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Identification of factors associated with resilience in medical students through a cross sectional census

AUTHOR AND CO-AUTHOR'S

Anna Christina Pinho de Oliveira
André Paes Goulart Machado
Renata Nunes Aranha

AFFILIATIONS

Anna Christina Pinho de Oliveira
Lecturer in Pulmonology, Universidade Federal Fluminense (UFF)

André Paes Goulart Machado
Lecturer in Clinical Medicine, Universidade Estadual do Rio de Janeiro (UERJ)

Renata Nunes Aranha
Reader in Gynecology, Universidade Estadual do Rio de Janeiro (UERJ)

CORRESPONDING AUTHOR

Anna Christina Pinho de Oliveira
pinho.christina64@gmail.com
+55 21 999429415 or +55 21 22250717
fax +55 21 22256008

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ABSTRACT

OBJECTIVES: Research on resilience has been gaining momentum, and it has already been shown that increased resilience generates positive changes at the individual and collective levels. Understanding of the factors associated with resilience may guide specific actions directed toward different populations. The objective of this study was to investigate these associated factors

DESIGN: Cross-sectional census

SETTING: A public School of Medicine in the state of Rio de Janeiro, Brazil

PARTICIPANTS: from 551 medical students, five students were excluded due to inactive registrations, and four transferred students were also excluded, resulting in a total of 542 remaining participants.

MEASURES: Using an anonymous questionnaire that included the Resilience Scale as well as questions related to sociodemographic, behavioral health-related, and academic variables, the association between these variables and resilience were investigated.

RESULTS: The mean resilience score obtained was considered moderate. Factors such as gender, race, previous school attended, financial independence, living situation, parents' education level, religion, quota-based admission, smoking, abusive alcohol consumption, and use of illegal drugs were not associated with resilience. In a multivariate analysis using ordinal logistic regression, associations were maintained only between the highest resilience score and not using addictive prescription drugs (odds

ratio (OR): 0.58; confidence interval (CI): 0.41-0.80), having a better perception of one's own health (OR: 0.57; CI: 0.41-0.81), and being older (OR: 1.37; CI: 1.12-1.67).

CONCLUSION: In addition to age, the variables most closely associated with resilience were: health and medicalization. The findings raise the following question: is resilience predominantly influenced by the particular values of a population? This interpretation may encourage the development of strategies that promote increased resilience during medical school.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- This study compares the factors associated with resilience in medical students and so compares them to other populations that have been already studied
- Design strengths of the study: it is a census, using Resilience Scale, a tool used in different populations with validity for Portuguese, instead of indirect assessments commonly used with this kind of population. The questioner was anonymous. The intention here was to increase the accuracy of the most delicate questions
- Limitation include: the cross-sectional design of the study does not allow to establish temporal relation between exposure to situations of distress and its effects on medical student.

INTRODUCTION

All people are subject to negative situations, the causes of which often cannot be controlled. Learning how to cope with such situations may decrease the damage that they cause and increase one's ability to address daily challenges. Thus, one way to improve the ability to cope with undesirable situations is to increase individual resilience.

The definition of resilience used in the present study is "something that helps us to withstand and to grow from negative experiences" [1-3], i.e., positive psychosocial adaptation to important events. This understanding, which was previously restricted to children [4,5], is now being expanded and applied in different areas, such as the corporate world [6], health [7], education [8], and communities [9].

Previous studies have indicated a number of factors that may affect individual resilience. Factors that may increase resilience include time spent with loving and sensitive parents [3], peer support [10], spending time with oneself [11], and professional stability [12, 13]. In contrast, factors that may decrease resilience include an absence of affection during childhood or adolescence [14, 15], sleep disorders [10], and unemployment [16]. Most relevant studies have shown that education level [17], income [18], and gender [8, 14, 19] do not affect resilience.

Understanding of the factors that may increase individual or collective resilience is important because of the benefits that this understanding may offer: increased well-being and improved quality of life [3, 20], reduced chances of engaging in prostitution [21] and violent behavior [22,23], and decreased tobacco [21] and drug [21] use as well as depression and suicidal ideation [16, 24]. In addition, resilience is related to increased stress tolerance in the work environment [25], an increased ability to cope with chronic pain [26], and aging in the context of fewer limitations and higher cognitive levels [16].

These findings, which associate resilience with different variables, are the outcomes of studies conducted in various countries and on groups with diverse backgrounds. However, in many of these studies, resilience was not measured using a specific scale. Therefore, based on these prior studies, the objective of the present study was to use the Wagnild and Young Resilience Scale [27] in a survey of medical students to measure and understand the associations between resilience and sociodemographic, behavioral health-related, and academic variables in this group.

METHODS

This cross-sectional study was conducted by administering a survey from October to December 2011. The participants consisted of 551 medical students of the public School of Medicine in the state of Rio de Janeiro, Brazil. Five students were excluded due to inactive registrations, and four transferred students were also excluded, resulting in a total of 542 remaining participants.

A self-administered questionnaire that addressed several dimensions (sociodemographic, behavioral health-related, and academic) and that included the Resilience Scale was developed. The sociodemographic variables included gender, race, age, year in the program, previous school attended, family income, financial independence, living situation, parents' education level, religion, and whether the respondent was a quota-based student (i.e., university admission based on a quota).

The behavioral health-related dimensions included perception of own health, smoking habits, use of addictive prescription drugs (e.g., medications for sleeping, staying awake, or anxiety), and use of illicit drugs (e.g., marijuana, cocaine, or crack) and alcohol. In addition, the CAGE questionnaire was used; this questionnaire's objective is to identify individuals suspected of abusing alcohol (i.e., when respondents answer two or three of its four questions affirmatively) [28]. However, in the present study, two positive answers sufficed for us to consider the CAGE result as positive.

The variable of primary interest was measured using the Wagnild and Young Resilience Scale [27], which has been translated into Portuguese and cross-culturally adapted for use in Brazil [29]. This scale consists of 25 positively described items. The questions are answered on a Likert scale with values that range from 1-7 (1 means "completely disagree," and 7 means "completely agree"). Thus, final scores may vary from 25-175 points. To measure resilience levels, Wagnild [30] adopted the following score ranges: very low (25-100), low (101-115), on the low end (116-130), moderate (131-145), moderately high (146-160), and high (161-175). In the current study, these score ranges were regrouped into three categories: low (25-130), moderate (131-145), and high (146-175).

A pre-test was conducted with 12 volunteers with social and functional profiles similar to those of the sample population. In compliance with institutional and legal requirements, all study participants were informed regarding the objectives and stages of the study, its voluntary basis, the confidentiality of the data, and the absence of any associated risk. After signing an informed consent form, the students completed the questionnaire, which was presented to them online, in a clear and friendly manner, using Qualtrics software on computers that were made available at the School of Medicine. The invitation to participate in the survey was sent through class e-mail address lists. The students were encouraged to participate in the study via additional e-mails, online social networks, and personal contact from the researchers and class representatives.

Central tendency measures, frequency distributions, and proportions were used for descriptive analysis of the study population. The main variable (i.e., the resilience score) was evaluated in both continuous and categorical forms. The categorical variables were analyzed using the Chi-square test, whereby a p-value of <0.05 was considered statistically significant. The odds ratio (OR) and its 95% confidence interval (CI) were estimated using logistic regression to compare high with low resilience and moderate with low resilience. The statistical software program Stata 11.0 was used.

Ordinal logistic regression was used for the subsequent multivariate analysis. All variables that presented a p-value of ≤ 0.20 in the Chi-square test were incorporated into the model. Thus, initially, the following variables were selected: age, parents' education level, year in the program, perception of own health, alcohol use, CAGE result, and use of addictive prescription drugs. The Brant test was used to evaluate the pre-assumption fit of the logistic ordinal model, i.e., to test whether the relationship between each pair in the outcome groups was always the same. Each variable was introduced individually to determine if it would remain in the model considering the change caused in the log-likelihood and pseudo R^2 values. The Besley test was conducted to test for collinearity between certain variables.

RESULTS

All 542 students in the study population participated in the survey. Of these students, 328 were female (60%), and 214 were male (40%). The age range was between 17 and 30 years for 95% of the participants. The lowest number of answers received was for the variable of illicit drug use, with a 97.1% response rate.

The mean resilience score was 133.4 points, with a standard deviation (SD) of 15.8. In the stratification using the resilience score ranges, the following were observed: a mean of 120 (SD=11.6) in the low category, a mean of 138 (SD=4.3) in the moderate category, and a mean of 151 (SD=5.8) in the high category (see Table 1).

There was no significant association between resilience and socioeconomic variables (family income, previous school attended, financial independence, parents' education level, and quota-based admission), except for age. In addition, there was no significant association between resilience and religion, gender, race, or living situation. Regarding the variable of age, the older that the individual was, the greater his or her resilience was. Among younger students (younger than 22 years), only 15% displayed high resilience. In contrast, among students older than 22 years, the percentage displaying high resilience was approximately 28%. The bivariate analysis indicated an increase in resilience with age. When moderate resilience was compared with low resilience among older participants (22-24 years) in relation to younger participants (17-22 years), the OR was 1.8 (CI: 1.1-2.8). When high resilience and low resilience were compared, the OR was higher, namely, 2.9 (CI: 1.6-5.1) (Table 2).

Table 1 Distribution of resilience scores according to category

	N	Median	Mean	SD	Minimum	Maximum
Low	203	120	117	11.6	70	130
Moderate	212	138	138	4.3	131	145
High	127	149	151	5.8	146	171

Table 2 Proportions and odds ratios (ORs) with confidence intervals (CIs) for the socio-demographic variables according to the level of resilience

		Resilience			Moderate resilience	High resilience
	N	% Low	% Moderate	% High	OR (95% CI)	OR (95% CI)
Gender						
Male	214	39.3	39.3	21.4		
Female	328	36.3	39	24.7	1.1 (0.7-1.6)	1.2 (0.8-2.0)
Race						
White	330	35.1	42.1	22.8		
Mixed-race	139	38.1	41	20.9	1.1 (0.7-1.7)	0.9 (0.4-2.0)
Black	57	37.9	38.5	23.6	1.2 (0.6-2.2)	1.0 (0.4-2.0)
Age*						
1 st tertile (17-22)	181	48.1	36.5	15.4		
2 nd tertile (22-24)	180	30.6	41.1	28.3	1.8 (1.1-2.8)	2.9 (1.6-5.1)
3 rd tertile (24-57)	181	33.7	39.8	26.5	1.5 (1.0-2.5)	2.4 (1.4-4.3)
Previous school						
Private	280	33.3	43.3	23.4		
Both	116	33.6	37.9	28.5	1.2 (0.7-2.1)	1.6 (0.9-2.8)
Public	141	41.4	37.1	21.5	1.4 (0.7-2.3)	1.3 (0.8-2.3)
Financial independence						
No	377	38.5	39.5	22		
Yes	162	35.2	37.6	27.2	1.0 (0.7-1.6)	1.3 (0.8-2.2)
Lives with						
Father and/or mother	330	36.7	40.9	22.4		
Partner	39	30.8	38.5	30.7	1.1 (0.5-2.5)	1.6 (0.7-3.8)
Other relatives	45	37.8	33.3	28.9	0.8 (0.4-1.7)	1.2 (0.6-2.7)
Friends	88	37.5	40.9	21.6	1.0 (0.6-1.7)	0.9 (0.5-1.8)
Alone	38	50	26.3	23.7	0.5 (0.2-1.1)	0.8 (0.3-1.8)
Parents' education level*						
Primary	64	35.9	34.5	29.6		
Secondary	141	30.5	43.3	26.2	1.5 (0.7-3.0)	1.0 (0.5-2.2)
Higher	334	41	37.7	21.3	1.0 (0.5-1.8)	0.6 (0.3-1.2)
Religion						
No religion	126	36.5	45.2	18.3		
Catholic	210	35.2	38.1	26.7	0.9 (0.5-1.4)	1.5 (0.8-2.8)
Protestant	98	42.9	34.7	22.4	0.6 (0.3-1.2)	1.0 (0.5-2.1)
Spiritualist	86	43	36.1	20.9	0.7 (0.4-1.2)	1.0 (0.4-2.1)
Quota-based student						
No	290	39.7	39.3	21		
Yes	252	34.9	38.9	26.2	1.1 (0.8-1.7)	1.4 (0.9-2.2)

*p-value < 0.2; reference category: low resilience

Table 3 Proportions and odds ratios (ORs) with confidence intervals (CIs) for resilience according to health variables.

		Resilience			Moderate resilience	High resilience
	N	% Low	% Moderate	% High	OR (95% CI)	OR (95% CI)
Perception of own health state*						
Regular/poor	238	57.7	32.5	9.8		
Good	252	39.7	42.5	17.8	1.9 (1.1-3.4)	2.5 (1.1-5.8)
Very good	211	27.5	37.4	35.1	2.5 (1.4-4.5)	7.1 (3.1-16.2)
Smoking habits						
Never smoked	491	36.9	39.3	23.8		
Former smoker or current smoker	51	43.1	37.3	19.6	0.8 (0.4-1.5)	0.7 (0.3-1.5)
CAGE^{a*}						
No	452	35	40.9	24.1		
Yes	90	50	30	20	0.5 (0.3-0.9)	0.6 (0.3-1.0)
Addictive prescription drug use^{b*}						
Never used	463	34.3	40.6	25.1		

Have used	79	55.7	30.4	13.9	0.5 (0.3-0.8)	0.3 (0.2-0.7)
Illicit drug use^c						
Never used	379	36.2	40.1	23.7		
Have used	147	40.1	38.1	21.8	0.9 (0.6-1.3)	0.8 (0.5-1.4)

*p-value < 0.2; reference category: Low resilience

^aCAGE questionnaire with the objective of identifying disorders caused by alcohol use; considered positive when two responses are positive; ^baddictive prescription drug: medication that may cause dependence; ^cillicit drugs: marijuana, cocaine, and crack.

Resilience was associated with perception of own health ($p=0.00$). Students with very good perception in that area more often exhibited high resilience than those with regular or poor perception (35.1% vs. 9.8%). In addition, the following relationship was observed: the better the perception of own health was, the higher one's resilience was, with a seven-fold difference in the resilience score between the extreme categories.

Among the participants who used or had used addictive prescription drugs, there was a higher number of students with low resilience (55.7%) than among those who had never used these drugs (34.3%). Smoking and illicit drug use were not associated with resilience. Students who had a positive CAGE result exhibited a higher frequency of low resilience (50%) than those with a negative result (35%), with an OR of 0.5 (CI: 0.3-0.9). The health variables studied are described in Table 3.

Only the variables that were significant were retained in the multivariate analysis. When year in the program and age were introduced separately, both were significant. However, when these two variables were introduced into the model together, neither was significant, which indicates a probable collinearity effect in the model. However, the collinearity between these two variables was not very high (Besley test of collinearity = 6.49).

The multivariate analysis (Table 4) showed the result of a parsimonious model (which has greater explanatory power) that only consisted of the variables that presented statistical significance after being controlled for (perception of own health, age, and use of addictive prescription drugs); the adjusted ORs and their respective CIs are presented in the table.

Table 4 Multivariate model for resilience^a

	Odds ratio	Standard deviation	Z	p > z	95% Confidence interval
Health	0.57	0.69	-4.61	0.00	0.45-0.73
Age	1.37	0.14	3.12	0.00	1.12-1.67
Prescription drug use ^b	0.58	0.10	-3.21	0.00	0.41-0.80

^aThe table shows only variables with statistical significance; ^baddictive prescription drugs.

The model showed statistical significance (p-value of the Log-Chi² < 0.05), although the pseudo-R² was low (0.05). The Brant test was not significant ($p=0.54$), which indicates that there was no difference in the coefficient among the pairs. This outcome confirms that this type of analysis was appropriate for the present study. In this analysis, the variables of use of addictive prescription drugs (OR: 0.58; CI: 0.41-0.80), perception of own health (OR: 0.57; CI: 0.41-0.81), and age (OR: 1.37; CI: 1.12-1.67) maintained their association with resilience.

DISCUSSION

The evaluation of the medical students revealed a group with moderate resilience, with a mean score of 133.4 points on the Resilience Scale. In studies on other groups, such as middle-aged Spanish women [16], street children and adolescents in Ghana [21], and health professionals in the United Kingdom [31], a pattern of resilience similar to that of the group under study was found (even though other scales, considered more relevant by the researchers, were used). In contrast, other groups have presented greater than moderate resilience: a group of elderly individuals in the United States exhibited slightly high resilience [32], a randomly selected Swedish population displayed high resilience [33], and the majority of a population of medical students from the United Kingdom exhibited slightly high resilience [8]. Despite the diversity of countries and population characteristics represented by these studies, there was homogeneity in the mean resilience (i.e., extreme values were not found in any of the studies).

The present study selected medical students for participation because of the current consensus that medical training causes psychological distress [34-36]. This distress is related to parents' high expectations regarding their children's study program and to curriculum overload, fears regarding the future, anxiety regarding the medical residency selection process, and the process of learning to cope with death [37, 38]. There has been interest in better understanding resilience in these students precisely due to the many factors that they are exposed to during an important period of their lives, i.e., the undergraduate program in medicine, which entails undergoing a number of significant changes on the part of the students.

It was assumed that resilience in women would be higher due to the explicit and implicit barriers that they must continuously overcome. Brazil remains a sexist country, although there is an increasing movement toward changing this culture. In addition, greater sensitivity and the ability to better process feelings are characteristics that define the female profile. In contrast to this assumption, the present findings corroborated other studies that did not find an association between gender and resilience [8, 14, 19, 33, 39]. However, yet other studies have shown higher resilience in women, such as a study on health professionals in England [31]. In addition, other studies have demonstrated the contrary, such as higher resilience in Italian adolescents and male Chinese medical students [9, 40], although these populations were from countries in which sexism is more common.

Although black and mixed-race individuals represent 50.2% of Brazil's population, they are categorized as a minority among medical students because the proportion of blacks and mixed-race individuals is very low in this context [41]. A probable explanation for this disparity is that the white population is typically more affluent and thus has more resources to pursue medical education. However, in the present survey, the proportion of future black and mixed-race doctors (40.7%) was higher than at other schools because the studied institution adopted a quota-based admissions policy in 2003. Although the literature suggests higher resilience among groups that are considered minorities [11] precisely because they must break barriers and face more adversity starting at a young age, no difference in resilience was found in the current study.

Similarly to other studies, in the present study, no association was found between sociodemographic variables and resilience, except for age. In this study, based on the survey, age

contributed to the resilience level: the older that a participant was, the more resilient he or she was. This finding is similar to the results of the majority of related studies [10, 26, 31, 33], including one that specifically evaluated health professionals [31]. It is likely that individuals are exposed to various negative situations throughout their lifetime, which contributes to better insight into the self and personal growth over time, which in turn increase resilience.

In the analyses conducted here, students who lived alone did not differ regarding the resilience shown compared with students with different living situations. A possible explanation for this finding is that living alone does not mean that the student does not feel protected by a support network outside the current living situation. This explanation may account for the similarity found between children [17] and elderly individuals [42] from developing countries in previous research.

It is commonly believed that a good income level is associated with material and emotional well-being. Having money may resemble protection because of the access that it affords to good schools, good medical care, and peace of mind during old age. However, the present study and the analyzed literature [17, 18, 31] show that the variables related to income are not associated with resilience. This finding is important because it suggests that movements or activities, whether personal or collective, to increase resilience and consequently improve the individual's quality of life in several aspects may be undertaken regardless of financial situation.

At first glance, the association between resilience and religion may seem relevant. The World Health Organization (WHO) uses faith as a marker of quality of life [43], which implies that having a faith can increase quality of life. In addition, religion is known to promote well-being, which may indicate that religious individuals are more resilient due to the sense of protection that they experience [4, 10]. However, in the present study, there was no association between these variables. This finding may have been due to the fact that the instrument used measured the individual's choice of religion, and not religiosity or belief in religion's essence.

The inability to attribute causality in this study, which originates in its cross-sectional design, is particularly apparent for the behavioral health-related variables. For example, is the individual more resilient because he or she invests more in self-care, or does the individual invest more in self-care because he or she is more resilient? The literature states that increased resilience promotes better care of one's own health in HIV patients [44], may protect against depression in prison guards [45], and helps prostate cancer patients to cope better with their disease [46]. In addition, increasing resilience may be an important means to encourage engaging in sports activities and adopting a healthy diet [7], to prevent adolescents from engaging in promiscuous sexual behavior [21], and to promote an improvement in general health [18, 47].

In this study, the vast majority of the participating students did not use addictive prescription drugs, which differs from what was found in another study on Brazilian medical students [48]. However, awareness regarding the risks of this practice and unnecessary use of these substances makes their consumption less likely among individuals with higher resilience.

Resilience may serve as a protective factor against smoking and alcoholism, as previously observed in studies on different populations, including middle-aged Spanish women [16], Turkish adolescents [24], and American war veterans [49]. Understanding of how harmful these substances are to

health may encourage more resilient individuals to avoid these addictions [50], corroborating the association found between a lack of use of addictive prescription drugs and high resilience. Alternatively, high resilience may decrease substance abuse in response to stress and mental suffering. In the current study, suspected abusive alcohol consumption, which was identified using the CAGE questionnaire, displayed an inverse association with resilience levels in the bivariate analysis. However, when abusive alcohol consumption was analyzed while controlling for other variables, it lost its effect and was not useful for identifying vulnerable groups. Presumably, the effect of high resilience on preventing the use of addictive prescription drugs minimized the effect of alcohol dependence in the multivariate analysis.

In addition to the limitation regarding attribution of causality, this study encountered difficulty in analyzing certain variables with less prevalent responses because the population size was insufficient for drawing conclusions. After all, the study population was highly specific, consisting of a survey of medical students. On the one hand, this specificity facilitated a better understanding of this group, but on the other hand, it restricts our ability to apply the results to other groups.

Resilience has received increasing attention in recent years due to the finding that strategies to increase resilience could be positive and transformative measures from an individual or collective perspective. The present study examined characteristics related to resilience and showed that being older, having a good perception of one's own health, and not using addictive prescription drugs increase individual resilience. Interestingly, the population under study, namely, medical students, who are involved in the study of health/disease and medicalization/non-medicalization, presented two variables closely associated with resilience that are also related to closely held values in this group: health and medicalization. Thus, the following question may arise: is resilience predominantly influenced by the particular values of a population?

To answer this question, additional studies are required. However, our findings may encourage the development of strategies that promote an increase in resilience during medical school. This effort could be extended to different populations, e.g., other undergraduate programs, companies, or neighborhoods, with the aim of strengthening resilience based on the specific values that are relevant for each group.

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CONTRIBUTORSHIP STATEMENT

Anna Christina Pinho de Oliveira: Substantial contributions to the conception and design of the work; analysis and interpretation of data for the work. Drafting the work and revising it critically for important intellectual content. Final approval of the version to be published. Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

André Paes Goulart Machado: Substantial contributions to the conception and design of the work; the acquisition of data for the work. Revising the work critically for important intellectual content. Final approval of the version to be published. Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy and integrity of any part of the work are appropriately investigated and resolved.

Renata Nunes Aranha: Substantial contributions to the conception and design of the work; the acquisition, analysis, and interpretation of data for the work. Revising the work critically for important intellectual content. Final approval of the version to be published. Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy and integrity of any part of the work are appropriately investigated and resolved.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest

DATA SHARING STATEMENT

We shall make data available to the scientific community with as few restrictions as feasible, while retaining exclusive use until the publication of major outputs. All available data can be obtained by contacting the corresponding author.

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STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No/ page	Recommendation
Title and abstract	1 1a - 1 1b- 1	(a) Indicate the study’s design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2 - 2	Explain the scientific background and rationale for the investigation being reported
Objectives	3- 3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4 - 3	Present key elements of study design early in the paper
Setting	5 - 3	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6 - 3	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up <i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls <i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants (b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case
Variables	7- NA	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*- 4	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9- NA	Describe any efforts to address potential sources of bias (it is a census)
Study size	10 3	Explain how the study size was arrived at
Quantitative variables	11 3	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12 - 4	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses

Continued on next page

For peer review only

Results

Participants	13*4	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram
Descriptive data	14*4	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest (c) Cohort study—Summarise follow-up time (eg, average and total amount)
Outcome data	15*4/5	Cohort study—Report numbers of outcome events or summary measures over time Case-control study—Report numbers in each exposure category, or summary measures of exposure Cross-sectional study—Report numbers of outcome events or summary measures
Main results	16-4/5	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17- 6	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses

Discussion

Key results	18- 7	Summarise key results with reference to study objectives
Limitations	19- 8	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20 7/8	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21- 8	Discuss the generalisability (external validity) of the study results

Other information

Funding	22- 9	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based
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*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

NA not applicable

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Identification of factors associated with resilience in medical students through a cross-sectional census

AUTHOR AND CO-AUTHORS

Anna Christina Pinho de Oliveira
André Paes Goulart Machado
Renata Nunes Aranha

AFFILIATIONS

Anna Christina Pinho de Oliveira
Lecturer on Pulmonology, Universidade Federal Fluminense (UFF)

André Paes Goulart Machado
Lecturer on Clinical Medicine, University of the State of Rio de Janeiro (UERJ)

Renata Nunes Aranha
Reader of Gynecology, University of the State of Rio de Janeiro (UERJ)

CORRESPONDING AUTHOR

Anna Christina Pinho de Oliveira
pinho.christina64@gmail.com
+55 21 999429415 or +55 21 22250717
fax +55 21 22256008

KEYWORDS: resilience, medical education, and training, Resilience Scale, census, medicalization

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ABBREVIATION: CAGE questionnaire, in view of identifying disorders caused by alcohol use

STRENGTHS AND LIMITATIONS OF THIS STUDY

- This study compares the factors associated with resilience in medical students and so compares them to other populations that have been already studied
- Design strengths of the study: it is a census, using a Resilience Scale, a tool used in different populations, and valid for Portuguese, instead of indirect assessments commonly used with this kind of population. The questionnaire was anonymous. The intention here was to improve the accuracy of the most delicate questions
- The limitations include: the cross-sectional design of the study does not allow the establishment of a temporal relation between exposure to situations of distress and its effects on medical students.

ABSTRACT

OBJECTIVES: Research on resilience has been gaining momentum, and it has already been shown that increased resilience creates positive changes at the individual and collective levels. Understanding of the factors associated with resilience may guide specific actions directed toward different populations. The objective of this study was to investigate these associated factors within a population of medical students

DESIGN: Cross-sectional census

SETTING: A public Medical School in the State of Rio de Janeiro, Brazil

PARTICIPANTS: out of a total of 551 medical students, five students were excluded due to inactive registrations, and four transferred students were also excluded, resulting in a total of 542 remaining participants.

MEASURES: Adopting an anonymous questionnaire that included the Resilience Scale, in addition to questions related to sociodemographic, behavioral health-related, and academic variables, the association between these variables and resilience was investigated.

RESULTS: The high rate of answers to each item constitutes a indication of students' interest in participating, whereas the lowest percentile was 97,1%. The mean resilience score obtained was considered moderate. Factors such as gender, race, previous schools attended, financial independence, living situation, parents' education level, religion, quota-based admission, smoking, alcohol abuse, and use of illegal drugs were not associated with resilience. In a multivariate analysis using ordinal logistic regression, associations were maintained only between the highest resilience score and the non-use of habit-forming prescription drugs (odds ratio (OR): 0.58; confidence interval (CI): 0.41-0.80), having a better perception of one's own health (OR: 0.57; CI: 0.41-0.81), and being older (OR: 1.37; CI: 1.12-1.67).

CONCLUSION: the census performed with the medical students showed, with the multivariate analysis, that besides age, the variables most closely tied with resilience were: health and medicalization, and the variables connected with income and religion showed no association.

INTRODUCTION

All people are subject to negative situations and, often times, the causes cannot be controlled. Learning how to cope with such situations may reduce the damage they cause and increase one's ability to address daily challenges. So, one way to improve the ability to cope with undesirable situations is to increase individual resilience.

Resilience is defined as a person's ability to, in different degrees, when exposed to negative experiences, recover and, even, grow as a result of the adversity experienced [1-5], by way of a positive psychosocial adaptation to the experience. This understanding, which before was nearly restricted to children [6,7], is now being applied in many different scenarios, such as the corporate world [8], health [9], education [10], and the communities [11], and is expanding day by day.

Previous studies have indicated a number of factors capable of affecting individual resilience. Among the factors that might increase resilience is time spent with loving and sensitive parents [3], peer support [12], taking time out for oneself, [13] and professional stability [14, 15]. In contrast, among the factors capable of reducing one's resilience are the lack of affection during childhood or youth [16, 17], sleep disorders, [12] or unemployment [18]. Most relevant studies have shown that the level of education [19], income [20], and sex [10, 16, 21] do not impact resilience.

Understanding the factors that can increase individual or collective resilience is important because of the benefits that this understanding can bring, such as: increased well-being and improved quality of life [3, 22], reduced chances of engaging in prostitution [23] and violent behavior [24,25],

reduced tobacco use [23] and drug use, [23] and lessened depression and suicidal thoughts [18, 26]. Resilience is also associated with the greater tolerance to work-related stress [27], an increased ability to cope with chronic pain, [28] and aging with fewer limitations and higher cognitive levels [18].

These findings, associating resilience to a number of different variables, were reached through studies conducted in several countries, among highly diversified groups, although in many of these studies, resilience was not measured using a specific scale. There is an understanding today that medical school might, for a number of reasons [29, 30, 31], expose the student to different forms of suffering [29, 32, 33], while increased resilience can help minimize this, in addition to affording other gains to this specific population [34, 35]. In light of this, this study proposes to apply the Wagnild and Young Resilience Scale [36] to a census performed among medical students, to measure and understand the associations between resilience and sociodemographic, behavioral health-related, and academic variables within this group.

METHODOLOGY

This article describes a cross-sectional study conducted through the performance of a census, from October to December 2011. The sample population included all of the 551 students of a public Medical School in Rio de Janeiro, Brazil, excluding five students whose enrollment was inactive at the time and four others who had transferred into the course. So, a total of 542 students remained. A self-administered questionnaire was prepared, addressing several aspects (sociodemographic, academic and health behavior), in addition to the Resilience Scale. The sociodemographic variables included sex, race, age, course year, prior schools, financial independence, living situation, living situation, parents' education level, religion, and whether the respondent was a quota-admitted student (admission to the university as a result of a quota system).

The behavioral health-related aspects included a perception of the student's own health, smoking habits, use of habit-forming medications (sleeping pills, staying awake, and anxiety), use of illegal drugs (marijuana, cocaine, and crack), and alcohol. In addition, the CAGE questionnaire was used, which has the purpose of identifying individuals suspected of abusing alcohol, when the respondents answer two or three of its four questions affirmatively [37]. In this study, two affirmative answers in the CAGE rendered the test positive.

The variable of primary interest was measured using the Wagnild and Young Resilience Scale [36], which has been translated into Portuguese and cross-culturally adapted for use in Brazil [38]. The scale consists of 25 positively described items. The answers are quantified based on a Likert scale, with values ranging from 1 to 7, where 1 means "I completely disagree" and 7 means "I completely agree". So, the final scores can vary between 25 and 175 points. To measure resilience levels, Wagnild [39] proposed the following score ranges: very low (25-100), low (101-115), on the low end (116-130), moderate (131-145), moderately high, (146-160) and high (161-175). In this study, these score ranges were regrouped into three categories: low (25-130), moderate, (131-145) and high (146-175).

A preliminary test was conducted with 12 volunteers with social and functional profiles similar to those of the sample population. In compliance with institutional and legal requirements, all the participants in the census were informed of the study's purposes and stages, its voluntary nature, the

confidentiality of the data, and the lack of associated risks. It was only after the student signed the informed consent form that he or she completed the questionnaire, which was presented online, in a clear and user-friendly form, with the Qualtrics software, on computers made available during flexible hours, in comfortable rooms, at the Medical School. The students were invited to participate in the study by e-mail, and encouraged to participate via additional e-mails, online social networks, and considerable personal involvement of the researchers and class representatives. No pressure was made, nor was any reward offered for the students' participation in the study.

Central trend measurements, proportions and frequency distributions were used for the descriptive analysis of the sample population. The main variable (resilience score) was evaluated in the continuous and categorical forms. The categorical variables were analyzed using the Chi-square test, whereby a p-value of <0.05 was considered statistically significant. The odds ratio (OR) and its 95% confidence interval (CI) were estimated using logistic regression to compare high with low resilience and moderate with low resilience. The statistical software program Stata 11.0 was used.

Ordinal logistic regression was used for the subsequent multivariate analysis. All the variables that presented a p-value of ≤ 0.20 in the Chi-square test were incorporated into the model. So, initially, the following variables were selected: age, parents' education level, year in the program, perception of one's own health, alcohol use, CAGE result, and use of medications. The Brant test was used to evaluate the pre-assumption fit of the logistic ordinal model, that is to say, to test whether the relationship between each pair in the outcome groups was always the same. Each variable was introduced individually to determine if it would remain in the model considering the change caused in the log-likelihood and the pseudo R^2 values. The Besley Test was performed to test for collinearity between certain variables.

RESULTS

All 542 students in the study population participated in the survey. Of those students, 328 were female (60%), and 214 were male (40%). 95% of the participants ranged between the ages of 17 to 30 years. The authors believe that the high rate of answers to each item constitutes a clear indication of the real interest in participating, whereas the lowest percentile was 97.1% (for the variable concerning the use of illegal drugs), that is to say, even in anonymity, the participation was considered good. Female participation predominated, with 328 students (60%).

The mean resilience score was 133.4 points, with a standard deviation (SD) of 15.8. In the stratification using the resilience score ranges, the following was noted: in the low category, mean score of 120 (SD = 11.6); in the moderate category, mean score of 138 (SD = 4.3); and, in the high category, mean score of 151 (SD = 5.8).

Table 1 - Distribution of resilience scores by category

	N	Median	Mean	SD	Minimum	Maximum
Low	203	120	117	11.6	70	130
Moderate	212	138	138	4.3	131	145
High	127	149	151	5.8	146	171

No significant association was found between resilience and nearly all social-economic variables (prior schools, financial independence, parents’ education level, and quota-based admission). Likewise, no association was found between resilience and religion, gender, race, or living situation.

Regarding the variable of age, the older that the individual was, the greater his or her resilience. Among younger students (younger than 22 years), only 15% showed high resilience; in contrast, among students older than 22 years, the percentage displaying high resilience was approximately 28%. The bivariate analysis indicated increased resilience with age. When moderate resilience was compared with low resilience among older participants (22-24 years) as compared with younger participants (17-22 years), the OR was 1.8 (CI:1.1-2.8) and, when high resilience and low resilience were compared, the OR was higher, namely: 2.9 (CI:1.6-5.1) (Table 2).

Table 2 - Proportions and odds ratios (ORs) with confidence intervals (CIs) for the sociodemographic variables according to the resilience levels (RSL)

		Resilience			Moderate Resilience OR (IC 95%)	High Resilience OR (IC 95%)
	N	%low	%moderate	%high		
Sex						
Male	214	39.3	39.3	21.4		
Fem	328	36.3	39	24.7	1.1 (0.7-1.6)	1.2 (0.8-2.0)
Race						
white	330	35.1	42.1	22.8		
mixed-race	139	38.1	41	20.9	1.1 (0.7-1.7)	0.9 (0.4-2.0)
black	57	37.9	38.5	23.6	1.2 (0.6-2.2)	1.0 (0.4-2.0)
Age*						
1 st tertile (17-22)	181	48.1	36.5	15.4		
2 nd tertile (22-24)	180	30.6	41.1	28.3	1.8 (1.1-2.8)	2.9 (1.6-5.1)
3 rd tertile (24-57)	181	33.7	39.8	26.5	1.5 (1.0-2.5)	2.4 (1.4-4.3)
Previous school						
private	280	33.3	43.3	23.4		
both	116	33.6	37.9	28.5	1.2 (0.7-2.1)	1.6 (0.9-2.8)
public	141	41.4	37.1	21.5	1.4 (0.7-2.3)	1.3 (0.8-2.3)
Financial independence						
No	377	38.5	39.5	22		
Yes	162	35.2	37.6	27.2	1.0 (0.7-1.6)	1.3 (0.8-2.2)
Lives with						
father and/or mother	330	36.7	40.9	22.4		
spouse	39	30.8	38.5	30.7	1.1 (0.5-2.5)	1.6 (0.7-3.8)
other relatives	45	37.8	33.3	28.9	0.8 (0.4-1.7)	1.2 (0.6-2.7)
friends	88	37.5	40.9	21.6	1.0 (0.6-1.7)	0.9 (0.5-1.8)
alone	38	50	26.3	23.7	0.5 (0.2-1.1)	0.8 (0.3-1.8)
Parents’ education level*						
primary	64	35.9	34.5	29.6		
secondary	141	30.5	43.3	26.2	1.5 (0.7-3.0)	1.0 (0.5-2.2)
higher	334	41	37.7	21.3	1.0 (0.5-1.8)	0.6 (0.3-1.2)
Religion						
no religion	126	36.5	45.2	18.3		
catholic	210	35.2	38.1	26.7	0.9 (0.5-1.4)	1.5 (0.8-2.8)
protestant	98	42.9	34.7	22.4	0.6 (0.3-1.2)	1.0 (0.5-2.1)
spiritualist	86	43	36.1	20.9	0.7 (0.4-1.2)	1.0 (0.4-2.1)
Quota student						
No	290	39.7	39.3	21		

Yes 252 34.9 38.9 26.2 1.1 (0.8-1.7) 1.4 (0.9-2.2)
 *p-value<0.2; reference category: low resilience

Resilience was associated with perception of one's own health ($p=0.00$). Students with very good perception in that area more often showed high resilience than those with regular or poor perception (35.1% vs. 9.8%). In addition, the following relation was observed: the better the perception of one's own health, the higher the person's resilience, up to a seven-fold difference in the resilience score between the extremes.

Table 3 - Proportions and odds ratios (ORs) with confidence intervals (CIs) for Resilience according to health variables

	N	%low	%moderate	%high	Moderate Resilience (CI 95%)	High Resilience CI
Perception of one's own health*						
regular/poor	238	57.7	32.5	9.8		
Good	252	39.7	42.5	17.8	1.9 (1.1-3.4)	2.5 (1.1-5.8)
very good	211	27.5	37.4	35.1	2.5 (1.4-4.5)	7.1 (3.1-16.2)
Smoking Habits						
never smoked	491	36.9	39.3	23.8		
former smoker or current smoker	51	43.1	37.3	19.6	0.8 (0.4-1.5)	0.7 (0.3-1.5)
CAGE[†]						
No	452	35	40.9	24.1		
Yes	90	50	30	20	0.5 (0.3-0.9)	0.6 (0.3-1.0)
Use of medications[‡]						
Never used	463	34.3	40.6	25.1		
Used in the past	79	55.7	30.4	13.9	0.5 (0.3-0.8)	0.3 (0.2-0.7)
Use of illegal drugs^{‡‡}						
Never used	379	36.2	40.1	23.7		
Used in the past	147	40.1	38.1	21.8	0.9 (0.6-1.3)	0.8 (0.5-1.4)

*p-value<0.2; reference category: Low resilience

CAGE[†] questionnaire with the purpose of identifying disorders caused by alcohol abuse, rendered positive by two affirmative answers

[‡] prescription drugs: used of habit-forming medications

^{‡‡} illegal drugs: marijuana, cocaine, and crack

A higher number of students with low resilience (55.7%) were found among the participants who use or have used habit-forming medications, as compared to the participants who have never used said medications (34.3%). Smoking and illegal drug use showed no association with resilience. Students who presented a positive CAGE result showed higher rates of low resilience (50%) than those with a negative result (35%), with an OR of 0.5 (CI: 0.3-0.9).

Only the variables that were significant were retained in the multivariate analysis. The year in the program and age were significant variables, when introduced separately. However, when introduced

in the model together, neither proved significant, which indicates a likely collinearity in the model, although the collinearity between the two variables was not very high (Besley Test of Collinearity = 6.49).

The multivariate analysis in Table 4 shows the result of a parsimonious model, which has greater explanatory power, consisting only of the variables with statistical significance following control – perception of one’s own health, age, and use of medications –, showing the adjusted ORs and the respective CIs.

Table 4 - Multivariate model* for Resilience

	Odds ratio	Standard Deviation	Z	p> z	95% Confidence Interval
health	0.57	0.69	-4.61	0.00	0.45 - 0.73
age	1.37	0.14	3.12	0.00	1.12 - 1.67
medications**	0.58	0.10	-3.21	0.00	0.41 - 0.80

* table shows only the variables with statistical significance

**habit-forming medications

The model showed statistical significance (p-value of the Log-Chi2 <0.05), although the pseudo-R² was low (0.05). The Brant test result was not significant (p=0.54), which indicates that there was no difference in the coefficient among the pairs, proving that this type of analysis is appropriate for this study. In this analysis, the variables of use of habit-forming medications (OR:0.58; CI:0.41-0.80), the perception of one’s own health (OR:0.57; CI:0.41-0.81), and age (OR:1.37; CI:1.12–1.67) maintained their association with resilience.

DISCUSSION

The evaluation of the medical students showed a group with moderate resilience, with a mean score of 133.4 points on the Resilience Scale. In published studies involving other groups, such as middle-aged Spanish women [18], street children and youngsters in Ghana, [23] and health professionals in the United Kingdom [40], a pattern of resilience similar to that of the group under study was found, despite the use of though other scales, considered more relevant by the researchers.

In contrast, other groups have shown higher than moderate resilience: a group of elderly individuals in the United States showed moderately high resilience [41]; a randomly selected Swedish population displayed high resilience [42]; and a study conducted among medical students in the United States showed the majority to have moderately high resilience [43]. Despite the diversity of countries and populational characteristics represented by these studies, a certain consistency was found in the mean resilience, as neither of them produced extreme values.

This study chose medical students as its sample population. There is a consensus today that medical school is a source of psychological suffering due to the ongoing exposure to stress factors, such as the broad curriculum, concern about the future, parents’ high expectations [38], concerns about self-competence [35], the value placed on the students’ selflessness [31], among many others. In response, the

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2
3 student can show signs of distress, such as depression, suicidal thoughts, burnout [29, 32, 33]. Better
4 resilience levels not only protect against these negative responses, but also drive the student to act more
5 ethically and responsibly [34], in addition to taking better care of him or herself and others. [35].
6

7 There has been interest in better understanding resilience in these students precisely due to the
8 many factors to which they are exposed during an important period of their lives, specifically the
9 undergraduate program in medicine, and the many important changes they experience.
10

11 The assumption was that resilience in women would be higher due to the explicit and implicit
12 barriers that they must continuously overcome. A greater sensitivity and the ability to better process
13 feelings are characteristics that define the female profile. In contrast to this assumption, the present
14 findings corroborated other studies, some involving medical students [10], that found no association
15 between gender and resilience [16, 21, 42, 44]. However, other studies have shown higher resilience in
16 women, such as a study conducted among health professionals in England [40]. And others still have
17 shown the contrary, such as the higher resilience rates found in male Chinese medical students and Italian
18 youngsters [11, 45].
19

20 In light of the meager number of black and mixed-race individuals among medical students in
21 Brazil, this group represents a minority within this context, even though it represents 50.2% of the
22 Brazilian population [46]. This difference is likely justified by the fact that the white population is still
23 economically affluent and, therefore, it has better access to the course of medicine. In this census,
24 however, the proportion of future black and mixed-race doctors (40.7%) was higher than at other schools
25 because the captioned institution has adopted a quota system of admissions since 2003. Although the
26 literature suggests higher resilience among groups that are considered minorities [12], precisely because
27 they have to break down barriers and face greater adversity from a young age, no such difference in
28 resilience was found in this study.
29

30 Similarly to other studies, in this study, no association was found between sociodemographic
31 variables and resilience, with the exception of age. In this study, according to the census, age contributes
32 to the resilience level: the older the participant, the more resilient. Although a Brazilian article has been
33 produced that found no variance in resilience based on the year of the program [10], that is to say, that
34 resilience is no higher in older students, the results of this study were similar to the majority of the
35 existing studies [12, 27, 41, 42], including one focusing on health professionals [40].
36

37 As the existing literature indicates, medical students [47] mature over time, as they are
38 repeatedly exposed to difficult situations. In the two final years, the students spend most of their time in
39 the company of residents and teachers. Indications show that disciplined association, structured on
40 partnership, within an ethical environment, boosts students' resilience [47]. The researchers believe that
41 the students evaluated feel a sense of belonging to such positive environments and this, combined with
42 the repeated exposures resulting from their activity profile, contribute to the building of resilience during
43 the clerkship period.
44

45 In the analyses conducted here, students who lived alone showed no difference in resilience as
46 compared to students with different living situations. A possible explanation for this is that living alone
47 does not mean that the student does not feel protected by a support system outside the current living
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situation. This might also account for the similarity with other groups studied, involving children [19] and elderly individuals [48] from developed countries, described in prior studies.

It is a common belief that a good income level is associated with material and emotional wellbeing. Having money can resemble protection due to the access it affords to good schools, good medical care, and peace of mind in old age. The variables related to income were represented in this study by the type of school attended before, by whether or not the student is financially independent, by the parents' education level, and whether or not the student was admitted as a result of a quota system.

In Brazil, public schools are usually attended by the low-income population, while medical students are mostly supported financially by their families, and so a direct association exists between a better education level of the parents and higher income, whereas the precondition for the quota system is low income. This study found, as did the existing literature examined [19, 20, 41], that the variables related to income show no association with resilience. This is a very interesting conclusion as it forces us to consider the possibility that personal or collective attitudes or approaches could be capable of boosting resilience and, so, improving people's lives in different ways, regardless of each person's financial possibilities.

At first glance, the association between resilience and religion may seem relevant. The World Health Organization (WHO) uses faith as a quality of life [49] indicator, which implies that having a faith can increase the quality of life. In addition, religion is known to promote well-being, which might indicate that religious individuals are more resilient due to the sense of protection that they experience [6, 12]. However, this study found no association between these variables. This may be due to the fact that the instrument was used to measure the individual's choice to embrace a religion, and not the person's religiousness or belief in its essence.

The questionnaire used in this study made no distinction between self-prescribed use of habit-forming drugs and their use as part of a treatment under medical supervision, which could be construed as a limitation of the study. At any rate, the census's findings show that the vast majority of the students studied do not use such medications, which differs from the findings of another study on Brazilian medical students [50]. However, awareness of the risks of this practice and the unnecessary use of these substances makes their consumption less likely among individuals with greater resilience.

It is not hard to believe that resilience might act as a protective factor against smoking and alcoholism, as previously noted in studies on different populations: middle-aged Spanish women [18], Turkish youngsters, [26] and American war veterans [51]. Understanding how damaging those substances are to health might encourage more resilient individuals to avoid those addictions [52], confirming the association found between the non-use of habit-forming medications and high resilience. Alternately, high resilience could reduce substance abuse in response to stress and mental suffering.

In this study, suspected alcohol abuse, which was identified using the CAGE questionnaire, showed a reverse association with resilience levels in the bivariate analysis. However, when controlled in terms of other variables, this variable lost its effect and was useless in identifying vulnerable groups. Presumably, the effect of high resilience on preventing the use of habit-forming medications minimized the effect of alcohol dependence in the multivariate analysis.

The responding students described their perception of their own health. The literature indicates, supported by highly reliable data, that self-assessments are capable of conveying additional knowledge that might not be fully determined through epidemiological clinical measurements, or any other available measurements. For some reason, which has yet to be fully understood, the individual has a knowledge of the self that he or she is not even aware of [53]

The findings of this study showed an important association between high resilience and a good perception of one's own health. At the same time, a number of articles show that increased resilience promotes better self-care among HIV-positive patients [54], protects against depression among prison workers, [55] and helps the partners of prostate cancer patients to better cope with the disease [56].

It is also believed that working on building resilience is an important tool to encourage the practice of sports and healthier eating habits [9], to dissuade youngsters from engaging in sexual promiscuity, [23] and allow them to benefit from an overall improvement to their health [19, 57].

The limited causality established in this study, due to fact that it is a cross-sectional survey, is more strongly reflected in the variables concerning health behavior, such as: is the individual more resilient because he or she takes better care of him or herself, or does he or she takes better care of him or herself because he or she is more resilient?

Please note that the study population, namely medical students, who work with health/disease and medicalization/non-medicalization, tends to have as the variables most closely associated to resilience two aspects falling within their core values: health and medication. This raises the following question: is resilience influenced, primarily, by the specific values tied to each populational group? Would it be appropriate to extend the results to other realities? Additional studies would have to be conducted with other populations in order to confirm this association. A better understanding of this possibility might be useful in devising specific actions to boost resilience within the various groups. Or should we pursue other explanations for these findings?

In past years, genetic issues have been found to be associated with resilience, which shows that it might be mediated by adaptive changes to a number of neural circuits involving several neurotransmitters and molecular pathways. [58] There is still much to be understood about this, but we believe that it is important to reflect on the likely relevance of these individual variances impacting the temperament traits and character traits. [59,60].

So, by association, does a better state of health or better conditions exist to prevent students from feeling the need to resort to the use of habit-forming drugs, before medical school? It is a known fact that those students are, in their majority, resilient. And, in turn, those who are most resilient possess temperament features, such as reward dependence and persistence, and character traits, such as self directedness and cooperativeness. [59] These findings have been repeated in another study involving physicians. [60] Should we be allowed to speculate that it is precisely because they possess these qualities that medical students choose to take the course, and that the associations found between high resilience, a good perception of one's own health, and the non-use of habit-forming drugs are simply a consequence of this?

Resilience has received growing attention in recent years due to the finding that strategies to boost resilience could be positive, transformative measures, from the individual and collective viewpoints.

This article discusses certain characteristics of medical students and shows that being older, having a good perception of one's health, and refraining from using habit-forming medications are associated with increased resilience. On the other hand, variables concerning income and religion were not associated with resilience.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest

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STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No/ page	Recommendation
Title and abstract	1 1a - 1 1b- 1	(a) Indicate the study’s design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2 - 2	Explain the scientific background and rationale for the investigation being reported
Objectives	3- 3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4 - 3	Present key elements of study design early in the paper
Setting	5 - 3	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6 - 3	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up <i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls <i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants (b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case
Variables	7- NA	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*- 4	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9- NA	Describe any efforts to address potential sources of bias (it is a census)
Study size	10 3	Explain how the study size was arrived at
Quantitative variables	11 3	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12 - 4	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses

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Results

Participants	13*4	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram
Descriptive data	14*4	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest (c) Cohort study—Summarise follow-up time (eg, average and total amount)
Outcome data	15*4/5	Cohort study—Report numbers of outcome events or summary measures over time Case-control study—Report numbers in each exposure category, or summary measures of exposure Cross-sectional study—Report numbers of outcome events or summary measures
Main results	16-4/5	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17- 6	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses

Discussion

Key results	18- 7	Summarise key results with reference to study objectives
Limitations	19- 8	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20 7/8	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21- 8	Discuss the generalisability (external validity) of the study results

Other information

Funding	22- 9	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based
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*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

NA not applicable

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.