ARTICLE

The Relationship Between Self-injurious Behavior and Suicide in a Young Adult Population

Janis Whitlock, MPH, PhD; Kerry L. Knox, PhD

Objective: To test the hypothesis that self-injurious behavior (SIB) signals an attempt to cope with psychological distress that may co-occur or lead to suicidal behaviors in individuals experiencing more duress than they can effectively mitigate.

Design: Analysis of a cross-sectional data set of college-age students.

Setting: Two universities in the northeastern United States in the spring of 2005.

Participants: A random sample of 8300 students was invited to participate in a Web-based survey; 3069 (37.0%) responded. Cases in which a majority of the responses were missing or in which SIB or suicide status was indeterminable were omitted, resulting in 2875 usable cases.

Exposure: Self-injurious behavior.

Main Outcome Measures: Main outcome was suicidality; adjusted odds ratios (AORs) for suicidality by SIB status when demographic characteristics, history of trauma, distress, informal help-seeking, and attraction to life are considered.

Results: One quarter of the sample reported SIB, suicidality, or both; 40.3% of those reporting SIB also report suicidality. Self-injurious behavior status was predictive of suicidality when controlling for demographic variables (AOR, 6.2; 95% confidence interval [CI], 4.9-7.8). Addition of trauma and distress variables attenuated this relationship (AOR, 3.7; 95% CI, 2.7-4.9). Compared with respondents reporting only suicidality, those also reporting SIB were more likely to report suicide ideation (AOR, 2.8; 95% CI, 2.0-3.8), plan (AOR, 5.6; 95% CI, 3.9-7.9), gesture (AOR, 7.3; 95% CI, 3.4-15.8), and attempt (AOR, 9.6; 95% CI, 5.4-17.1). Lifetime SIB frequency exhibits a curvilinear relationship to suicidality.

Conclusions: Since it is well established that SIB is not a suicidal gesture, many clinicians assume that suicide assessment is unnecessary. Our findings suggest that the presence of SIB should trigger suicide assessment.

Arch Pediatr Adolesc Med. 2007;161(7):634-640

SELF-INJURIOUS BEHAVIOR (SIB) is defined[1] as self-inflicted destruction of the body for purposes not socially sanctioned and without suicidal intent. Typically associated with clinical populations, there are few epidemiological studies of SIB in community populations. Extant studies are limited by small or potentially biased samples. Available evidence suggests that approximately 4% of the general adult population and 21% of clinical populations report at least occasional SIB. Estimates of SIB prevalence in college and high school students range from 12% to 38%.[2-5] A recent representative study of college students, using the same data on which these analyses are based, showed a 17% lifetime prevalence.[6]

Several researchers have postulated that SIB is a mechanism used to compensate for inadequate affect regulation in situations perceived as stressful.[7,8] Although primarily derived from clinical populations, the affect-regulation theory helps to explain SIB in community populations as well, since many report it as a method of coping with unwanted negative emotion.[9,10] If so, individuals vulnerable to SIB may also be at heightened risk of suicidality when trauma or psychological distress overwhelms their capacity to cope effectively.

See also page 641

Most clinical and community studies show an average age of onset in mid to late adolescence followed by a decline in early adulthood.[1,4,11] In high school and college students, between 34% and 45% of individuals with SIB indicate that they also experience suicidal ideation.[6,12] While there is consistent evidence that SIB and suicide co-occur,[13-17] the nature of this relationship is less clear. Self-injurious behavior and suicide appear to share several important correlates, including depression, alcohol or substance abuse, psycho

Author Affiliations: From the Department of Human Development and the Family Life Development Center, Cornell University, Ithaca, New York (Dr Whitlock), and Department of Community and Preventive Medicine, University of Rochester, Rochester, New York (Dr Knox).

©2007 American Medical Association. All rights reserved.
Downloaded From: http://archpedi.jamanetwork.com/ on 10/10/2015

logical pain, cognitive constriction, and dysregulation of the serotonin and noradrenergic systems.[18-27] However, SIB and attempted and completed suicide are widely recognized to exhibit key differences in motivation, lethality, hopelessness, intent to die, and attraction to life even when an individual displays both forms of behavior.[6,13,14]

Two distinct models dominate conceptualization of the relationship between SIB and suicidal behaviors. One model views SIB as part of a constellation of suicidal behaviors.[28] The other model views individuals who deliberately injure themselves and those who are suicidal as 2 different populations.[1,13,29,30] Typically, the latter model is used to argue that SIB is most commonly used as a way to regulate negative affect and to *avoid* suicide.

We posit an alternative to both of these models. We hypothesize that while individual SIB acts are rarely, if ever, undertaken with suicidal intent, SIB signals an attempt to cope with psychological distress that may cooccur or lead to suicidal behaviors in individuals experiencing more duress than they can effectively mitigate. If so, suicidal behaviors would be likely to either coexist or evolve over time if SIB begins to fail as a functional coping mechanism. Consistent with this, we expected that (1) SIB status would predict suicidality independent of demographic characteristics associated with either, (2) SIB respondents who were also suicidal would exhibit higher levels of conditions known to be associated with distress and fewer protective factors than SIB only or suicidality-only individuals, (3) SIB frequency would bear a positive linear relationship to suicidality, and (4) SIB status would significantly predict all forms of suicidal behaviors rather than solely ideation. These hypotheses were tested using combined data from 2 college student populations.

METHODS

SAMPLE

Participants were drawn from a random sample of 8300 undergraduate and graduate students (33.7% of the total combined population) from 2 northeastern universities. All were sent a postcard inviting them to participate in a Web-based survey in the spring of 2005. Soon after, each received a personalized e-mail with a link to the survey. A total of 3069 (37.0%) students completed the survey. Cases in which a majority of the responses were missing or in which SIB or suicide status was indeterminable were omitted (n=194), resulting in 2875 (34.6%) cases retained for analysis. Sample demographics were largely representative of the overall student population, although there were significantly more women in the sample population than in the population from which they were drawn (56.3% vs 47.6%). Of these, 490 (17.0%) had practiced SIB and 423 (14.7%) reported suicidality (715 unduplicated responses).

STUDY DESIGN AND QUESTIONNAIRE

The survey was administered on a secure Internet server, requiring 10 to 25 minutes to complete. The Web-based survey allowed for complex skip patterns viewable only by those for whom the questions were relevant. The survey also allowed students to immediately make the screen go blank if they were interrupted or feared being observed. Links to local resources were placed on the bottom of every page and a "distraction" toggle allowed anyone who needed a break to see an unrelated Web page. The study was approved by the Committee for Human Subjects at both institutions. All students provided online assent before taking the survey and were free to discontinue participation at any time by closing their Web browser.

The survey consisted of 4 broad conceptual domains: (1) sociodemographic characteristics, (2) mental health indicators, (3) risk and protective factors, and (4) help-seeking history and preferences. There was a mix of epidemiological and psychological survey items. Multiple existing scales were reviewed and, where possible, the survey contained validated items. The survey was field tested with 25 students, 13 of whom were known to be self-injurious. Measures for which rates are well documented, such as lifetime prevalence of suicidality, were consistent with other available data.[31,32] Examination of discriminate and convergent validity in between variable analyses within the survey also showed predictable relationship patterns. For example, the Attraction to Life Scale was inversely correlated with the K-6 scale ($r=-0.64$) and positively associated with life satisfaction ($r=0.67$) at $P<.001$. Although too numerous to report here (validity and reliability of this tool is the subject of a future article), there were no unexpected correlations in any of the discriminate and convergent validity tests.

ASSESSMENT OF SIB

All respondents received an initial screening question for SIB: "Have you ever done any of the following with the intention of hurting yourself?" This was followed by a list of 16 SIB behaviors identified through examination of existing SIB surveys,[33] a review of existing literature, and ongoing interviews with mental health providers and self-injurers. A later question asked respondents who indicated having practiced SIB whether they had done so "to practice suicide" or "to commit suicide." Fourteen observations were omitted from the SIB category for purposes of analyses, since, by definition, SIB is an act undertaken without suicidal intent.

ASSESSMENT OF SUICIDALITY

Lifetime suicidality was measured using a binary response item[34] that asked, "Have you ever seriously considered suicide or attempted suicide?" Respondents who answered affirmatively were asked to select any of 8 statements that applied to them. For purposes of these analyses, these statements were clustered into the following 4 categories: (1) ideation ("I thought seriously about it"), (2) plan ("I had a general plan but did not carry it out "; "I had a method but did not carry it out"), (3) gesture ("I wrote a suicide note but did not leave it where it could be found"; "I wrote a suicide note and did leave it where it could be found"), and (4) attempt ("I made a serious attempt but no medical intervention occurred"; "I made a serious attempt that received medical attention"). Respondents with multiple responses were placed into only 1 of these categories based on the most serious of their response selections, since understanding lethality may be a critical discriminating factor among self-injurious individuals. Respondents could also select the statement, "Although I considered suicide, I was not that serious about it." This statement was not categorized, but was used independently to examine whether SIB status affected the selection of this response.

DEMOGRAPHIC CORRELATES

Demographic characteristics and known or putative conditions comorbid with SIB, suicidality, or both were included in

©2007 American Medical Association. All rights reserved.
Downloaded From: http://archpedi.jamanetwork.com/ on 10/10/2015

the analyses, including gender, age, race/ethnicity, and sexual orientation. Following US census codes, race/ethnicity codes included non-Hispanic black, non-Hispanic white, and Hispanic. An Asian/Asian American category was included as well. The "other" category included American Indian/Alaskan Native, Middle Eastern or East Indian, Native Hawaiian or Pacific Islander, and biracial/ethnic or multiracial/ethnic. These were collapsed into 4 broader categories: Caucasian, black, Asian/Asian American, and other. Gender included 3 options: male, female, and transgendered/nongendered; only 2 respondents selected the last category. Sexual orientation included 4 response options: straight, gay or lesbian, bisexual, and questioning; all that applied could be selected. For these analyses, the 51 respondents who chose 2 or more sexual orientations were categorized as "questioning."

INDICATORS OF TRAUMA AND DISTRESS

Respondent reports of several risk factors included eating disorders; history of sexual, emotional, or physical abuse; and psychological and physical distress. Physical distress was measured using a binary variable reflecting the presence of 4 *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*[35] characteristics of disordered eating, which was coded positively if respondents indicated that they had ever repeatedly: (1) severely restricted eating, (2) binged or purged, (3) overexercised to lose or manage weight, or (4) used laxatives to lose or manage weight. Psychological distress in the past 30 days was assessed using the K-6 scale[36,37] (Chronbach $\alpha = 0.78$). Presence or absence of abuse history was measured using 3 questions developed for this study: "Have you ever been in a physically abusive relationship (including family relationships, romantic relationships, acquaintances, or friendships)?", "Have you ever experienced sexual touching or penetration against your will?", and "Have you ever been in a relationship that was emotionally abusive (including family relationships, romantic relationships, acquaintances, or friendships)?"

PROTECTIVE FACTORS

Two protective factors were included in these analyses: attraction to life and informal help-seeking. The Attraction to Life Scale was taken from the Multi-Attitude Suicide Tendency Scale.[38] Four items with the highest factor loading were selected from the original 7-item scale. All 4 items loaded above 0.7 in the present study and showed acceptable reliability (Chronbach $\alpha = 0.77$). The informal help-seeking variable was derived from the question: "Who do you feel comfortable getting help from when you feel anxious, sad, or depressed?" Respondents were presented with 17 options and asked to select all that applied. These were then totaled to create the informal help-seeking variable.

STATISTICAL ANALYSES

All analyses were conducted using SPSS version 13.0 (SPSS Inc, Chicago, Illinois). Descriptive statistics and crude and adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were used to examine the relationship between SIB, suicidality, and correlates. Both bivariate and multinomial logistic regression analyses were used. To examine the extent to which SIB status predicted suicidality, the first analysis used binary logistic regression to examine the relationship between demographic characteristics, trauma and distress indicators, and protective factors and suicidality (coded as absent or present). The second analysis sought to differentiate respondents with SIB only from respondents who reported both SIB and suicidality. Using the group reporting SIB only as the reference group, multinomial logistic regression was then used to examine 3 SIB and suicide-related categories: SIB only, SIB and suicidality, and suicidality only. The analysis examined the extent to which these groups differed from the SIB-only group on demographic characteristics, trauma and distress indicators, and protective factors. The last analysis was intended to determine whether suicidal SIB respondents differed from suicidal non-SIB respondents in terms of specific suicidal characteristics or lethality. To accomplish this, logistic regression analysis was conducted between SIB status (SIB or no SIB) and 4 binary-coded measures of suicidality: ideation, plan, gesture, and attempt. Since demographic characteristics of the population were known, all logistic regression analyses were weighted to control for gender differences in the sample and the population and to equalize differences in response rates in each university. Univariate statistics reported in **Table 1** were not weighted.

RESULTS

STUDY POPULATION

Overall, the sample contained more women than men and 73.0% of the entire group was between the ages of 18 and 24 years. Two thirds of the sample (66.4%) was Caucasian, with Asian/Asian American being the next most represented ethnic/racial category (17.1%). Respondents identifying as heterosexual accounted for 92.5% of the total sample, with 2.2% identifying as gay or lesbian, 2.9% identifying as bisexual, and 2.6% indicating that they were questioning their sexual orientation. As shown in Table 1, 715 (24.9%) respondents ever reported SIB, suicidality, or both. Of those reporting SIB, suicidality, or both, most (40.8%; 10.2% of the total sample) practiced only SIB, 27.4% (6.9% of the total sample) reported SIB and suicidality, and 31.7% (7.9% of the total sample) reported just suicidality. Although not shown in Table 1, when SIB only is broken down by reported lifetime frequency 117 (23.9%) report single incidents, 227 (46.5%) report 2 to 10 incidents, 78 (15.9%) report 11 to 50 incidents, and 42 (8.6%) report more than 50 incidents; in 24 (4.9%) cases, SIB frequency was unknown.

Table 1 shows a pattern in keeping with our prediction that individuals reporting no SIB or suicide report lower levels of trauma and distress than those reporting SIB, suicidality, or both. It also shows that individuals reporting both SIB and suicide also report higher levels of trauma and psychological and physical distress than SIB only, suicide only, and neither SIB nor suicide before all variables are taken into account.

RELATIONSHIP BETWEEN SIB AND SUICIDALITY

The second analysis tested our first hypothesis, that SIB status would predict suicide status even when demographic variables were controlled. As shown in **Table 2**, SIB was strongly predictive of suicidality. Analyses that examine the relationship between reported lifetime SIB frequency and suicide suggest that the relationship to suicidality increases as SIB activity increases until respondents report more than 50 SIB incidents. Adjusted odds ratios for demographics comparing individuals report-

©2007 American Medical Association. All rights reserved.
Downloaded From: http://archpedi.jamanetwork.com/ on 10/10/2015

Table 1. Unweighted Univariate Statistics for Demographic and Trauma Variables Used in Analyses[a]

Characteristic	No. (%) of Respondents			
	SIB Only (n = 292)	SIB and Suicide (n = 196)	Suicide Only (n = 227)	Neither SIB Nor Suicide (n = 2160)
Sex				
Female	177 (60.6)	143 (73.0)	131 (58.2)	1167 (54.0)
Male	113 (38.7)	53 (27.0)	94 (41.8)	985 (45.6)
Age, y				
18-20	131 (44.8)	87 (44.6)	77 (34.4)	846 (39.2)
21-24	99 (33.9)	62 (31.8)	71 (31.7)	725 (33.5)
≥25	61 (20.8)	46 (23.6)	76 (33.9)	573 (26.5)
Race/ethnicity				
Caucasian	213 (72.9)	131 (66.8)	121 (54.0)	1388 (64.2)
Black	6 (2.1)	9 (4.6)	16 (7.1)	74 (3.4)
Asian/Asian American	37 (12.7)	25 (12.8)	54 (24.1)	374 (17.3)
Other	35 (12.0)	31 (15.8)	33 (14.7)	316 (14.7)
Sexual orientation				
Straight	256 (87.7)	155 (78.3)	194 (86.2)	2027 (93.8)
Gay/lesbian	7 (2.4)	5 (2.5)	9 (4.0)	42 (1.9)
Bisexual	17 (5.1)	21 (10.6)	14 (6.2)	32 (1.5)
Questioning	11 (3.8)	15 (7.6)	8 (3.6)	42 (1.9)
History of abuse[b]				
Sexual abuse	42 (14.3)	57 (29.1)	38 (16.7)	181 (8.3)
Emotional abuse	109 (37.3)	106 (54.1)	90 (39.6)	390 (18.0)
Physical abuse	23 (7.8)	39 (19.9)	28 (12.3)	92 (4.2)
Indicators of distress				
Possess ≥1 characteristic of an eating disorder	93 (31.8)	99 (50)	74 (32.8)	398 (18.4)
Psychological distress				
6-12	118 (40.8)	51 (26.3)	73 (32.3)	1319 (62.0)
13-18	141 (48.8)	99 (51.0)	129 (57.1)	741 (34.8)
19-24	30 (10.3)	44 (22.7)	24 (10.6)	69 (3.2)

Abbreviation: SIB, self-injurious behavior.
[a]The sum in each subgroup may not equal the total number because of missing data.
[b]Percentages do not add up to 100 owing to multiple responses in a category.

ing any suicidality showed that suicidal individuals were more likely to be black and to report their sexual orientation as bisexual. They were also more likely to exhibit heightened psychological distress in the last 30 days (a score higher than 13 is considered an indication of psychological distress), to report a greater lifetime prevalence of eating disorders, and to report a history of emotional and sexual trauma. They were also less likely to report informal help-seeking and attraction to life.

We also predicted that trauma, distress variables, and protective factors would attenuate this relationship by accounting for some of the variance observed. To test this, variables were entered in blocks with demographic characteristics entered first, followed by trauma variables and distress variables. The final block entered the 2 protective factors. Entry of demographic variables had no effect on the relationship between self-injury and suicide (AOR, 6.2; 95% CI, 4.9-7.8). Addition of trauma and psychological and physical distress variables significantly attenuated the relationship between SIB status and suicidality (AOR, 3.7; 95% CI, 2.7-4.9). As shown in the final model, addition of the protective factors weakened the relationship between SIB and suicide only modestly (AOR, 3.4; 95% CI, 2.5-4.6).

Close examination of differences between SIB-only respondents and those reporting any suicidality (not shown) were consistent with the hypothesis that respondents reporting both SIB and suicide would report more history of trauma, more psychological and physical distress, and fewer protective factors. Compared with SIB-only respondents, those reporting SIB and suicidality cited higher rates of sexual abuse (AOR, 2.9; 95% CI, 1.4-5.4), emotional abuse (AOR, 1.9; 95% CI, 1.1-3.1), and disordered eating (AOR, 1.8; 95% CI, 1.1-2.9). They also reported less informal help-seeking (AOR, 0.8; 95% CI, 0.7-0.9) and attraction to life (AOR, 0.7; 95% CI, 0.5-0.9).

Examination of differences between SIB only and suicide only showed that those reporting suicidality only were significantly more likely to be black (AOR, 5.4; 95% CI, 1.6-17.9) or Asian/Asian American (AOR, 2.7; 95% CI, 1.5-4.7) than Caucasian. They were also significantly more likely to be older than 24 years than between 18 and 20 years (AOR, 2.3; 95% CI, 1.37-4.0) and report less attraction to life (AOR, 0.7; 95% CI, 0.6-0.9).

The last hypothesis examined the extent to which SIB and suicide overlap for some individuals. We hypothesized that, among respondents reporting suicidality, those also reporting SIB would be equally likely to report all forms of suicidal behavior, not solely ideation. Adjusted odds ratios (**Table 3**) support this hypothesis and show that SIB status significantly predicts suicide ideation, plan, gesture, and attempt. Indeed, the strength of the AORs increased as the reported suicide-linked behaviors became more serious and, therefore, potentially more lethal. Examination of differences in the statement "Al-

©2007 American Medical Association. All rights reserved.
Downloaded From: http://archpedi.jamanetwork.com/ on 10/10/2015

Table 2. Logistic Regression of Suicide Status on Demographics, Indicators of Trauma and Distress, Protective Factors, and Self-injury Status[a]

Demographic Characteristics	Odds Ratio (95% Confidence Interval) Univariate Model	Multivariate Model[b]
Self-injury status (any vs no self-injury)	**6.3 (5.1-7.9)**	**3.4 (2.5-4.6)**
Self-injury status by lifetime frequency		
No SIB incident	1.0	1.0
Single SIB incident	**2.5 (1.5-3.9)**	1.3 (0.7-2.5)
2-10 incidents	**6.1 (4.3-8.2)**	**3.4 (2.3-5.0)**
11-50 incidents	**20.4 (12.3-33.7)**	**10.4 (5.3-20.2)**
≥51 incidents	**12.5 (6.3-24.6)**	**9.3 (3.3-25.9)**
Sex		
Male	1.0	1.0
Female	1.5 (1.2-1.8)	1.0 (0.7-1.3)
Age, y		
18-20	1.0	1.0
21-24	1.0 (0.8-1.3)	1.2 (0.8-1.6)
≥25	1.2 (0.8-1.6)	1.4 (1.0-1.9)
Race/ethnicity		
Caucasian	1.0	1.0
Black	**2.2 (1.2-3.3)**	**2.3 (1.2-4.5)**
Asian/Asian American	1.2 (0.9-1.6)	1.3 (0.9-1.9)
Other	1.1 (0.8-1.4)	1.1 (0.7-1.7)
Sexual orientation		
Straight	1.0	1.0
Gay/lesbian	1.7 (0.9-3.2)	1.7 (0.7-3.7)
Bisexual	**4.9 (3.0-7.9)**	**3.7 (1.8-7.3)**
Questioning	**2.7 (1.6-4.6)**	1.2 (0.6-2.6)
History of abuse		
Sexual abuse	**3.2 (2.4-4.2)**	**1.8 (1.2-2.7)**
Emotional abuse	**4.2 (3.4-5.3)**	**2.4 (1.8-3.2)**
Physical abuse	**3.9 (2.8-5.4)**	1.2 (0.8-1.9)
Indicators of distress		
Psychological distress (K-6 scale score)	**2.0 (1.8-2.2)**	**1.3 (1.1-1.4)**
Presence of disordered eating	**2.7 (2.1-3.3)**	**1.7 (1.2-2.3)**
Protective factors		
Informal help-seeking	**0.8 (0.7-0.8)**	**0.9 (0.8-0.9)**
Attraction to life	**0.5 (0.4-0.6)**	**0.6 (0.5-0.7)**

Abbreviation: SIB, self-injurious behavior.

[a] Derived from bivariate logistic regression analysis with demographics, indicators of trauma and distress, and protective factors entered as predictors of any suicidality. Results significant at $P<.05$ are in bold.

[b] All effects were adjusted simultaneously for any SIB (vs no SIB); sex; age; race/ethnicity; sexual orientation; physical, emotional, and sexual abuse; psychological distress; disordered eating; social connection; and attraction to life.

though I considered suicide, I was not that serious about it" when controlling for all other demographic variables showed no difference between SIB and non-SIB respondents. Although not shown in the table, results also showed that women were 2.2 times (95% CI, 1.2-3.4) more likely to report attempting suicide than men. In comparison to students identifying as straight, students reporting as gay or lesbian were 4.2 times (95% CI, 1.2-14.1) more likely to report attempting suicide, while students identifying as bisexual or questioning were more likely to report planning suicide (AOR, 4.0; 95% CI, 2.1-7.6). These findings are consistent with existing research.[39,40]

COMMENT

We hypothesized that SIB signals a coping strategy to deal with psychological distress that may co-occur or lead to suicidal behaviors in individuals experiencing more duress than they can ultimately effectively mitigate. Consistent with our hypotheses, this study showed that SIB was a strong predictor of suicidality, that individuals who evidenced SIB and suicidality were significantly more likely to score higher on trauma and distress variables and lower on protective factors than those exhibiting SIB only, and that the risk of suicidality increased as SIB frequency increased. We also found that a reported history of SIB predicted all forms of suicidal behavior, not solely ideation. Assuming that the temporal sequence is as we hypothesize here, namely, that SIB precedes or co-occurs with suicide, these findings suggest that, in individuals using SIB as a means of coping with undesired affect, suicide may become a viable consideration if psychological duress overwhelms their capacity to functionally cope using SIB or other methods, such as substance use.

Finding that the association between SIB incidents and suicide peaks at 11 to 50 incidents (after which the risk declines) invites several possible interpretations. The one most consistent with our hypotheses suggests that SIB, alone or in addition to other mechanisms, effectively mitigates sustained or sporadic distress for enduring periods among some individuals. The fact that most (60.0%) of those reporting SIB evidenced no suicidality at all supports this theory and helps to explain why so many individuals in the study population using SIB remain undetected by informal and formal support systems.[6,12] An alternative explanation for the curvilinear relationship between SIB frequency and suicidality is that high lev-

Table 3. Bivariate Logistic Regression of Demographic and Self-injury Status on Suicidality[a]

Demographic Characteristics	Odds Ratio (95% Confidence Interval) Ideation	Plan	Gesture	Attempt
No.	189	143	31	60
SI status				
Non SI	1.0	1.0	1.0	1.0
SI	**2.8 (2.0-3.8)**	**5.6 (3.9-7.9)**	**7.3 (3.4-15.8)**	**9.6 (5.4-17.1)**
χ^2_1	**39.5**	**91.8**	**27.8**	**70.8**

[a] Based on bivariate logistic regression analysis with key sociodemographic and self-injury (SI) status variables treated as predictors of dichotomously coded suicidal behaviors. Effects were adjusted simultaneously for sex, age, sexual orientation, and race/ethnicity. Results significant at $P<.001$ are in bold.

©2007 American Medical Association. All rights reserved.
Downloaded From: http://archpedi.jamanetwork.com/ on 10/10/2015

els of SIB include individuals for whom SIB becomes habitual, compulsive, and initiated in response to stimuli not directly linked to current affective state. Although not explored here, the trend raises questions with clinical implications worthy of further investigation.

Our finding that SIB predicted all forms of suicidality and that the magnitude of the association increased as the seriousness of the suicidality increased is consistent with Joiner's[41] theory that engagement in SIB may inadvertently embolden and prepare individuals for more lethal suicide-related behaviors than those who do not engage in SIB. However, because we cannot discern temporal sequence of SIB relative to suicide in these analyses, the applicability of Joiner's theory to this data are limited. Our findings do, however, point to the need for effective means of distinguishing deliberately self-injurious individuals likely to exhibit suicidal behavior from those unlikely to exhibit suicidality.

This study is not without limitations. Reliance on data from 2 universities and a less than ideal response rate suggests the possibility of systematic bias among nonrespondents. Nevertheless, the response rate in this study was higher than reported for national surveys conducted on college campuses.[42] Moreover, demographic characteristics of the population were known; we were able to use weighted analyses that may compensate for any systematic bias. Comparison to the results reported from the 2005 National College Health Assessment study demonstrates that our sample was more diverse than the national sample, containing more graduate students, international students, men, and minority students.[43] Finally, reliance on single-item measures may not capture experiences of interest with a high degree of specificity, and these analyses did not differentiate between a number of potentially important temporal issues such as age at onset and cessation for SIB and suicidality.

Self-injurious behavior is present at concerning levels among community adolescents and young adults. Since it is well established that SIB is not a suicidal gesture in and of itself, many clinicians assume that suicide assessment is unnecessary. Our study suggests that, while SIB may serve as a functional, if maladaptive, coping mechanism used to avoid suicide, it may also serve as a harbinger of all forms of suicidality in a subset of individuals. Until clinical tools capable of differentiating levels of risk of suicidality or serious physical harm in patients who exhibit SIB are developed, our findings suggest that the presence of SIB should trigger suicide assessment. The variance accounted for in the link between SIB and suicide by trauma and distress variables also suggests that presence of SIB should trigger psychological assessment and referral.

Accepted for Publication: October 19, 2006.
Correspondence: Janis Whitlock, MPH, PhD, Family Life Development Center, Beebe Hall, Cornell University, Ithaca, NY 14853 (jlw43@cornell.edu).
Author Contributions: Dr Whitlock has had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. *Study concept and design:* Whitlock and Knox. *Acquisition of data:* Whitlock. *Analysis and interpretation of data:* Whitlock and Knox. *Drafting of the manuscript:* Whitlock and Knox. *Critical revision of the manuscript for important intellectual content*: Whitlock and Knox. *Statistical analysis:* Whitlock and Knox. *Obtained funding:* Whitlock. *Administrative, technical, and material support:* Whitlock. *Study supervision:* Whitlock.
Financial Disclosure: None reported.
Funding/Support: This study was supported by the Seed and Innovation grant awarded by the School of Human Ecology, Cornell University (Dr Whitlock). Analyses were supported, in part, by grant MH055317 of the National Institutes of Mental Health–funded P20 Developing Center for Public Health and Population-Based Approaches to Suicide Prevention (Dr Knox).
Disclaimer: The statements and opinions expressed are those of the authors and are not a reflection of the institutions that funded this study.
Additional Contributions: John Eckenrode, PhD, and Wendy Nilsen, PhD, provided substantive contributions to early drafts of the manuscript; Amanda Purington, BA, Brian Lukoff, BA, Daniel Silverman, MD, Gina Baral, MPH, and John Kolligian, PhD, made this study possible.

REFERENCES

1. Favazza AR, Conterio K. Female habitual self-mutilators. *Acta Psychiatr Scand*. 1989;79:283-289.
2. Gratz KL. Measurement of deliberate self-harm: preliminary data on the Deliberate Self-Harm Inventory. *J Psychopathol Behav Assess*. 2001;23:253-263.
3. Muehlenkamp JJ, Gutierrez PM, Osman A, Barrios LC. Validation of the Positive and Negative Suicide Ideation (PANSI) inventory in a diverse sample of young adults. *J Clin Psychol*. 2005;61:431-445.
4. Stanley B, Gameroff MJ, Michalsen BA, Mann JJ. Are suicide attempters who self-mutilate a unique population? *Am J Psychiatry*. 2001;158:427-432.
5. Kokaliari E. *Deliberate Self-injury: An Investigation of the Prevalence and Psychosocial Meanings in a Non-clinical Female College Population*. Northampton, Mass: Smith College School for Social Work; 2005.
6. Whitlock JL, Eckenrode JE, Silverman D. Self-injurious behavior in a college population. *Pediatrics*. 2006;117:1939-1948.
7. Esposito C, Spirito A, Boergers J, Donaldson D. Affective, behavioral, and cognitive functioning in adolescents with multiple suicide attempts. *Suicide Life Threat Behav*. 2003;33:389-399.
8. Chapman AL, Gratz KL, Brown MZ. Solving the puzzle of deliberate self-harm: the experimental avoidance model. *Behav Res Ther*. 2006;44:371-394.
9. Ross S, Heath N. A study of the frequency of self-mutilation in a community sample of adolescents. *J Youth Adolesc*. 2002;31:66-77.
10. Klonsky ED. The functions of deliberate self-injury: a review of the evidence. *Clin Psychol Rev*. In press.
11. Briere J, Gil E. Self-mutilation in clinical and general population samples: prevalence, correlates, and functions. *Am J Orthopsychiatry*. 1998;68:609-620.
12. Hawton K, Rodham K, Evans E, Weatherall R. Deliberate self-harm in adolescents: self report survey in schools in England. *BMJ*. 2002;325:1207-1211.
13. Linehan MM. Suicidal people: one population or two? *Ann N Y Acad Sci*. 1986; 487:16-33.
14. Brown M, Comtois KA, Lineham MM. Reasons for suicide attempts and nonsuicidal self-injury in women with borderline personality disorder. *J Abnorm Psychol*. 2002;111:198-202.
15. Nock MK, Joiner TE, Gordon KH, Loyd-Richardson E, Prinstein M. Non-suicidal self-injury among adolescents: diagnostic correlates and relation to suicide attempts. *Psychiatry Res*. 2006;144:65-72.
16. Guertin T, Lloyd-Richardson E, Spirito A, Donaldson D, Boergers J. Self-mutilative behavior in adolescents who attempt suicide by overdose. *J Am Acad Child Adolesc Psychiatry*. 2001;40:1062-1069.
17. Muehlenkamp JJ, Gutierrez PM. An investigation of differences between self-injurious behavior and suicide attempts in a sample of adolescents. *Suicide Life Threat Behav*. 2004;34:12-24.
18. Bennett S, Coggan C, Adams P. Problematising depression: young people, mental health and suicidal behaviours. *Soc Sci Med*. 2003;57:289-299.

©2007 American Medical Association. All rights reserved.
Downloaded From: http://archpedi.jamanetwork.com/ on 10/10/2015

19. Linehan MM, Armstrong HE, Suarez A, Allmon D, Heard HL. Cognitive-behavioral treatment of chronically parasuicidal borderline patients. *Arch Gen Psychiatry*. 1991;48:1060-1064.
20. Linehan MM, Tutek DA, Heard HL, HE A. Interpersonal outcome of cognitive behavioral treatment for chronically suicidal borderline patients. *Am J Psychiatry*. 1994;151:1771-1776.
21. Salkovskis PM, Atha C, Storer D. Cognitive-behavioural problem solving in the treatment of patients who repeatedly attempt suicide: a controlled trial. *Br J Psychiatry*. 1990;157:871-876.
22. Upadhyaya AK, Conwell Y, Duberstein PR, Denning D, Cox C. Attempted suicide in older depressed patients: effect of cognitive functioning. *Am J Geriatr Psychiatry*. 1999;7:317-320.
23. Andrus JK, Fleming DW, Heumann MA, Wassell JT, Hopkins DD, Gordon J. Surveillance of attempted suicide among adolescents in Oregon, 1988. *Am J Public Health*. 1991;81:1067-1069.
24. Mann JJ, Waternaux C, Haas GL, Malone KM. Toward a clinical model of suicidal behavior in psychiatric patients. *Am J Psychiatry*. 1999;156:181-189.
25. Mann JJ. Searching for triggers of suicidal behavior. *Am J Psychiatry*. 2004;161:395-397.
26. Oquendo MA, Malone KM, Ellis SP, Sackeim HA, Mann JJ. Inadequacy of antidepressant treatment for patients with major depression who are at risk for suicidal behavior. *Am J Psychiatry*. 1999;156:190-194.
27. Yates TM. The developmental psychopathology of self-injurious behavior: compensatory regulation in posttraumatic adaptation. *Clin Psychol Rev*. 2004;24:35-74.
28. Skegg K. Self-harm. *Lancet*. 2005;366:1471-1483.
29. Linehan MM. Behavioral treatments of suicidal behaviors: definitional obfuscation and treatment outcomes. In: Maris RW, Canetto SS, Sara S, eds. *Review of Suicidology*. New York, NY: Guilford Press; 2000:84-111.
30. Muehlenkamp JJ. Self-injurious behavior as a separate clinical syndrome. *Am J Orthopsychiatry*. 2005;75:324-333.
31. Kessler RC, Borges G, Walters EE. Prevalence of and risk factors for lifetime suicide attempts in the National Comorbidity Survey. *Arch Gen Psychiatry*. 1999;56:617-626.
32. National Center for Health Statistics Table 46: death rates for suicide, according to sex, race, Hispanic origin, and age: selected years 1950-2003. In: Health, United States, 2005: with chartbook on trends in the health of Americans. http://www.cdc.gov/nchs/data/hus/hus05.pdf#046. Accessed December 11, 2006.
33. Gutierrez PM, Osman A, Barrios FX, Kopper BA. Development and initial validation of the Self-Harm Behavior Survey. *J Pers Assess*. 2001;77:475-490.
34. Savin-Williams RC, Ream GL. Suicide attempts among sexual-minority male youth. *J Clin Child Adolesc Psychol*. 2003;32:509-522.
35. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 4th ed. Washington, DC: American Psychiatric Association; 1994.
36. Kessler RC, McGonagle KA, Zhao S, et al. Lifetime and 12-month prevalence of *DSM-III-R* psychiatric disorders in the United States: results from the National Comorbidity Survey. *Arch Gen Psychiatry*. 1994;51:8-19.
37. Kessler RC, Barker PR, Colpe LJ, et al. Screening for serious mental illness in the general population. *Arch Gen Psychiatry*. 2003;60:184-189.
38. Orbach I, Milstein I, Har-Even D, Apter A, Tyano S, Welizur A. A Multi-Attitude Suicide Tendency Scale for adolescents. *Psychol Assess*. 1991;3:398-404.
39. Muehrer P. Suicide and sexual orientation: a critical summary of recent research and directions for future research. *Suicide Life Threat Behav*. 1995;25:72-81.
40. Remafedi G, French S, Story M. The relationship between suicide risk and sexual orientation: results from a population-based study. *Am J Public Health*. 1998;88:57-60.
41. Joiner TE. *Why People Die by Suicide*. Cambridge, Mass: Harvard University Press; 2006.
42. American College Health Association, National College Health Assessment. Reference group data report, fall 2003. http://www.acha.org/projects_programs/NCHA_docs/ACHA-NCHA_Reference_Group_Report_Fall2003.pdf.
43. American College Health Association. American College Health Association: National College Health Assessment: Spring 2003 reference group report. *J Am Coll Health*. 2005;53:199-210.

Correction

Error in Text. In the article titled "Understanding Autism: Parents and Pediatricians in Historical Perspective" by Silverman and Brosco published in the April issue of the *Archives* (2007;161[4]:392-398), an error occurred on page 394. In the first paragraph of the second column, the fourth and fifth sentences should have read as follows: "Parents are guaranteed a say in the review process: CAN maintains a scientific review committee comprising scientific degree–holding parents of children with autism; this review committee ranks projects after an initial review by a scientific advisory group (written communication, Therese Finazzo, January 5, 2006). The National Alliance for Autism Research maintains a similar 2-tiered system (written communication, Alycia Halladay, PhD, December 27, 2005)."

©2007 American Medical Association. All rights reserved.
Downloaded From: http://archpedi.jamanetwork.com/ on 10/10/2015