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Latent Heterogeneity in Depressive Symptoms, Suicidal Thoughts and Behaviors Among Brazilian Medical Students: Prevalence, Associated Factors, and Group Differences

Short Title: Suicidality in Brazilian Medical Students

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Abstract

Objective: Suicidal thoughts and behaviors (STBs) are common among medical students, but larger, diverse studies are needed, especially in low- and middle-income countries. This study aims to assess the prevalence and factors associated with STBs among Brazilian medical students.

Methods: A survey of 1,026 Brazilian medical students gathered data on sociodemographics, STBs, depressive (PHQ-9) and anxiety symptoms (GAD-7), university stressors, learning environment, religiosity, and hazing. Prevalence and regression analyses identified associated factors, and latent class analysis (LCA) identified distinct risk groups.

Results: Lifetime prevalence rates were 62.7% for passive thoughts of death, 39.6% for suicidal ideation, and 12.7% for lifetime suicide attempts, with 4.4% reporting at least one attempt in the past year. Anxiety symptoms were associated with all suicidal outcomes. Depressive symptoms, university stressors, and poorer learning environment were associated with higher suicidal ideation scores, while male sex and higher intrinsic religiosity were inversely associated with depressive symptoms. In the LCA, all religiosity dimensions differed significantly across classes, with the highest levels in the Low-Risk group. Hazing victimization and non-cisgender identity were associated with suicidal behaviors. LCA identified three groups: Low-Risk (42.4%) with minimal suicidal thoughts, distress, and higher religiosity; Moderate-Risk (41.1%) with intermediate levels; High-Risk

(16.5%) with severe suicidal thoughts, depression, anxiety, university stress, poor environment, and hazing.

Conclusions: Based on our findings, interventions designed to address suicidality in this population may benefit from focusing on modifiable institutional factors (learning environment, university stressors, hazing) alongside individual mental health support, particularly for minority students.

Keywords: Suicidal ideation; medical students; depression; anxiety; latent class analysis; religion.

Introduction

Brazil is experiencing a mental health crisis; the country is among those with the highest prevalence of mental disorders [1] and has witnessed an increase in suicide rates in recent years, contrary to the global tendency for decline [2,3]. Medical students, as a specific demographic group, experience disproportionately elevated levels of psychological distress, which can be attributed to distinctive stressors, including rigorous academic demands, emotionally taxing clinical experiences, competitive environments, and frequent exposure to death and suffering [4,5].

Prior epidemiological studies have revealed a troubling prevalence of suicidal thoughts and behaviors within the medical student population, with depression and anxiety identified as significant correlates[6-8]. In Brazil, a meta-analysis shows relatively high prevalence of depression (30%), burnout (13.1%), problematic alcohol use (32.9%), stress (49.9%), low sleep quality (51.5%), excessive daytime sleepiness (46.1%), and anxiety (32.9%) among medical students [9]. Nevertheless, a significant gap persists in understanding the root causes of these mental health challenges. While most studies focus on sociodemographic factors and individual mental health indicators, relatively few investigate the institutional factors directly contributing to suicidality among medical students, such as university-specific stressors, the quality of the learning environment, student-faculty relationships, and peer dynamics, including hazing practices [10]. These institutional factors may be more amenable to intervention than individual characteristics and represent crucial but understudied determinants of student wellbeing. Additionally,

protective factors such as spiritual and religious beliefs remain inadequately explored in this context.

Thus, this study endeavors to address these pressing gaps by examining the prevalence and factors associated with suicidal ideation and behaviors, investigating both institutional factors (learning environment, university stressors, hazing experiences) and individual characteristics (psychological, sociodemographic, and religious factors), and utilizing latent class analysis to characterize distinct risk subgroups among Brazilian medical students. We hypothesize that identifiable subgroups with varying risk profiles exist and that key factors, including university-related stressors, learning environment quality, depression, anxiety, and religiosity, will significantly differentiate these subgroups' classes.

Methods

Study Design and Participants

We conducted a multicenter, cross-sectional, web-based survey targeting medical students across multiple institutions in Brazil. The study adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines[11]. Participants were medical students aged 18 years or older enrolled at any stage of undergraduate medical education throughout Brazil, where medical education comprises six years divided into twelve semesters. Our participant recruitment employed a comprehensive multicenter approach designed to achieve broad geographic and institutional coverage of medical students across Brazil. Recruitment transpired between September 2023 and September 2024. Initially, we established a recruitment framework by systematically identifying all medical schools in Brazil and creating a network of key institutional contacts. These contacts included academic department chairs, curriculum directors, student affairs coordinators, and elected student representatives who served as dissemination partners.

We collaborated strategically with the Brazilian division of the International Federation of Medical Students' Associations (IFMSA-Brazil) to enhance geographic and institutional diversity. This partnership gave us access to an established network of medical student representatives across multiple institutions. The IFMSA-Brazil leadership

facilitated communication channels with local chapters, significantly augmenting our recruitment reach. Survey distribution occurred through a multi-channel approach. Digital invitations containing the secure questionnaire link were distributed via institutional listservs, academic platforms, and student organization networks. All communications emphasized the voluntary nature of participation and the importance of the research for improving medical education environments. No financial or academic incentives were offered to participants.

To maximize response rates, we implemented a structured follow-up protocol. Initial non-responders received systematically timed reminder communications at four-week intervals. Given the assessment of suicidal thoughts and behaviors, safety measures were integrated into the survey. Upon completing the suicidality items, all participants were presented with crisis support resources and guidance for accessing university psychological support services. Due to the anonymous web-based design, individual-level active monitoring was not feasible.

All data were collected electronically through REDCap (Research Electronic Data Capture). Ethical approval was obtained from the Research Ethics Committee of the Hospital das Clínicas, Faculty of Medicine, University of São Paulo, Brazil (CAAE: 70017023.4.0000.00680). Electronic informed consent was systematically acquired prior to study participation.

Measures

Our models included demographic, socioeconomic, and academic variables based on prior research and theoretical considerations suggesting their potential influence on mental health outcomes. The selection of covariates was defined a priori based on a conceptual framework informed by existing literature on suicidality in medical students. Sociodemographic variables (age, sex, gender identity, race/ethnicity, marital status, family income) were included based on established associations with suicidal outcomes[6,7]. Institutional factors (learning environment, university stressors, hazing) were included, given evidence of their role in medical student distress[4,12,13]. Religiosity dimensions were included as potential correlates[14].

Specifically, we assessed participants' age (in years), biological sex (male/female), gender identity (cisgender/non-cisgender), marital status (single/non-single), and race/ethnicity (white/non-white) to capture key sociodemographic characteristics. Socioeconomic status was operationalized by comparing each participant's family income to the Brazilian minimum wage, allowing us to control for variations in economic resources. Additionally, we documented the religious affiliations of participants, as well as whether the student resided in a capital city prior to attending medical school and whether they are currently residing in a capital city. Academic advancement was represented by the year in the medical program, and we considered university location (current city versus another city) to account for potential geographic differences. Involvement in affirmative action initiatives (quota holding) and scholarship or financial assistance status were each included to address how institutional support and educational equity measures might shape students' psychological well-being.

Suicidal thoughts and behaviors were comprehensively assessed using a structured, six-item instrument specifically developed for this study (supplementary material 1). This instrument was developed based on the Suicidal Behaviors Questionnaire-Revised[15] (SBQ-R), validated in Brazilian Portuguese by Aprigio and Gauer (2024)[16], and adapted to separately assess passive thoughts of death and active suicidal ideation across both lifetime and past-year time windows, dimensions that the original SBQ-R captures in fewer items. The adaptation also enabled graded frequency assessment of suicide attempts. Alternative instruments, such as the Columbia-Suicide Severity Rating Scale (C-SSRS), were considered; however, the C-SSRS is designed primarily for clinician-administered interviews and is less suitable for anonymous web-based surveys in large epidemiological samples. The psychometric properties of the 6-item suicidality scale were assessed to establish its reliability and validity. Internal consistency was evaluated using Cronbach's alpha, yielding a coefficient of 0.86, indicating good reliability. Item-total correlations ranged from 0.465 to 0.854, with the highest correlations observed for suicidal thoughts in the past year (r = 0.854) and death thoughts in the past year (r = 0.818). To assess convergent validity, we examined the relationship between the total suicidality score and item 9 of the PHQ-9, which specifically addresses thoughts of death or self-harm. Spearman's rank correlation analysis revealed

a significant positive association ($\rho = 0.564$, $p < 0.001$), supporting the concurrent validity of the scale. Nearly complete data were available for this analysis, with 1024 participants (99.8% of the sample) providing responses to all suicidality items.

Each question captured different dimensions of suicidal phenomena, ranging from passive death wishes to active suicidal ideation and suicide attempts, reflecting various levels of severity and frequency. The first item assessed passive suicidal thoughts, asking participants: *"Have you seriously thought about being dead (for example: 'life is so difficult that it would be better not to exist,' 'I don't want to be a burden to others,' 'everything is so difficult that it would be better to sleep and not wake up anymore')?"* Responses were rated on a 5-point ordinal scale: (1) “Never,” (2) “It was only a brief passing thought,” (3) “I have these thoughts occasionally,” (4) “I frequently have these thoughts,” and (5) “I can't stop thinking about it.” The second item focused on the intensity of these death-related thoughts, specifically within the past year: *"On average, how strong were your thoughts about death in the past year?"* Participants answered using a 7-point ordinal scale ranging from (1) “I have no thoughts about death” to (7) “Extremely strong (very difficult to ignore/resist),” thereby capturing both frequency and intensity.

Item three assessed a lifetime history of more severe suicidal thoughts and behaviors, asking: *"Have you ever seriously thought about or attempted suicide?"* Response categories included progressively severe levels, starting from (1) “Never,” (2) “It was just a brief passing thought,” (3) “At least once, I planned to kill myself, but I did not attempt,” (4) “I planned to kill myself at least once, and I really wanted to die,” (5) “I attempted suicide but did not really want to die (‘cry for help’),” up to (6) “I attempted suicide, and I truly wanted to die.” The fourth item measured recent (past year) suicidal ideation intensity explicitly related to a desire to die, asking: *"On average, how strong were your suicidal ideation/desire to kill yourself in the past year?"* Response options matched those of item two, ranging from (1) “I have no thoughts about suicide” to (7) “Extremely strong (very difficult to ignore/resist).” The fifth item assessed the lifetime history of actual suicide attempts explicitly: *"Have you ever attempted suicide (also consider interrupted attempts)?"* Response options included: (1) “No,” (2) “Yes, once,” (3) “Yes, two times,” and (4) “Yes, three or more times.” Finally, the sixth item specifically assessed suicide attempts within the previous year: *"Have you made any suicide attempt*

in the last year (also consider interrupted attempts)?" Response options mirrored the fifth item, ranging from (1) “No” to (4) “Yes, three or more times.” These structured items enabled a comprehensive characterization of both the severity and temporal patterns of suicidal thoughts and behaviors among medical students. Suicidal Ideation was calculated by summing responses from questionnaire items 2 and 3, reflecting the intensity or frequency of suicidal thoughts. Higher summed scores indicate greater severity of suicidal ideation. Suicidal Behavior was calculated by summing responses from items 4 and 5, capturing self-reported suicidal actions or attempts. Higher summed scores represent a greater extent or severity of suicidal behavior.

Mental Health and Psychosocial Instruments: Psychometric assessments comprising internationally validated scales translated and culturally adapted to Brazilian Portuguese. Depression symptoms were evaluated with the Patient Health Questionnaire-9 (PHQ-9) [17], anxiety through the Generalized Anxiety Disorder-7 (GAD-7) [18,19], and medical student-specific stress via the Medical Student Stress Factor (MSSF) scale [4]. Perceptions of the medical school’s learning environment were assessed using the Johns Hopkins Learning Environment Scale (JHLES), a 28-item instrument evaluating seven domains: community of peers, faculty relationships, academic climate, meaningful engagement, mentorship, inclusion and safety, and physical space (scored 28–140; higher scores = more positive perceptions)[20,21]. Religious dimensions were captured through the Duke University Religion Index (DUREL)[22,23]. The DUREL assesses three domains: organizational religiosity (frequency of attending religious services; 1 item, score 1–6), non-organizational religiosity (frequency of private religious activities such as prayer, meditation, or scripture reading; 1 item, score 1–6), and intrinsic religiosity (the degree to which religious beliefs provide internal motivation and guide daily living; 3 items, score 3–15). The DUREL is designed to assess religiosity dimensions and does not include a separate spirituality subscale; accordingly, our analyses focus on religiosity. Hazing experiences and perceptions were assessed using the University Hazing Self-Report Scale (UNI-Hazing; manuscript submitted), a self-report instrument comprising three subscales: hazing victimization (experiences as a direct target), hazing observation (witnessing hazing events), and hazing opinion (attitudes toward hazing practices). Psychometric evaluation indicated excellent internal consistency (Cronbach’s α = 0.93,

95% CI: 0.92–0.94 for the hazing opinion subscale) and adequate test-retest reliability (global score r = 0.86).

Statistical Analyses

We used Latent Class Analysis (LCA) with the poLCA package in R to identify subgroups with distinct suicidal thoughts and behaviors. The six suicidality items served as indicators. We estimated models with 2 to 5 classes using maximum likelihood, 5,000 iterations, and 10 random starts to avoid local maxima. Model selection was based on AIC, BIC, adjusted BIC, entropy, and the Lo-Mendell-Rubin test, considering interpretability and relevance. The three-class model was optimal, balancing fit and interpretability. Participants were assigned to low-, moderate-, or high-risk classes based on their response patterns. Conditional response probabilities for each suicidality item by latent class are presented in Supplementary Table S3. Model fit indices comparing 2- to 5-class solutions are provided in Supplementary Table S4.

To characterize the latent classes, we undertook comprehensive comparisons across a variety of variables. For continuous variables (age, learning environment, school semester, stress, depression, anxiety, religiosity dimensions, and hazing scores), a one-way analysis of variance (ANOVA) was employed to ascertain significant differences between classes. For categorical variables (sex, gender, marital status, race, geographic origin, quota status, and income level), chi-square tests were utilized. Effect sizes were computed using eta-squared for continuous variables and Cramer's V for categorical variables. To address the issue of multiple comparisons and to control the false discovery rate, we implemented the Benjamini-Hochberg procedure for adjusting p-values. This correction was conducted separately for continuous and categorical variables to ensure appropriate type I error control while maximizing statistical power.

A series of regression analyses identified predictors of mental health and suicidality. Univariate regressions for each dependent variable (PHQ-9, death thoughts, suicidal ideation, behavior) with potential predictors were performed. Variables with $p < 0.05$ in univariate analyses were included in multiple models. These models assessed independent predictor contributions, controlling for confounders. Multicollinearity was

checked using VIF, with values over 5 flagged. Standardized coefficients with 95% CIs were reported. The Benjamini-Hochberg method managed multiple testing.

To facilitate interpretation of latent classes, standardized scores were calculated across key variables. Suicidality scores were standardized from their ordinal scale, with higher scores indicating greater severity. For continuous measures like depression and anxiety, min-max normalization ensured comparability across different scales. These profiles visually highlighted the distinct patterns defining each class. Missing data were minimal: only 2 participants (0.2%) had incomplete data across key sociodemographic, clinical, and suicidality variables, while composite scores, learning environment (JHLES), and hazing measures had no missing values. Primary analyses used complete-case analysis (n=1,024 for LCA; n=1,023–1,024 for regressions). Sensitivity analyses using multiple imputation (m=20, predictive mean matching) confirmed the robustness of findings: LCA class proportions remained stable (Supplementary Table 5), and regression estimates showed complete concordance in direction and statistical significance between approaches (Supplementary Table 6).

All analyses were conducted using R version 4.2.0 (R Core Team, 2022). Latent class analysis was carried out utilizing the poLCA package. Multiple testing correction was performed using the p.adjust function with the "BH" method. Data visualization was achieved through the ggplot2 package, employing customized parameters to enhance the interpretability of complex patterns. The openxlsx package was utilized to prepare formatted tables of results.

Results

From the total of almost 42 thousand Brazilian medical students (data from 2022 regarding the medical demography study of the Brazilian Medical Association – the last available data), the final analytical sample comprised 1024 participants (99.8% of the initial 1026 enrolled students) who provided complete data on all six suicidality items and were included in the inferential statistical analyses, while the full sample was retained for descriptive analyses to maximize representation of the study population.

Sociodemographic Characteristics (Table 1)

The mean age is 25.44 years (SD = 6.29). Most were female (63.71%) and cisgender (98.52%). Most participants were single (86.92%), with a smaller fraction married or in stable unions (12%). The racial distribution revealed a predominantly White sample (64.60%), followed by Brown (28.42%), Black (3.83%), Asian (3.05%), and Indigenous individuals (0.10%). Regarding religious affiliation, nearly half of the students identified as Catholic (44.74%), while significant portions reported no religion (26.65%) or atheism (8.65%). Economic diversity was also observed, with 24.09% of the students coming from families earning between 5-10 minimum wages and 19.17% from households with incomes exceeding 20 minimum wages.

Table 1. Sociodemographic sample description

	N (%) / Mean (SD)		N (%)
Age	25,444 (±6.29)	**Religion**	
Sex		Atheist	88 (8.65%)
Male	369 (36.28%)	No religion	271 (26.65%)
Female	648 (63.71%)	Catholic	455 (44.74%)
Gender		Evangelical	145 (14.26%)
Cisgender	1002 (98.52%)	Others	142 (13.96%)
Non-cisgender	15 (1.48%)	**Income (minimum wage)**	
Marital status		1-2	101 (9.93%)
Single	884 (86.92%)	2-3	95 (9.34%)
Married / Stable union	122 (12.00%)	3-5	165 (16.22%)
Divorced	10 (0.98%)	5-10	245 (24.09%)
Widowed	1 (0.10%)	10-20	216 (21.24%)
Race		> 20	195 (19.17%)
White	657 (64.60%)	**University Year**	
Brown	289 (28.42%)	1st	185 (18.19%)
Black	39 (3.83%)	2nd	117 (11.50%)
Yellow (Asian)	31 (3.05%)	3rd	209 (20.55%)
Indigenous	1 (0.10%)	4th	261 (25.66%)
		5th	127 (12.49%)
		6th	118 (11.60%)

Prevalence of Suicidal Thoughts and Behaviors (Table 2)

The analysis found a high rate of suicidal thoughts among Brazilian medical students. 62.7% endorsed any lifetime passive thoughts of death (Item 1, response >1): 33.04% as brief passing thoughts, 18.81% occasionally, 9.06% frequently, and 1.66% as uncontrollable (Table 2). Over the past year, 58.09% had at least weak suicidal thoughts, with some experiencing strong or extremely strong ideation. Lifetime suicidal ideation was endorsed by 39.55% (Item 3, response >1), with responses ranging from brief passing thoughts (17.06%) to having attempted suicide with intent to die (3.22%). Separately, 12.7% reported at least one lifetime suicide attempt when directly asked (Item 5), and 4.39% reported at least one attempt in the past year (Item 6). In the past year, 4.39% attempted. Spearman's correlations between suicidality items and PHQ-9 item 9 were all significant, strongest for recent thoughts ($\rho = 0.601$ and 0.563). Correlations for lifetime items were lower but still significant. These results show strong convergent validity, especially for recent suicidal thoughts.

Table 2. Prevalence of suicidal thoughts and behaviors among Brazilian medical students

Item	Response	Count (n)	Percentage (%)
Thoughts about death lifetime	Overall (>1)		62.7
	Never	382	37.23
	It was just a brief passing thought	339	33.04
	I have these thoughts occasionally	193	18.81
	I have these thoughts often	93	9.06
	I can't stop thinking about my death	17	1.66
Thoughts about death last year			
	I have no thoughts about death	430	41.91
	Weak/mild	250	24.37
	Mild	95	9.26
	Moderately strong (easy to ignore/resist)	118	11.5
	Strong	64	6.24
	Very Strong (hard to ignore/resist)	44	4.29
	Extremely strong (very hard to ignore/resist)	23	2.24
Suicidal thoughts lifetime			
	Overall (>1)		39.55
	Never	619	60.33
	It was just a brief passing thought	175	17.06
	At least once, I planned to kill myself, but I didn't try to do it	91	8.87

	I planned to kill myself at least once, and I really wanted to die	64	6.24
	I attempted suicide but did not really want to die ('cry for help')	42	4.09
	I tried to kill myself, and I really expected to die	33	3.22
Suicidal thoughts last year			
	I have no thoughts about death	597	58.19
	Weak/mild	214	20.86
	Mild	43	4.19
	Moderately strong (easy to ignore/resist)	83	8.09
	Strong	48	4.68
	Very Strong (hard to ignore/resist)	25	2.44
	Extremely strong (very hard to ignore/resist)	14	1.36
Suicide attempts lifetime			
	Overall (>1)		12.7
	None	894	87.13
	Yes, once	82	7.99
	Yes, twice	27	2.63
	Yes, three or more times	21	2.05
Suicide attempts last year			
	Overall (>1)		4.39
	None	979	95.42
	Yes, once	40	3.9
	Yes, twice	3	0.29
	Yes, three or more times	2	0.19

Regression Analyses

Univariate Regression Analyses are in Supplementary Table 2. Four multiple regression models assessed factors linked to mental health among Brazilian medical students (Table 3). All VIFs were below five, indicating no multicollinearity issues. The depressive symptoms model fit well (R^2 = 0.653), explaining about 65% of the variance. Key associations before correction included higher depressive symptoms with anxiety (β=0.702), stressors (β=0.044), lower learning environment scores (β=-0.039), and lower depressive scores among males (β=-0.749) and those with higher religiosity (β=-0.116). All remained significant after correction.

Table 3. Multiple models for associations between depressive symptoms, thoughts about death, suicidal thoughts, and behaviors among Brazilian medical students.

Predictors / Outcomes	Depressive Symptoms	Thoughts of Death	Suicidal Ideation	Suicidal Behavior
Anxiety Symptoms	0.70 (0.66-0.75)***	0.16 (0.07-0.25) *	0.22 (0.13-0.31)***	0.03 (0.02-0.03)***
Learning Environment	-0.04 (-0.06--0.02)***	-0.03 (-0.07-0.01)	-0.02 (-0.05-0.02)	-0.00 (-0.01-0.00)
University Stressors	0.04 (0.03-0.06)***	0.01 (-0.01-0.02)	-0.00 (-0.02-0.02)	0.00 (-0.00-0.00)
Sex (Male)	-0.75 (-1.29--0.21)*	-0.18 (-1.14-0.79)	0.21 (-0.68-1.10)	-0.07 (-0.16-0.03)
Gender (non-cisgender)	—	-1.08 (-4.21-2.06)	-1.00 (-4.05-2.04)	0.50 (0.13-0.87)*
Intrinsic Religiosity	-0.12 (-0.21--0.02)*	-0.28 (-0.49--0.06)	-0.17 (-0.38-0.03)	-0.01 (-0.02--0.00)
Organizational Religiosity	0.10 (-0.14-0.33)	0.18 (-0.27-0.62)	0.06 (-0.37-0.49)	—
Non-organizational Religiosity	-0.11 (-0.31-0.08)	0.18 (-0.18-0.54)	0.17 (-0.18-0.52)	—
Hazing Victim Score	0.05 (-0.00-0.10)	0.05 (-0.05-0.14)	0.06 (-0.03-0.15)	0.01 (0.00-0.02)*
Hazing Observer Score	-0.02 (-0.05-0.01)	-0.03 (-0.09-0.04)	-0.04 (-0.10-0.03)	-0.00 (-0.01-0.00)
Age	—	-0.05 (-0.10-0.00)	-0.05 (-0.09-0.00)	—
Family Income	-0.09 (-0.27-0.09)	-0.30 (-0.63-0.04)	-0.11 (-0.40-0.18)	—
Race (White)	-0.20 (-0.74-0.35)	—	—	—
Quota Holder	0.35 (-0.31-1.01)	0.03 (-1.08-1.13)	—	—
Current City Capital - Yes	—	0.62 (-0.29-1.52)	0.52 (-0.33-1.36)	—
Marital Status (Single)	—	-0.02 (-1.32-1.27)	—	—
(Intercept)	4.47 (1.66-7.29)**	8.22 (2.72-13.71)*	5.01 (0.22-9.80)	2.04 (1.55-2.52)***
Model Statistics	R^2 = 0.65***	R^2 = 0.40***	R^2 = 0.40***	R^2 = 0.09***
Adjusted R^2	0.65	0.30	0.31	0.08
F-statistic	158.68	4.08	4.77	12.30

*Note: Values presented as unstandardized regression coefficients B (95% Confidence Interval). Predictor scales: GAD-7 (0–21), PHQ-9 (0–27), JHLES (28–140), MSSF (45–225), DUREL intrinsic religiosity (3–15), DUREL organizational (1–6), DUREL non-organizational (1–6), Hazing victim/observer scores (continuous). Sex: 0=female, 1=male; Gender: 0=cisgender, 1=non-cisgender. --- indicates variable excluded from that model based on non-significance (p≥0.05) in univariate screening). All variables present in each column were mutually adjusted. Significance levels: * p<0.05, ** p<0.01, *** p<0.001. VIF <5 for all predictors across all models.*

The thoughts of death model had a moderate fit (R^2=0.400), explaining 30%. Before correction, anxiety was positively linked (β=0.159), and religiosity was negatively linked (β=-0.277). Only anxiety remained significant after correction. The suicidal ideation model had moderate fit (R^2=0.397), with anxiety linked to higher ideation (β=0.221), both before

and after correction. The suicidal behavior model had modest fit (R^2=0.088), with anxiety (β=0.025), non-cisgender identity (β=0.498), and hazing victim score (β=0.012) being positively associated, and intrinsic religiosity (β=-0.012) being inversely associated before correction. After correction, anxiety, non-cisgender identity, and hazing victimization remained significant; intrinsic religiosity's inverse association approached but did not reach significance.

Table 4. Latent Class Group Differences in Suicidal Thoughts, Behaviors, and Associated Variables Among Brazilian Medical Students

Variables		Low-Risk (Class 1)	Moderate-Risk (Class 2)	High-Risk (Class 3)	p-value	Adjusted p-value
Continuous			Mean (SD)			
	Age	26.03 (10.09)	25.74 (7.30)	21.29 (8.71)	0.077	0.084
	Learning Environment	86.65 (11.99)	82.75 (12.22)	77.38 (13.93)	**<0.001**	**<0.001**
	School Semester	6.53 (3.18)	6.28 (3.13)	6.05 (3.05)	0.211	0.211
	University Stressors	120.66 (28.71)	134.69 (25.06)	143.52 (25.12)	**<0.001**	**<0.001**
	Depressive Symptoms	9.51 (5.48)	14.00 (5.75)	20.09 (5.54)	**<0.001**	**<0.001**
	Anxiety Symptoms	7.41 (5.32)	11.18 (5.64)	15.43 (5.22)	**<0.001**	**<0.001**
	Organizational Religiosity	3.06 (1.58)	2.80 (1.53)	2.51 (1.46)	**<0.001**	**<0.001**
	Non-organizational Religiosity	4.02 (1.94)	3.57 (2.08)	3.25 (2.00)	**<0.001**	**<0.001**
	Intrinsic Religiosity	10.81 (3.77)	9.52 (4.03)	8.41 (4.08)	**<0.001**	**<0.001**
	Hazing Victim Score	28.76 (5.10)	29.58 (6.12)	31.70 (10.97)	**<0.001**	**<0.001**
	Hazing Observer Score	34.67 (11.85)	35.65 (12.06)	39.51 (17.11)	**<0.001**	**<0.001**
	Hazing Opinion Score	50.99 (8.47)	52.19 (7.86)	52.47 (9.15)	**0.049**	0.059
Categorical			**Frequency (%)**			
	Sex (Female)	59.1	66.8	68.6	**0.024**	0.053
	Gender (non-cisgender)	0.2	1.9	3.6	**0.006**	**0.027**
	Marital Status (Single)	82.7	89.3	91.1	**0.003**	**0.027**
	Race (Non-white)	37.2	31.3	40.8	0.052	0.094
	City of Origin (capital) -Yes	35.1	34.8	32.5	0.829	0.829
	Current City (capital) - Yes	62.8	58.8	50.3	**0.019**	0.053
	Moved from Origin City - Yes	73.2	68.2	70.4	0.279	0.359
	Quota Holder - Yes	78.5	76.8	72.2	0.255	0.359
	Sponsorship - Yes	79.7	78.2	75.1	0.478	0.538
	Family Income					
	1 to 2 minimum wages	9.0	10.2	11.8		
	2 to 3 minimum wages	8.3	10.2	10.1	0.086	0.086
	3 to 5 minimum wages	14.1	15.2	23.7		
	5 to 10 minimum wages	23.3	24.4	24.3		

10 to 20 minimum wages	24.0	20.4	16.6
More than 20 minimum wages	21.2	19.7	13.6

Note: P-values for continuous variables were calculated using one-way ANOVA. P-values for categorical variables were calculated using chi-square tests. Adjusted p-values were calculated using the Benjamini-Hochberg method to control for multiple comparisons. Class 1 = Low-Risk, Class 2 = Moderate-Risk, Class 3 = High-Risk.

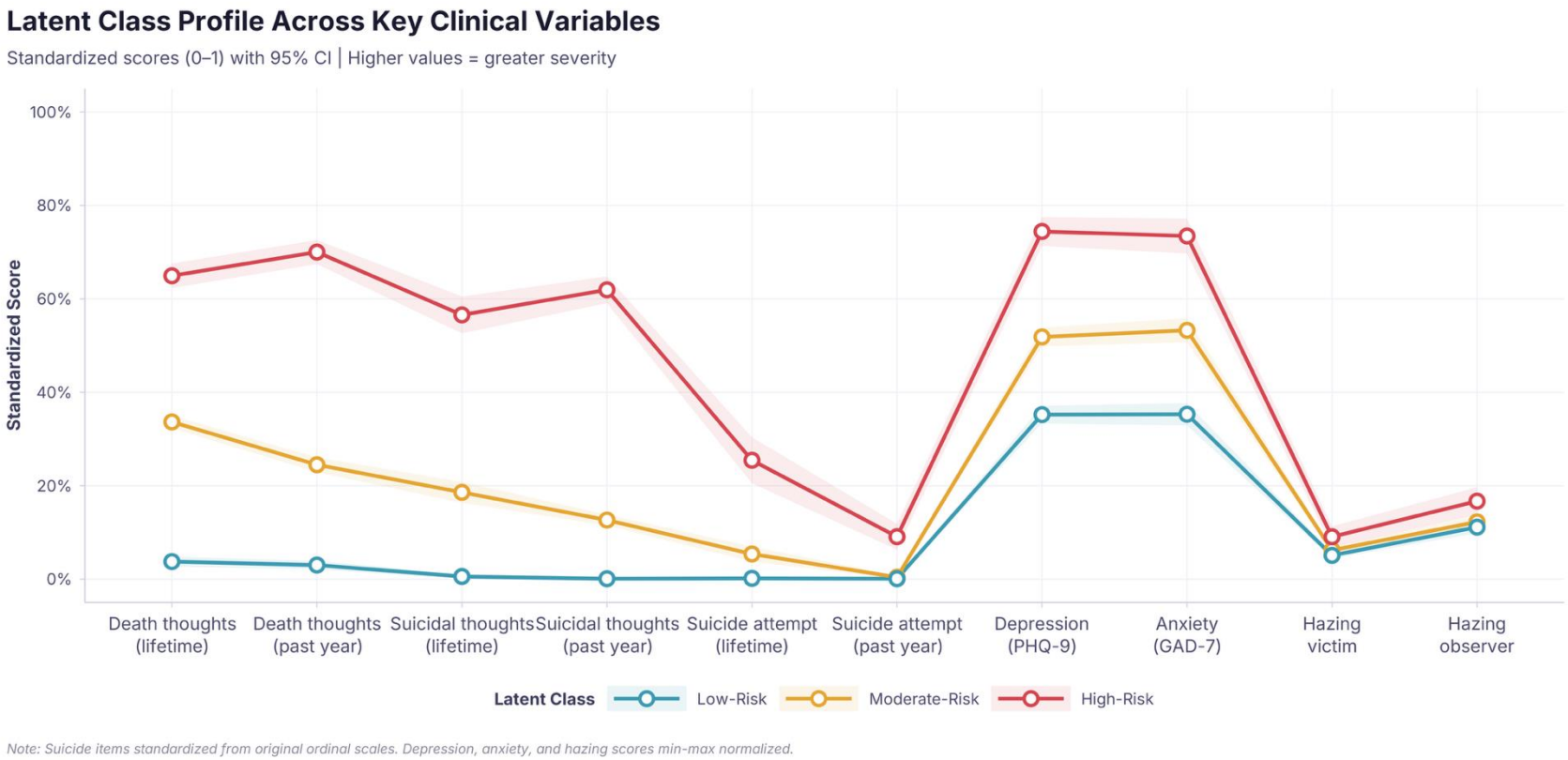
Latent Class Analysis

Model fit indices indicated that a three-class solution was optimal, with the lowest BIC (10154.423) compared to two-class and higher-class solutions. Although AIC decreased with more classes, the three- class model was most interpretable. LCA identified three groups: Low Risk (42.40%), Moderate Risk (41.13%), and High Risk (16.47%). After multiple-comparison adjustments, these groups showed significant differences across many variables. High-Risk students exhibited higher depressive symptoms (mean PHQ-9 = 20.09 ± 5.54) than Moderate-Risk (14.00 ± 5.75) and Low-Risk (9.51 ± 5.48; $p < 0.001$). Anxiety was also higher in High-Risk (mean GAD-7 = 15.43 ± 5.22) than in Moderate (11.18 ± 5.64) and Low (7.41 ± 5.32; $p < 0.001$). Perceptions of the learning environment and stressors were poorest and highest among High-Risk students. All religiosity dimensions were protective, with the highest intrinsic religiosity in Low Risk (10.77 ± 13.93), decreasing in Moderate (9.82 ± 4.12) and High (86.65 ± 4.11), $p < 0.001$. Similarly, organizational and non-organizational religiosity followed this pattern ($p<0.001$). Hazing exposure was highest among High-Risk students as victims (31.70 ± 10.10.97) and observers (39.29 ± 17.11) ($p < 0.001$). Hazing opinion scores showed marginal differences pre- adjustment, not after.

Demographics revealed more females in High-Risk (68.6%) than in Moderate (66.8%) and Low (59.1%; $p = 0.024$), but significance waned after adjustment. Non-cisgender identity was more common in High-Risk (3.6%) than in Moderate (1.9%) and Low (0.2%; $p = 0.027$). The High-Risk group was younger (mean age 21.29 ± 8.71) than the Moderate (25.74 ± 7.30) and Low (26.26 ± 10.09) groups, but the difference was borderline significant ($p = 0.084$). Single marital status was more prevalent in High- Risk (91. 89.3%) ($p = 0. 027$). Fewer High-Risk students lived in capital cities (50.3%) than Low (62.8%), though this difference was not significant after adjustment. Income levels varied, with

High-Risk students more often in lower income brackets (23. 23.7%) and less often in higher brackets (>20 wages at 13. 13.6%) than Low-Risk students, but the differences were not statistically significant post-adjustment (p = 0. 086). The High-Risk profile is characterized by elevated risk-associated factors and lower levels of factors inversely associated with suicidality. Figure 1 summarizes the model findings.

Figure 1. Latent Class Solution: Conditional Item-Response Probabilities and Class Population Shares



Discussion

In this multicenter cross-sectional investigation of 1,026 Brazilian medical students, more than 50% of the evaluated students reported any suicidal thoughts and behaviors, with rates of suicidal ideation (39.6%) and attempts (12.7%), constituting a significant public health concern within medical education. Through rigorous multivariate analyses and latent class modeling, we revealed substantial heterogeneity in suicide risk that extends beyond traditional unidimensional assessment approaches. While anxiety symptoms not surprisingly predicted all suicidal outcomes, our findings importantly highlight the critical contribution of institutional factors—impoverished learning environments, university-specific stressors, and exposure to hazing practices—to suicidal risk. The identification of three distinct risk profiles suggests that a substantial proportion of medical students experience clinically significant psychological distress, warranting intervention. The High-Risk group demonstrated a particularly concerning constellation of vulnerabilities, including severe psychopathology, worse perception of the medical school learning environment, more university stressors, extensive hazing victimization, non-cisgender identity, and markedly lower religiosity. These findings challenge medical schools to address both individual mental health needs and institutional factors contributing to student distress, suggesting that comprehensive reform of learning environments and student culture may be essential components of effective suicide prevention in medical education settings.

The 39.6% lifetime suicidal ideation prevalence (Item 3) in our sample notably exceeds global pooled estimates. Rotenstein et al.[6] (2016) reported a pooled suicidal ideation prevalence of 11.1% (95% CI: 9.0–13.7%) across 24 studies of medical students. More recently, Vera-Ponce et al. (2025), in a meta-analysis of health sciences students, reported prevalence estimates of 14.09% (95% CI: 11.39–17.02%) using the Beck Scale for lifetime assessment and 19.18% (95% CI: 12.65–26.69%) using PHQ-9 item 9 for the past two weeks[24]. A further systematic review documented even wider variation, with prevalence rates ranging from 1.8% to 53.6% across 17 studies from 13 countries[25]. Several factors may account for our higher estimates. First, our instrument separately assesses passive thoughts of death and active suicidal ideation, whereas many studies use single-item measures capturing only active ideation. Second, our primary estimates

are lifetime prevalence, which inherently exceeds past-year or past-month assessments used in many comparisons (e.g., Torres et al.[26], 2018: 7.2% using a single-item current assessment). Third, voluntary web-based recruitment may disproportionately attract students experiencing greater psychological distress.

The 12.7% lifetime suicide attempt prevalence (Item 5) also exceeds available pooled estimates. Vera-Ponce et al.[24] (2025) reported a pooled lifetime suicide attempt prevalence of 7.06% (95% CI: 4.35–10.35%) and a past-12-month prevalence of 4.45% (95% CI: 2.62–6.71%) among health sciences students. Individual studies have reported wide variation, from 0.6% in Serbia to 6.2% in South Africa[25]. Marcon et al.[27] (2020), in a nationwide Brazilian sample of 4,840 medical students, reported a lifetime suicide attempt prevalence of 8.94%, a figure comparable to our estimate and notably exceeding global pooled averages. However, this estimate should be interpreted with caution, as our item ("Have you ever attempted suicide?") may capture a broad spectrum of self-directed violence, and lifetime measurement is subject to recall and definitional variability across cultural contexts. Likewise, Quek et al.[28] (2019) emphasized anxiety and stress as critical factors contributing to suicidal thoughts and behaviors among medical students, underscoring the influence of competitive educational environments and demanding academic requirements. Our findings corroborate and extend this work by demonstrating how university-specific stressors and poor learning environments are associated with suicidal outcomes independently of psychological distress.

In Brazil, research also highlights a significant prevalence of mental health burdens, as well as elevated incidences of suicidal thoughts and behaviors[9,26]. Our group's study comparing medical students in Brazil and the United States revealed that Brazilian students experience notably higher levels of stress and depression, along with poorer environmental quality of life[29]. These studies collectively underscore the pressing need to systematically address mental health issues within medical education, considering the direct consequences of psychological distress on not only the personal well-being of students but also on patient safety and the quality of healthcare services. Additionally, our identification of distinct risk profiles through latent class analysis provides a novel framework for developing targeted interventions that address the specific needs

of vulnerable subgroups rather than applying one-size-fits-all approaches to suicide prevention in medical education settings [30].

Our findings also highlight the critical role of the learning environment in influencing mental health outcomes among medical students. Specifically, we identified significant associations between poorer perceptions of the learning environment and increased depressive symptoms, anxiety, and suicidal behaviors in our unadjusted models. A supportive educational climate is essential for academic success and fostering psychological well-being; conversely, negative institutional climates characterized by high stress, excessive academic pressures, and lack of psychosocial support may significantly impair students' mental health [31-34]. Beyond interpersonal relationships, multiple aspects of the learning environment contribute to psychological distress among medical students, including overwhelming curriculum demands, inflexible academic schedules, inadequate mentorship, competitive evaluation systems, limited career guidance, and insufficient work-life balance support [4,12,35]. Within this context, hazing practices represent a particularly detrimental component of a poor learning environment [36,37]. Hazing victimization and witnessing these abusive initiation rituals consistently emerged as significant predictors of mental health issues, even though they are largely understudied [38-40]. The combined impact of these institutional factors—curriculum overload, insufficient faculty support, inadequate wellness resources, and tolerance of abusive practices—creates a learning climate that can significantly compromise student well-being and potentially increase vulnerability to suicidal thoughts and behaviors.

Our findings also point to socioeconomic factors as relevant correlates of mental health outcomes. Lower family income was significantly associated with depressive symptoms, thoughts of death, and suicidal ideation in univariate analyses, and students in the High-Risk latent class tended to report lower family income compared to their Low-Risk peers (although this difference did not reach statistical significance after adjustment for multiple comparisons). These findings are consistent with evidence that inequality is associated with psychological distress among medical students[41-45] and underscore the potential importance of institutional policies promoting socioeconomic support, including robust financial aid programs, fee waivers, and emergency assistance funds, as components of a comprehensive approach to student well-being.

While our study identifies concerning risk patterns, it also suggests pathways for intervention. Various approaches aimed at transforming the learning environment have been shown to enhance medical student well-being, including curriculum reforms that reduce competitive grading, implement pass/fail systems, and integrate well-being into educational objectives [13,46,47]. Institutional interventions like mentorship programs, protected time for self-care, and structured support systems have demonstrated effectiveness in reducing psychological distress among students [48,49]. Particularly encouraging is our finding regarding intrinsic religiosity as a potential protective factor against thoughts about death, with more religious participants consistently falling within the low-risk latent subgroup. This aligns with literature suggesting that spirituality and internalized religious beliefs may offer resilience through enhanced coping mechanisms, meaning-making frameworks, and improved mental health [14].

The identification of a high-risk class (16.5% of our sample) has profound clinical and public health implications. These students exhibited markedly elevated depressive and anxiety symptoms, significantly higher perceived stress, and consistently reported poorer learning environments compared to their peers. Demographically, this vulnerable group was notably younger, more frequently female (68.6%), and more likely to identify as non-cisgender (3.6%), highlighting how psychological vulnerabilities may intersect with minority stressors. This group might also experience more discrimination and bullying from their peers, which can affect their mental health [50,51]. The convergence of these psychosocial, demographic, and environmental factors underscores the urgent need for targeted interventions that address the specific challenges faced by high-risk students. Strategies should include early identification systems, tailored mental health resources, and institutional reforms that create more supportive educational environments while eliminating abusive practices that disproportionately affect vulnerable students.

Intriguingly, intrinsic religiosity was significantly inversely associated with depressive symptoms in the adjusted model and showed inverse associations with thoughts of death and suicidal behavior that were attenuated after correction for multiple comparisons. Participants exhibiting higher intrinsic religiosity were consistently found within the low-risk latent subgroup, aligning with previous literature suggesting that spirituality and internalized religious beliefs may offer resilience through enhanced coping

mechanisms and community support [52-54]. Notably, religiosity was not significantly associated with suicidal behavior in the fully adjusted model. This differential pattern may reflect that religiosity operates primarily through cognitive and emotional pathways, such as meaning-making frameworks, moral objections to suicide, and community connectedness, that modulate suicidal cognitions and depressive symptoms, whereas the transition from ideation to behavior may involve additional situational factors (e.g., impulsivity, acute crises, access to means)[55]. These findings highlight a critical avenue for targeted preventive strategies, suggesting that interventions fostering resilience, community connectedness, and spiritual support may effectively mitigate suicidal risk within medical student populations.

Our findings should also be contextualized within the growing literature on medical student suicidality in low- and middle-income countries (LMICs). Meta-analyses of original studies in Africa, for example, with 8,585 medical students, showed a pooled-prevalence of lifetime suicidal ideation, suicidal plans, and suicide attempt of 18.7%, 3.8%, and 5.5%, respectively[56]. Prevalences are similar in India[57], Colombia[58], and Mexico[59]. Common themes include the influence of academic stressors, financial strain, and limited access to mental health support. Our study extends this literature by identifying institutional hazing as a significant correlate of suicidal behavior, a factor less frequently examined in international studies but potentially relevant across educational contexts where hazing persists. Additionally, the role of religiosity as an inverse correlate in our predominantly Catholic/Christian Brazilian sample may differ in magnitude in settings with different religious landscapes, highlighting the importance of culturally sensitive approaches to suicide prevention in medical education.

The convergence of these psychosocial, demographic, and environmental stressors underscores the critical need for early identification and targeted intervention strategies. Given that these students represent those at greatest immediate risk of adverse outcomes, including suicide attempts, proactive mental health initiatives could prioritize fostering supportive institutional climates[13,46], addressing abusive educational practices[36], and providing accessible psychological support[49]. Longitudinal and interventional studies are needed to determine whether such strategies effectively reduce suicidal outcomes in this population. Addressing the specific vulnerabilities and lived

experiences of this subgroup could significantly improve student well-being, reduce dropout rates, and foster healthier, safer academic environments.

Several limitations should be noted in interpreting our findings. Firstly, the cross-sectional nature of this study precludes establishing causality. Second, self-report measures may introduce recall and response biases, potentially leading to underreporting or exaggeration of symptoms and behaviors. Additionally, despite robust statistical controls, residual confounding by unmeasured psychological or environmental factors cannot be excluded. Moreover, because recruitment employed an open web-based survey distributed through multiple channels, a conventional response rate could not be calculated. The 1,026 respondents constitute a convenience sample from an estimated population of approximately 42,000 Brazilian medical students; thus, selection bias cannot be ruled out, and the findings should be interpreted as reflecting students who chose to participate rather than as nationally representative estimates. The ordinal structure of Item 3, which combines suicidal ideation and behavior in a single graduated scale, creates potential interpretive overlap with Items 5 and 6 that assess attempts directly. The 3.22% from Item 3's highest category (attempted with intent to die) represents a narrower construct than the 12.7% lifetime attempt prevalence from Item 5 (any attempt regardless of intent). Throughout this manuscript, Item 5 (12.7%) is used as the primary lifetime suicide attempt estimate. Finally, the generalizability of our results may be limited to medical students in similar socioeconomic and cultural contexts in Brazil, warranting caution when extrapolating to broader populations or different educational environments.

Our results highlight alarming levels of suicidal ideation and behaviors among Brazilian medical students, revealing a critical public health issue within this population. Depression and anxiety were consistent and robust predictors of suicidal outcomes, and latent class analysis successfully identified a subgroup at particularly high risk, characterized by severe psychological distress and demographic vulnerabilities. These findings underscore the potential value of implementing tailored, evidence-based mental health strategies that address specific risk profiles. Longitudinal studies and pragmatic clinical trials are needed to evaluate whether interventions targeting the modifiable

institutional and individual factors identified here can effectively promote psychological resilience and well-being among medical students.

Ethical Approval: The study was approved by the Research Ethics Committee of the Hospital das Clínicas of the Faculty of Medicine of the University of São Paulo. (CAAE: 70017023.4.0000.00680). All participants provided written informed consent before enrolment in the study.

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Supplementary material

Supplementary Table 1. Suicidality questions

ID	Question (English)	Response Options
[suicide_1]	Have you ever seriously thought about being dead (e.g., "life is so difficult it would be better not to exist," "I don't want to be a burden to others," "everything is so difficult that it would be better to go to sleep and never wake up again")?	1 = Never 2 = It was just a brief passing thought 3 = I have these thoughts occasionally 4 = I frequently have these thoughts 5 = I cannot stop thinking about my death
[suicide_2]	On average, how strong were your thoughts about death in the last year?	1 = I have had no thoughts about death 2 = Weak/light 3 = Mild 4 = Moderately strong (easy to ignore/resist) 5 = Strong 6 = Very strong (difficult to ignore/resist) 7 = Extremely strong (very difficult to ignore/resist)
[suicide_3]	Have you ever seriously thought about or tried to kill yourself (suicide)?	1 = Never 2 = It was just a brief passing thought 3 = At least once I planned to kill myself but did not try 4 = I have planned at least once to kill myself and really wanted to die 5 = I tried to kill myself but did not really want to die ("cry for help") 6 = I tried to kill myself and really expected to die
[suicide_4]	On average, how strong were your thoughts or desire to kill yourself in the last year?	1 = I have had no thoughts 2 = Weak/light 3 = Mild 4 = Moderately strong (easy to ignore/resist) 5 = Strong 6 = Very strong (difficult to ignore/resist)

ID	Question (English)	Response Options
		7 = Extremely strong (very difficult to ignore/resist)
[suicide_5]	Have you ever made a suicide attempt (also consider attempts that were interrupted)?	1 = No 2 = Yes, once 3 = Yes, twice 4 = Yes, three or more times
[suicide_6]	Have you made any suicide attempt in the last year (also consider attempts that were interrupted)?	1 = No 2 = Yes, once 3 = Yes, twice 4 = Yes, three or more times

Note: *In their respective surveys, all items are presented as required "radio" questions (i.e., respondents must select one option).*

Supplementary Table 2. Univariate Regression Analysis of Factors Associated with Mental Health Outcomes

Dependent Variable	Independent Variable	Estimate	Unadjusted p-value	Adjusted p-value	
Depressive Symptoms	Sex (Male)	-2.662 (-3.505 - -1.819)	<0.001	<0.001	***
	Gender (non-cisgender)	1.72 (-1.713 - 5.152)	0.326	0.377	
	Quota Holder (Yes)	1.379 (0.406 - 2.352)	0.006	0.012	*
	Race (White)	-0.918 (-1.779 - -0.057)	0.037	0.063	
	Sponsorship - Yes	0.855 (-0.145 - 1.854)	0.094	0.129	
	Anxiety Symptoms	0.851 (0.808 - 0.893)	<0.001	<0.001	***
	Moved from Origin City - Yes	0.831 (-0.074 - 1.736)	0.072	0.113	
	Current City (capital) - Yes	0.718 (-0.12 - 1.556)	0.093	0.129	
	Marital Status (Single)	0.65 (-0.568 - 1.869)	0.295	0.361	
	City of Origin (capital) -Yes	-0.532 (-1.399 - 0.334)	0.228	0.295	
	Family Income	-0.376 (-0.64 - -0.111)	0.005	0.012	*
	Non-organizational Religiosity	-0.324 (-0.526 - -0.121)	0.002	0.006	**
	Organizational Religiosity	-0.316 (-0.582 - -0.051)	0.020	0.037	*
	Altruism	-0.185 (-0.721 - 0.35)	0.497	0.497	
	Learning Environment	-0.173 (-0.204 - -0.143)	<0.001	<0.001	***
	Hazing Victim Score	0.172 (0.113 - 0.231)	<0.001	<0.001	***
	Intrinsic Religiosity	-0.144 (-0.246 - -0.042)	0.006	0.012	*
	University Stressors	0.136 (0.124 - 0.148)	<0.001	<0.001	***
	Hazing Observer Score	0.077 (0.046 - 0.108)	<0.001	<0.001	***
	Hazing Opinion Score	0.073 (0.024 - 0.122)	0.004	0.011	*
	School Semester	-0.058 (-0.189 - 0.073)	0.386	0.425	
	Age	-0.057 (-0.209 - 0.094)	0.453	0.475	
Suicidal Behavior	Gender (non-cisgender)	0.568 (0.184 - 0.951)	0.004	0.015	*
	Sex (Male)	-0.121 (-0.217 - -0.026)	0.012	0.038	*
	Moved from Origin City - Yes	0.068 (-0.032 - 0.169)	0.184	0.297	
	Sponsorship - Yes	0.061 (-0.05 - 0.172)	0.283	0.389	

	Quota Holder (Yes)	0.056 (-0.053 - 0.165)	0.316	0.409	
	Race (White)	0.054 (-0.041 - 0.15)	0.266	0.389	
	Altruism	0.049 (-0.01 - 0.109)	0.103	0.227	
	Anxiety Symptoms	0.031 (0.023 - 0.038)	<0.001	<0.001	***
	City of Origin (capital) -Yes	-0.029 (-0.126 - 0.067)	0.552	0.580	
	Current City (capital) - Yes	0.029 (-0.064 - 0.123)	0.535	0.580	
	Marital Status (Single)	0.026 (-0.109 - 0.162)	0.703	0.703	
	Organizational Religiosity	-0.022 (-0.051 - 0.008)	0.151	0.297	
	Non-organizational Religiosity	-0.019 (-0.042 - 0.003)	0.096	0.227	
	Hazing Victim Score	0.017 (0.011 - 0.024)	<0.001	<0.001	***
	Intrinsic Religiosity	-0.013 (-0.024 - -0.002)	0.025	0.069	
	School Semester	-0.01 (-0.024 - 0.005)	0.185	0.297	
	Family Income	-0.009 (-0.038 - 0.021)	0.554	0.580	
	Hazing Observer Score	0.007 (0.003 - 0.01)	<0.001	<0.001	***
	Learning Environment	-0.005 (-0.009 - -0.002)	0.003	0.013	*
	Age	-0.004 (-0.018 - 0.009)	0.527	0.580	
	University Stressors	0.004 (0.003 - 0.006)	<0.001	<0.001	***
	Hazing Opinion Score	0.004 (-0.002 - 0.009)	0.189	0.297	
Suicidal Ideation	Gender (non-cisgender)	2.387 (1.085 - 3.688)	<0.001	<0.001	***
	Sex (Male)	-0.436 (-0.762 - -0.11)	0.009	0.020	*
	Marital Status (Single)	0.397 (-0.067 - 0.861)	0.094	0.122	
	Quota Holder (Yes)	0.351 (-0.021 - 0.722)	0.064	0.088	
	Current City (capital) - Yes	0.341 (0.022 - 0.66)	0.036	0.061	
	Sponsorship - Yes	0.264 (-0.118 - 0.645)	0.175	0.214	
	Organizational Religiosity	-0.189 (-0.29 - -0.088)	<0.001	<0.001	***
	Anxiety Symptoms	0.182 (0.158 - 0.205)	<0.001	<0.001	***
	Non-organizational Religiosity	-0.171 (-0.248 - -0.094)	<0.001	<0.001	***
	Moved from Origin City - Yes	0.138 (-0.207 - 0.483)	0.433	0.497	
	City of Origin (capital) -Yes	-0.127 (-0.457 - 0.204)	0.452	0.497	
	Family Income	-0.123 (-0.224 - -0.022)	0.017	0.034	*

	Intrinsic Religiosity	-0.119 (-0.158 - -0.081)	<0.001	<0.001	***
	Race (White)	0.075 (-0.253 - 0.404)	0.653	0.684	
	Hazing Victim Score	0.066 (0.044 - 0.088)	<0.001	<0.001	***
	Age	-0.061 (-0.116 - -0.007)	0.027	0.049	*
	School Semester	-0.05 (-0.1 - 0)	0.052	0.076	
	Learning Environment	-0.038 (-0.049 - -0.026)	<0.001	<0.001	***
	Hazing Observer Score	0.03 (0.018 - 0.042)	<0.001	<0.001	***
	University Stressors	0.026 (0.021 - 0.032)	<0.001	<0.001	***
	Hazing Opinion Score	0.019 (0.001 - 0.037)	0.039	0.061	
	Altruism	-0.013 (-0.217 - 0.191)	0.902	0.902	
Thoughts of death	Gender (non-cisgender)	1.746 (0.454 - 3.037)	0.008	0.013	*
	Marital Status (Single)	0.742 (0.285 - 1.199)	0.001	0.002	**
	Current City (capital) - Yes	0.474 (0.159 - 0.788)	0.003	0.006	**
	Sex (Male)	-0.466 (-0.788 - -0.144)	0.005	0.008	**
	Quota Holder (Yes)	0.452 (0.085 - 0.819)	0.016	0.022	*
	Moved from Origin City - Yes	0.233 (-0.108 - 0.574)	0.180	0.220	
	Organizational Religiosity	-0.215 (-0.315 - -0.116)	<0.001	<0.001	***
	Anxiety Symptoms	0.208 (0.186 - 0.23)	<0.001	<0.001	***
	Sponsorship - Yes	0.203 (-0.174 - 0.58)	0.290	0.319	
	Non-organizational Religiosity	-0.18 (-0.256 - -0.104)	<0.001	<0.001	***
	Family Income	-0.161 (-0.261 - -0.062)	0.002	0.004	**
	City of Origin (capital) -Yes	-0.135 (-0.462 - 0.191)	0.416	0.436	
	Intrinsic Religiosity	-0.132 (-0.17 - -0.094)	<0.001	<0.001	***
	Altruism	-0.132 (-0.334 - 0.069)	0.197	0.228	
	Age	-0.072 (-0.127 - -0.017)	0.011	0.016	*
	Hazing Victim Score	0.056 (0.034 - 0.078)	<0.001	<0.001	***
	Learning Environment	-0.041 (-0.052 - -0.03)	<0.001	<0.001	***
	School Semester	-0.04 (-0.09 - 0.009)	0.111	0.144	
	University Stressors	0.031 (0.026 - 0.036)	<0.001	<0.001	***
	Hazing Observer Score	0.027 (0.015 - 0.039)	<0.001	<0.001	***

	Hazing Opinion Score	0.026 (0.008 - 0.044)	0.005	0.008	**
	Race (White)	-0.005 (-0.331 - 0.32)	0.974	0.974	

Note: * p<0.05, ** p<0.01, *** p<0.001 after Benjamini-Hochberg correction. CI = Confidence Interval

Supplementary Table 3. LCA Conditional Probabilities

Item	Response	Moderate-Risk	High-Risk	Low-Risk
Item 1: Thoughts about death (lifetime)	class 1:	0.014	0.621	0.326
	class 2:	0.000	0.038	0.411
	class 3:	0.793	0.201	0.000
Item 2: Thoughts about death intensity (past year)	class 1:	0.111	0.475	0.208
	class 2:	0.000	0.000	0.013
	class 3:	0.816	0.144	0.028
Item 3: Suicidal thoughts/attempts (lifetime)	class 1:	0.421	0.362	0.105
	class 2:	0.015	0.125	0.289
	class 3:	0.959	0.033	0.005
Item 4: Suicidal ideation intensity (past year)	class 1:	0.323	0.539	0.089
	class 2:	0.000	0.046	0.044
	class 3:	0.997	0.000	0.003
Item 5: Suicide attempts (lifetime)	class 1:	0.873	0.090	0.021
	class 2:	0.523	0.273	0.115
	class 3:	0.996	0.004	0.000
Item 6: Suicide attempts (past year)	class 1:	0.987	0.013	0.000
	class 2:	0.765	0.205	0.018
	class 3:	0.998	0.002	0.000

Values represent P(response | class). N = 1024 with complete data. BIC = 10154.4; AIC = 9745.1.

Class sizes: Moderate-Risk (n=422); High-Risk (n=169); Low-Risk (n=433).

Supplementary Table 4. LCA Model Fit Comparison (2–5 classes)

No. Classes	Log-Likelihood	Parameters	G^2	AIC	BIC	
2	-5,197	55	2,616	10,505	10,776	
3	**-4,790**	**83**	**1,801**	**9,745**	**10,154**	✓
4	-4,632	111	1,485	9,486	10,033	
5	-4,528	139	1,278	9,334	10,019	

G^2 = likelihood-ratio chi-square; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion.

The 3-class solution was selected based on the lowest BIC and substantive interpretability.

Supplementary Table 5. Sensitivity — LCA (complete cases vs. MI)

Dataset	Moderate-Risk (%)	High-Risk (%)	Low-Risk (%)	BIC	AIC	N
Complete-cases	**41.2**	**16.5**	**42.3**	**10,154**	**9,745**	**1,024**
1	48.0	35.6	16.5	10,187	9,778	1,026
2	16.5	42.3	41.2	10,170	9,760	1,026
3	41.1	42.3	16.6	10,175	9,766	1,026
4	49.8	16.5	33.7	10,180	9,771	1,026
5	16.4	33.2	50.4	10,179	9,770	1,026

Class proportions (%) from 3-class LCA solutions. Row 1: original complete-case analysis.

Rows 1–5: LCA re-estimated on each multiply imputed dataset (m = 20, first 5 shown).

BIC = Bayesian Information Criterion; AIC = Akaike Information Criterion; N = sample size.

Supplementary Table 6. Sensitivity — Regression (complete case vs. MI)

		Complete Case	Complete Case	Multiple Imputation	Multiple Imputation		Concordance	Concordance
Outcome	**Predictor**	**B (95% CI)**	**p**	**B**	**p**	**Δ%**	**Direction**	**Significance**
Depressive Symptoms (PHQ-9)	Anxiety Symptoms (GAD-7)	0.851 (0.808 to 0.893)	<0.001	0.851	<0.001	0%	Yes	Yes
	University Stressors (MSSF)	0.136 (0.124 to 0.148)	<0.001	0.134	<0.001	1.5%	Yes	Yes
	Learning Environment (JHLES)	-0.173 (-0.204 to -0.143)	<0.001	-0.159	<0.001	8.1%	Yes	Yes
	Hazing Victimization	0.172 (0.113 to 0.231)	<0.001	0.168	<0.001	2.3%	Yes	Yes
	Hazing Observer	0.077 (0.046 to 0.108)	<0.001	0.076	<0.001	1.3%	Yes	Yes
Anxiety Symptoms (GAD-7)	University Stressors (MSSF)	0.116 (0.104 to 0.127)	<0.001	0.115	<0.001	0.9%	Yes	Yes
	Learning Environment (JHLES)	-0.130 (-0.158 to -0.101)	<0.001	-0.118	<0.001	9.2%	Yes	Yes
	Hazing Victimization	0.146 (0.092 to 0.201)	<0.001	0.144	<0.001	1.4%	Yes	Yes
	Hazing Observer	0.067 (0.039 to 0.096)	<0.001	0.067	<0.001	0%	Yes	Yes

CC = complete-case; MI = multiple imputation (m = 20, predictive mean matching).

Δ% = absolute percent change in estimate. Dir. = direction concordance; Sig. = significance concordance.

✓ = concordant; ✗ = discordant.

Supplementary Figure 1. STROBE Participant Flowchart