Prevalence and predictors of persistent suicide ideation, plans, and attempts during college

Holly C. Wilcox, PhD[1], **Amelia M. Arria, PhD**[2,*], **Kimberly M. Caldeira, MS**[2], **Kathryn B. Vincent, MA**[2], **Gillian M. Pinchevsky, MA**[3], and **Kevin E. O'Grady, PhD**[4]

[1] Department of Psychiatry & Behavioral Sciences, Johns Hopkins University, Baltimore

[2] Center on Young Adult Health and Development (CYAHD), University of Maryland School of Public Health, Department of Family Science

[3] Department of Criminology & Criminal Justice, University of South Carolina

[4] Department of Psychology, University of Maryland, College Park

Abstract

Background—Suicide is the second-leading cause of death among college students in the US and is preventable. Approximately 1,100 college students die by suicide each year. This study examined the prevalence and predictors of one-time and persistent suicide ideation, plans, and attempts reported during college.

Methods—Data were gathered prospectively over four years. Face-to-face interviews were conducted with 1,253 first-year college students at one large mid-Atlantic university. Risk factors were measured in Year 1.

Results—An estimated $12\%_{wt}$ of individuals experienced suicide ideation at some point during college, and of those individuals, 25% had more than one episode of ideation (persistent ideation; $2.6\%_{wt}$ of the overall sample). Ten individuals had a plan or attempt during college ($0.9\%_{wt}$ of the sample). Risk factors for persistent suicide ideation included low social support, childhood or adolescent exposure to domestic violence, maternal depression, and high self-reported depressive symptoms. Persistent ideators differed from one-time ideators only by higher levels of depression (p=.027). Persistent ideators were no more likely than one-time ideators to have made a suicide plan or attempt during college (8% vs. 9%, respectively).

Limitations—Although the sample size is large, only a small percentage of participants had persistent ideation, suicide plans or attempts during college.

Conclusion—These results have implications for programs aimed at identifying college students at risk for suicide. The accurate identification of college students at-risk for suicide is an important step toward suicide prevention.

Keywords

College students; Depression; Family psychopathology; Social support; Suicidal behavior; Suicide ideation

*Corresponding Author: Amelia M. Arria, Director, Center on Young Adult Health and Development, University of Maryland, 8400 Baltimore Ave, Suite 100, College Park, MD 20740, USA; Phone: 1-301-405-9795; Fax: 1-301-314-1013; aarria@umd.edu.

Introduction

Suicide is a major preventable public health problem in the U.S. and worldwide. Suicide accounted for 2,381 deaths in 2006 among 18–22 year olds and is the second-leading cause of death among college-aged young adults in the United States, with approximately 1,100 suicides occurring each year among college students (Centers for Disease Control and Prevention, 2009). Several high-profile campus suicides have drawn attention to the psychological and social impact associated with suicide on individuals, families, and college campuses, potentially impacting hundreds or thousands of people. The 2008 American College Health Association (ACHA; 2009) assessment of 26,685 students in 40 postsecondary education institutions found that in the past 12 months, 1.3% of college students attempted suicide 6.4% seriously considered suicide at least once.

Although suicide ideation can be considered a first step on the pathway to suicide (Kachur et al., 1995), it can vary from fleeting thoughts of being better off dead to persistent, ruminative thoughts about suicide. In the context of other risk factors such as plans, intent, or prior attempts, those with persistent ideation are often deemed by clinicians to be at high risk for suicidal behaviors. Borges and colleagues (2008), using data from the National Comorbidity Survey (NCS), found that in the absence of suicide plans or prior attempts, persistent suicide ideation may actually decrease the risk of future suicide plans and attempts. Witte and colleagues (2005) found, in a study of college students that assessed suicide ideation everyday for four consecutive weeks, that fluctuating levels of suicide ideation ("variability") was associated with prior suicide attempts, especially among males. However, suicide ideation and attempts are difficult to predict due to the transient nature of suicide ideation (Nock and Banaji, 2007). More information on how to evaluate suicide risk among students is critically needed for health professionals working in campus mental health settings.

Suicidal behaviors are complex and a result of the interaction between psychosocial, psychological, environmental, and genetic risk factors. Many studies have provided solid evidence regarding the risk factors for adolescent suicide ideation and attempt but research is more limited on young adults, especially college students. Suicide ideation among college students may have a unique etiology because of the existing social and academic pressures that are distinct to this population. Several characteristics of this transitional developmental period, including leaving home and being away from family and peer support networks, increased opportunities for alcohol and drug use (Arria et al., 2009), and navigating through unfamiliar environments, make entry into college a particularly vulnerable time for young adults who might be predisposed to experiencing mental health problems. Moreover, college students are often subject to internal and external pressures to succeed academically, especially given the financial burden of college costs on families. Many psychiatric disorders first manifest during young adulthood and stress associated with the transition to college could exacerbate or heighten depression and anxiety. Studies of suicide ideation in college students have found that tobacco, alcohol, and drug use (Brener et al., 1999), negative life events, hopelessness, desperation, depressive symptoms (Garlow et al., 2008; Konick and Gutierrez, 2005), risky behaviors (Barrios et al., 2000), and a lack of social belongingness (Van Orden et al., 2008) are associated with suicide ideation.

Our research group recently reported that, depressive symptoms, low social support, affective dysregulation, father-child conflict, and alcohol use disorder were independently associated with suicide ideation among first-year college students. In that cross-sectional study, mother-child conflict increased the risk for suicide ideation, but only in the presence of high depressive symptoms. However, $60\%_{wt}$ of individuals with suicide ideation did not meet criteria for high depressive symptoms (Arria et al., 2009).

The present study extends our earlier findings by taking advantage of several waves of data from our longitudinal study. Specifically, we aimed to estimate the prevalence and identify predictors of persistent suicide ideation, suicide plans, and attempts among a cohort of students recruited during their first year of college and followed prospectively for four years. To the best of our knowledge, this is the first study of persistent suicide ideation in a college sample.

Methods

Study Design

This study uses data from the College Life Study (CLS), a longitudinal prospective study of college students. Sample selection took place in two stages. First, a screening survey was administered to 3,401 incoming first-time, first-year students ages 17 to 19, during new-student orientation in 2004 at one large, public university in the mid-Atlantic region of the U.S. The first stage response rate was 89%. Next, a stratified random sample of screener participants was selected to participate in a series of four annual follow-up interviews, beginning with a two-hour baseline interview administered by a trained interviewer during their first year of college. Purposive sampling strategies were employed to oversample students who had used an illicit drug in high school at least once; however, sampling weights were applied to produce weighted prevalence estimates ($_{wt}$), representative of the general population of first-year students. The second-stage response rate was 86%, and yielded a sample size of 1,253, which was representative of the first year class with respect to race, gender, and socioeconomic status (Arria et al., 2008). Participants received $5 and $50 for participating in the screener and interviews, respectively. An additional $20 bonus was provided to participants who completed the follow-up interviews within four weeks of the anniversary of their baseline interview date. Additional details on the methods of recruitment and sampling of this longitudinal cohort can be found elsewhere (Arria et al., 2008). The study was approved by the University IRB and a Federal Certificate of Confidentiality was obtained.

Participants

The analytic sample consisted of the 1,253 college students who completed the baseline interview as described above. Of these, 1,138 were enrolled in college for at least one semester and had data on suicide ideation during the study period (2004–2008).

Measures

Demographic characteristics—Sex was coded as observed by the interviewer during Year 1. Data on race was self-reported. For the present study, race was dichotomized as White vs. non-White. As an indicator of socioeconomic status, Adjusted Gross Income of participants' home zip codes in 2003 (the last year in which participants were living with their parents prior to college) was obtained from public use data files provided by the Internal Revenue Service. [1] Sexual orientation (e.g., heterosexual vs. homosexual, bisexual, or unsure) was also asked as part of a self-reported questionnaire on sexual behaviors.

Suicide ideation—The Beck Depression Inventory (BDI) was administered at each annual assessment. Item #9, pertaining to suicidal thoughts, was recoded into a binary variable to denote the presence or absence of suicide ideation in the past few days (Beck et al., 1979). Our definition of suicide ideation includes having thoughts of killing oneself, even if one would not carry them out, or having the desire to kill oneself, while participants who had no thoughts of killing themselves were coded for the absence of suicide ideation. No ideation during college

---

[1]www.melissadata.com/lookups/taxzip.asp

was coded as zero, one-time ideation was coded as one, and ideation reported during more than one of the annual assessments was coded as two (persistent suicide ideation).

Data recoding and inclusion criteria—Of the original 1,253, 81.3% (*n*=1,019) completed all four interviews. An additional 108 (8.6%), 67 (5.4%), and 59 (4.7%) participants completed three, two, or one interviews, respectively. Because suicide ideators comprised a minority of the sample, it was desirable to retain as many positive cases as possible. Therefore, for participants who reported suicide ideation at least once, all available data were used and missing responses were treated as the absence of ideation (see Table 1). For instance, two or more episodes of ideation were coded as "persistent ideation," and one episode of ideation was coded as "one-time ideation," regardless of how many waves were missing. Individuals without ideation were coded for "no ideation" if they had at least three negative (i.e., non-missing) responses, but were otherwise coded as missing.

During Year 4, independent of the BDI suicide item, participants were asked, "When was the last time you seriously thought about committing suicide?" Response options included "Never" and time frames ranged from "Less than 24 hours ago" to "More than a year ago." Based on this item, responses of past-year ideation were used to capture additional cases of onetime suicide ideation (i.e., 15 individuals with missing BDI data). "Never" responses were used to confirm 13 additional cases of "no ideation" that had missing BDI data. We reviewed interviewer notes in the data records of the 58 participants with responses of ideation "more than a year ago" to determine if the interviewers noted when the ideation occurred. For five participants, it was confirmed that ideation occurred during college. For 18 participants, we could not confirm when ideation occurred and 35 were confirmed as having ideation prior to college. In order to narrow our focus to ideation during college, individuals with ideation prior to college were coded as missing (*n*=53). In summary, the resulting sample sizes were 114 onetime ideators, 37 persistent ideators, 934 non-ideators, and 168 individuals with missing or non-conclusive data.

Suicide plans and attempts—The following questions, administered in Year 4, assessed plans for suicide and suicide attempts: "*When was the last time you made a plan for committing suicide?*" and "*When was the last time you attempted suicide?*" These questions are an adaptation of suicide items included in the Composite International Diagnostic Interview (CIDI) that was used in the National Comorbidity Survey (Kessler et al., 2005). Response options included "Never" and time frames ranged from "Less than 24 hours ago" to "More than a year ago." There were 58 participants who reported either an attempt or plan (29 with plan only, 23 with both, and six with attempt only). From the timeframe reported or data record review we confirmed that 10 of these cases occurred during college. For those with a plan, 22 occurred prior to college, eight during college, and for 22 no information on occurrence was available. For attempt, 17 occurred prior to college, five during college and seven were unknown. Those with plans and attempts only prior to college or of unknown occurrence were coded as missing.

Depressive symptoms—The Center for Epidemiological Studies Depression Scale (CESD), a self-report scale comprised of 20 items, was administered at Year 1 (Radloff, 1977). Participants indicated how often in the past week they had experienced depressed mood, feelings of worthlessness, feelings of hopelessness, loss of appetite, poor concentration, and sleep disturbance. The scale does not include items for increased appetite or sleep, anhedonia, psychomotor agitation or retardation, guilt, or suicidal thoughts. Responses are scored from 0 for "rarely or none of the time" to 3 for "most or all of the time." A scale score was computed as the sum of the 20 items, after reverse-coding four items. Prior studies have demonstrated good internal consistency, test-retest reliability, and concurrent validity of the CESD (Radloff, 1977). Quartiles were calculated and a binary variable was created for analysis of the CESD

with the highest quartile (indicating of the most symptoms of depressed mood) compared to the other quartiles.

Victimization and exposure to domestic violence—Victimization and exposure to domestic violence were assessed during Year 2 as part of a life events questionnaire developed for this study that was based largely on two widely used life events scales (Compas et al., 1987; Sarason et al., 1978). Age at first victimization and age at first exposure to domestic violence was assessed. Victimization and exposure to domestic violence experienced before age 18 (child or adolescent exposure) was coded as present whereas those with victimization and exposure to domestic violence reported at ages 18 to 22 were not included (67 and 32 participants, respectively).

Perceived social support—The Social Support Appraisals Scale (SSAS) was administered in Year 1. The SSAS is a 23-item self-administered assessment designed to measure subjective perceptions of the social support one currently receives, such as feeling loved and esteemed, and feeling involved with family, friends, and others (Vaux, 1986). Items are scored on a four-point Likert scale and summed (after reverse-coding five items) to derive a total score (Cronbach's α=0.916). Scores range from 23 to 92, with lower scores indicating stronger perceived social support. Quartiles were calculated and a binary variable was created with the highest quartile (indicating the lowest amount of perceived social support) compared to the other quartiles.

Affective dysregulation—Affective dysregulation was assessed during Year 1 using the Dysregulation Inventory (DI), a self-report questionnaire. The DI measures several temperament characteristics (Mezzich et al., 2001). Higher scores on the DI-A indicate high emotional reactivity and low control over one's emotional state, which we hypothesized would be a risk factor for suicide ideation, plan, and attempt. Participants are asked to indicate how often each statement is true in describing their behavior. Responses are scored from 0 for "never true" to 3 for "always true." Items were summed for the 28 items comprising the affective dysregulation subscale (DI-A; Cronbach's α=0.884, range 0 to 84). Quartiles were calculated and a binary variable was created with the highest quartile (indicating on the highest amount of affective dysregulation) compared to the other quartiles.

Cannabis use disorder—During Year 1, students who had used cannabis five or more times in the past year were assessed for cannabis use disorder (CUD), using questions based in part on the National Survey on Drug Use and Health (NSDUH) interview (Substance Abuse and Mental Health Services Administration, 2003). Students who used cannabis less than five times in the past year skipped out of this series, similar to procedures used in the NSDUH. Items in this series correspond to the DSM-IV criteria (American Psychiatric Association, 1994) for abuse and dependence. Dependence cases were defined by the endorsement of three or more of the following six criteria as a result of their cannabis use: tolerance, using more than intended, being unable to cut down, spending a lot of time obtaining or using, giving up important activities, or continuing to use despite problems with physical or mental health. Abuse cases were defined as non-dependent individuals who endorsed one or more of the following four problems resulting from their cannabis use: having serious problems at home, work, or school; regularly putting oneself in physical danger; repeatedly getting into trouble with the law; or continuing use despite problems with family or friends. Individuals who used cannabis less than five times in the past year were automatically coded for the absence of CUD.

Alcohol use disorder—Alcohol use disorder (AUD) was assessed using the same procedures as CUD above with the exception that withdrawal symptoms were also assessed for alcohol dependence.

Maternal and paternal history of depression—During Year 4 a Family Tree Questionnaire was used to assess maternal and paternal history of depression (Mann et al., 1985). Separately for biological mother and father, participants were asked to categorize each parent by providing a code: 1) *Definitely No*: This person definitely does not have depression; 2) *Maybe Yes*: this person could possibly have depression; 3) *Definitely Yes*: this person has been diagnosed with depression. Participants could also select the answer choice "don't know/ don't remember". A definite diagnosis of depression was combined with possible depression and coded as present whereas *Definitely No* was coded as absent. The responses "don't know" and "don't remember" were coded as missing.

Statistical Analyses

Sampling weights were computed to adjust for the purposive sampling design by dividing the number of screened individuals in each sex-race-drug use cell by the corresponding number of sampled individuals. Because there were only 10 participants who reported a plan or suicide attempt, results from chi-square tests are reported on the association between plan/attempt and predictors. The analyses were conducted in two steps. First, multinomial logistic regression models were used to estimate associations between independent variables and a single episode of ideation (one-time ideators), as well as persistence of suicide ideation during the four years, with non-ideators as the reference group (no ideation vs. one-time ideation vs. persistent ideation). Second, multivariate logistic regression analyses (Hosmer and Lemeshow, 1989) were used to estimate associations between independent variables and persistence of ideation, with one-time ideators during college as the reference group. This approach provides an indication of which variables distinguish those with persistent ideation from those with one-time ideation. Final models for one-time and persistent ideation were estimated by keeping only those variables that were statistically significant for either one-time or persistent ideation. Statistical analyses were performed using STATA version 10.0 (StataCorp, 2007).

Results

Overall Characteristics of the Sample

Of the 1,085 participants, 572 (52.7%) were female, 795 (73.3%) self-reported their race as White, and 82 (7.6%) reported homosexual, bisexual or unsure sexual orientation. Seventy-seven (7.7%) reported exposure to domestic violence during childhood or adolescence and 64 (6.6%) reported childhood or adolescence victimization. During Year 1 about one-quarter (n=289; 27%) qualified for AUD and 151 (14.3%) qualified for CUD. More than one-quarter (n=285; 28.6%) had a possible or definite history of maternal depression, and 212 (21.8%) had a possible or definite history of paternal depression (data are not presented in a table, percentages are not all out of 1,085 due to recoding and missing data).

Prevalence and Overlap of Suicide Ideation, Plan and Attempt during College

Suicide ideation was reported by $12\%_{wt}$ (151/1085) of the sample during the four years with 37 reporting persistent ideation (24.5% of the ideators and $2.6\%_{wt}$ of the overall sample). Ten participants reported a plan or attempt during the four years (10/1085 or $0.9\%_{wt}$ of the sample). Of these, three reported both a suicide plan and attempt during the four years (two reported an attempt without a plan and five had a plan without an attempt). All individuals who reported a plan or attempt also reported suicide ideation. Persistent ideators during the four years were no more likely than one-time ideators to have made a suicide plan or attempt (8% vs. 9%, respectively).

Group Comparisons on Demographic and Psychosocial Variables

Table 1 presents the demographic and psychosocial characteristics for each group (no ideation, one-time ideation, persistent ideation, and plan/attempt). Significant differences between each group compared to the no ideation group were evaluated with Chi-square tests. AUD, CUD and SES did not differ among the groups. The following variables were higher in one-time ideators, persistent ideators, and plan/attempters, as compared to non-ideators: social support ($p<0.001$, $p<0.001$ and $p<0.05$, respectively), possible/definite maternal depression ($p<0.01$, $p<0.01$, $p<0.001$, respectively), affective dysregulation ($p<0.001$, $p<0.001$ and $p<0.01$, respectively) and high self-reported depressive symptoms via the CES-D ($p<0.001$, $p<0.001$ and $p<0.01$, respectively).

Those with a single episode of suicide ideation were more likely to be female ($p=0.005$), non-White ($p=0.025$), and have a homosexual, bisexual or unsure sexual orientation ($p=0.001$). Moreover, aside from the variables mentioned above, one-time suicide ideation was associated with exposure to domestic violence and victimization during childhood or adolescence ($p=0.012$, $p=0.001$, respectively). One-time ideation was not significantly associated with paternal history of depression.

Results for the comparison between those with persistent ideation and the no-ideation group were quite similar to above, with a few important exceptions. With respect to demographics, neither gender nor race were associated with persistent ideation, although sexual orientation was ($p=0.018$). Unlike the comparison of non-ideators with one-time ideation, both maternal and paternal history of depression were significantly related to persistent ideation ($p=0.001$, $p<0.001$, respectively). A greater proportion of persistent ideators (74%), as compared to non-ideators (19%), self-reported high depressive symptoms as measured by the CES-D ($p<0.001$).

Results were somewhat different for the comparison of individuals with a plan or attempt with the non-ideators. Being female was significantly related to having a plan or attempt ($p=0.020$), but race, SES, and sexual orientation were not. Neither victimization nor domestic violence were significantly different from non-ideators, nor was paternal history of depression. Eighty percent (8 of 10) of those in the plan/attempt group reported a definite diagnosis of maternal depression ($p<0.001$).

Logistic Regression Analyses

Table 2 displays relative-risk ratios (*RRR*) from the multinomial logistic regression model that included each predictor variable, where the dependent variable compared both one-time ideation during college and persistent ideation to individuals without suicide ideation. Three of the psychosocial variables were independently associated with both one-time and persistent ideation, relative to non-ideators, namely, low social support ($p<0.001$ vs. $p=0.001$), exposure to domestic violence in childhood or adolescence ($p=0.02$ vs. $p=0.016$), and high depressive symptoms via the CESD ($p=0.012$ vs. $p<0.001$). However, maternal depression ($p=0.048$) was independently associated with one-time ideation but not persistent ideation, as were gender ($p=.015$) and sexual orientation ($p=0.001$). The remaining variables (i.e., race, SES, AUD, CUD, childhood victimization, affective dysregulation, and paternal depression) all failed to attain significance in this combined model for either comparison (all had ps>0.05).

Final Models for One-Time and Persistent Ideation

To obtain more parsimonious models, all non-significant predictors for either one-time or persistent ideation were dropped and final models were estimated (See Table 3). Thus, the final model for one-time ideation included two demographic variables {gender [*OR*=3.2, *95% CI* (1.7–5.8), *p*=<0.001] and sexual orientation [*OR*=4.7, *95% CI* (2.1–10.3), *p*<0.001]} and four psychosocial variables {social support [*OR*=3.7, *95% CI* (2.0–6.6), *p*<0.001], exposure to

domestic violence [*OR*=2.7, *95% CI* (1.2–6.1), *p*=0.014], high depressive symptoms [*OR*=2.4, *95% CI* (1.3–4.2), *p*=0.003], and maternal depression [*OR*=2.4, *95% CI* (1.4–4.1), *p*=0.002]}. The final model for persistent ideation included no demographic variables but all of the same four psychosocial variables: social support [*OR*=5.1, *95% CI* (2.0–13.1), *p*=0.001], exposure to domestic violence [*OR*=5.2, *95% CI* (1.9–14.3), *p*=0.001], high depressive symptoms [*OR*=8.7, *95% CI* (3.0–25.2), *p*<0.001], and maternal depression [*OR*=2.6, *95% CI* (1.1–6.1), *p*=0.033]. As in the original model, neither gender nor sexual orientation was associated with persistent ideation.

Predictors of Persistent Ideation among Ideators

In light of the observed differences in the pattern of results for one-time and persistent ideators, it was of interest to examine possible differences between these groups more directly. Therefore, the reference group was changed to one-time ideation and multivariate models of persistent ideation were re-estimated using logistic regression (data not shown in a table). Only high depressive symptoms (via CES-D score) distinguished persistent ideators from one-time ideators [*OR*=6.5, *95% CI* (1.2–34.4), *p*=0.027]. CUD was marginally associated with persistent among ideators [*OR*=6.8, *95% CI* (0.9–46.1), *p*=0.051].

Discussion

The results from this study may have important implications for identifying university students at risk for suicide on the basis of several risk factors measurable at college entry. The profile of risk factors for persistent suicide ideation in this large university sample included childhood or adolescent exposure to domestic violence, and low social support and high depressive symptoms in the first year of college. Although maternal depression was not statistically associated with persistent ideation in the original multinomial regression model, it was significant once non-significant variables were removed to estimate a final model. Moreover, the level of depressive symptoms during Year 1 of college was the only variable that independently predicted persistent suicide ideation during college among ideators.

Although suicide plans and attempts in our sample were rare, a history of possible or definite maternal depression was the variable most strongly linked with a suicide attempt/plan during college. Eighty percent (8 of 10) of those with a plan or suicide attempt reported a definite maternal history of depression. Female gender, low social support, high affective dysregulation, and high depressive symptoms were also associated with increased risk of a suicide plan or attempt. However, we did not find any evidence that the risk for suicide plan or attempt differed based on the number of episodes of ideation. Thus, it appears doubtful that individuals with persistent suicide ideation represent a group at any higher risk for suicide in this population as compared to individuals who reported ideation only once. This finding agrees with prior studies showing that persistent ideation does not appear to confer greater risk for attempt (Borges et al., 2008; Witte et al., 2005), but may be an indicator of elevated depressive symptoms.

Several study limitations merit attention. Although the entire sample size was large, the subsets of individuals with persistent suicide ideation, suicide plan and attempt were fairly small. Persistent suicide ideation was not directly assessed and no data were collected on age at ideation, plan and attempt. The BDI was administered annually but only assessed suicide ideation in the past week. However, lifetime suicide ideation, plan and attempt questions were assessed in Year 4 with emphasis on the past year. Those who reported these outcomes more than one year ago were grouped together. Data were not used when we did not know when the events occurred (during college or prior to college), which lowered the power to detect associations and may have biased our results. These data are based upon self-report and is thus subject to bias. Moreover, it is possible that individuals with depression were more likely to

be aware of a parental history of depression than those who were not depressed. Unfortunately, no measure of parental suicide attempts was gathered, primarily because this level of detailed information might not have been disclosed by parents to their young adult children. Our measure of social support, and possible maternal and paternal depression, were subjective and reflected the participant's perceptions; thus it is possible that suicidal thoughts might be related to negative views of their social support structures rather than actual deficits in social support. Moreover, in some cases, mental health problems might cause conflict in the participant's relationships.

Because our sample is limited to individuals from a single, public university, the results may not be generalizable to students at institutions in other areas of the country, or to students attending smaller, private universities. Suicide rates differ by geographic location (Centers for Disease Control and Prevention, 1997), and it is possible that rates of suicide ideation might vary similarly.

Despite such limitations, the present study also possesses a number of counterbalanced strengths. The longitudinal study design, following a large cohort through the college years, helps to constrain sources of bias and error that otherwise can complicate cross-sectional research. The sample is large with low attrition and temporality was constrained for most independent variables. The assessment battery was extensive covering a broad range of important variables.

The prevalence of suicide attempt in our sample over the course of four years ($0.09\%_{wt}$) is lower than the annual prevalence reported by the 2008 ACHA assessment (1.3% reported attempted suicide in the past 12 months; ACHA, 2009). One possible explanation for this discrepancy is that this study had a very comprehensive plan for addressing suicidality and getting help for participants in crisis. For example, interviewers were trained to score the BDI prior to concluding the interview and, depending on the severity of the responses, to either assist the participant in making an appointment at the campus health center or escort the participant to the health center for immediate attention, according to IRB-approved procedures. The research team repeatedly received positive feedback from participants in response to these actions, which we believe resulted in timely and needed intervention in several cases. Thus, perhaps those who continued to have plans and attempts, despite the assistance provided, had higher familial risk.

This research extends our knowledge regarding factors to identify college students at risk for ideation, plan, and attempt. As college is a time of transition from the family home to partial independence, it can be stressful, especially for students who are more psychologically vulnerable with inadequate support. Peak risk for suicide attempt is in late adolescence and young adulthood. Young adults are also entering the period of risk for disorders closely linked with suicide such as unipolar and bipolar depression, schizophrenia, and drug and alcohol dependence. Our results imply that markers of familial risk such as parental depression, exposure to domestic violence and low social support are influential risk factors for suicide ideation, persistent suicide ideation, and a suicide plan or attempt.

The present findings, if replicated, have important implications for prevention. College campuses are an ideal setting for prevention as students are a "captive audience" and ideally, campuses should place a greater emphasis on ensuring easy access to quality mental health services at this critical period of young adult development. The present findings point to a number of risk factors that college health providers could consider when screening for suicide risk. Moreover, the finding that low social support predicted suicide ideation, independent of depressive symptoms and other factors, suggests that health promotion activities on college campuses should strive to promote social support as a key protective factor.

Although this project aimed to identify specific risk factors for suicidal thoughts and behaviors, the complexity of these associations must be acknowledged; risk and protection are processes that interact with each other to increase or decrease risk (Goldsmith et al., 2002). Future studies with larger samples should aim to identify interaction of risk and protective factors. The findings reported by Witte and colleagues (2005) are in agreement with the present findings, and with our prior findings (Arria et al., 2009) showing an association of affective dysregulation with suicide ideation and attempt. We did not have power herein to study if affective dysregulation was an independent predictor of suicide attempt but future studies are warranted that could sort out the potential unique role of mood lability on suicide attempt.

References

American College Health Association. National College Health Assessment II: Reference group executive summary, fall 2008. American College Health Association; Baltimore, MD: 2009.

American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders: DSM-IV. American Psychiatric Press; Washington, DC: 1994.

Arria AM, Caldeira KM, O'Grady KE, Vincent KB, Fitzelle DB, Johnson EP, Wish ED. Drug exposure opportunities and use patterns among college students: Results of a longitudinal prospective cohort study. Subst Abus 2008;29:19–38. [PubMed: 19042196]

Arria AM, O'Grady KE, Caldeira KM, Vincent KB, Wilcox HC, Wish ED. Suicide ideation among college students: A multivariate analysis. Arch Suicide Res 2009;13:230–246. [PubMed: 19590997]

Barrios LC, Everett SA, Simon TR, Brener ND. Suicide ideation among US college students: Associations with other injury risk behaviors. J Am Coll Health 2000;48:229–233. [PubMed: 10778023]

Beck, AT.; Rush, AJ.; Shaw, BF.; Emery, G. Cognitive therapy of depression. The Guilford Press; New York: 1979.

Borges G, Angst J, Nock MK, Ruscio AM, Kessler RC. Risk factors for the incidence and persistence of suicide-related outcome: A 10-year follow-up study using the National Comorbidity Surveys. J Affect Disord 2008;105:25–33. [PubMed: 17507099]

Brener ND, Hassan SS, Barrios LC. Suicidal ideation among college students in the United States. J Consult Clin Psychol 1999;67:1004–1008. [PubMed: 10596523]

Centers for Disease Control and Prevention. Regional variations in suicide rates—United States 1990–1994. 1997. p. 789-792.

Centers for Disease Control and Prevention. Web-based Injury Statistics Query and Reporting System (WISQARS) [online]. National Center for Injury Prevention and Control; Atlanta: 2009.

Compas BE, Davis GE, Forsythe CJ, Wagner BM. Assessment of major and daily stressful events during adolescence: The Adolescent Perceived Events Scale. J Consul Clin Psychol 1987;55:534–541.

Garlow SJ, Rosenberg J, Moore JD, Haas AP, Koestner B, Hendin H, Nemeroff CB. Depression, desperation, and suicidal ideation in college students: Results from the American Foundation for Suicide Prevention College Screening Project at Emory University. Depress Anxiety 2008;25:482–488. [PubMed: 17559087]

Goldsmith, SK.; Pellmar, TC.; Kleinman, AM.; Bunney, WE.; Goldsmith, SK.; Pellmar, TC.; Kleinman, AM.; Bunney, WE. Reducing suicide: A national imperative. Institute of Medicine; Washington, DC US: 2002.

Hosmer, DW.; Lemeshow, S. Applied logistic regression. John Wiley & Sons, Inc; New York: 1989.

Kachur SP, Potter LB, Powell KE, Rosenberg ML. Suicide: Epidemiology, prevention, treatment. Adolesc Med State Art Rev 1995;6:171–182.

Kessler RC, Berglund P, Borges G, Nock M, Wang PS. Trends in suicide ideation, plans, gestures, and attempts in the United States, 1990–1992 to 2001–2003. J Am Med Assoc 2005;293:2487–2495.

Konick LC, Gutierrez PM. Testing a model of suicide ideation in college students. Suicide Life Threat Behav 2005;35:181–192. [PubMed: 15843335]

Mann RE, Sobell LC, Sobell MB, Pavan D. Reliability of a family tree questionnaire for assessing family history of alcohol problems. Drug Alcohol Depend 1985;15:61–67. [PubMed: 4017879]

Mezzich AC, Tarter RE, Giancola PR, Kirisci L. The dysregulation inventory: A new scale to assess the risk for substance use disorder. J Child Adolesc Subst Abuse 2001;10:35–43.

Nock MK, Banaji MR. Prediction of suicide ideation and attempts among adolescents using a brief performance-based test. J Consult Clin Psychol 2007;75:707–715. [PubMed: 17907852]

Radloff LS. The CES-D Scale: A self-report depression scale for research in the general population. Appl Psychol Meas 1977;1:385–401.

Sarason IG, Johnson JH, Siegel JM. Assessing the impact of life changes: Development of the Life Experiences Survey. J Consult Clin Psychol 1978;46:932–946. [PubMed: 701572]

StataCorp. Stata Statistical Software: Release 10. StataCorp LP; College Station, TX: 2007.

Substance Abuse and Mental Health Services Administration. 2002 National Survey on Drug Use and Health Questionnaire. Rockville, MD: 2003.

Van Orden KA, Witte TK, James LM, Castro Y, Gordon KH, Braithwaite SR, Hollar DL, Joiner TE Jr. Suicidal ideation in college students varies across semesters: The mediating role of belongingness. Suicide Life Threat Behav 2008;38:427–435. [PubMed: 18724790]

Vaux A. The social support appraisals (SS-A) scale: Studies of reliability and validity. Am J Community Psychol 1986;14:195–219.

Witte TK, Fitzpatrick KK, TEJJ, Schmidt NB. Variability in suicidal ideation: A better predictor of suicide attempts than intensity or duration of ideation? J Affect Disord 2005;88:131–136. [PubMed: 16054227]

Table 1

Demographic and psychosocial characteristics of college students with and without suicide ideation (n=1,085)

	No Ideation (n=934)		One-Time Ideation (n=114)		Persistent Ideation (n=37)		Plan or Attempt[a] (n=10)	
	n	%	n	%	n	%	n	%
Demographic Variables								
Sex (female)	477	51	74	65**	21	57	9	90*
Race (non-White)	236	25	40	35*	14	38	5	50
SES (highest quartile of AGI)[b]	233	25	30	27	8	22	2	20
Sexual orientation (homosexual, bisexual, not sure)	59	6	17	15**	6	16*	2	20
Suspected Psychosocial Risk Factors								
Alcohol use disorder[c]	241	26	35	31	13	35	4	40
Cannabis use disorder[c]	124	13	18	16	9	24	0	0
Lowest perceived social support[c]	149	17	44	44***	22	63***	5	50*
Childhood victimization	46	5	13	11**	5	14*	1	10
Exposure to domestic violence	55	6	12	11*	10	27***	1	10
Possible/Definite maternal depression	227	24	41	36**	17	46**	8	80***
Possible/Definite paternal depression	173	20	24	26	15	48***	3	30
Highest affective dysregulation[c]	180	20	40	38***	19	61***	6	60**
Highest depressive symptoms[c]	171	19	52	49***	26	74***	6	60**

Note:

*
Chi squared tests: $p < 0.05$;

**
$p < 0.01$;

***
$p < 0.001$

[a] The ten individuals in this group are also included in the one-time and persistent ideation groups.

[b] The mean adjusted gross income (AGI) reported by the Internal Revenue Service for each participant's home ZIP code during their last year in high school.

[c] As measured at Year 1.

Table 2

Multinomial analyses for one-time suicide ideation and persistent ideation during college, each as compared to non-ideators during college

	One-Time Ideation (*n*=114)			Persistent Ideation (*n*=37)		
	RRR	95 % CI	p	RRR	95 % CI	P
Demographic Variables						
Sex (female)	2.3	1.2–4.5	0.015	1.4	0.5–3.8	0. 563
Race (non-White)	1.4	0.7–2.7	0.367	2.1	0.7–6.1	0.165
SES (highest quartile of AGI)[a]	1.2	0.6–2.6	0.602	1.3	0.4–4.2	0.696
Sexual orientation (homosexual, bisexual, not sure)	4.8	1.9–11.7	0.001	2.7	0.6–12.1	0.186
Psychosocial Variables						
Alcohol use disorder[b]	1.1	0.5–2.3	0.868	0.9	0.3–3.1	0.867
Cannabis use disorder[b]	1.4	0.6–3.5	0.413	3.4	0.9–12.1	0.059
Lowest perceived social support[b]	3.9	2.0–7.4	<0.001	6.1	2.2–17.3	0.001
Childhood victimization	1.6	0.7–4.1	0.290	1.9	0.5–7.3	0.347
Exposure to domestic violence	3.0	1.2–7.5	0.020	4.4	1.3–14.9	0.016
Possible/Definite maternal depression	2.0	1.0–3.9	0.048	1.7	0.6–4.9	0.293
Possible/Definite paternal depression	1.4	0.7–2.9	0.334	2.2	0.8–6.4	0.143
Highest affective dysregulation[b]	1.4	0.7–2.8	0.388	2.2	0.8–6.2	0.124
Highest depressive symptoms[b]	2.4	1.2–4.9	0.012	9.0	2.6–30.9	<0.001

Note: *RRR*=Relative Risk Ratios

[a] The mean adjusted gross income (AGI) reported by the Internal Revenue Service for each participant's home ZIP code during their last year in high school.

[b] As measured at Year 1.

Table 3

Final multinomial model for one-time suicide ideation and persistent ideation during college, each as compared to non-ideators during college

	One-Time Ideation (*n*=114)			Persistent Ideation (*n*=37)		
	RRR	*95 % CI*	*p*	*RRR*	*95 % CI*	*p*
Demographic Variables						
Sex (female)	**3.2**	**1.7–5.8**	**<0.001**	1.3	0.5–3.1	0. 563
Sexual orientation (homosexual, bisexual, not sure)	**4.7**	**2.1–10.3**	**<0.001**	2.4	0.6–9.6	0.232
Psychosocial Variables						
Lowest perceived social support[a]	**3.7**	**2.0–6.6**	**<0.001**	**5.1**	**2.0–13.1**	**0.001**
Exposure to domestic violence	**2.7**	**1.2–6.1**	**0.014**	**5.2**	**1.9–14.3**	**0.001**
Possible/Definite maternal depression	**2.4**	**1.4–4.1**	**0.002**	**2.6**	**1.1–6.1**	**0.033**
Highest depressive symptoms[a]	**2.4**	**1.3–4.2**	**0.003**	**8.7**	**3.0–25.2**	**<0.001**

Note: *RRR*=Relative Risk Ratios

[a] As measured at Year 1.