideation and NSSI over a 2-year period in adolescence and provided novel and important evidence on (a) the peer experiences predicting trajectory membership, (b) the joint development of suicide ideation and NSSI, and (c) the risk for SA associated with joint trajectory classes. Findings from this study advance our knowledge about adolescent SITBs and have significant theoretical and clinical implications.

Although not a primary goal of this study, a preliminary result that deserves attention concerns the identification of different subgroups of adolescents following diverse pathways of suicide ideation over time. We previously have documented the existence of different NSSI trajectory classes in this sample (see Barrocas et al., 2015); yet, only one prior study empirically identified trajectories of suicide ideation during adolescence, based on the probability of occurrence (Rueter et al., 2008). Results from the current study indicate that, similarly to NSSI, three distinct suicide ideation trajectory classes could be identified in our sample. This finding can inform clinical assessment and interventions as they highlight that, during this developmental period, a significant proportion of youth (8.2%) may be at risk for experiencing frequent and recurrent suicide ideation over time.

Consistent with interpersonal models of SITBs (e.g., Davila & Daley, 2000; Prinstein et al., 2009), this study provides strong evidence for the role of negative peer experiences, in particular peer victimization, for understanding the development of adolescent SITBs, independently from depressive symptoms. Notably, these findings extend prior research (e.g., Fisher et al., 2012; Winsper et al., 2012) by demonstrating that not only may peer

<sup>3</sup> Although the moderate suicide ideation and low NSSI trajectory class also was sufficiently large ( $n = 36$ ; 6.4%), including this class in the analyses resulted in complete separation of data points. This occurred because no adolescents in this joint trajectory class reported SA between 6 and 24 months post-baseline.

experiences differentiate adolescents who engage in SITBs from those who do not, but peer victimization may also contribute to distinguish between subgroups of adolescents who engage in SITBs to a different extent.

The clinical implications of these findings are noteworthy. First, results provide critical information for identifying adolescents who are at risk for chronic elevations in NSSI and suicide ideation. Given that peer victimization, rather than dyadic peer experiences (i.e., lacking friends; having unsupportive friends), increased risk for reporting chronically high NSSI and suicide ideation, screening for adolescent SITBs would benefit from adding assessments of a history of peer victimization. Second, corroborating decades of peer relations research, findings indicate that different peer experiences cannot be collapsed into a single “peer problem” construct. Therefore, assessing adolescents’ peer problems as a global risk factor in clinical settings is not optimal for identifying youth who are clinically at risk for SITBs. Third, given the differential risk associated with diverse peer experiences, adolescents exposed to different peer stressors may necessitate different clinical interventions. On the one hand, in addition to universal programs aimed at preventing victimization within school settings, it would be crucial for clinicians to target specific interventions and empirically based treatments (e.g., dialectical behavior therapy; see Groves, Backer, van den Bosch, & Miller, 2012) to prevent adolescents who are exposed to peer victimization from developing and/or maintaining chronic suicide ideation and NSSI. On the other hand, treatment and intervention programs aimed specifically at improving social skills to promote the formation of positive friendships may be helpful for adolescents experiencing difficulties in dyadic relationships, thus reducing their risk for engaging in moderate NSSI.

The second key finding of this study pertained to the strong overlap between the longitudinal course of NSSI and suicide ideation. This result corroborates prior evidence on within-time associations (see Hamza et al., 2012) and highlights that, even over time, suicide ideation and NSSI are highly comorbid, at least during this developmental period. It is important that a symmetrical relation was found between suicide ideation and NSSI, with adolescents showing chronically high suicide ideation being at greatest risk for engaging in persistently high NSSI, and vice versa. Moreover, although a sizable group of adolescents followed a moderate suicide ideation and a low NSSI trajectory, unexpectedly, practically no adolescent had a history of moderate NSSI and low stable suicide ideation. Thus, results from these joint trajectory models somewhat challenge the hypothesis of NSSI as a distinct entity, which can be empirically disentangled from SA based on the absence of suicide ideation (Kapur et al., 2013). However, given prior evidence supporting the distinction between NSSI and SA (see Hamza et al., 2012) and the lack of data examining the developmental course of these phenomena, no firm conclusions should be drawn from these findings.

The third major finding was that the group of adolescents following a chronically high joint trajectory of suicide ideation and NSSI were at the highest risk for attempting suicide. Specifically, adolescents with chronic high levels of both suicide ideation and NSSI were about 5 times more likely to report SA between 6 and 24 months post-baseline, compared with adolescents following different joint developmental patterns of suicide ideation and NSSI. Notably, being in the joint high trajectory increased risk for SA, even after accounting for prior SA assessed at 3 months

post-baseline. Thus, clinicians working with adolescents who report chronically high levels of NSSI or suicide ideation need to seriously consider their increased risk for suicide. This finding is consistent with the interpersonal theory of suicide (Joiner, 2005; Van Orden et al., 2010), suggesting that the combination of high desire and capability for suicide may result in SA. On the one hand, the repeated exposure to physically painful events, which likely results from chronic experiences of NSSI, may enhance adolescent capability to commit suicide (Joiner et al., 2012). On the other hand, adolescents with a history of high stable suicide ideation may be more likely to develop a desire for suicide (i.e., “active” suicide ideation; Van Orden et al., 2010). Yet, although in line with the interpersonal theory of suicide, these results need to be interpreted with caution in light of the large overlap between suicide ideation and NSSI trajectories, given that their high co-occurrence prevented examination of the individual contribution of NSSI and suicide ideation (e.g., moderate NSSI and low suicide ideation trajectory class) on SA.

A final result that deserves consideration is that, contrary to our expectations, friends’ NSSI was the only peer factor that did not differentiate trajectory classes. Despite theoretical models suggesting NSSI contagion (Heilbron & Prinstein, 2008), to date, direct evidence for peer contagion effects is rare and inconsistent. One potential explanation for these mixed findings is that NSSI contagion only occurs within intimate relationship contexts, such as best friend dyads and small peer groups (i.e., cliques). Indeed, although in the current study friends’ characteristics were operationalized as having at least one (mutual) friend who engaged in NSSI, evidence supporting peer contagion of NSSI comes primarily from studies examining friendship dyads (Prinstein et al., 2010) and cliques (You et al., 2013) and not the peer group at large (Giletta, Burk, Scholte, Engels, & Prinstein, 2013). Moreover, the lack of findings may be attributable to the sociometric procedure used in this study that limited the assessment of friendships to the classroom context. During high school, adolescent friendships extend outside the classroom as well as school context, and these friendships may be more intimate and influential than within-school friendships (e.g., Van Zalk, Kerr, Branje, Stattin, & Meeus, 2010).

Overall, this study offers novel and important data on the prevalence and longitudinal course of SITBs in an understudied population of adolescents. Research on SITBs in China is rather rare, with the exception of a few studies conducted among Hong Kong adolescents (e.g., You et al., 2013), which may not be representative of adolescents in mainland China. SITBs were found to be relatively common in this sample, with similar, and in the case of suicide ideation, higher frequencies than those previously reported among U.S. adolescents (Guan et al., 2012). These data are in line with extant evidence from Chinese studies (e.g., Cheng et al., 2009; Tang et al., 2011; You et al., 2013) and support the hypothesis of adolescence as a developmentally sensitive period for SITBs worldwide. An unexpected finding pertained to gender differences on SITBs. While in Western countries, females are frequently found to be at higher risk for NSSI, and especially suicide ideation, in this sample no gender differences were observed on suicide ideation, and higher prevalence and frequencies of NSSI emerged among males than females. These findings are not uncommon in the literature, because males have been previously shown to report higher NSSI than females in mainland China (Tang et al., 2011). Cultural differences may exist in the role of

gender on SITBs, hypothesis that would be consistent with parallel research failing to show gender differences in internalizing disorders (e.g., depression) in Chinese adolescents (see Ryder, Sun, Zhu, Yao, & Chentsova-Dutton, 2012). Yet, the reasons for these potential differences remain unknown and, given the early stage of this research, these findings need to be replicated before any firm conclusions can be drawn.

Findings that peer experiences differentiated suicide ideation and NSSI trajectories support the validity of interpersonal models for understanding SITBs among adolescents in mainland China (see also Cui et al., 2011), similarly to Western adolescents. However, it should be noted that interpersonal factors may be particularly powerful predictors of SITBs in this population. Compared with Western cultures, traditional collectivistic Asian cultures emphasize interpersonal relationships, group belongingness, and cohesion as more central dimensions of individuals' self-construal (Markus & Kitayama, 1991). Therefore, lacking friends, perceiving poor interpersonal support and having a reputation as a victim in the peer group may be remarkably stressful events for these adolescents (Wong et al., 2011). Thus, replication of these findings in different populations of adolescents is high priority for future research.

This study offers valuable and unique contributions to better understand the longitudinal course, the interpersonal antecedents and potential outcomes of NSSI and suicide ideation during adolescence. However, findings should be interpreted in light of a number of limitations. First, SITBs were assessed with self-report measures. Although self-report assessments of SITBs are widely used with adolescents (e.g., Guan et al., 2012; Klonsky et al., 2013; Prinstein et al., 2008) and yield valid and reliable measures (for a review, see Nock, Wedig, Janis, & Deliberto, 2008), clinical interviews would have allowed to better introduce and clarify the nature of the assessed constructs. However, it should be noted that self-report assessments may allow adolescents to more easily disclose their thoughts and behaviors compared with face-to-face clinical interviews (Prinstein, Nock, Spirito, & Grapentine, 2001). Thus, a multimethod assessment that relies on different reporters would be ideal to provide a more accurate assessment of SITBs (see Nock, Borges, et al., 2008). Second, the use of a nonexperimental design precludes firm causal conclusions on the associations found. For instance, it cannot be ruled out that the effects of peer experiences on SITBs are due to third variable factors that have been found to be related to both SITBs and negative peer experiences, such as poor emotion regulation or personality traits (e.g., Hanish et al., 2004; Nock & Prinstein, 2004). Moreover, given the low rates of SA at 24 months post-baseline, the associations between joint trajectory classes and risk for SA was concurrent in nature, limiting the ability to draw clear conclusions on the temporal order. Third, peer experiences were assessed only at baseline. Therefore, transactional processes that likely occur between peer experiences and SITBs could not be examined. Fourth, as discussed previously, the generalizability of the findings is limited given that participants were all Chinese adolescents recruited from high schools in the Hunan province. Finally, limitations in the analytic approach should be noted. Most important, although GBTMs are widely used in clinical research and provide a useful approach to examine the longitudinal course of symptoms and behaviors, it is crucial to remember that trajectory classes should be seen as approximations and not as "distinct entities"

(Nagin & Odgers, 2010, p 118). Moreover, it should be acknowledged that alternative methodologies have been proposed to analyze the joint development of related phenomena, such as transition analysis based on mixture latent Markov models (see Vermunt, Tran, & Magidson, 2008). Latent Markov models would allow examining the development of multiple outcomes simultaneously. Despite the advantages of this approach (Vermunt et al., 2008), in this study, latent trajectories of NSSI and suicide ideation were first examined separately based on prior theoretical and empirical work suggesting that these are two distinct phenomena. Subsequently, to provide new insights into the relation between these phenomena, the association between latent trajectories of NSSI and suicide ideation was investigated.

In conclusion, this study highlighted the importance of peer experiences, in particular peer victimization, as relevant sources of stress that strongly contribute to influence the development and maintenance of SITBs during adolescence. Furthermore, this study indicated that suicide ideation and NSSI, while representing different phenomena, may substantially overlap across time during adolescence. As a consequence, adolescents experiencing high suicide ideation or NSSI are at significantly higher risk for future SA. While these novel findings can inform clinical assessment and interventions, future research that seeks to understand the underlying processes linking peer experiences to suicide ideation and NSSI, as well as their comorbid nature, represents a crucial next step that would better inform development of interventions to reduce SA and better identify mechanisms of change.

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