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Sociodemographic, economic, and academic factors linked with resilience in university students during covid-19 pandemic: a Brazilian cross-sectional study

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Abstract

Background Resilience is a crucial factor in students' mental health, playing an important role in their successful adaptation to the academic environment. However, there is a lack of understanding about resilience and its associated factors in students from different undergraduate courses. This study aimed to describe the resilience profile of undergraduate students from various courses in Brazil and identify sociodemographic, economic, and academic factors associated with resilience.

Methods This study has data from a cross-sectional multicenter study involving undergraduate students from eight Federal Institutions of Higher Education in Minas Gerais, Brazil. The dependent variable was resilience, measured using the Connor-Davidson Resilience Scale (CD-RISC) 10-item version, with sociodemographic, economic, and academic factors considered independent variables. Data was collected virtually via a self-administered questionnaire between October 2021 and February 2022 (during the covid-19 pandemic). Independent samples t-tests and ANOVAs were conducted to compare resilience scores between independent variables, and Tukey's post-hoc test was performed when necessary. Multiple linear regression was performed to create three models.

Results 8,650 undergraduate students were included in this study. The average score on the resilience scale was 19.86 ± 8.15, with a normal distribution. The respondents ranged from 18 to 71 years old, averaging 23.9 ± 6.33. Being female, not having a religious belief, having low per capita family income, having had a decrease in the family income, not being heterosexual, or having the head of the family with a low education level were the main factors associated, individually, with low resilience scores in the sociodemographic and economic multiple linear regression model constructed. Being from linguistics, letters and arts courses, being enrolled in fewer subjects, or being from UFMG

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were the main factors associated, individually, with low resilience scores in the academic multiple linear regression model constructed.

Conclusions The study's findings revealed that sociodemographic, economic, and academic variables were significantly associated with resilience scores in undergraduates from Minas Gerais during the covid-19 pandemic. These findings can help universities develop target strategies to promote students' resilience and reduce the risk of poor mental health among this population.

Keywords Resilience, psychological, Mental Health, Students, Health Equity, COVID-19, Multicenter Study

Background

University students' mental health has been the subject of concern globally, as the presence of symptoms like anxiety, mood disorders, and substance use disorders are estimated to affect around one-third of students in their first academic year [1]. Suicidal ideation or attempts are also estimated to be high, at around 8.4 and 1%, respectively [2]. In Brazil, the number of students reporting some emotional difficulty, such as anxiety (58.4% in 2014 to 63.6% in 2018) or suicidal thinking (4.1% in 2014 to 8.5% in 2018) during their course, has been increasing [3].

Undergraduate students face specific demands as part of university life that may increase the risk of poor mental health [4]. This includes adapting to new living situation away from friends and family, changes in financial resources, and expectations regarding their educational performance [3–5]. Furthermore, there is evidence that the covid-19 pandemic has had an impact on students [6–8] as universities suspended face-to-face activities for a period before adopting remote teaching. These strategies might have resulted in negative psychological consequences for many students [9–11], who were forced to adjust to changes in their study, work, and social life routine [12, 13].

That not all students develop symptoms of poor mental health in response to the specific stresses of university life or the covid-19 pandemic [14], suggests there may be differences in how students cope with adversity. Resilience has been proposed as a protective factor which may help individuals, including undergraduate students, adapt to life events [5] and has also been linked to psychological well-being [15], psychological distress [16], and general mental health [17].

Despite disagreements about what resilience is [18], one established definition is "the capacity of a system to adapt successfully to significant challenges that threaten the function, viability, or development of the system" [19]. It is important to say that one's resilience can change over time, as well as being more present in some contexts whilst less so in others [18].

A number of factors have been linked to increased resilience [18], including personal characteristics, such as sex, relationships, and social and economic aspects [20]. Understanding factors related to resilience in undergraduate students could help identify those at most risk of developing poor mental health. This understanding could help the creation of target strategies to promote resilience in this population and to prevent the emergence or mitigate mental health problems in students [21].

Studies to date have mainly focused on students of specific student groups, such as those studying on health courses [22], but less is known about resilience across different courses and higher education institutions. Therefore, this study aimed to describe the resilience profile of undergraduate students from various courses of Federal Institutions of Higher Education in Minas Gerais and identify sociodemographic, economic and academic factors associated with resilience.

Methods

Study design and population

This cross-sectional study is part of a multicenter survey, "Symptoms of anxiety and depression disorder among university students in Minas Gerais: Prevalence and associated factors", referred to as the Project on Anxiety and Depression in University Students (PADu-multicenter). The PADu-multicenter was carried out with students enrolled in face-to-face and distance learning undergraduate courses during the second academic semester of 2021 at eight Federal Institutions of Higher Education (IFES) in Minas Gerais, Brazil: Universidade Federal de Ouro Preto (UFOP), Universidade Federal de Minas Gerais (UFMG), Universidade Federal de Uberlândia (UFU), Universidade Federal de Juiz de Fora (UFJF), Universidade Federal de São João del-Rei (UFSJ), Universidade Federal de Lavras (UFLA), Universidade Federal dos Vales do Jequitinhonha e Mucuri (UFVJM) and Universidade Federal de Alfenas (UNIFAL-MG). The PADu-multicenter project was conducted in accordance with the guidelines established by the Declaration of Helsinki and was approved by the Research Ethics Committee (CEP) of all participating IFES.

Minas Gerais is Brazil's second most populous state, with an estimated population of 20,538,718 inhabitants across 586,513,983 km², corresponding to approximately 10.1% of the population and 6.9% of the Brazilian territory [23]. The eight IFES participating in the study have

campuses in different municipalities in the State, as shown in the figure below [Fig. 1].

All students enrolled in undergraduate courses of the IFES during any academic period and aged 18 years or over were eligible for the study (118,828). Data from students who did not complete the entire questionnaire, were postgraduate or residency students, or were enrolled but were away from academic activities or on exchange during data collection were excluded. Data from 8,650 undergraduates (7.3% of the target population) were analyzed.

Data collection

Data was collected virtually between October 2021 and February 2022, lasting three months in each IFES. The research was publicized via IFES websites, social networks, and project social network (@padufederais), as well as tutoring programs, laboratories, study and research groups, centers, and academic directories. All eligible students received, via academic email, an invitation providing information about the study as well as the link to access the Free and Informed Consent Form (TCLE), and the self-administered and confidential questionnaire provided on Google Forms.

In the invitation email, all participants were informed about the voluntary nature of their involvement and the condition of anonymity. They were also informed of the research objectives, the steps to be taken, the risks and benefits of their participation, and their right to withdraw at any time from the study. The TCLE, approved by the CEP, was signed through an online check box before each student could then fill out the questionnaire, ensuring that each participant understood and agreed to the terms before proceeding. This consent form was then available for the student to download.

Instruments and study variables

The questionnaire included validated scales that have been used in national studies, and questions created and/or adapted by researchers to meet the project objectives.

To assess resilience, the 10 items of the reduced version of the Connor-Davidson Resilience Scale (CD-RISC-10), adapted to the Brazilian context by Solano [24], were used. The CD-RISC-10 is a single-factor scale that assesses individuals' perception of their ability to adapt to changes and overcome obstacles and illnesses [25]. The instrument is self-reported with a 5-point Likert scale, ranging from 0 (never true) to 4 (always true), is adapted

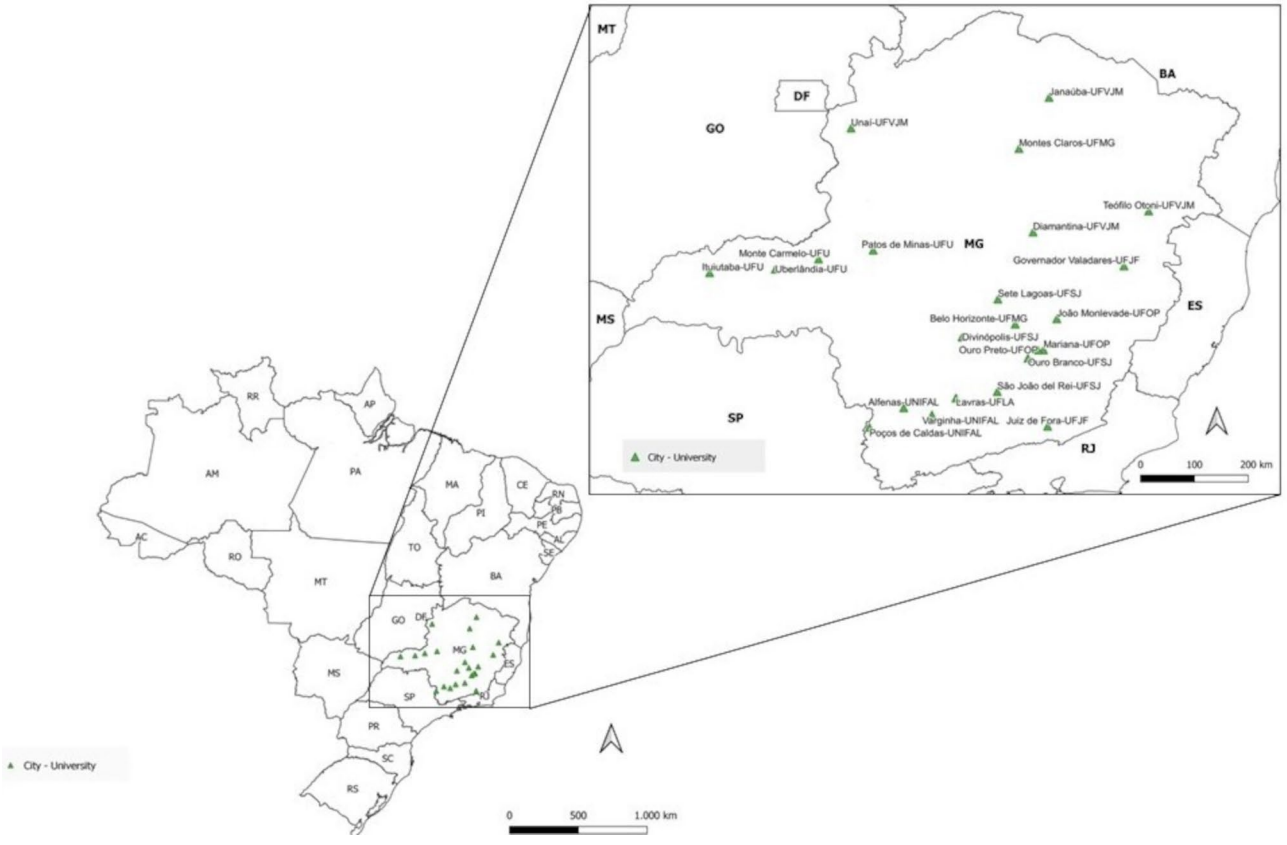

Fig. 1 Geographical distribution of the campuses of the IFES participating in the PADu-multicenter, Brazil, 2021–2022
Legend: Geodetic reference system: SIRGAS 2000

from the American "Connor-Davidson Resilience Scale" [26], and has been validated in Brazilian samples [27]. The total score ranges from 0 to 40, with greater scores indicating higher levels of resilience.

The questions developed and/or adapted by the researchers, which led to the sociodemographic, economic, and academic variables, are presented in Additional file 1 [see Additional file 1]. The questions were taken and/or adapted from the Brazilian Institute of Geography and Statistics [28] and National Health Survey [29] censuses.

Regarding sociodemographic variables, date of birth was used to create the variable age (in years). For the analyses, the race/skin color categories "oriental", "indigenous" and "other" were grouped together due to the small number in each category. Participants' religious beliefs were grouped into the "Yes" category. Level of education of the head of the family was grouped as follows: "up to incomplete primary education", "complete primary education to incomplete lower secondary education", "complete lower secondary education to complete upper secondary education", and "incomplete or complete higher education".

To describe the economic profile of the sample, the gross total monthly income of all family members was divided by the number of people who depended on this income to create a per capita family income variable (banded as: "R$ 550.00 or below", "between R$ 550.01 and R$ 1,100.00", "between R$ 1,100.01 and R$ 2,200.00", "between R$ 2,200.01 and R$ 3,300.00", or "above R$ 3,300.00"). The family income bands used correspond to Brazil's minimum wage in 2021 (R$ 1,100.00 / USD$ 197.12). There was also information as to whether any family member living in the student's household participated in any social assistance program, providing the variable "government social assistance" ("yes" or "no").

In the study of students' academic characteristics, the subject of the undergraduate course ("engineering", "health sciences", "exact and earth sciences", "applied social sciences", "agricultural sciences", "human sciences", "biological sciences" and "linguistics, letters and arts") was categorized according to the Grandes Áreas de avaliação da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior do Governo Federal (CAPES) [30]. The number of difficulties faced with graduation during the pandemic was also collected, with individuals scoring more than five capped at five difficulties due to small numbers.

In the variables where the answers "I prefer not to answer" or "I prefer not to identify myself" were possible, these categories were maintained in the analyses rather than treated as missing.

Further methodological details of the PADu-multicenter are presented elsewhere [31].

Statistical analyzes

Resilience score was considered the dependent variable, and sociodemographic, economic, and academic variables were considered independent variables in analyses.

The categorical variables were described with absolute and relative frequencies of their categories. Continuous variables were described by minimum and maximum values, mean and standard deviation (SD). Resilience measures were described by mean and SD, across participants and within each category of independent variables.

Due to the large sample size, a normality test for the resilience measure was not performed. Normality was verified through the histogram and QQ-Plot.

Independent samples t-tests were used to compare mean resilience in independent variables with two categories, and ANOVA tests for independent variables with more than two categories. Tukey's post-hoc tests were used to identify specific categories with differences in mean resilience measure when suggested by statistically significant ANOVA f-values ($p<0.05$).

Cohen's d and Eta-squared effect sizes were reported for comparisons of means of the resilience measure in independent variables with two or more than two categories, respectively. The following values were considered for Cohen's d (small: 0.20, medium: 0.50 and large: 0.80) and Eta-squared (small: 0.01, medium: 0.06 and large: 0.14) effect sizes [32, 33].

Pearson correlation was calculated between resilience score and the only continuous independent variable, "number of subjects enrolled in" at university.

The variables associated with resilience (in analyses described above) were considered in multiple linear regression models to assess those associated with resilience when adjusting for other independent variables. In order to understand which sociodemographic and economic variables were associated with resilience and which academics were, separately, two models were constructed: (1) One model included both sociodemographic and economic variables, and (2) Other model included just academic variables. In addition, (3) we also considered all sociodemographic, economic, and academic variables together to examine which were associated with resilience whilst adjusting for all other variables. For all three analyses, models were re-run, including only those variables found to be statistically associated with resilience. In all tests, the significance level considered was 5%.

Data analyses were performed using RStudio, version 4.3.3.

Results

A total of 8,650 students were included in the study. The average score on the resilience scale was 19.86±8.15, ranging from 0 to 40 points with a normal distribution [Fig. 2].

Descriptive and comparative analysis - sociodemographic variables

The respondents ranged from 18 to 71 years of age, averaging 23.9±6.33. The majority of participants were white (54.3%), female (65.4%), cisgender (94.9%), heterosexual (66.1%) and single (89.9%). Most lived with family (76.3%), had religious beliefs (61.7%), and came from a family in which the head of the household had at least incomplete higher education (48.3%) [see Additional file 2].

When analyzing the average resilience score among different groups of students categorized by sociodemographic variables, it was found that those over 41 years old, male, heterosexual, or with religious beliefs had higher resilience scores compared to those younger than 40 years old, female or undeclared, non-heterosexual, or who do not have or have not declared religious beliefs, respectively ($p<0.001$). On the other hand, students who identified as black had lower resilience scores compared to those of another race/skin color ($p<0.001$). Regarding gender identity, a significant difference was found between the cisgender and non-binary groups, with the first group having a higher resilience score ($p=0.038$). Widowed/widow or divorced students scored higher in resilience compared to those who preferred not to respond or were single, with this group of students also having a lower score in resilience than married students ($p<0.001$). Concerning living situation, students who lived alone had higher resilience scores compared to those who lived with family ($p<0.001$). Students whose head of family attended higher education scored higher in resilience compared to students whose head of family had lower education. There was also a difference between students whose head of family had complete lower secondary education to complete upper secondary education and those whose head of family had up to incomplete primary education, with the latter group reporting lower levels of resilience ($p<0.001$) [see Additional file 2].

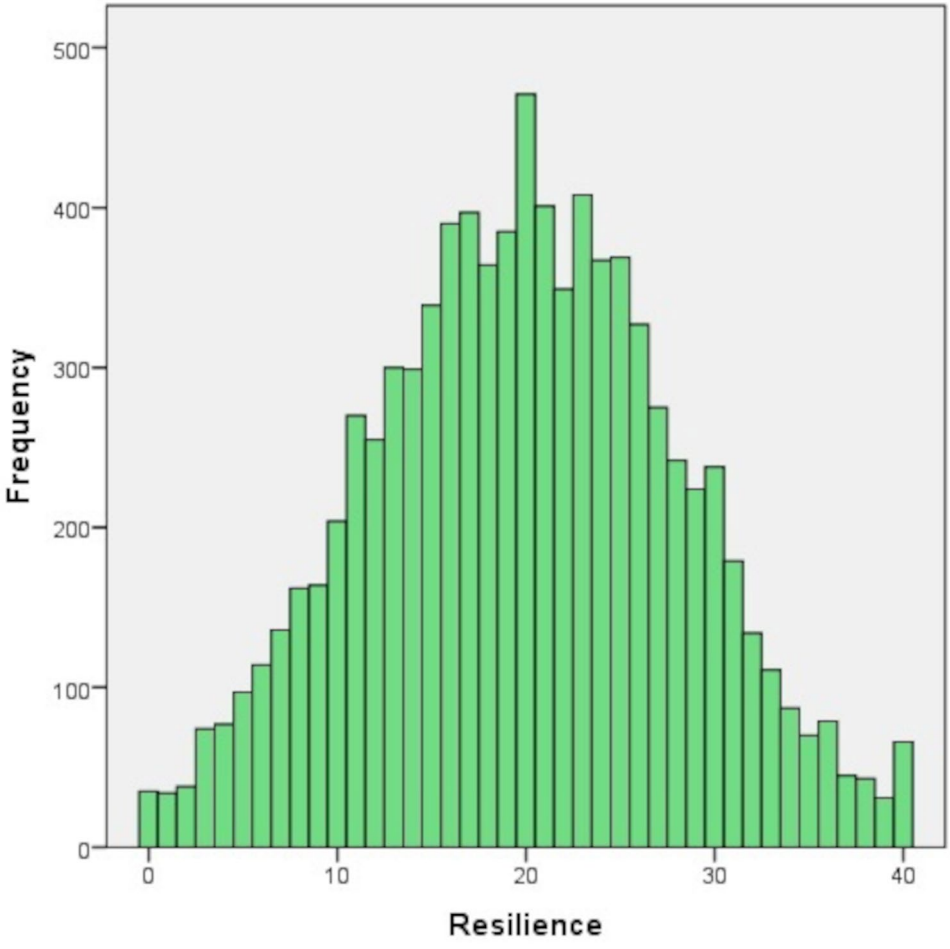

Fig. 2 Histogram of total resilience in the PADu-multicenter, Brazil, 2021–2022

It was found that regardless of gender identity, males scored significantly higher in resilience than females. Among males, there was no significant difference in resilience scores between people of different gender identities [F (3,2951)=0.556, p=0.644, η^2=0.000]. The same was observed among individuals who preferred not to identify themselves [F (3,31)=0.283, p=0.838, η^2=0.027]. However, among females, there was a significant difference in resilience scores between people of different gender identities [F (3,5656)=2.626, p=0.049, η^2=0.001], with cisgender females scoring higher in resilience than non-binary females [see Additional file 3].

Grouping all students who did not declare themselves heterosexual, it was observed that heterosexuals had higher resilience scores regardless of gender identity, with a statistically significant difference in cisgender (p<0.001), non-binary gender (p=0.046), and those who preferred not to identify themselves (p=0.022). Within the group of people who declared themselves heterosexual, there was no significant difference in the resilience score between people of different gender identities [F (3,5710)=0.484, p=0.693, η^2=0.000]. The same was observed among people who did not declare themselves heterosexual [F (3,2932)=0.534, p=0.659, η^2=0.000] [see Additional file 4].

Descriptive and comparative analysis - economic variables

It was observed that half of the sample had a per capita family income of R$ 1,100.00 or below (50.0%), and 48.9% had experienced a decrease in family income in the three months before completing the questionnaire. Most of the sample did not have anyone in their family receiving government social assistance (75.8%) [see Additional file 5].

When examining resilience among the different groups of students categorized by economic variables, lower scores were observed in students from families with a per capita income of R$ 550.00 or below or between R$ 550.01 and R$ 1,100.00 compared to those students from families with income of above R$ 1,100.01 or who preferred not to answer. Lower resilience scores were also found among students from families with a per capita income between R$ 1,100.01 and R$ 2,200.00 compared to those from families with a per capita income above R$ 3,300.01 (p<0.001). Students who did not experience a decrease in family income in the last three months before the date of data collection or who did not have someone in their family who received government social assistance had higher resilience scores compared to students who did not respond or had a decrease in family income or had someone in their family who received social assistance from the government, respectively (p<0.001) [see Additional file 5].

Descriptive and comparative analysis - academic variables

A large part of the sample was made up of students from UFMG (23.1%) or UFOP (20.9%), enrolled in health sciences (22.1%) or applied social sciences (18.7%) courses. Most students were in a fully remote study routine (89.2%) and faced only one difficulty in dealing with graduation during the covid-19 pandemic (45%). The most frequent difficulty graduating was having to help with household chores or in activities that generate income for the family (51.6%), followed by not having a dedicated space to study and carry out University activities (45.9%). Most students did not report having had any difficulties in dealing with graduation during the covid-19 pandemic, except for helping with household chores or activities that generate income for the family (48.4%) [see Additional file 6]. The number of subjects students were enrolled in at the time of the research ranged from 0 to 21, with an average of 5.24±2.33 subjects.

Students enrolled at UFOP scored higher in resilience than students from other institutions, except UFSJ and UNIFAL-MG. Students enrolled at UFSJ also had higher resilience scores than those enrolled at UFMG, UFJF, and UFVJM (p<0.001). Students from engineering courses scored higher in resilience than students in other subject areas, as well as students in courses in the health sciences area concerning students in courses in other areas, except for the areas of exact and earth sciences and agricultural sciences. Students in exact and earth sciences had higher resilience scores than those studying biological sciences, human sciences, linguistics, letters and arts. Finally, students in applied social sciences had higher resilience scores than those in linguistics, letters and arts (p<0.001) [see Additional file 6]. The number of subjects students were enrolled in at the time of the research had a weak positive correlation with the students' resilience score (r=0.05, p<0.001).

Students in a fully remote study routine had lower resilience scores than those with a fully or partially in-person routine (p<0.001). Regarding each of the difficulties in dealing with graduation during the covid-19 pandemic listed, higher resilience scores were found in students who said they did not have them (p<0.001), except for the "other" difficulty (p=0.019). There was also a significant difference between students who faced different amounts of difficulties in dealing with graduation during the covid-19 pandemic, with those who reported one difficulty having a higher resilience score when compared to those who reported more difficulties, as well as those who reported two when compared to those who reported three to six, and among those who reported three when compared to those who reported five or six difficulties (p<0.001) [see Additional file 6].

When considering the average resilience measure of students from each area of the undergraduate courses,

according to male or female biological sex, males from all areas of undergraduate courses had significantly higher resilience scores than females ($p<0.001$ for all areas except Biological sciences $p=0.018$) [see Additional file 7]. Among males, there was a significant difference in the means of the resilience measure of students from different areas of the undergraduate courses [F (7,2947)=6.441, $p<0.001$, $\eta^2=0.015$]. Males from engineering or health sciences courses reported higher resilience than males from exact and earth sciences, human sciences, biological sciences, and linguistics, letters and arts [see Additional file 7]. Similarly, among females, there was also a difference in the means of the resilience measure of students from different areas of the undergraduate courses [F (7,5652)=5.268, $p<0.001$, $\eta^2=0.006$]. Females from health science courses scored significantly higher on the resilience measure than females from applied social sciences and human sciences. The same was observed in females in engineering compared to the ones in linguistics, letters and arts [see Additional file 7].

Multiple linear regression model - sociodemographic and economic variables

The multiple linear regression model constructed with all sociodemographic and economic variables (Model 1a) was significant (F (39,8610)=21.54, $p<0.001$, adjR^2 = 0.084), with all variables, except gender identity and government social assistance, being associated with resilience score. The multiple linear regression model was then re-runed including the sociodemographic and economic variables, except gender identity and government social assistance (Model 1b) (F (35,8614)=23.98, $p<0.001$, adjR^2 = 0.085) with all variables being associated to the resilience measure [see Additional file 8].

The main factors associated with lower resilience measures were: being female compared to being male (sβ=0.190, $p<0.001$); not having religious beliefs compared to having (sβ = -0.094, $p<0.001$); having a per capita family income between R$ 550.01 and R$ 1,100.00 compared to having an income above R$ 3,300.00 (sβ=0.069, $p<0.001$); having had a decrease in family income in the last 3 months compared to not having had this decrease (sβ=0.066, $p<0.001$); being homosexual (sβ = -0.064, $p<0.001$) or bisexual (sβ = -0.055, $p<0.001$) compared to being heterosexual and the education level of the head of the family being up to incomplete primary education compared to being incomplete or complete higher education (sβ = -0.050, $p<0.001$) [see Additional file 8].

Multiple linear regression model - academic variables

The multiple linear regression model constructed with all academic variables (Model 2a) was significant (F (27,8622)=13.67, $p<0.001$, adjR^2 = 0.038), with all variables, except those related to difficulties in dealing with graduation during the covid-19 pandemic, associated with the resilience score. The multiple linear regression model was re-runed excluding the variables related to difficulties in dealing with graduation during the covid-19 pandemic (Model 2b), and was also significant (F (17,8632)=11.24, $p<0.001$, adjR^2 = 0.019) with all variables being associated to the resilience measure [see Additional file 9].

The main factors associated with lower resilience measures were: being a student at UFMG compared to being a student at UFOP (sβ=0.071, $p<0.001$); being a student of courses in the areas of linguistics, letters and arts compared to being a health sciences student (sβ = -0.053, $p<0.001$), and being enrolled in fewer subjects (sβ=0.039, $p<0.001$) [see Additional file 9].

Multiple linear regression model - sociodemographic, economic and academic variables

The final multiple linear regression model constructed with all sociodemographic, economic and academic variables (Model 3b) was significant (F (49,8600)=19.54, $p<0.001$, adjR^2 = 0.095), with the same variables as those in Models 1b and 2b, except living situation being associated with the resilience score [see Additional file 10].

Discussion

We examined resilience in undergraduate students in Minas Gerais and analyzed sociodemographic, economic, and academic factors associated with reported resilience. Biological sex, religious belief, per capita family income, decrease in family income, sexual orientation, education level of the head of the family, age, living situation, race/skin color, and marital status were associated with resilience in models considering sociodemographic and economic factors. Federal Institutions of Higher Education, area of the undergraduate course, number of subjects enrolled in, and undergraduate study routine were associated with resilience in the model considering academic factors.

Resilience levels in undergraduate students followed a normal distribution in our sample, with a lower mean score compared to validations of the CD-RISC-10 scale in Brazil's general population [27]. The lower resilience scores observed in our study may be due to the specific nature of our participant group or the pandemic period during which the study was conducted [34]. However, Slovenian and North American studies focusing on higher education students during the covid-19 pandemic reported resilience scores around 25 and 28 using the CD RISC-10 scale [15, 35, 36]. Differences in the moment of data collection and the countries' experience during the covid-19 pandemic, for the whole population and in the

education scenario, may be some of the reasons for the difference reported in our study.

When considering each independent variable separately, we observed statistically significant associations with resilience scores, likely due to the large sample size available. However, in the multiple linear regression models, we could ascertain which factors were associated with resilience when adjusting for other variables which may also explain some variance in resilience scores.

Biological sex was associated with resilience in the sociodemographic and economic multiple linear regression model, with males having higher resilience scores when compared to females. Previous studies conducted before, during, and after the covid-19 pandemic also reported higher resilience scores in North American, Peruvian, Turkish, Egyptian, and Chinese male higher education students compared to female ones [37–41]. However, there was a lack of differences between sexes among students in other Brazilian and Chinese studies [42–44]. Some authors have speculated that the difference in resilience between females and males may be due to a reporting bias caused by cultural differences. This is because males are more likely to present themselves as strong in the face of adversity than females [45]. Consistent with this hypothesis, Fragkaki et al. [46] reported that males were more optimistic about the covid-19 pandemic than females, who also perceived greater severity of the situation and were more anxious about it than males. This might help us understand the differences in resilience reported between the sexes in the context of the covid-19 pandemic. It is important to note that many studies did not distinguish between biological sex (sex assigned at birth) and gender identity, as we did. This led to a mix of terms such as female/woman and male/man in the literature, without analyzing the relationship between these distinct categories and resilience.

Being heterosexual was also associated with higher resilience scores compared to not being heterosexual. A study of 848 undergraduates enrolled in psychology courses at a US university yielded similar results [39]. It may be that belonging to a minority group that experiences discrimination may lead to lower resilience levels due to the impact of social belonging in resilience [47].

Religious belief was one of the variables most associated with resilience in the multiple linear regression models constructed. Having a religious belief is associated with higher resilience scores than not having one. Few studies examining resilience and religious belief in university students were found in the literature. Pinto et al. [48] analyzed data from 361 Brazilian administration students and found that having or not having a religion was not associated with resilience, measured using a different instrument from the current study. However, it is known that having a religious belief can influence the meaning individuals attribute to life and how they deal with adversity [49], which can directly impact their resilience (for example in the context of a pandemic).

Students with higher per capita family income or who had not experienced a decrease in family income had higher resilience scores than those with lower per capita family income or who had a decrease in family income, respectively. These findings are consistent with a pre covid-19 pandemic study by Melo et al. [50], which showed a direct relationship between income and resilience in 2,038 Brazilians of various educational levels. However, these results are not supported by other pre covid-19 pandemic studies of Brazilian students that focused on the monthly income of either the family [51] or the student [42], nor by studies conducted during and after the covid-19 pandemic, that examined the monthly family income of Chinese [52] and Omani students [53]. It is important to consider that individuals with better financial support may encounter fewer adversities and, when faced with adversity, have more resources to cope with it. These variables, therefore, may be strongly connected with how the country managed its economy during the covid-19 pandemic.

The education level of the head of the family was associated with resilience. Students with the head of the family having at least incomplete higher education had higher resilience scores than those with the head of the family having up to incomplete primary education. No studies were found in the literature that relate these variables. We hypothesize that this relationship is influenced by economic factors since education and income are often interrelated variables [54].

Regarding academic variables, studying on health science courses was associated with higher resilience scores than being from linguistics, letters and arts courses. This finding is consistent with a study by Mourad et al. [55], who accessed, during the covid-19 pandemic, 421 undergraduate and postgraduate Italian students divided into three groups depending on their study area: health sciences, humanities, and political sciences. There was a difference in resilience between the health sciences and humanities groups, with the first group scoring higher in resilience. No studies were found that assessed resilience in students across such a varied range of undergraduate course areas. Even though our results showed the impact of biological sex on resilience scores across different study areas, further research is needed to fully understand this phenomenon.

The number of subjects in which the student was enrolled was also associated with resilience. The higher the number of subjects, the higher the observed resilience score. As the items of the resilience measure we used relate to one's perception of their capacity to handle adversity [25], it is hypothesized that students who feel

more capable and score higher are likely to enroll in more subjects.

The Federal Institution of Higher Education of the student was also associated with resilience. Students from UFOP had higher resilience scores than students from UFMG. Searches on the IFES websites did not reveal differences that justify these findings, such as in the culture of student assistance or actions aimed at students' mental health. These IFES maintain, as a rule, student assistance programs such as a university restaurant, food grants, transportation, and housing assistance. Even medical assistance services for students with social vulnerability and/or psychological support services are aimed at all students. Other variables, such as those related to the characteristics of the cities where these institutions have campuses, for example, may be related to the findings and could be the subject of future research, primarily qualitative research that can delve into the topic.

Effect sizes overall were small, but not much needed considering our objectives.

Limitations and strengths

It is important to note that conducting a cross-sectional study does not allow us to determine causality and changes in resilience, but only the associations between independent variables and resilience at the same time point. This limitation is crucial for understanding the scope of our study. The results should be interpreted in the context of associated factors, not predictors. Longitudinal studies in the future can help deepen our understanding of students' resilience and its risk factors.

Using a self-reported and online questionnaire with questions related to the past may have led to recall bias, overestimating and/or underestimating the data. Despite using a validated measure of resilience, the self-reported nature of the questionnaire introduces potential social desirability bias, as respondents may try to respond in a way that they consider to be more socially desirable. We aimed to minimize this bias by ensuring anonymity. Another potential response bias is due to unique circumstances related to the pandemic in which the survey was conducted, which may have affected how students perceive their resilience and other study variables. It's important to consider the Brazilian context during the survey when interpreting the results.

Another limitation of the present study is the potential for selection bias. We didn't include students who didn't complete the entire questionnaire or were regularly enrolled but were away from academic activities due to reasons such as mental distress. Additionally, using a convenience sample may have led to only students interested in the subject participating. We cannot exclude the possibility of a difference between the students who chose to participate in the study and those who did not. We attempted to mitigate this limitation by widely publicizing the research and its importance to the university community.

Despite the large sample, it is important to avoid overgeneralizing the findings to all undergraduate students in Minas Gerais or Brazil. Although Minas Gerais is a central state in Brazil with representation from different regions of the country, future research with participants from various states across Brazil is essential to enhance generalizability.

However, this study has some unique strengths. As far as we know, our study is the first to assess resilience and investigate the potential role of sociodemographic, economic and academic factors as being associated with differences in resilience during the covid-19 pandemic. In addition, the study benefits from a large sample size that includes undergraduate students from different courses and institutions. These characteristics distinguish our study from others conducted in Brazil and worldwide since most research typically involves small samples of students studying health-related courses [22].

Conclusions

We examined the resilience profile of undergraduate students of several courses at Federal Institutions of Higher Education in Minas Gerais and identified sociodemographic, economic, and academic factors associated with differences in resilience. Being female, non-heterosexual, not having a religious belief, or having the head of the family with a lower educational level were the main socioeconomic factors associated with lower resilience. Having lower per capita family income and a decrease in family income at the time of the study were the main economic factors associated with lower scores of resilience. Finally, students from UFMG had lower resilience scores compared to students from UFOP, as students from linguistics, letters and arts compared to the ones from health sciences and students who were enrolled in fewer subjects at the time of the study. An understanding of the factors associated with low resilience is essential for universities to develop targeted strategies to promote resilience among groups who may find it challenging to adjust to the academic setting. By doing so, universities can reduce the risk of poor mental health among these students, ultimately working to minimize inequalities and ensure that all students receive a fair and supportive academic education.

Abbreviations

ANOVA	Analysis of variance
CAPES	Coordenação de Aperfeiçoamento de Pessoal de Nível Superior do Governo Federal
CD-RISC-10	Connor-Davidson Resilience Scale 10 itens version
CEP	Research Ethics Committee
covid-19	Coronavirus disease 2019
IFES	Federal Institutions of Higher Education

PADu	Project on Anxiety and Depression in University Students
SD	Standard deviation
TCLE	Free and Informed Consent Term
UFJF	Universidade Federal de Juiz de Fora
UFLA	Universidade Federal de Lavras
UFMG	Universidade Federal de Minas Gerais
UFOP	Universidade Federal de Ouro Preto
UFSJ	Universidade Federal de São João del-Rei
UFU	Universidade Federal de Uberlândia
UFVJM	Universidade Federal dos Vales do Jequitinhonha e Mucuri
UNIFAL - MG	Universidade Federal de Alfenas

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s40359-024-02138-1.

Additional File 1: Title of data: Questions who originated the sociodemographic, economic, and academic variables in the PADu-multicenter, Brazil, 2021–2022. Description of data: Questions who originated the sociodemographic, economic, and academic variables in the PADu-multicenter, Brazil, 2021–2022

Additional File 2: Title of data: Table 1: Sociodemographic characteristics and average resilience of the PADu-multicenter sample, Brazil, 2021–2022. Description of data: Sociodemographic characteristics and average resilience of the PADu-multicenter sample, Brazil, 2021–2022

Additional File 3: Title of data: Table 2: Resilience according to gender identity and biological sex in PADu-multicenter sample, Brazil, 2021–2022. Description of data: Resilience according to gender identity and biological sex in PADu-multicenter sample, Brazil, 2021–2022

Additional File 4: Title of data: Table 3: Resilience according to gender identity and sexual orientation in PADu-multicenter sample, Brazil, 2021–2022. Description of data: Resilience according to gender identity and sexual orientation in PADu-multicenter sample, Brazil, 2021–2022

Additional File 5: Title of data: Table 4: Economic characteristics and average resilience of the PADu-multicenter sample, Brazil, 2021–2022. Description of data: Economic characteristics and average resilience of the PADu-multicenter sample, Brazil, 2021–2022

Additional File 6: Title of data: Table 5: Academic characteristics and average resilience of the PADu-multicenter sample, Brazil, 2021–2022. Description of data: Academic characteristics and average resilience of the PADu-multicenter sample, Brazil, 2021–2022

Additional File 7: Title of data: Table 6: Resilience according to area of the undergraduate course and biological sex in PADu-multicenter sample, Brazil, 2021–2022. Description of data: Resilience according to the area of the undergraduate course and biological sex in PADu-multicenter sample, Brazil, 2021–2022

Additional File 8: Title of data: Table 7: Multiple linear regression model with sociodemographic and economic variables. PADu-multicenter, Brazil, 2021–2022. Description of data: Multiple linear regression model with sociodemographic and economic variables. PADu-multicenter, Brazil, 2021–2022

Additional File 9: Title of data: Table 8: Multiple linear regression model with academic variables. PADu-multicenter, Brazil, 2021–2022. Description of data: Multiple linear regression model with academic variables. PADu-multicenter, Brazil, 2021–2022

Additional File 10: Title of data: Table 9: Multiple linear regression model with sociodemographic, economic, and academic variables. PADu-multicenter, Brazil, 2021–2022. Description of data: Multiple linear regression model with sociodemographic, economic, and academic variables. PADu-multicenter, Brazil, 2021–2022

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Author contributions
JEA wrote the manuscript and prepared Figs. 1 and 2, participated in the data collection process at UFMG, and performed statistical analysis. ALM conceptualized and coordinated the project "Symptoms of anxiety disorder and depression among university students in Minas Gerais: prevalence and associated factors". ELM, HNO, ADFS, CSC, EDF, FCV, LGF, LNN, and LSS participated in the project "Symptoms of anxiety disorder and depression among university students in Minas Gerais: prevalence and associated factors" design; coordinated data collection at their respective institution and revised the manuscript. EAR suggested and supervised statistical analyses and revised the manuscript. RS suggested statistical analyses and revised the manuscript. BCRB prepared and wrote the project "Symptoms of anxiety disorder and depression among university students in Minas Gerais: prevalence and associated factors", coordinated data collection at universities, carried out data consistency, and revised the manuscript. CMR supervised and revised the manuscript. All authors approved the final version of the manuscript.

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The funders had no role in the study design, data collection and analysis, decision to publish or preparation of the article.

Data availability
The datasets generated and/or analyzed during the current study are not publicly available due to the confidentiality guaranteed to the participants but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The PADu-multicenter project was conducted in accordance with the guidelines established by the Declaration of Helsinki and is approved by the Research Ethics Committee (CEP) of all participating IFES (UFOP: 43027421.3.1001.5150; UFMG: 43027421.3.2004.5149; UFU: 43027421.3.2001.5152; UFJF: 43027421.3.2003.5147; UFSJ: 43027421.3.2002.5545; UFLA: 43027421.3.2006.5148; UFVJM: 43027421.3.2009.5108; and UNIFAL-MG: 43027421.3.2008.5142), being initiated at each university, after approval by the CEP of the same.
All participants were informed about voluntary collaboration and the condition of anonymity, in addition to the research objectives, the steps to be taken, and the risks and benefits of their participation. The Free and Informed Consent Form (TCLE), approved by the CEP, was signed through the online check before each student filled out the questionnaire and was available for download.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Footnotes
Not applicable.

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