Suicidal ideation and behavior in institutions of higher learning: A latent class analysis

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ARTICLE INFO

ABSTRACT

Suicide is the second leading cause of death among undergraduate students, with an annual rate of 7.5 per 100,000. Suicidal behavior (SB) is complex and heterogeneous, which might be explained by there being multiple etiologies of SB. Data-driven identification of distinct at-risk subgroups among undergraduates would bolster this argument. We conducted a latent class analysis (LCA) on survey data from a large convenience sample of undergraduates to identify subgroups, and validated the resulting latent class model on a sample of graduate students. Data were collected through the Interactive Screening Program deployed by the American Foundation for Suicide Prevention. LCA identified 6 subgroups from the undergraduate sample (N = 5654). In the group with the most students reporting current suicidal thoughts (N = 623, 66% suicidal), 22.5% reported a prior suicide attempt, and 97.6% endorsed moderately severe or worse depressive symptoms. Notably, LCA identified a second at-risk group (N = 662, 27% suicidal), in which only 1.5% of respondents noted moderately severe or worse depressive symptoms. When graduate students (N = 1138) were classified using the model, a similar frequency distribution of groups was found. Finding multiple replicable groups at-risk for suicidal behavior, each with a distinct prevalence of risk factors, including a group of students who would not be classified as high risk with depression-based screening, is consistent with previous studies that identified multiple potential etiologies of SB.

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1. Introduction

Suicide is the second leading cause of death for college students, with an estimated overall annual suicide rate of 7.5 per 100,000 (Drum et al., 2009; Silverman et al., 1997). The highest suicide rates are among students over age 25 and those enrolled in graduate school (Silverman et al., 1997). Factors associated with increased risk for suicidal behavior among young people include history of suicide attempt, depression, and substance use (D'Eramo et al., 2004; Dvorak et al., 2013; Esposito-Smythers and Spirito, 2004; Fowler et al., 1986; Garlow, 2002; Gonzalez, 2012; Nemeroff et al., 2001). Other risk factors include adverse life events, contact with legal authorities, family history of mental illness, family history of suicide, and history of sexual abuse (Agerbo et al., 2002; Cooper et al., 2002; Gray et al., 2002; Juon and Ensminger, 1997).

Mood, anxiety, and substance use disorders commonly emerge during late adolescence and early adulthood (Kessler et al., 2005). Among college students, the difficulties of age-related transitions are further exacerbated by social, academic, and professional stressors (Ross et al., 1999). A 2015 survey found that one in three college students reported "feeling so depressed that it was difficult to function," and one in 10 said they had "seriously considered

attempting suicide" in the last 12 months (American College Health Association, 2015). Alarmingly, results from a screening project at one university found that only 14.5% of moderately severe or severely depressed students were receiving mental health treatment (Garlow et al., 2008).

The American Foundation for Suicide Prevention (AFSP) developed the Interactive Screening Program (ISP) to support institutions of higher learning in engaging at-risk students in mental healthcare. Implemented by each school's counseling center, the ISP provides screening, personalized feedback, and recommendations for next steps entirely online. The program offers students concerned about stigma and confidentially—common barriers to accessing services—an anonymous way to obtain information and support (Haas et al., 2008).

Latent class analysis (LCA), related to cluster analysis, can be used to discover groups of similar cases in multivariate categorical data. In the suicide risk literature, LCA has been used to identify precipitants for suicidal thoughts among adolescents of various ethnic and racial backgrounds (De Luca et al., 2014; Stoep et al., 2009); to predict suicidal behavior (Thompson et al., 2009); to recognize patterns in known risk factors for suicide among suicide decedents (Judd et al., 2012; Kim et al., 2003; Logan et al., 2011); to identify psychiatric disorder subtypes that might be more strongly associated with suicidal thoughts or behaviors (Li et al., 2014; Pan et al., 2014); and to explore interactions among suicide risk factors (Pena et al., 2012).

We used LCA to identify subgroups of at-risk students using data collected via the ISP. Since suicidal behavior is complex and heterogeneous, there are likely multiple subtypes of suicidal behavior, and risk factors can differ across subtypes (Conner et al., 2007; Dombrovski et al., 2013; Mann et al., 2009). Data-driven identification of distinct at-risk groups in this sample would further bolster this argument. Characterization of these groups might propel a deeper understanding of suicidal behavior subtypes and their respective etiologies.

2. Methods

2.1. Data collection and measures

The ISP was implemented at a diverse set of United States institutions of higher learning over a 12-year period (2002–2014). The 45 schools varied in size (ranging from approximately 900 to 65,000 students), were from all major geographic regions, varied by urban or rural location, and educational environment. Each institution selected which students to invite to the ISP. Emails were sent from designated officials in batches at each school to the selected students' school email addresses. The emails linked to school-specific ISP websites where students could register using a self-assigned user ID and password. Once registered, access was provided to the online Stress and Depression Questionnaire (SDQ). All students completing the survey were invited to "dialogue" with a counselor on the website.

There were three versions of the core SDQ corresponding to the three waves of data collection (2002–2005; 2006–2011; and 2011–2013), with later versions including more detailed questions about suicidality and treatment. Wave 1 only included two institutions, and response options on the questions were worded differently from subsequent waves. Eighteen demographic questions were provided to every site; schools chose 5–8 to include with the SDQ. The core SDQ in wave 3 was composed of 36 questions covering: stress-related behaviors (e.g. fights), intense emotional states (e.g. rage, feeling out of control), substance use, eating disorder symptoms, depressive symptoms using the PHQ-9, self-harm, suicidality (e.g. recent thoughts of suicide, history of

suicide attempt), and treatment (e.g. on medication, in therapy) (Garlow et al., 2008; Kroenke et al., 2001; Spitzer et al., 1999, 2000). Most questions used a 4-point Likert scale (ranging from "not at all" to "most of the time"), some asked for a "yes/no" answer. The survey and data collection process were reviewed by the New York State Psychiatric Institute Institutional Review Board (IRB) and deemed not to require IRB approval.

2.2. Data preparation and statistical analyses

Data collected through the ISP were stored on each institution's ISP server. The data were then downloaded by the AFSP and prepared for analysis. The complete ISP data set included 9535 entries (1522 entries from wave 1; 3197 from wave 2; 4816 from wave 3). Analyses were performed using the statistical software R, version 2.12.1 (Team, 2008). To take advantage of the additional questions included in in waves 2 and 3, and the consistency of the response options in these waves, we excluded the data from wave 1 and combined waves 2 and 3. Subjects filling out the survey more than once were excluded. Additionally, subjects identifying as non-students (e.g. medical residents), or who did not identify their position at their school (e.g. undergraduate student), were excluded. These steps resulted in 6792 unique entries (5654 undergraduate students; 1138 graduate and professional students) from 40 schools.

Descriptive statistics for the undergraduate and graduate students were calculated. Throughout the analysis, mixed effect models were applied with school as a random effect to adjust for differences between institutions. Mixed models with age as a fixed effect were used to compare the undergraduate and graduate samples. Mixed logistic models were used to test the association between recent suicidal ideation and answers to other survey questions. The False Discovery Rate was controlled using the Benjamini-Hochberg adjustment.

In preparation for performing LCA, school identity and measures with more than 30% missing values were removed. For interpretability, most questionnaire items on a 4-point Likert scale were dichotomized into two categories: "never" and "some of the time" versus "a lot of the time" and "most of the time." Items measuring suicidal or self-injurious thoughts were dichotomized into absent ("never") versus present (all other responses). Age was grouped into 3 categories ($\leq$22, 23–29, $\geq$30) and total PHQ-9 score into 4 categories (none = 0, minimal/mild = 1–9, moderate = 10–14, moderately severe/severe = 15–27). Any remaining missing values were coded into a separate category, instead of imputed, because their distribution was considered informative. Thirty-three variables were used in the LCA.

Latent class models with 3 through 10 classes were generated from the undergraduate data. Models were excluded if a class contained 5% (283) or less of the sample. Bayes Information Criterion (BIC) was used to select the optimal model. In the selected model, classes were categorized from very low to high risk according to the proportion of respondents endorsing thoughts of suicide in the past 2 weeks. Descriptive statistics were generated by class in the selected model. Mixed models with class as fixed effect were used to compare proportions of certain characteristics across classes. Significance levels for comparison of pairs of adjacently ranked classes were adjusted using Bonferroni correction (k = 5).

The PHQ-9 was used preferentially to characterize depression in the sample; the PHQ-8 was used when modeling the relationship between depressive symptoms and suicidal ideation. To illustrate the relationship between depression and suicidal ideation, especially the departures of class-level aggregate measures from an expected logistic relationship between the two, we prepared a figure of average PHQ-8 score by proportion of respondents with