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Association between empathy and personality in a sample of Brazilian medical students: a cross-sectional study

Short title: Empathy and personality In Brazilian med students

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Abstract

Objectives: Empathy is crucial in patient-centered care, enabling shared decision-making, better satisfaction, and clinical outcomes. We examined the association between empathy and personality in a sample of medical students from Brazil.

Methods: The sample comprised medical students from the first to sixth year at a private university in Sao Paulo. Empathy was evaluated cross-sectionally using the Interpersonal Reactivity Index. The NEO Five-Factor Inventory was used to assess personality domains. A multivariate linear regression analysis modeled the association between personality and empathy.

Results: The final sample consisted of 227 subjects. The mean age was 24.2 (SD 4.3) years, and the sample was predominately female (75%). **Higher levels of Neuroticism ($\beta = 2.11$, 95% CI 0.84–3.38, $P = 0.001$) and Agreeableness ($\beta = 2.50$, 95% CI 1.46–3.53, $P < 0.001$) were associated with higher empathy scores.** Extraversion ($\beta = 0.00$, 95% CI -1.26–1.26, $P = 0.998$); Openness to Experience ($\beta = 0.85$, 95% CI -0.28–1.98, $P = 0.138$), and Conscientiousness ($\beta = -0.80$, 95% CI -1.95–0.35, $P = 0.173$) did not show significant associations with empathy scores. **Female gender, year in the program, and sociodemographic characteristics did not show significant associations with empathy.**

Conclusion: Both Neuroticism and Agreeableness were found to be associated with higher empathy. We review available interventions to enhance empathy and identified potential medical education curricular changes that could foster empathy development.

Keywords: empathy; medical education; medical students; personality; personality inventory.

Introduction

Medicine has undergone increasingly rapid changes over the past centuries¹. Today, there is not only a focus on scientific evidence to inform decisions but also a growing interest in what makes a physician more effective². Effective communication is essential in patient-centered care, enabling shared decision-making³. The cornerstone of this approach is empathy, in which the physician strives to understand patients' perspectives, enabling more accurate responses to patients' emotions and demands⁴.

Empathy is a multidimensional construct involving emotions and relationships, forming a psychological system associated with feelings of connectedness with others ⁵. **Davis describes empathy as a way of responding to the experiences of others, highlighting its cognitive and emotional aspects ⁵. The cognitive dimension of empathy refers to the ability to understand another person's experiences and inner emotions, predict their thoughts and feelings, and adopt their perspective when viewing the world ^{5, 6, 7, 8}. On the other hand, its emotional dimension involves a genuine interest in others' needs and the capacity to share or partake in their experiences and emotions ^{5, 6, 7, 8}.** Mastery of these components is crucial for successful clinical interactions ⁴. Physician empathy is linked to improved patient reporting of symptoms and concerns, better understanding of illness-related information, increased treatment engagement and compliance, greater diagnostic accuracy, and improved patient quality of life ^{9, 10}. Furthermore, empathy aids in identifying social determinants of health, contributing to a culturally sensitive medical practice, and helping to mitigate prejudice ^{11,12}.

Various personal characteristics, such as gender and stage of medical training, influence empathy toward patients ¹³. Research points to higher empathy scores in women in the general population and among medical students ^{13,14}. Another aspect often observed in medical students, especially from North America and Europe, is that lower empathy scores are found in those in more advanced stages of their medical course, closer to graduation ^{15,16}. In addition, sociodemographic and curricular aspects also seem to have an important impact on determining empathy ^{15,17}. Socioeconomic status (SES) is inversely related to empathy in most studies among medical students ¹⁷, and a stressful work environment and poor role model interaction are among the main curricular factors that most influence the decline of empathy in medical students ¹⁵.

Personality is another critical domain of individual factors influencing dispositional empathy and overt helping behaviors ¹⁸. Each person has a unique way of thinking, behaving, and expressing feelings or emotions, which define their personality and significantly influence all human behavior ¹⁹. The Five-Factor Model is one of the most robust and validated personality models to describe individual differences in social, emotional, and behavioral patterns and is organized into five dimensions: neuroticism,

extraversion, openness to experience, agreeableness, and conscientiousness²⁰. It has been previously demonstrated that correlations between specific Five-Factor Model dimensions and higher empathy, especially agreeableness and conscientiousness, were predictors of higher levels of empathy among college students in four different cultures²¹. However, there is conflicting evidence about which personality domains correlate more with empathy among medical students. Previous studies have shown that empathy was more strongly associated with either openness to experience and neuroticism²² or openness to experience and agreeableness²³.

In Brazil, although previous studies have investigated empathy^{1, 24, 25}, and personality²⁶ among medical students, very few have examined the relationship between the two. In a sample of medical students from the South region of Brazil, female students presented higher levels of empathy, but the authors did not find any significant associations between empathy levels and the five dimensions of the Five-Factor Model²⁷. Thus, further investigation of the relationship between empathy and personality domains in this population is necessary. This is especially true given that Brazil has a high demand for physicians and the second-highest number of medical schools in the world (over 357, second only to India)²⁸. As the number of medical schools in the country continues to expand²⁸, the quality of medical education represents a significant challenge. In such a scenario, evaluating how individual factors, such as personality, can influence the development of empathy in medical students is paramount.

Empathy can vary across different fields of study^{15, 29}. A comparative study at a Swedish university found that engineering students scored lower on empathy than in medicine, psychology, and social work³⁰. Similarly, studies in Brazilian universities reported higher empathy levels among psychology students compared to engineering and higher empathy scores in healthcare students compared to those in the exact sciences and humanities, particularly in the affective domain³¹. Moreover, major world events can influence empathy in populations. The COVID-19 pandemic marked a significant turning point in history, not only in terms of public health structure but also due to the scarcity of material and human resources, which sparked crucial ethical debates³², particularly concerning mental health and illness³³. In this context,

healthcare professionals and students were directly impacted. Studies indicate a significant increase in psychological concerns among individuals working in healthcare during the pandemic³⁴, with a notable rise in the prevalence of mental disorders, particularly among those with direct patient contact³⁵. Interestingly, the literature suggests that students exposed to frontline work during the pandemic displayed higher empathy scores than those not exposed³⁶. This increase in empathy is likely linked to affective components such as empathic concern, where individuals prioritize alleviating others' suffering before their own distress.^{16, 36}.

Although previous research has evaluated associations between empathy and personality in other countries^{21, 22, 27}, exploring these factors within our population's distinct socioeconomic and cultural characteristics is crucial. The main objective of the present study is to evaluate the relationship between empathy and Five-Factor Model personality domains in a sample of medical students—the only group of students going to campus in person during the COVID-19 pandemic at a private university in the city of Sao Paulo—across the six-year medical school program. Also, we examined the relationship between empathy, sociodemographic factors, and the student's year in the medical program. Our main hypothesis is that personality domains, particularly agreeableness, positively correlate with higher empathy scores. In addition, as a secondary hypothesis, we expect to find correlations between sociodemographic factors and empathy, especially gender and the student's year.

Methods

Design and ethical aspects

In the current study, we conducted a cross-sectional, self-report survey with medical students from all six years of the program at Santo Amaro University, a private institution in Sao Paulo, Brazil. Data collection occurred between August 2021 and November 2022. During this period, the university's medical program had a total enrollment of 1,730 students. However, the survey was not distributed to the entire student body. Questionnaires were administered during classroom sessions of the Medical Psychology and Clinical Psychiatry courses and at the outpatient psychiatry clinic. The survey was offered to 340

students attending these sessions, of whom 229 (67.4%) voluntarily agreed to participate and completed the instruments. Inclusion criteria required participants to be enrolled medical students in any program semester. Exclusion criteria included being under 18 years of age, having their university enrollment suspended, or being on medical or other forms of leave.

In Brazil, **primary education typically encompasses ages 6 to 14 (elementary and middle school), while secondary education covers ages 15 to 17 (high school). Some students enter undergraduate education immediately after high school. However, a significant number of students, particularly medical students, attend preparatory courses to enhance their performance on college admissions tests, which are typically held once or twice a year.** The undergraduate medical course spans six years, commonly divided into three two-year phases: initial (first and second years), intermediate (third and fourth years), and clerkship rotations (fifth and sixth years)²⁵. Accordingly, we divided our sample into three corresponding groups.

The university's ethical committee reviewed and approved the study methodology under protocol number CAE 52557021.5.0000.0081. After the study procedures were explained, written informed consent was obtained. The first author, a general psychiatry resident at the time, invited medical students to participate in the study in the classroom during breaks. Those who chose to participate responded to the questionnaires at that moment.

Instruments

For measuring empathy, we used the Brazilian version of the Interpersonal Reactivity Index (IRI), which includes four subscales: Perspective Taking (cognitive empathy), Empathic Concern (warmth and compassion for others), Fantasy (identification with fictional characters), and Personal Distress (self-oriented negative reactions to others' distress)¹⁶. During validation, the Fantasy subscale was removed due to a lack of cultural reproducibility³⁷. The adapted IRI consists of 21 items across three subscales, each scored on a Likert scale from 1 ('Does not describe me well') to 5 ('Describes me very well'), with six items

reverse-scored. Scores range from 21 to 105, with higher scores indicating greater empathy. Cronbach's coefficient for the scale is 0.75³⁷.

The translated and validated Portuguese version of the NEO Five-Factor Inventory (NEO-FFI) by Magalhães et al. (2014) was used to assess personality domains^{38, 39}. The NEO-FFI measures five personality domains: Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness³⁸. The inventory includes 60 items, each rated on a 5-point Likert scale from 0 ('strongly disagree') to 4 ('strongly agree'). Scores for each domain are summed, reflecting the degree of the respective personality domain. The Cronbach's coefficients for the domains ranged from 0.71–0.81³⁸.

Procedures

We administered the self-report instruments described above, along with a sociodemographic questionnaire specifically developed for this study. The questionnaire collected data on students' age, gender, year in the program, type of elementary, middle, and high school education (private or public), receipt of financial aid for tuition, and housing arrangements (living alone, with family, or with friends).

Each student completed the instruments in the following order: sociodemographic questionnaire, IRI and NEO-FFI. Each student completed the forms at once, with data collected from different subgroups on different occasions. For first- and second-year students, the instruments were administered before medical psychology classes on four occasions. For third- and fourth-year students, the instruments were administered before psychiatry classes on five occasions. For fifth- and sixth-year students, the instruments were administered during the psychiatry clerkship rotation on ten occasions.

During data collection, Brazil was under a COVID-19 public health emergency. Precautions included providing alcohol-based hand sanitizer and disposable pens, requiring participants to wear masks, and maintaining a minimum one-meter distance between desks in the classroom. Completed paper scales were stored in plastic bags for later analysis.

Statistical analysis

First, we performed the descriptive statistics for the following variables: age, gender, year in the program, type of (private or public) elementary and middle, and high school educational background, student financial aid, housing (living alone, with family, or with friends) and IRI total scores, and NEO-FFI domains' scores. Medical School in Brazil consists of a six-year undergraduate course. For this analysis, the six years of the program were divided into three two-year periods, as commonly segmented in related studies: initial (first and second years), intermediate (third and fourth years), and clerkship rotations (fifth and sixth years). Categorical data are reported as N (%) and dimensional data as mean (SD). Second, we performed a multivariate linear regression using the IRI total score as the dependent variable and the sociodemographic data and personality domains as the independent variables. We calculated the Generalized Variance Inflation Factor (GVIF) to check for multicollinearity among predictor variables. **Also, violations of linear regression assumptions were tested, including the normality of residual distribution using the Shapiro-Wilk test and homoscedasticity using the studentized Breusch-Pagan test.** All analyses were conducted using R (Project for Statistical Computing) version 4.3.2. All p-values are two-tailed, with a significance level set at 0.05.

Results

Subjects

The initial sample included 229 medical students, with 227 remaining after excluding two subjects due to incomplete responses. This final group represented 13% of all students enrolled in the medical course and 67% of those offered voluntary participation. Table 1 contains the final sample sociodemographic characteristics. Most participants were female ($n = 171, 75.3\%$), with a mean age of 24.2 years ($SD = 4.3$). The largest proportion of respondents were in the intermediate period of the program ($n = 92, 40.5\%$). Most had a private education for both elementary and middle ($n = 175, 77.1\%$) and high ($n = 193, 85\%$) schools. Most subjects did not receive student aid ($n = 186, 81.9\%$) and lived with their family ($n = 111, 48.9\%$).

Table 1. Sociodemographic characteristics

Variable	All subjects (N = 227)	
	Mean (SD)	n (%)
Age	24.2 (4.3)	
Gender		
<i>Female</i>		171 (75.3%)
<i>Male</i>		56 (24.7%)
Year at the program		
<i>Initial (1st and 2nd)</i>		49 (21.6%)
<i>Intermediate (3rd and 4th)</i>		92 (40.5%)
<i>Clerkship rotations (5th and 6th)</i>		86 (37.9%)
Elementary and middle school education		
<i>All public</i>		30 (13.2%)
<i>Mostly public</i>		7 (3.1%)
<i>Public and private (evenly split)</i>		3 (1.3%)
<i>Mostly private</i>		12 (5.2%)
<i>All private</i>		175 (77.1%)
High school education		
<i>All public</i>		27 (11.9%)
<i>Mostly public</i>		2 (0.9%)
<i>Public and private (evenly split)</i>		0
<i>Mostly private</i>		5 (2.2%)
<i>All private</i>		193 (85%)
Student aid		
<i>Any</i>		41 (18.1%)
<i>None</i>		186 (81.9%)
Housing (lives with)		
<i>Alone</i>		41 (18.1%)
<i>Exclusively with family</i>		111 (48.9%)
<i>Exclusively with friends</i>		46 (20.3%)
<i>With family and friends</i>		29 (12.8%)

Table 2 contains the sample empathy and personality scores. The mean scores (SD) for the IRI were 73.8 (8.9). Respondents showed a higher frequency of moderate (n = 76, 33.5%) and high (n = 76, 33.5%) scores for neuroticism on the NEO-FFI, along with moderate scores for extraversion (n = 93, 41%), openness to experience (n = 75, 33%), agreeableness (n = 77, 33.9%), and conscientiousness (n = 78, 34.4%).

Table 2. Empathy scores and personality factors

Variable	All subjects (N = 227)	
	Mean (SD)	n (%)
Empathy total scores		
<i>JSE</i>	123.2 (8.52)	
Personality factors (NEO-FFI)		
<i>Neuroticism</i>		
<i>Very Low</i>		
<i>Low</i>		
<i>Moderate</i>		5 (2.2%)
<i>High</i>		37 (16.3%)
<i>Very High</i>		76 (33.5%)
<i>Extraversion</i>		76 (33.5%)
<i>Very Low</i>		33 (14.5%)
<i>Low</i>		
<i>Moderate</i>		15 (6.6%)
<i>High</i>		54 (23.8%)
<i>Very High</i>		93 (41%)
<i>Openness to experience</i>		55 (24.2%)
<i>Very Low</i>		10 (4.4%)
<i>Low</i>		
<i>Moderate</i>		17 (7.5%)
<i>High</i>		48 (21.2%)
<i>Very High</i>		75 (33.0%)
<i>Agreeableness</i>		67 (29.5%)
<i>Very Low</i>		20 (8.8%)
<i>Low</i>		
<i>Moderate</i>		21 (9.3%)
<i>High</i>		39 (17.2%)
<i>Very High</i>		77 (33.9%)
<i>Conscientiousness</i>		69 (30.4%)
<i>Very Low</i>		21 (9.3%)
<i>Low</i>		
<i>Moderate</i>		21 (9.3%)

<i>High</i>	53 (23.4%)
<i>Very High</i>	78 (34.4%)
	63 (27.8%)
	12 (5.3%)

Empathy predictors

In the multivariate linear regression analysis (Table 3), the IRI total scores presented a statistically significant **association** with neuroticism ($P = 0.001$) and agreeableness ($P < 0.001$). The model explained 22% of the variance in the IRI total score, with an adjusted R-squared value of 17%. The GVIF values for all predictors are below two, which indicates low multicollinearity. **Also, the normality of the residuals' distribution was confirmed ($W = 0.99, P = 0.71$), and there was no evidence of heteroscedasticity ($BP = 14.39, df = 14, P = 0.42$).**

Table 3. Multivariate linear regression for empathy total scores

	IRI				Adjusted GVIF ¹
	β	SE	95% CI	p-value	
(Intercept)	61.85	6.09	49.85, 73.85	< 0.001***	–
Age	-0.03	0.15	-0.32, 0.27	0.865	1.18
Female gender	2.17	1.34	-0.48, 4.82	0.108	1.08
Year at the program (higher)	0.24	0.85	-1.44, 1.91	0.779	1.19
Elementary and middle school background (private)	0.96	0.61	-0.25, 2.16	0.119	1.62
High school background (private)	-0.93	0.71	-2.33, 0.46	0.188	1.73
Student aid (any)	0	2.09	-4.12, 4.11	0.998	1.49
Housing – Exclusively with family	0.98	1.60	-2.17, 4.13	0.540	
Housing – Exclusively with friends	-0.69	1.91	-4.46, 3.08	0.719	1.08
Housing – With family and friends	-2.24	2.06	-6.29, 1.81	0.277	
Neuroticism	2.11	0.65	0.84, 3.38	0.001**	1.20
Extraversion	0	0.64	-1.26, 1.26	0.998	1.14
Openness to experience	0.85	0.57	-0.28, 1.98	0.138	1.14
Agreeableness	2.50	0.53	1.46, 3.53	< 0.001***	1.07
Conscientiousness	-0.80	0.59	-1.95, 0.35	0.173	1.14
<i>Residual standard error (on 212 df)</i>			8.10		
<i>R²</i>			0.22		
<i>Adjusted R²</i>			0.17		
<i>F-statistic (on 14 and 212 df)</i>			4.32		
			<i>P</i> < 0.001		=

Abbreviation: IRI
Interpersonal
Reactivity Index

Significant predictors are shown in bold. * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

¹Adjusted Generalized Variance Inflation Factor (GVIF) = $GVIF^{1/2}$ (df). Values below 2.5 denote non-significant collinearity between each variable and others.

Discussion

In our sample, we found that higher levels of neuroticism and agreeableness were significantly associated with higher empathy.

Neuroticism is a personality domain characterized by an increased tendency to experience negative feelings such as anxiety, distress, and perceived threats in relationships, accompanied by emotional instability, impulsiveness,

and difficulty managing stress constructively ²⁰. Individuals high in neuroticism also tend to interpret ordinary situations as threatening and are susceptible to mood swings ²⁰. Neuroticism has been positively associated with empathy, especially in its affective domain (personal distress), which includes the discomfort and anxiety experienced when witnessing another person's adverse experiences ^{22, 41, 42}. The conceptual overlap between neuroticism's vulnerability to stress and the tendency to experience unpleasant feelings in response to others' distress suggests that these constructs encompass similar aspects of human emotional functioning ⁷. This is consistent with the higher empathy scores observed in individuals with high neuroticism in our study, consistent with previous research ^{22, 41, 42}.

Our findings regarding agreeableness align with previous studies that show a correlation between this domain and empathy in the general population ⁴⁴. Individuals high in agreeableness are generally better at understanding others' perspectives and feeling compassion, though they may not necessarily experience personal distress when witnessing others' sorrow ¹⁸. These cognitive and emotional processes are linked to overt helping behaviors, indicating that those high in agreeableness are more likely to engage in empathic actions that drive prosocial behavior, such as helping both acquaintances and strangers ¹⁸. This connection is further supported by neurophysiological pathways, including mirror neurons, which help us interpret others' attitudes and understand their intentions, emotions, and mental states ²⁰. Consequently, medical students with higher agreeableness are expected to exhibit greater empathy, enabling them to understand patients' perspectives better and express more sympathy, warmth, and compassion in their future practice ⁴¹. This association between agreeableness and higher empathy, theory of mind, and other forms of social information processing ¹⁸ is consistently supported by empirical evidence, including studies among Portuguese ⁴⁵ and American ⁴⁶ medical students and a cross-cultural assessment involving university students from China, Germany, Spain, and the United States ²¹.

Our study did not find significant associations between empathy and the three other personality dimensions—Openness to Experience, Extraversion, and

Conscientiousness. Openness to Experience, which encompasses receptiveness to emotional experiences, self-awareness, and flexibility in thinking and decision-making, has been strongly linked to understanding others' inner experiences, including their intentions, beliefs, emotions, and needs ⁴⁷. Some studies have reported a positive association between Openness to Experience and empathy, particularly among medical students ^{7, 22, 41}. However, a multicenter study by Melchers et al. (2016) involving the general population found no such association using the IRI scale ²¹, consistent with our findings. Sociodemographic differences may account for these discrepancies between studies, consistent with results from a similar investigation among medical students in northeastern Brazil, which also found no association between Openness to Experience and empathy ⁴³.

Previous authors have presented a positive relationship between Extraversion and empathy among medical students ²². Extraverted individuals, often described as sociable, kind, and inclined toward positive emotions, tend to focus outwardly and actively seek social interactions ⁴⁸. This outward tendency and their ability to express warmth and friendliness are particularly valuable in situations that require empathetic care ^{7, 49}. Previous studies were primarily conducted in European populations ^{7, 22}, and a Brazilian study found a positive association between Extraversion and the cognitive domain of empathy and a negative association with the affective domain ⁴³. In contrast, our study assessed global IRI scores, which may account for the discrepancies. These findings suggest that Extraversion may influence empathy differently across its domains, and methodological and sociodemographic differences likely contribute to the variations observed across studies.

Some previous studies have reported a positive association between Conscientiousness and empathy ^{21, 41, 50}. This may be partly explained by the inverse relationship between Conscientiousness and domains such as egocentricity and lack of concern for others, which are linked to lower levels of empathy ^{21, 52}. Conscientious individuals, in contrast, are often described as organized, responsible, and emotionally regulated, domains that can contribute positively to certain aspects of empathy ⁵¹. That perception is enhanced by other

studies that found a negative correlation between Conscientiousness and the emotional domain of empathy. One explanation is that highly conscientious individuals may prioritize efficiency and self-control over emotional involvement with others ^{7, 22, 41}. Adding to the complexity, Costa et al. (2014) found no correlation between Conscientiousness and empathy among Portuguese medical students, suggesting these constructs may operate independently in certain populations ²³. Another Brazilian study found no significant association between Conscientiousness and empathy ⁴³, similarly to our findings. These discrepancies highlight the potential role of sociocultural factors in shaping the relationship between Conscientiousness and empathy across different cultural contexts.

The sociodemographic characteristics included in our study were not associated with empathy levels. This finding is in contrast with the well-established link between the female gender and higher empathy levels reported in previous studies ^{13, 14}. Similarly, another Brazilian study of medical students also failed to find this association ⁴³. We also expected to find an association between the period of the medical course and empathy levels, as demonstrated in other studies, which reported lower empathy values in the more advanced periods of the course ^{1, 15, 16, 24}. However, our findings align with a recent Spanish prospective cohort study by Blanco et al. (2020), which observed no empathy decline over five years of medical education ⁵³. This difference may reflect a more contemporary trend in medical education practices within universities.

According to the literature, empathy is not developed automatically in medical students by default; therefore, it is essential to design targeted educational programs to enhance empathy in junior doctors ³. Most curricula tend to focus on cognitive learning rather than on attitudes. Prevailing medical school programs prioritize objective biomedical facts to the detriment of doctor-patient relation discussion. These teaching patterns are generally associated with a culture that considers anything not strictly derived from a scientific paradigm of lesser importance, often neglecting the less tangible elements of interpersonal relationships, such as understanding others' feelings and perceptions ⁴. Despite the cultural challenge, over the years, many approaches have been described to narrow this gap, including training in interpersonal or

communication skills, as well as audio or video recording of encounters with patients, exposure to role models, role-playing, shadowing patients, hospitalization experiences, study of literature and the arts, theatrical performances, training in narrative skills and reflective writing³. The educational environment also plays a vital role since burnout is implicated in lower empathy levels in medical students⁵⁴. Moreover, besides self-confidence, a positive role model provided by more experienced professors encouraged more empathetic behaviors in medical students⁵⁵. To this end, teaching staff should also receive training on improving empathy.

In Brazil, studies have observed that active teaching methodologies at different stages of medical training and activities within small groups working on problematization or motivating cases bring students closer to the reality experienced by the population⁵⁶. These practices present medicine in a positive light and are valuable for preserving and expanding empathy⁵⁶. In a systematic review, Patel et al. (2019) observed that compassion and empathy training improved these outcomes in medical students⁵⁷. The authors describe that training methods involving actual patients and recorded video interviews were the strategies with the highest success rate⁵⁷. Furthermore, some behaviors can increase the patient's perception of the caregiver's empathy, including: (1) sitting (rather than standing) throughout the interview; (2) being aware of the patient's facial expressions and non-verbal signs; (3) being responsive to opportunities for showing empathy; (4) non-verbal communication of care (e.g., eye contact); and (5) verbal statements of acknowledgment, validation, and support⁵⁷. A potential common factor between these interventions is that the patient is assured of the doctor's presence and focus⁵⁷. Also, early clinical exposure, role-playing as patients, exposure to literary and performing arts; enhancement of communication, narrative, and stress management skills; and exposure to role models improved empathy in medical students¹⁵. Role modeling by clinical instructors during experiential training has been reported as the most crucial influence on empathy education¹⁵. Our results highlight the importance of incorporating empathy-related concepts into the curriculum from the initial years, particularly in subjects like medical ethics, psychology, psychiatry, and clinical medicine. Qualitative research suggests that empathy begins as an affective emotion and is expressed cognitively as students progress through their training⁵⁸, indicating that

curriculum changes could promote more empathetic practices. Additionally, understanding how personality domains influence empathy can guide schools in tailoring interventions to foster empathy, with a particular focus on male students with low levels of neuroticism and agreeableness.

The present study has several strengths, such as the participation of students from all six years of the medical school program and as one of the few studies that evaluated the association between empathy and personality among Brazilian medical students, an underexplored field in the international research literature as well. It also has important limitations, such as having a cross-sectional design and a sample from a single and private university in Southeast Brazil. Recruitment was voluntary, which may have attracted students with a greater predisposition toward empathy while excluding those less inclined to it. Additionally, our study was conducted during the COVID-19 pandemic, when empathy levels among medical students in Brazil increased, which may have directly influenced our findings³⁶. The reliance on self-report questionnaires may have led to data underestimation, particularly in cases where empathy scores were borderline, and we only collected data on sex assigned at birth, omitting sexual orientation and gender identity, despite evidence that sexual orientation can influence empathy levels⁵⁹. **Another limitation is the absence of an analysis of empathy subscales and their interaction with mental health symptoms. Previous research highlights the importance of examining empathy domains separately (i.e., affective and cognitive), as they interact differently with mental health factors (e.g., depression, anxiety, burnout)^{60, 61, 62}, which can affect the levels of empathy reflected in questionnaires. Addressing these limitations in future research (e.g., by individually evaluating affective and cognitive empathy domains) could provide more nuanced insights into the relationship between empathy, medical students' personality, and mental health.**

In conclusion, in our sample of medical students, we found that higher levels of agreeableness and neuroticism were significantly associated with higher empathy. Medical schools should consider interventions for empathy development. The present study adds to the scarce literature on this subject. Future research is needed to confirm these findings, including studies with longitudinal designs.

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