Brazilian Journal of Psychiatry
bjp
Revista Brasileira de Psiquiatria

Braz J Psychiatry. 2026;48:e20254113
doi:10.47626/1516-4446-2025-4113
Brazilian Psychiatric Association

CC BY

ORIGINAL ARTICLE

Latent class analysis of academic adjustment and mental health among Brazilian college students: association with depression and suicide ideation

Camila Siebert **Altavini**,[1,2] Geilson Lima **Santana**,[1] Laura Helena **Andrade**,[1] Lúcio Garcia **Oliveira**,[3] Arthur Guerra **Andrade**,[1,3] Clarice **Gorenstein**,[1,4] Yuan-Pang **Wang**[1]

[1]*Departamento de Psiquiatria, Instituto de Psiquiatria (LIM-23), Hospital das Clínicas, Faculdade de Medicina, Universidade de São Paulo (USP), São Paulo, SP, Brazil.* [2]*Centro de Atendimento e Estudos Psicológicos, Instituto de Psicologia, Universidade de Brasília, Brasília, DF, Brazil.* [3]*Faculdade de Medicina, Fundação do ABC, Santo André, SP, Brazil.* [4]*Instituto de Ciências Biomédicas, USP, São Paulo SP, Brazil.*

Objective: Suicide is a leading cause of death among youth aged 15-29, with rates of suicidal thoughts and behaviors increasing over the years. University students, facing the challenges of early adulthood alongside mental health issues, are particularly at risk. Effective prevention strategies are urgently needed, but knowledge gaps hinder intervention efforts. This study aimed to identify specific subgroups within Brazilian college students and examine their relationship with suicidal ideation (SI) and depression.
Methods: Using academic and mental health indicators from a cross-sectional national survey (n=12,245), a latent class analysis was conducted to identify subgroups based on similar characteristics. Logistic regression was used to identify potential associations of identified classes with SI and depressive symptoms (DS).
Results: Four distinct classes emerged: ordinary, psychologically distressed, dissatisfied, and binge drinkers. The psychologically distressed and dissatisfied subgroups were associated with higher odds of SI (OR = 7.90, 95%CI 1.94-32.22; 8.12, 95%CI 2.27-29.02, respectively) and DS (OR = 28.77, 95% CI 6.43-128.75; 13.63, 95%CI 3.47-53.59, respectively).
Conclusion: Students facing academic adjustment and mental health issues are potentially vulnerable to SI and DS. Universities must monitor the impact of academic life on mental health, identify at-risk students, and provide appropriate support. Further research on suicide-related vulnerabilities can guide prevention strategies in educational settings.

Keywords: Suicide; young adult; students; depression; Brazil

Introduction

The increasing incidence of suicidal thoughts and behavior (STB) among youth is worrisome and represents a wake-up call to understand its epidemiology and develop preventive strategies.[1-3] During the adulting process, youths take greater responsibility and independence than in adolescence. Additionally, college students are challenged with demanding academic routines.

Previous studies found associations of STB with low social connectedness, early-life adversities, mood and substance-use disorders, and school-related problems.[4-9] However, the predictive value of individual risk factors is limited regarding STB for the general population.[10] A person-centered approach that combines multiple factors could be more effective in detecting vulnerable individuals in epidemiological studies.[11] We hypothesize that students can be clustered into subgroups based on academic adjustment and mental health indicators and that these subgroups could have distinct likelihood of reporting suicidal ideation (SI), depressive symptoms (DS), risky behaviors, and low academic achievement. To the best of our knowledge, no study has examined patterns of academic adjustment and mental health indicators while measuring their relationship to suicide ideation. A recent meta-analysis[12] revealed that over 70% of studies on depression, anxiety, and suicidal behavior among Brazilian students use non-representative samples, often focusing on medical students and other health professions, which limits generalizability. Additionally, previous studies investigating depression and STB in subgroups of youth or college students in other countries have often been limited to mental health or other health-related indicators, not including academic adjustment variables.[13-18] The present study not only uses a representative sample, but the chosen person-centered

Correspondence: Camila Siebert Altavini, Centro de Atendimento e Estudos Psicológicos, Instituto de Psicologia, Campus Darcy Ribeiro, Universidade de Brasília, CEP 70904-970, Brasília, DF, Brazil.
E-mail: camila.saltavini@gmail.com
Submitted Jan 08 2025, accepted Jul 03 2025.

How to cite: Altavini CS, Santana GL, Andrade LH, Oliveira LG, Andrade AG, Gorenstein C, et al. Latent class analysis of academic adjustment and mental health among Brazilian college students: association with depression and suicide ideation. Braz J Psychiatry. 2026;48:e20254113. http://doi.org/10.47626/1516-4446-2025-4113

statistical approach could help identify subgroups of students vulnerable to STB.

Latent class analysis (LCA) allows grouping of individuals with similar characteristics within heterogeneous populations. By combining observable variables, LCA is a person-centered approach that categorizes complex real-world patterns that would otherwise be hard to depict.[19] In the present study, our primary aim is to identify subgroups of Brazilian college students, defined by academic adjustment and mental health indicators, within a nationally representative sample (n=12,245). Secondarily, we aim to analyze the association of these subgroups with SI, DS, risky behaviors, and low academic achievement. These findings could help in the early identification of psychologically distressed and at-risk students.

Methods

Sampling

Using a cross-sectional design, this nationwide study investigated the use of alcohol, tobacco, and other drugs among college students from 27 Brazilian state capitals.[20] A probabilistic and stratified sample from higher education institutions (HEIs) was randomly selected and participants were recruited in a two-stage sampling process. Two HEIs (one each with public and private funding) from each state capital were selected, for a total of 114 institutions. The participating HEIs provided a list of all classroom-based undergraduate programs, from which classes were randomly selected. ''Classes'' refers to groups of students enrolled in a particular subject during their undergraduate program. The data collection process was completed in 2009.

Students from selected classes were invited to participate in the study. Considering the students in class during the survey, the response rate was 95.6%. All students regularly enrolled and who were present in the classroom during the questionnaire application were eligible. A total of 12,245 valid questionnaires were considered for analysis after excluding those who stated using the dummy drug Relevin and those who did not answer the suicide ideation item. The dummy drug Relevin was a fictitious medication included in the questionnaire to identify unreliable responses, thus ensuring the dataset's quality and validity. More details about the sampling process and statistical corrections can be found elsewhere.[20]

Instruments

The students completed an anonymous, structured, and self-administered questionnaire with 98 closed items focusing on drug use and related disorders, risky behavior, and psychiatric comorbidity, as well as sociodemographic and academic-life characteristics.

DS were assessed using the Beck Depression Inventory-II (BDI-II), dichotomized to indicate the presence (score $\geqslant$ 11) or absence of depression.[21] The BDI-II is a validated self-reporting tool for assessing DS in the Brazilian Portuguese-speaking population.[21] To assess SI, we used BDI-II item #9, which asks the individual to choose which of the following statements best describes their feelings during the last 15 days: 0) ''I don't have thoughts of killing myself''; 1) ''I have thoughts of killing myself, but I would not carry this out''; 2) ''I would like to kill myself''; 3) ''I would kill myself if I had the chance.'' We defined SI in a broader sense, including any cognition of killing oneself even if one would not carry it out.[22,23] Accordingly, item #9 was dichotomized into a yes/no variable to denote the presence or absence of suicide ideation, as in previous literature.[24-26]

The construct of psychological distress was investigated using the self-administered version of the K6 Scale, designed to discriminate probable cases of mental illness from non-cases.[27] This tool uses six items with a five-point Likert scale to assess the frequency of reported symptoms, ranging from all the time (4) to never (0). The K6 scale was designed as a one-factor instrument to capture psychological distress around the threshold of clinical significance in the past 30 days, covering depressed mood, motor agitation, fatigue, worthlessness, and anxiety.[27,28] The higher the K6 score, the higher the level of psychological distress. The reliability of the K6 scale was good, with a Cronbach's alpha of 0.89. Regarding criterion validity, a sensitivity of 0.36 (standard error [SE] = 0.08) and a specificity of 0.96 (SE = 0.02) were established.[27,29] For analytical purposes, the K6 score was dichotomized to indicate the presence (score $\geqslant$ 6) or absence of psychological distress.[30]

Four questions from the Self-Report Questionnaire (SRQ) investigate past-month unusual experiences (e.g., hearing voices that others cannot, suspicions of being followed). Participants were asked to answer yes or no: 1) ''Do you feel that somebody has been trying to harm you in some way?''; 2) ''Are you a much more important person than most people think?''; 3) ''Have you noticed any interference or anything else unusual with your thinking?''; and 4) ''Do you ever hear voices without knowing where they come from or which other people cannot hear?'' The SRQ is recommended by the World Health Organization (WHO) for quick detection and classification of community-dwelling individuals presenting persecutory symptoms, especially in developing countries.[31,32] Despite being quite common in the general population (and sometimes of no clinical significance), unusual psychotic-like experiences can be associated with reduced psychological functioning and poorer health status.[33,34] For analysis, the SRQ items were combined into a dichotomized variable to denote the presence or absence of such experiences.

The Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) structured questionnaire was used to collect substance use information. Our analysis focused on past-month binge drinking behavior[35] and general use of non-prescribed substances (inhalants, marijuana, cocaine, crack-cocaine, cocaine paste, amphetamines, anticholinergics, tranquilizers, opiate analgesics, sedatives, anabolic androgenic steroids, hallucinogens, ecstasy, and synthetic drugs). We combined the general non-prescribed drug items into a dichotomized item to indicate non-users and users. The ''social activities'' variable was categorized considering if the student took part in none, one, or two or more activities that involved interaction with other persons.

Further relevant topics were addressed in the survey tool by individual questions, such as academic performance in the last semester ("In the past semester or academic year, you have: 1) Passed all subjects; 2) Resat the exam but passed these subjects; 3) Pending subjects, but have not missed the year; 4) Repeated the year"), thoughts about dropping out the program or taking leave ("Regarding your undergraduate course [circle only one answer]: 1) I've never thought of dropping out of the course or taking a leave of absence; 2) I've thought of dropping out of the course or taking a leave of absence; 3) I took a leave of absence once"), current satisfaction with the chosen undergraduate program ("Are you satisfied with the undergraduate course you have chosen?"), and social activities when not in class ("Except for your vacation period, which activities do you usually engage in when out of classroom?; 1) I take part in student organizations [academic center/fraternity]; 2) I take part in academic projects guided by one or more professors; 3) I take part in physical or sporting activities; 4) I take part in competitive intercollegiate sports; 5) I study outside class hours; 6) I interact and spend time with my friends; 7) I watch TV or videos/DVDs; 8) I play video or PC games; 9) I use the internet for fun [social networks, chat rooms, music, games and other types of online entertainment]; 10) I send and receive emails; 11) I use instant messengers [e.g., MSN]; 12) Other hobbies [reading books for pleasure, playing musical instruments, singing in choirs, drawing, painting, and other artistic activities]; 13) Volunteer work; 14) Paid employment"). To better control for the effect of outliers, the variable "age" was categorized into four categories: under 18 years, 18-24, 25-34, and 35 or older. Economic strata were defined according to the Brazilian Association of Research Companies.[36]

Analysis

The LCA method was used to group individuals based on shared features by identifying data covariance patterns in responses. The best-fitting model was selected, and posterior probabilities were saved into a new dataset for the inclusion of covariates and outcomes.[37,38] Then, a logistic regression was conducted to examine relationships of identified latent classes with covariates and outcomes. Correction weights were applied to adjust for sampling error.

We built the model based on previous findings.[9] The variable-specific entropy was considered when examining the quality of individual items, and those with near-zero values were removed from the model.[39] The latent-class model included indicators for academic adjustment (thoughts about dropping out or taking leave, satisfaction with the chosen course) and past-month mental health (psychological distress, unusual experiences, non-prescribed drug use, and binge drinking behavior). We then examined associations of identified latent classes with the outcomes SI, DS, risky behavior, and academic achievement, adjusting for the covariates age, sex, economic status, HEI funding (public or private), employment, and social activity. Figure 1 provides a path diagram of the analysis. To facilitate reading and interpretation of the

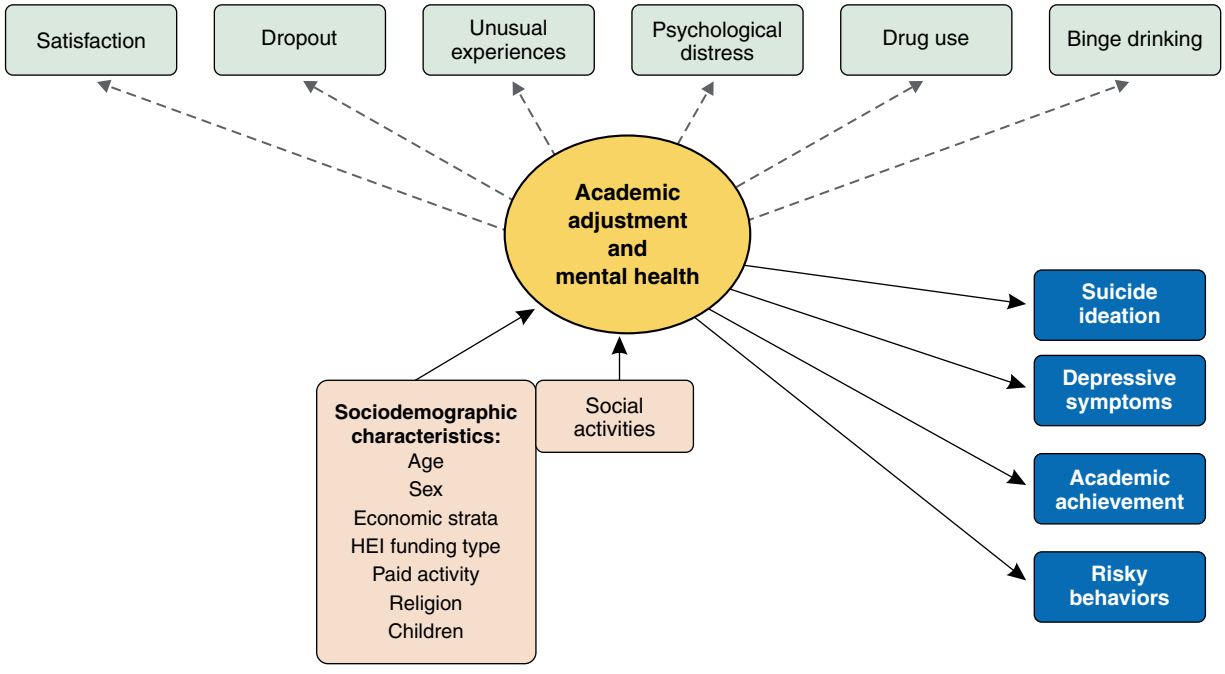


Figure 1 Path diagram for the latent class analyses, including covariates and outcomes. The diagram illustrates the relationships between various factors such as academic adjustment, mental health, sociodemographic characteristics, and behaviors like drug use and binge drinking. The arrows indicate potential influences among these variables. The variables on the upper side of the figure represent the latent class indicators, the covariates are at the bottom, and the outcomes are on the right side of the figure, represented by the blue boxes. HEI = higher education institutions.

results, we labeled the model as an ''academic adjustment and mental health'' model.

SI provides important information for assessing and preventing suicide,[40] as it is associated with future suicidal behavior.[10,41] DS were a separate outcome to prevent overlap with SI, as both were assessed with the BDI-II. Depression, identified as the most common mental disorder among college students,[7] is a major suicide risk factor.[42,43] Additionally, it also relates to psychological distress and challenges in academic life.[8] Academic achievement was also considered as an outcome due to its potential impact on academic adjustment and mental health issues.[44]

We tested different models with increasing numbers of classes to find the best fit for identifying patterns of academic adjustment and mental health. The model fit was assessed by combining theoretical understanding of students' mental health,[7-9] information criteria (Akaike's information criterion [AIC], Bayesian information criterion [BIC], sample-adjusted BIC [ABIC], and consistent AIC [CAIC]), diagnostic criteria (e.g., entropy, class counts, average latent class posterior probability), and the interpretability of the different models, as recommended.[11] Supplementary Table S1 presents the results of information and diagnostic criteria for each *k*-class solution tested.

The relationship between the identified classes with outcomes was examined using a logistic regression, adjusting for covariates. Highly skewed covariates were removed from the final logistic regression models, as recommended (Muthén L, 2024, personal communication via email).

STATA version 15.0[45] was used to run descriptive statistics, using the survey option (*svy* command) to adjust for sampling error and unequal probability of selection. For the target population, prevalence estimates and regression analyses are presented as weighted indicators. For the LCA and logistic regression analysis, we used Mplus software, version 8.10.[46] The logistic regression statistical tests were two-tailed with a significance level of 5%.

Ethics statement

All participants provided written informed consent before data collection. The Ethics Committee for the Analysis of Research Projects at the Faculdade de Medicina, Universidade de São Paulo, approved the present study (protocol #4.711.369).

Results

The mean age of our sample was 25 years (SD = 7.81); 57.5% of participants were women. Most participants had never been married (77.2%), identified as White (62.2%), and followed a religion (84.7%). Around half came from middle-to-high-income families (48.7%), and most attended privately funded HEIs (77.7%). Nearly half reported past-month unusual experiences (49%), while 32.5% reported past-month psychological distress. Additionally, 25.7% endorsed DS, and 5.9% reported SI within the last 2 weeks. Regarding substance use, 24.4% of students indicated past-month use of non-prescribed drugs, while the majority (58.5%) reported engaging in binge-drinking behaviors. Detailed weighted proportions of sociodemographic characteristics are presented in previous analyses.[9] Table 1 provides the weighted proportions for the LCA model variables, covariates, and outcomes.

Table 1 Weighted proportions of the college students' academic and mental health characteristics from the I Levantamento Nacional sobre o Uso de Álcool, Tabaco e Outras Drogas entre Universitários das 27 Capitais Brasileiras, 2009 (n=12,245)

Variable	
Academic characteristics	
Satisfaction with course	
No	997 (7.75)
Yes	11,201 (92.25)
Drop-out thoughts	
Never thought about dropping out or taking a leave of absence	7,866 (63.99)
Have thought about dropping out or taking a leave of absence	3,721 (28.95)
Have already taken a leave of absence	606 (7.06)
Academic achievement	
Passed all courses	10,317 (86.06)
Repeated the year	192 (2.47)
Other	1,284 (11.47)
Mental health and substance use	
High-risk behaviors	
None	6,463 (57.19)
At least one	4,694 (42.81)
Depressive symptoms	
No	8,344 (74.32)
Yes	2,818 (25.68)
Suicidal ideation	
No	11,377 (94.08)
Yes	868 (5.92)
Psychological distress	
No	7,406 (67.55)
Yes	3,718 (32.45)
Unusual experiences	
None	5,937 (50.91)
At least one	5,757 (49.09)
Drug consumption	
No	9,912 (75.64)
Yes	2,333 (24.36)
Binge drinking	
No	4,071 (41.48)
Yes	5,499 (58.52)

Data presented as n (%) (weighted proportion of the full sample).

Figure 2 shows the conditional item probability for the 4-class LCA model. The x-axis represents the six items, while the y-axis shows the probability of endorsing a given item. More than half of the students were clustered into the binge-drinkers class. These students exhibited overall satisfaction with the course, a probability of approximately 0.25 of considering dropping out of college or taking a leave of absence, less than 0.5 probability of reporting unusual experiences, zero endorsement for psychological distress, 0.27 probability of using drugs, and a higher probability of engaging in binge drinking behavior than other classes (0.74). The class of distressed students (26.3% of students) also reported overall satisfaction with the course, a slightly higher probability (0.36) of considering dropping out, higher probabilities of unusual

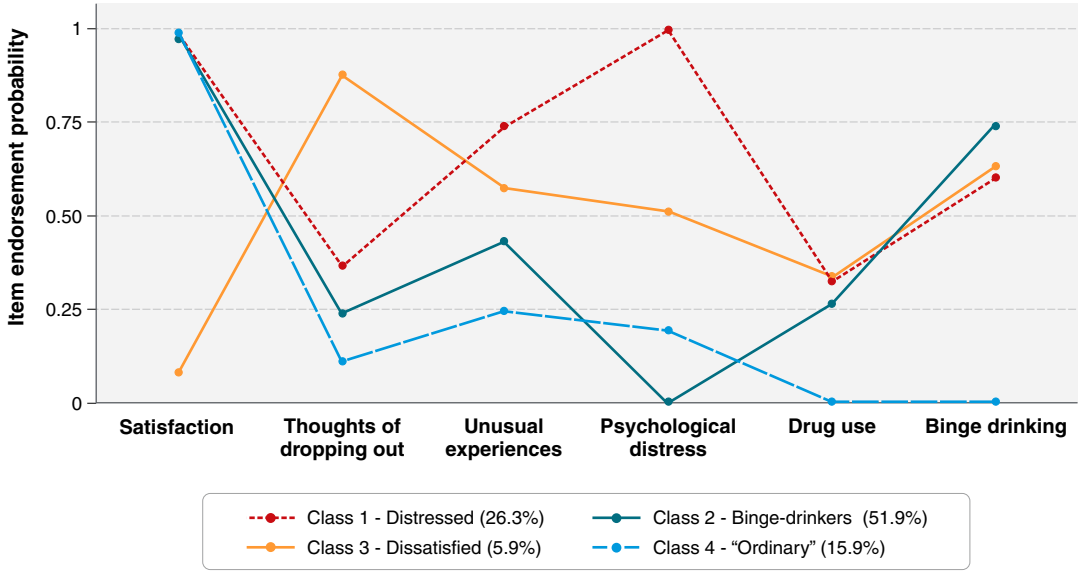


Figure 2 Conditional item probability plot for the 4-class latent class analyses (LCA) model of academic adjustment and mental health. This graph illustrates the conditional item probability towards academic adjustment and mental health indicators among four classes: Class 1, distressed (26.3%); Class 2, binge-drinkers (51.9%); Class 3, dissatisfied (5.9%); and Class 4, ordinary (15.9%). The y-axis represents the item endorsement probability ranging from 0 to 1, while the x-axis lists factors such as satisfaction, thoughts of dropping out, unusual experiences, psychological distress, drug use, and binge drinking.

Table 2 Associations between class membership and outcomes

	OR (95%CI)			
	Ordinary (Class 4)	Binge drinkers (Class 2)	Psychologically distressed (Class 1)	Dissatisfied (Class 3)
Suicidal ideation	1.00	0.83 (0.14-4.93)	7.90 (1.94-32.22)	8.12 (2.27-29.02)
Depressive symptoms	1.00	3.08 (0.54-17.52)	28.77 (6.43-128.75)	13.63 (3.47-53.59)
Low academic achievement	1.00	1.87 (0.12-29.13)	1.64 (0.15-18.16)	3.26 (0.44-24.22)
Risky behaviors	1.00	1.23 (0.70-2.16)	1.63 (0.90-2.94)	1.85 (1.00-3.40)

"Ordinary" as reference.
OR = odds ratio.

experiences (0.74), and psychological distress (1.00), somewhat higher probability of overall drug use (0.33) and a slightly lower tendency for binge drinking behavior (0.60). The ordinary class held 15.9% of students, characterized by the highest level of satisfaction (0.98), the lowest probability of considering dropping out (0.11), the lowest levels of unusual experiences (0.24), 0.20 probability of psychological distress, and no endorsement for drug use and binge drinking behavior. Finally, the dissatisfied class was the least frequent (5.9% of students), characterized by the lowest levels of satisfaction with the course (0.08), the highest probability of considering dropping out (0.88), 0.57 probabilities of reporting unusual experiences, and 0.51 for psychological distress, 0.34 probability of engaging in drug use, and 0.63 probability of engaging in drinking behavior.

In brief, we found four student classes: Class 2 (51.9%), represented by a higher probability of engaging in binge drinking behavior, labeled as "binge drinkers"; Class 1 (26.3%), with a higher probability of unusual experiences and psychological distress, labeled as "distressed"; Class 4 (15.9%), reporting high satisfaction with the course, low desire to drop out, low levels of mental health problems, and low drug use and binge drinking, considered "ordinary" students; and Class 3 (5.9%) representing the "dissatisfied" students, with a higher likelihood of considering dropping out. Despite not being a central focus of this study, results indicated that "binge drinkers" and "dissatisfied" students were less likely to be women compared with the "ordinary" class. No other significant sociodemographic differences were found among classes (Supplementary Table S2).

Findings from logistic regression (Table 2) suggest that class membership may be linked to SI, DS, and risky behaviors, but not academic achievement. This indicates the presence of student subgroups with similar academic and mental health characteristics that may be associated with SI and DS.

As shown, the odds ratio (OR) for SI and DS was higher among psychologically distressed (SI: OR = 7.90, 95%CI 1.94-32.22; DS: OR = 28.77, 95%CI 6.43-128.75) and dissatisfied students (SI: OR = 8.12, 95%CI 2.27-29.02; DS: OR = 13.63, 95%CI 3.47-53.59). It is noteworthy, however, that the CIs are too large, which hinders the accuracy of estimates. Dissatisfied students also presented a higher likelihood of engaging in risky

behaviors (OR = 1.85, 95%CI 1.00-3.40). There was also a marginally significant association between being psychologically distressed and risky behavior (OR = 1.63, 95%CI 0.90-2.94). There was no difference among classes regarding academic achievement.

Discussion

Using LCA, we identified four subgroups of undergraduate students regarding academic adjustment and mental health. To the best of our knowledge, no prior research has investigated the relationship of SI and DS with latent classes of academic adjustment and mental health indicators. Moreover, earlier research on depression and STB among young people or college students using similar statistical methods typically centered on mental health or health-related measures, overlooking factors related to academic adjustment.[13-18] Our large sample size and sampling methods allow generalization of findings for this population without overestimating the results. A representative sample of Brazilian students could even yield results generalizable for other Latin American countries and upper-middle-income countries which share comparable sociodemographic characteristics. Both academic life and mental health aspects can be combined to identify students in different subgroups. In our study, the dissatisfied class represented a minor proportion of students (5.9%), while at least one in four students was identified as psychologically distressed. The distressed class presented associations with SI and DS, whereas the dissatisfied class was associated not only with SI and DS, but also with risky behavior. Clustering students into subgroups can facilitate early identification of vulnerable students, which can be used as a roadmap for institutional policy for mental health promotion and STB prevention.

While the DS prevalence found herein (25.7%) is in line with previous studies using Brazilian college-student samples, the SI prevalence (5.9%) was lower.[12] Direct comparisons are unadvisable due to methodological differences. The limited sample sizes and lack of standardized definitions, tools, and measures hinder comparisons and highlight the need for representative research among college students. Less than one-third of studies about Brazilian college students used probabilistic sampling, and most were restricted to medical students,[12] which might lead to overestimations. While our initial findings provide valuable insights, wide 95%CIs indicate statistical imprecision and suggest considerable variability in the data, highlighting the importance of further research for a comprehensive understanding of mental health issues among Brazilian college students. Knowing population-specific stressors and protective factors can help in tailoring effective interventions.

In the final step of our analysis, the logistic regression results indicated that ''distressed'' students might have a higher prevalence of SI and DS. Dealing with the challenges of the adulting phase and demanding academic routines becomes even harder when low social-connectedness, early-life adversities, mood and substance-use disorders, and school-related problems are included in the basket.[4-6,8,43] These associations between psychological distress, DS, and SI serve as a warning call for stakeholders and reinforce the need for a broad policy for mental health promotion and suicide prevention strategies targeting college students.

The model also identified a group of ''dissatisfied'' students with a higher prevalence of SI, DS, and risky behaviors. The well-established association between health outcomes and life satisfaction argues in favor of a relationship between university satisfaction and SI, depression, and risky behaviors. Life satisfaction is known to be related to suicide-related outcomes.[47] It is plausible to hypothesize that students' satisfaction with their courses could influence their overall life satisfaction, as they spend most of their time at university, engaged in academic activities. This is especially true when social support is lacking and pressures for academic and professional success are high. Considering these findings, university staff should be vigilant in recognizing both explicit and implicit signs of student dissatisfaction so that they can identify vulnerable individuals at risk not only for DS and SI but also for risky behaviors that could result in serious and irreparable harm.

Our results suggest that monitoring and tutoring specific subgroups of college students, defined on the basis of academic adjustment and mental health, can help identify those most at risk. Timely actions from university policymakers and managers are needed to address these challenges. Early identification of socio-academic vulnerabilities is crucial for implementing preventive initiatives, supporting students with personal and social difficulties, and ensuring access to mental health services and academic support. Due to limited evidence, university staff often take *ad hoc* measures in response to observed demands.[48] One example of these measures is the implementation of a tutoring system where professors monitor the academic and extracurricular challenges of small group of students. These actions, akin to gatekeeping, enable early detection and referral to health services. However, many preventive actions in Brazilian universities are underreported and insufficiently evaluated.

There is an evident need for more representative research using standardized outcomes to confirm vulnerabilities. Prospective studies should be able to identify temporal relationships among these variables. Youth suicide leads to too many potential years of life lost, highlighting the need for a better understanding of this phenomenon and the development of effective evidence-based prevention strategies.

While LCA is an effective statistical technique, it has limitations. Individuals are assigned to classes based on their indicator variable scores. Additionally, since class assignment is probabilistic, the exact number or proportion of sample members in each class cannot be precisely determined. Furthermore, there is the risk of ''naming fallacy,''[11] as researchers name the identified classes, which may not always accurately reflect class membership. While our analytical approach helps control for confounding factors and potential collinearity, caution is necessary when interpreting results to avoid overlooking

the multivariate complexities involved. Conversely, membership in different latent classes might be associated with the outcome variable due to overfitting. An additional limitation is that our sample was recruited from state capitals. Thus, stated findings may only be generalizable to students living in urban areas. Although the questionnaire was built using reliable and validated instruments, recall errors and information biases cannot be ruled out when using self-administered questionnaires. Additionally, as respondents may be reluctant to disclose sensitive or embarrassing facts (e.g., drug use and suicide-related questions), the possibility of response biases should not be excluded. It is also important to note that unusual psychotic-like experiences can be quite common in the general population, and sometimes have no clinical significance; therefore, this indicator should be interpreted with caution. Since data collection in 2009, college students' characteristics have changed, making the need for updated studies with representative samples addressing students' mental health even more urgent. Finally, our cross-sectional design precludes any inference of causality between associations and outcomes of interest.

This study enhances the understanding of STB among young adults by being the first to explore potential subgroups of college students based on mental health and academic factors combined. The findings show that students can be clustered into subgroups with similar traits of academic adjustment and mental health, which, in turn, can be related to SI, depression, and risky behavior. These outcomes, along with social and individual vulnerabilities, are recognized risk factors for STB. The present results can serve as a starting point for the development of in-campus interventions. By assessing students' vulnerabilities and needs while considering cultural, social, and institutional contexts, universities can effectively tailor policies and interventions. Using predefined indicators, institutions can identify key issues and address them with strategic actions. Students struggling with academic adjustment, dissatisfaction, or expressing a desire to drop out should be considered as a potentially vulnerable group. Implementation of preventive strategies, including facilitating access to healthcare and educational support, is crucial for supporting vulnerable students and promoting their well-being.

Acknowledgements

Data collection for this study was supported by the Secretaria Nacional de Políticas sobre Drogas (SENAD), Brazilian Ministry of Health. The agency had no further influence on the results reported herein, the decision to disseminate the analytical strategy, or the contents of this article.

The authors thank Linda Muthén and the Mplus support service team for their support with statistical analysis and data management.

Disclosure

The authors report no conflicts of interest.

Data availability statement

The data that support this study are not publicly available.

Author contributions

CSA: Conceptualization, Formal analysis, Methodology, Project administration, Software, Writing – original draft, Writing – review & editing.
GLS: Conceptualization, Data curation, Formal analysis, Methodology, Software, Writing – original draft.
LHA: Resources, Writing – review & editing.
LGO: Data curation, Funding acquisition, Methodology.
AGA: Funding acquisition, Resources.
CG: Resources, Validation.
YPW: Conceptualization, Data curation, Formal analysis, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing.
All authors have read and approved the final version to be published.

Handling Editor: Natan Gosmann

References

1 Alves FJO, Fialho E, de Araújo JAP, Naslund JA, Barreto ML, Patel V, et al. The rising trends of self-harm in Brazil: an ecological analysis of notifications, hospitalisations, and mortality between 2011 and 2022. Lancet Reg Health Am. 2024;31:100691.
2 Van Meter AR, Knowles EA, Mintz EH. Systematic review and meta-analysis: international prevalence of suicidal ideation and attempt in youth. J Am Acad Child Adolesc Psychiatry. 2023;62:973-86.
3 Lipson SK, Zhou S, Abelson S, Heinze J, Jirsa M, Morigney J, et al. Trends in college student mental health and help-seeking by race/ethnicity: Findings from the national healthy minds study, 2013–2021. J Affect Disord. 2022;306:138-47.
4 Drum DJ, Brownson C, Denmark AB, Smith SE. New data on the nature of suicidal crises in college students: shifting the paradigm. Prof Psychol Res Pr. 2009;40:213-22.
5 Aggarwal S, Patton G, Reavley N, Sreenivasan SA, Berk M. Youth self-harm in low- and middle-income countries: Systematic review of the risk and protective factors. Int J Soc Psychiatry. 2017;63:359-75.
6 Li W, Dorstyn DS, Jarmon E. Identifying suicide risk among college students: a systematic review. Death Stud. 2020;44:450-8.
7 Auerbach RP, Mortier P, Bruffaerts R, Alonso J, Benjet C, Cuijpers P, et al. WHO World Mental Health Surveys International College Student Project: prevalence and distribution of mental disorders J Abnorm Psychol. 2018;127:623-38.
8 Sheldon E, Simmonds-Buckley M, Bone C, Mascarenhas T, Chan N, Wincott M, et al. Prevalence and risk factors for mental health problems in university undergraduate students: a systematic review with meta-analysis. J Affect Disord. 2021;287:282-92.
9 Altavini CS, Asciutti APR, Santana GL, Solis ACO, Andrade LH, Oliveira LG, et al. Suicide ideation among Brazilian college students: Relationship with academic factors, mental health, and sexual abuse. J Affect Disord. 2023;329:324-34.
10 Franklin JC, Ribeiro JD, Fox KR, Bentley KH, Kleiman EM, Huang X, et al. Risk factors for suicidal thoughts and behaviors: a meta-analysis of 50 years of research. Psychol Bull. 2017;143:187-232.
11 Weller BE, Bowen NK, Faubert SJ. Latent class analysis: a guide to best practice. Int J Forensic Ment Health. 2020;46:287-311.
12 Demenech LM, Oliveira AT, Neiva-Silva L, Dumith SC. Prevalence of anxiety, depression and suicidal behaviors among Brazilian undergraduate students: a systematic review and meta-analysis. J Affect Disord. 2021;282:147-59.
13 Nelon JL, De Pedro KT, Gilreath TD, Patterson MS, Holden CB, Esquivel CH. A latent class analysis of the co-occurrence of sexual violence, substance use, and mental health in youth. Subst Use Misuse. 2019;54:1938-44.

14 Hayes JA, Petrovich J, Janis RA, Yang Y, Castonguay LG, Locke BD. Suicide among college students in psychotherapy: individual predictors and latent classes. J Couns Psychol. 2020;67:104-14.
15 Pérez T, Pardo MC, Cabellos Y, Peressini M, Ureña-Vacas I, Serrano DR, et al. Mental health and drug use in college students: should we take action? J Affect Disord. 2023;338:32-40.
16 Marraccini ME, Brick LA, O'Neill JC, Weyandt LL, Buchanan AL. Self-injurious thoughts and behaviors among college students: a latent class analysis. Arch Suicide Res. 2021;25:731-50.
17 Li L, Wang P, Zhao Q, Liu Z, Li S, Wang X. Latent profile analysis of depressive symptoms in college students and its relationship with physical activity. J Affect Disord. 2024;351:364-71.
18 Jiang Y, Ding C, Shen B. Latent profile analysis of mental health among Chinese university students: evidence for the dual-factor model. Healthcare (Basel). 2023;11:2719.
19 Nylund-Gibson K, Garber AC, Singh J, Witkow MR, Nishina A, Bellmore A. The utility of latent class analysis to understand heterogeneity in youth coping strategies: a methodological introduction. Behav Disord. 2023;48:106-20.
20 Brasil, Presidência da República Secretaria Nacional de Políticas sobre Drogas. I Levantamento nacional sobre o uso de álcool, tabaco e outras drogas entre universitários das 27 capitais brasileiras. Brasília: SENAD; 2010.
21 Gomes-Oliveira MH, Gorenstein C, Neto FL, Andrade LH, Wang YP. Validation of the Brazilian Portuguese Version of the Beck Depression Inventory-II in a community sample. Braz J Psychiatry. 2012;34:389-94.
22 Wenzel A, Brown GK, Beck AT, Duarte MF, Piccoloto NM. Terapia cognitivo-comportamental para pacientes suicidas. Porto Alegre: Artmed; 2010.
23 American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders – DSM-5-TR. 5th ed. Arlington: American Psychiatric Publishing; 2022.
24 Fitzpatrick KK, Witte TK, Schmidt NB. Randomized controlled trial of a brief problem-orientation intervention for suicidal ideation. Behav Ther. 2005;36:323-33.
25 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;13:230-46.
26 Farabaugh A, Bitran S, Nyer M, Holt DJ, Pedrelli P, Shyu I, et al. Depression and suicidal ideation in college students. Psychopathology. 2012;45:228-34.
27 Kessler RC, Andrews G, Colpe LJ, Hiripi E, Mroczek DK, Normand SLT, et al. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. Psychol Med. 2002;32:959-76.
28 Kessler RC, Green JG, Gruber MJ, Sampson NA, Bromet E, Cuitan M, et al. Screening for serious mental illness in the general population with the K6 screening scale: results from the WHO World Mental Health (WMH) survey initiative. Int J Methods Psychiatr Res. 2010; 19 Suppl 1:4-22.
29 Kessler RC, Barker PR, Colpe LJ, Epstein JF, Gfroerer JC, Hiripi E, et al. Screening for serious mental illness in the general population. Arch Gen Psychiatry. 2003;60:184-9.
30 Bruzeguini MV, Pereira TF, Pagel ML, Lemos TC, Prata ES, da Cruz KC, et al. Instrumentos de rastreio e diagnóstico de transtornos depressivos utilizados na atenção primária: uma revisão integrativa. Rev Bras Med Fam Comun. 2023;18:3817.
31 Harding TW, de Arango V, Baltazar J, Climent CE, Ibrahim HHA, Ladrido-Ignacio L, et al. Mental disorders in primary health care: a study of their frequency and diagnosis in four developing countries. Psychol Med. 1980;10:231-41.
32 Salleh MR. Psychiatric morbidity in schizophrenic relatives--use of Self-Reporting Questionnaires (SRQ). Singapore Med J. 1990;31: 457-62.
33 Unterrassner L, Wyss TA, Wotruba D, Ajdacic-Gross V, Haker H, Rössler W. Psychotic-like experiences at the healthy end of the psychosis continuum. Front Psychol. 2017;8:775.
34 Nuevo R, Chatterji S, Verdes E, Naidoo N, Arango C, Ayuso-Mateos JL. The Continuum of psychotic symptoms in the general population: a cross-national study. Schizophr Bull. 2012;38:475-85.
35 Centers for Disease Control and Prevention (CDC). What is excessive alcohol use? [Internet]. 2019 [cited 2021 Jul 03]. www.cdc.gov/alcohol/onlinemedia/infographics/excessive-alcohol-use.html
36 Associação Brasileira de Empresas de Pesquisa (ABEP). Critério de classificação econômica Brasil [Internet]. 2011 [cited 2021 Jul 03]. www.abep.org/criterio-brasil
37 Asparouhov T, Muthén B. Auxiliary variables in mixture modeling: three-step approaches using Mplus. Struct Equ Modeling. 2014;21:329-41.
38 Nylund-Gibson K, Grimm RP, Masyn KE. Prediction from latent classes: a demonstration of different approaches to include distal outcomes in mixture models. Struct Equ Modeling. 2019;26: 967-85.
39 Asparouhov T, Muthén B. Variable-specific entropy contribution. 2018 [cited 2025 Aug 13]. www.statmodel.com/download/UnivariateEntropy.pdf
40 Hawton K, Lascelles K, Pitman A, Gilbert S, Silverman M. Assessment of suicide risk in mental health practice: shifting from prediction to therapeutic assessment, formulation, and risk management. Lancet Psychiatry. 2022;9:922-8.
41 Large M, Corderoy A, McHugh C. Is suicidal behaviour a stronger predictor of later suicide than suicidal ideation? A systematic review and meta-analysis. Aust N Z J Psychiatry. 2021;55:254-67.
42 Bernanke J, Galfalvy HC, Mortali MG, Hoffman LA, Moutier C, Nemeroff CB, et al. Suicidal ideation and behavior in institutions of higher learning: a latent class analysis. J Psychiatr Res. 2017;95: 253-9.
43 Casey SM, Varela A, Marriott JP, Coleman CM, Harlow BL. The influence of diagnosed mental health conditions and symptoms of depression and/or anxiety on suicide ideation, plan, and attempt among college students: findings from the Healthy Minds Study, 2018–2019. J Affect Disord. 2022;298:464-71.
44 BlackDeer AA, Wolf DAPS, Maguin E, Beeler-Stinn S. Depression and anxiety among college students: understanding the impact on grade average and differences in gender and ethnicity. J Am Coll Health. 2023;71:1091-1102.
45 Stata Corp LLC. Stata statistical software. College Station, TX: Stata Corp LLC; 2017.
46 Muthén LK, Muthén BO. Mplus: statistical analysis with latent variables user's guide. Los Angeles, CA: Muthén & Muthén; 1998.
47 Goldman-Mellor SJ, Caspi A, Harrington H, Hogan S, Nada-Raja S, Poulton R, et al. Suicide attempt in young people: a signal for long-term health care and social needs. JAMA Psychiatry. 2014; 71:119-27.
48 Reifschneider EDB, Altavini CS, Beckmann CAA. Teaching suicide prevention: experiences from a social-ecological approach. In: Akerman M, Germani ACCG, eds. International handbook of teaching and learning in health promotion: practices and reflections from around the world. New York: Springer; 2022. p. 469-86.