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Unveiling empathy determinants across borders: a comparative analysis of medical students from two geo-sociocultural backgrounds

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Abstract

Background Empathy plays a pivotal role in healthcare professions, influencing patient satisfaction and treatment outcomes. Understanding the determinants of empathy in medical students is essential. However, findings from previous studies have been inconsistent. We hypothesized that part of this variability may be attributed to the influence of the geo-sociocultural context. In this study, we aimed to compare the longitudinal determinants of empathy in four cohorts of medical students from two distinct geo-sociocultural backgrounds.

Methods This study included 199 medical students from Porto Alegre, Brazil and Geneva, Switzerland who were in their 1 st and 4 th years of training and agreed to participate on both occasions. The outcome variable was empathy scores (total and subdimensions) assessed through the Jefferson Scale of Empathy for Medical Students (JSE-S). Independent variables included gender, personality, motives for studying medicine, specialty preferences, and the level of motivation for medical studies. Multivariate regression analyses were conducted to investigate the associations between independent variables and empathy at each site in years 1 and 4.

Results In year 1, the personality trait *openness to experience* was associated with higher empathy (total score) in both Porto Alegre (b = 0.503, $p \leq 0.01$) and Geneva (b = 0.592, $p \leq 0.001$), with this association persisting over time. However, the relationships between empathy and the other independent variables varied significantly depending on the site.

Conclusions The determinants of empathy were significantly modulated by the geo-sociocultural context. The personality trait *openness to experience* was the only consistent determinant of empathy across both sites over time. Associations between empathy and gender, motives for studying medicine, and specialty preferences were site specific. Our findings underscore the importance of considering students' backgrounds when assessing empathy teaching and learning.

Keywords Empathy, Medical students, Cross-cultural, Gender, Personality, Motivations, Specialty preference

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Background

Empathy is a central competence in professions that involve interaction with people, especially patients. A substantial body of evidence sustains that empathy positively impacts the patients' satisfaction, treatment adherence and clinical outcomes [1, 2]. Therefore, empathy skills are crucial for health professionals and trainees.

In recent years, there has been growing attention to the assessment and training of empathy during medical studies [3, 4]. Various instruments have been used to assess empathy in medical students, including the Interpersonal Reactivity Index (IRI) [5], the Empathy Quotient (EQ) [6], and the Jefferson Scale of Empathy for medical students (JSE-S) [7], all of which are self-reported measures. The IRI and the EQ were developed for administration to the general population of adults. In contrast, the JSE-S was specifically developed to assess self-reported empathy in medical students and has become the most commonly used tool within the context of medical education [4].

Empathy is an aptitude that may involve both innate personal traits and acquired characteristics influenced by educational and sociocultural backgrounds [8]. Over the years, several studies have used the JSE-S to identify the variables associated with empathic dispositions in medical students, but the results remain unclear. For example, it was often hypothesized that students who have person-oriented motives for studying medicine, such as "altruism" and "caring for patients", would have higher empathy scores compared to students with security-oriented motives, such as "income" and "prestige". While some studies support this hypothesis [9, 10], others do not [11, 12]. Similarly, students interested in person-oriented specialties (e.g., pediatrics) as opposed to non-person-oriented specialties (e.g., pathology) have shown higher empathy scores in some studies [9, 13–17] but not in others [18–20, 12, 21, 11, 22, 23]. Furthermore, while certain personality traits, such as agreeableness and openness to experience, have been consistently linked to high empathy levels [18, 24–27], the influence of other traits remains unclear [24, 27, 28].

The discrepancies among studies may be multifactorial [29]. One factor that has been highlighted in recent reports is sociocultural differences. Using the IRI, Chopik et al. found that the association between individual characteristics and self-reported empathy changed depending on the context [30]. Similarly, Zhao et al., using the EQ and the IRI, suggested that the association between female sex and higher self-reported empathy is influenced by cultural context [31], possibly because empathy is more encouraged in women than in men in certain societies. Additionally, a recent review of the literature suggests that changes in empathic dispositions over the course of medical training might be determined by geo-sociocultural characteristics, such as language and whether a culture is more individualistic or collectivistic [32]. However, studies examining the influence of sociocultural context on empathy in medical students remain scarce and inconclusive [4]. Furthermore, no studies have explored the interplay of potential determinants of empathy in a longitudinal cross-national context throughout medical training.

From another perspective, it is recognized that empathy encompasses two constructs embodying emotional and cognitive dimensions [33]. The Jefferson Scale of Empathy for Medical Students (JSE-S) [7] can assess both empathy and its subdomains. However, many studies using the JSE-S have focused solely on global scores, potentially overlooking the emotional and cognitive dimensions. Studies examining the subdimensions of empathy are still lacking.

In this study, we aimed to compare the longitudinal determinants of self-reported empathy in two cohorts of medical students from different sociocultural and educational backgrounds in Brazil and Switzerland. Additionally, we investigated the impact of empathy determinants on the global score as well as the partial subdomains derived from the JSE-S questionnaire.

Methods

Study design

This is a cohort study that started in 2011 at the University of Geneva, Switzerland, and evolved to a larger multicenter project which included among others, the University of Lyon, France, and the Federal University of Health Sciences of Porto Alegre, Brazil. The original research was designed to follow medical students throughout their whole training (6 years) by assessing how contextual and personal characteristics influenced their academic performance, career intentions, and empathy over time [34–36]. In each site, two cohorts of students were followed. The selection of students occurred through convenience sampling: all students enrolled in the first year of medical school during the specified academic years were invited to participate. In Geneva, students were recruited during year 1 in 2011 for cohort 1 and 2012 for cohort 2. A total of 767 students were invited to participate, and the response rate was 80%. In Porto Alegre, students were recruited during year 1 in the academic years 2015 (cohort 1) and 2017 (cohort 2). A total of 210 students were invited to participate in Year 1, and the mean response rate was 86.8%. Data collection was performed each year for the purpose of the project, but only data from year 1 and year 4 were considered for the present study.

Participants

Out of 462 students who participated in the study in year 1, and 242 who participated in year 4, 199 students with complete data on both years were included in the final analyses. Of these, 130 were from UNIGE (mean age 19.9 years, 58.5% female) and 69 were from UFCSPA (mean age 20.1 years, 50.7% female).

Data collection was performed through self-reporting questionnaires and, typically, took place in a classroom during school hours. However, because of the Covid- 19 lockdown, data in year 4 at Porto Alegre was collected through online questionnaires.

Social and educational context

The socioeconomic context is different across both study locations; in Geneva the minimum hourly wage it is USD 28.52 [37], while in Porto Alegre it is USD 7.27 [38]. Regarding the medical training in each site, in both Geneva and Porto Alegre there is a predetermined and limited number of admissions for medical student candidates and in both sites the undergraduate medical training lasts six years. However, the selection process and the division of the medical curriculum on preclinical and clinical years between the two sites are different. In Geneva, all students aspiring to be admitted to medical school must undertake a pre-clinical selection year (year 1), where they learn about the fundamentals of medicine. According to their end-of-year academic performance, a subset of students is selected to continue their medical training. Selected students undergo two pre-clinical years (years 2 and 3), two clinical years (years 4 and 5), and one elective year (year 6). By contrast, all medical candidates in Porto Alegre must undertake a national written exam following the conclusion of high school before entering medical school, and those with the higher scores are selected for medical studies. Once admitted, students follow a six-year curriculum track, divided into two preclinical years (years 1 and 2), two clinical years (years 3 and 4), and two elective years (years 5 and 6).

Ethical aspects

Before agreeing to take part in the study by signing a consent form, students were informed about the content of the research project, their entitlements and commitments as voluntary participants and the terms of confidentiality and privacy. Participants provided their student ID in order to be matched throughout the duration of the study. Researchers did not have simultaneous access to the data and student IDs, as the latter were managed by a technical administrator. In Geneva, the Chair of the Cantonal Commission for Ethical Research (CCER) designated the study as exempt from formal review. In Porto Alegre, the study was approved by the Ethics Committee of Research in Humans from the University of Health Sciences of Porto Alegre (protocol number 1.151.091).

Measures

Empathy

Empathy was assessed using the medical student's version of the Jefferson Scale of Empathy (JSE-S) validated in French [39] and Portuguese [40]. The JSE-S was specifically developed to measure self-reported empathy in the context of medical education. This tool includes 20 items on a 7-point Likert scale ranging from "strongly disagree" (1) to "strongly agree" (7). Items 1, 3, 6, 7, 8, 11, 12, 14, 18, 19 are reversely coded. The JSE-S items reflect students' empathic dispositions, which allow for the calculation of a total score (possible maximum score of 140), as well as three subscores capturing three distinct dimensions, namely *Compassionate care*, *Perspective taking*, and *Standing in patient's shoes*. As determined by their developers, *Compassionate care* expresses the emotional domain, while *Perspective taking* and *Standing in patient's shoes* represent the cognitive domain of empathy [33].

Personality

Personality was assessed using the NEO Five Factor Inventory (NEO-FFI) [41] validated to French [42] and Portuguese [43]. The NEO-FFI includes five dimensions: *agreeableness, extraversion, openness to experience, conscientiousness,* and *neuroticism*. Each of these dimensions is measured by 12 items on a 5-point Likert scale ranging from "strongly disagree" (0) to "strongly agree" (4). Because previous evidence indicated that personality remains stable over the years [29], the personality questionnaire was applied in year 1 only.

Motives for studying medicine

A list of motives for studying medicine adapted from Vaglum et al. [44] was presented to the students. The following items were included in the survey: *income, prestige, liberal activity, saving lives, caring for patients, altruism, mission, vocation, curing illness* and *academic interest*. Students were asked to indicate on a 6-point Likert scale ranging from "not important" to "very important", how important each of these motives was for themselves. For the statistical analysis, 10 motives were used. On the other hand, for the interpretation of the results, we organized the motives into three categories, also following the work by Vaglum et al.:

[44] (1) person-oriented, which includes *caring for patients*, *treating illness*, *saving lives, mission, vocation and altruism*; (2) security-oriented, including *prestige*, *income*, and *liberal activity*; and (3) science-oriented, which includes *academic interest*.

Specialty preferences

Students were asked to indicate their specialty preference among a list with the following options: internal medicine, family medicine, pediatrics, neurology, rehabilitation, psychiatry, emergency medicine, obstetrics and gynecology, ophthalmology, dermatology, surgery and surgical specialties, radiology, pathology, and anesthesiology. The students could also respond that they were still unsure or undecided. Specialties were then combined into two categories based on the study of Hojat et al. [33]: 1) *person-oriented specialties*, including internal medicine, family medicine, pediatrics, neurology, rehabilitation, psychiatry, emergency medicine, obstetrics and gynecology, ophthalmology and dermatology; and 2) *non person-oriented specialties*, which included surgery and surgical specialties, radiology, pathology, and anesthesiology.

Level of motivation for medical studies

Students were asked to indicate how motivated they were for the study of medicine, on a 6-point Likert scale ranging from "very little" (1) to "very much" (6). This was appraised in each survey.

Data analysis

To compare students' profiles in the two sites, we performed descriptive statistics after stratification by study year and site. Normality of the distribution of the numerical variables was assessed. As they did not appear normal, these numerical variables were tested through Wilcoxon test and expressed as mean ± SD. Categorical variables were tested through Chi-square test and expressed as n (%).

To assess the association of the independent variables with empathy we performed two sets of regressions. Each set included four empathy outcomes (total score and its three subdimension scores). In the first set of regressions, we used only the data collected in year 1. In the second set of regressions, we used data collected in year 4 and added as control variables the scores of empathy subdimensions that were measured in year 1. This enabled us to build models that captured the relationship between the variable measured in both year 1 and year 4, and to assess the associations between the covariates of interest and the dependent variable, while considering the empathy subdimensions measured in year 1 as control variables. Hence, eight regression models were examined in total. In all models, the independent variables considered were site, gender, the five personality traits, the 10 motives for studying medicine, the three specialty preferences (person-oriented, non-person-oriented, undecided), the level of motivation for medical studies as well as interaction terms combining site to each one of the other independent variables. This enabled us to estimate the effect of each variable in each study site. Before the estimation procedure, the Spearman correlation between the independent variables was explored and no excessive correlation was found. Before the estimation procedure, the Spearman correlation between these variables was explored and no excessive correlation was found.

In addition, a thorough residuals' analysis assessed the adequacy of the model with the data. To interpret the results from the estimated models, we considered the sign, the magnitude, and the significance of the estimated parameters. The level of significance was set at $p \leq 0.05$. All statistical analyses were carried out in R (version 4.3.1).

Results

Comparison of students' profiles between sites

Table 1 details the main characteristics of the 199 students included in the analyses. Students in Porto Alegre had a higher total empathy score than their counterparts from Geneva in year 1 ($p < 0.001$) and in year 4 ($p < 0.001$). Further analyses (Tables S- 1 and S- 2 in the Online Supplement) revealed that this was due to Geneva men having lower empathy scores than women, in year 1 (respectively, 109.2 ± 11 *vs.* 115.7 ± 7.4; $p < 0.001$) and in year 4 (respectively, 110.5 ± 12.8 *vs.* 115.4 ± 9.1; $p = 0.040$). Conversely, in Porto Alegre, there were no significant differences in empathy scores between men and women neither in year 1 (respectively, 117.5 ± 10.9 *vs.* 118.5 ± 9.9; $p = 0.528$) or year 4 (respectively, 119.4 ± 10.8 *vs.* 122 ± 12.2; $p = 0.251$).

The personality profiles of students from the two sites were significantly different: those in Porto Alegre showed higher scores for *neuroticism* ($p < 0.001$) and *agreeableness* ($p = 0.014$) while those in Geneva showed more *extraversion* ($p = 0.021$) and *conscientiousness* ($p < 0.001$). Motives for studying medicine were also different between sites. At year 1, several motives were more relevant to students in Porto Alegre than to those in Geneva: *income* ($p = 0.031$), *liberal activity* ($p = 0.015$), *academic interest* ($p < 0.001$) and *saving lives* ($p = 0.042$). However, by year 4, the only significant difference that remained was regarding *income* as a motive ($p < 0.001$). The *level of motivation* for medical studies

Table 1 Comparison of the main characteristics of the study sample between sites and years

	Year 1			Year 4			*p*-value between years	
	Geneva (n = 130)	Porto Alegre (n = 69)	*p*-value	Geneva (n = 130)	Porto Alegre (n = 69)	*p*-value	Geneva	Porto Alegre
Independent variables								
Age (years)	19.9 ± 2.3	20.1 ± 1.7	0.172	-	-	-	-	-
Gender (female), n (%)	76 (58.5)	35 (50.7)	0.370	-	-	-	-	-
Personality, scores								
Neuroticism	20.8 ± 8.6	25.6 ± 7.9	< 0.001	-	-	-	-	-
Extraversion	31.3 ± 5.2	29.0 ± 6.9	0.021	-	-	-	-	-
Openness to experience	30.1 ± 6.3	32.1 ± 6.3	0.061	-	-	-	-	-
Agreeableness	29.4 ± 4.8	31.3 ± 5.7	0.014	-	-	-	-	-
Conscientiousness	34.9 ± 7.4	29.8 ± 7.2	< 0.001	-	-	-	-	-
Motives for studying medicine, scores								
Income	3.5 ± 1.2	3.9 ± 1.3	0.031	3.97 ± 1.1	4.6 ± 1.1	< 0.001	0.003	0.002
Prestige	3.4 ± 1.4	3.2 ± 1.6	0.298	3.36 ± 1.3	3.6 ± 1.3	0.200	0.496	0.129
Liberal activity	3.6 ± 1.4	4.1 ± 1.4	0.015	3.96 ± 1.3	4.2 ± 1.6	0.127	0.020	0.534
Academic interest	4.5 ± 1.4	5.2 ± 1.2	< 0.001	4.64 ± 1.2	4.5 ± 1.3	0.740	0.777	< 0.001
Cure illness	5.4 ± 1.0	5.3 ± 0.9	0.216	5.10 ± 1.0	4.9 ± 1.1	0.307	0.002	0.038
Saving lives	5.3 ± 1.1	5.6 ± 0.8	0.042	5.04 ± 1.1	5.1 ± 1.1	0.926	0.029	0.001
Caring for patients	5.4 ± 1.1	5.6 ± 0.7	0.149	5.35 ± 0.9	5.5 ± 0.9	0.157	0.238	0.346
Altruism	4.9 ± 1.2	5.2 ± 1.1	0.059	4.86 ± 1.1	4.8 ± 1.2	0.820	0.461	0.025
Mission	4.4 ± 1.4	4.8 ± 1.3	0.061	4.00 ± 1.4	4.2 ± 1.5	0.255	0.007	0.019
Vocation	4.5 ± 1.5	4.78 ± 1.3	0.349	4.13 ± 1.4	4.3 ± 1.6	0.185	0.014	0.165
Specialty preference, n (%)			0.797			0.636	0.202	0.589
Non-person-oriented	43 (33,1)	26 (37.7)		46.0 (35.4)	22 (31.9)			
Person-oriented	58 (44.6)	28 (40.6)		66.0 (50.8)	34 (49.3)			
Undecided or unsure	29 (22.3)	15 (21.7)		18.0 (13.9)				
					13 (18.9)			
Level of motivation, score	3.7 ± 2.1	3.7 ± 1.4	0.711	5.0 ± 0.9	4.3 ± 1.4	< 0.001	< 0.001	0.016
Outcomes (JSE-S scores)								
Total score of empathy	113.1 ± 9.6	118.1 ± 10.4	< 0.001	113.4 ± 11.1	120.7 ± 11.6	< 0.001	0.623	0.087
Compassionate care	46.2 ± 5.0	49.9 ± 3.9	< 0.001	46.7 ± 5.0	49.8 ± 4.5	< 0.001	0.386	0.864
Perspective taking	59.0 ± 5.8	59.3 ± 6.8	0.672	58.3 ± 6.5	61.4 ± 7.9	< 0.001	0.564	0.029
Standing in the patient's shoes	7.8 ± 2.4	8.9 ± 2.5	0.002	8.3 ± 2.7	9.5 ± 2.5	< 0.001	0.119	0.303

Numerical data expressed as mean ± SD and analyzed using Wilcoxon test. Categorical data expressed as n (%) and analyzed using Chi-square test. The same data on gender and personality were used in year 1 and year 4. SD: standard deviation, n: sample size, JSE-S: Jefferson Scale of Empathy for Medical Students

was similar between the two groups at year 1 (Geneva: 3.7 ± 2.1; Porto Alegre: 3.7 ± 1.4; $p = 0.711$). Furthermore, motivation increased in both sites overtime, but by year 4 students in Geneva were significantly more motivated than in Porto Alegre (Geneva: 5.0 ± 0.9; Porto Alegre: 4.3 ± 1.4; $p < 0.001$).

Determinants of students' empathy at the beginning of medical school (year 1)

Table 2 shows the results of the linear regression analyses investigating—in each study site—the associations between independent variables and empathy scores at year 1.

In both sites, the total score of empathy was directly associated with the personality trait *openness to experience* (Geneva: b = 0.592, $p \leq 0.001$; Porto Alegre: b = 0.503, $p \leq 0.01$). Three additional associations were only found in Geneva: higher empathy scores were associated with having a *person-oriented specialty preference* (b = 4.324, $p \leq 0.05$), while lower empathy scores were associated with being a male (b = − 6.551, $p \leq 0.01$) and with having *prestige* as a motive for studying medicine (b = − 1.849, $p \leq 0.01$).

The association between independent variables and the subdomains of empathy were also quite different between sites, except for the direct association found between *openness to experience* and *Perspective taking,* which was statistically significant in Geneva (b = 0.277, $p \leq 0.001$) and in Porto Alegre (b = 0.391, $p \leq 0.001$). All the other significant associations were only found in Geneva.

Determinants of students' empathy after four years in medical school (year 4)

Table 3 shows the associations between the independent variables and empathy at year 4, after controlling for the empathy subscores at year 1. In other words, the results highlighted in Table 3 present the estimated effects per site of each covariate on the dependent variables measured in year 4, while also incorporating the estimated effects of empathy subscores measured in year 1 on those measured in year 4.

Table 2 Determinants of empathy in Geneva and Porto Alegre at year 1

	Empathy total score		Compassionate care		Perspective taking		Standing in patients' shoes	
	Geneva	Porto Alegre	Geneva	Porto Alegre	Geneva	Porto Alegre	Geneva	Porto Alegre
Gender (Male)	-6.551**	-3.464	-3.194**	-2.413	-2.314	-2.542	-1.043	1.491
Current level of motivation	-0.311	-0.384	-0.273	0.215	0.065	-0.415	-0.103	-0.185
Site (Porto Alegre)		21.053		13.317		14.582		-6.846
Personality								
Neuroticism	-0.087	0.035	0.007	0.036	-0.008	0.001	-0.086**	-0.002
Extraversion	0.221	0.272	0.059	0.013	0.135	0.234	0.026	0.025
Openness to experience	0.592***	0.503**	0.256***	0.115	0.277**	0.391**	0.058	-0.004
Agreeableness	0.259	-0.245	0.137	-0.066	0.146	-0.281	-0.025	0.102
Conscientiousness	0.251	-0.400	0.070	-0.141	0.176*	-0.212	0.004	-0.047
Motives for studying medicine								
Income	1.246	1.028	0.235	0.337	0.630	0.659	0.381	-0.004
Prestige	-1.849**	-0-015	-0.364	0.234	-1.308**	-0.188	-0.177	-0.060
Liberal activity	-0.266	-1.604	-0.431	-0.758	0.272	-1.013	-0.107	0.167
Academic interest	0.677	0.481	-0.081	-0.043	0.646	0.501	0.112	0.023
Curing illness	-1.530	1.362	-0.491	-0.167	-0.738	1.298	-0.300	0.231
Saving lives	0.779	-1.999	0.536	-0.089	1.053	-1.801	-0.809*	-0.110
Caring for patients	-0.398	0.801	0.139	0.402	-1.235	0.160	0.699	0.238
Altruism	-0.123	2.371	-0.004	0.798	-0.229	1.196	0.110	0.377
Mission	0.268	-0.380	0.214	-0.401	0.206	0.417	-0.153	0.396
Vocation	0.674	0.715	-0.370	0.261	0.659	-0.035	0.384	0.488
Specialty preference								
Non-person-oriented	3.376	3.368	0.863	2.515	1.996	0.816	0.517	0.037
Person-oriented	4.324*	4.893	2.283*	2.223	2.169	1.511	-0.129	1.159

This table presents the estimated effects per site for each component of the JSE scale and the total empathy score as dependent variables. Specifically, each main column (representing the total empathy score or a subdimension of the JSE scale) shows the estimated effects per site from a separate linear regression model, with the variable indicated in the main column serving as the dependent variable. * $0.01 < p$-value ≤ 0.05; ** $0.001 < p$-value ≤ 0.01; *** p-value ≤ 0.001

Table 3 Determinants of empathy in Geneva and Porto Alegre at year 4

	Empathy total score		Compassionate care		Perspective taking		Standing in patients' shoes	
	Geneva	Porto Alegre	Geneva	Porto Alegre	Geneva	Porto Alegre	Geneva	Porto Alegre
Gender (Male)	-2.206	-3.848	-1.147	-1.431	-0.647	-1.339	-0.411	-1.078
Current level of motivation	1.137	-0.772	0.458	-0.460	0.635	-0.798	0.044	0.486
Site (Porto Alegre)		46.007		24.370		21.735		-0.097
Personality								
Neuroticism	-0.039	0.066	-0.026	-0.052	-0.047	0.098	-0.059	0.020
Extraversion	-0.051	0.519*	-0.047	0.157	0.009	0.339*	0.013	0.023
Openness to experience	0.137	-0.429	0.170*	-0.059	-0.019	-0.347*	0.013	-0.023
Agreeableness	0.491*	-0.068	0.146	-0.037	0.231	0.087	0.114	-0.119
Conscientiousness	-0.008	-0.379	0.045	-0.163	-0.086	-0.191	-0.047	-0.025
Motives for studying medicine								
Income	0.581	2.634	0.314	1.353*	0.561	1.322	-0.293	-0.042
Prestige	-0.039	-2.833*	-0.160	-0.964	-0.262	-1.615	0.384	-0.254
Liberal activity	-0.286	0.242	-0.514	0.071	0.316	0.501	-0.088	-0.330
Academic interest	2.501**	1.442	0.708*	0.564	1.575**	0.726	0.219	0.152
Curing illness	-0.776	-2.934	-0.254	-1.247	-0.540	-1.321	0.018	-0.366
Saving lives	0.333	5.262**	0.216	1.458	0.402	3.041**	-0.285	0.762
Caring for patients	0.650	-3.996*	-0.064	-0.782	0.928	-3.048**	-0.214	-0.166
Altruism	-0.155	-0.245	-0.605	-0.779	-0.117	0.620	0.567	-0.086
Mission	0.770	1.847	0.784*	1.033	0.200	0.695	-0.214	0.119
Vocation	0.312	-0.580	-0.001	-0.428	0.153	-0.198	0.159	0.046
Specialty preference								
Non-person-oriented	2.099	7.462	0.165	4.190*	2.046	1.749	-0.113	1.524
Person-oriented	0.073	8.999*	-0.122	3.829*	0.357	3.361	-0.162	1.809
Control variable								
Compassionate care (Year 1)	0.528*	-0.161	0.361***	0.158	0.195	-0.319	-0.027	-0.001
Perspective taking (Year 1)	0.359*	0.949***	0.089	0.115	0.237*	0.812***	0.033	0.021
Standing in patients' shoes (Year 1)	0.172	0.177	0.003	0.140	0.002	-0.415	0.168	0.452**

This table presents the estimated effects per site for each component of the JSE scale and the total empathy score as dependent variables. Specifically, each main column (representing the total empathy score or a subdimension of the JSE scale) shows the estimated effects from a separate linear regression model, with the variable indicated in the main column serving as the dependent variable. The key difference between Table 3 and Table 2 is that the former includes control variables measured in year 1. * $0.01 < p$-value ≤ 0.05; ** $0.001 < p$-value ≤ 0.01; *** p-value ≤ 0.001

Regarding the total score of empathy, two associations – which by year 1 were found only in Geneva—appeared also in Porto Alegre at year 4: the direct association with having a *person-oriented specialty preference* (b = 8.999, $p \leq 0.05$) and the inverse association with *prestige* as a motive for studying medicine (b = − 2.833, $p \leq 0.05$). Moreover, several new associations appeared, with notable differences across the two sites. Contrary to the results from the analysis performed considering the dependent variables measured in year 1, the total score of empathy in year 4 was associated with the personality trait *agreeableness* in Geneva (b = 0.491, $p \leq 0.05$), and with the trait *extraversion* in Porto Alegre (b = 0.519, $p \leq 0.05$). Similarly, higher empathy became associated with *academic interest* as a motive for studying medicine in Geneva (b = 2.501, $p \leq 0.01$), and *saving lives* as a motive in Porto Alegre (b = 5.262, $p \leq 0.01$); also, in Porto Alegre alone, lower empathy scores in year 4 were associated with *caring for patients* as a motive for studying medicine (b = − 3.996, $p \leq 0.05$), as opposed to results from year 1 showing no association between these two variables.

In terms of the empathy subdomains, the associations measured in year 4 were not identical across the two sites. For example, in both sites, associations appeared between motives for studying medicine and empathy subdomains, but the specific motives associated with empathy were not the same: in Geneva, *academic interest* predicted a higher score in both *Compassionate care* (b = 0.708, $p \leq 0.05$) and *Perspective taking* (b = 1.575, $p \leq 0.01$), whereas in Porto Alegre a higher score in *Compassionate care* was predicted by *income* as a motive (b = 1.353, $p \leq 0.05$), and a higher score in *Perspective taking* was predicted by *saving lives* as a motive (b = 3.041, $p \leq 0.01$).

Relation between empathy total score at year 4 and its subdomains at year 1

Table 3 shows that the level of empathy at year 1 influenced the level of empathy at year 4, with site-specific differences. In Geneva, both the *Compassionate care* and the *Perspective taking* scores at year 1 had a significant estimated effect on empathy in year 4 (b = 0.528, $p \leq 0.05$ and b = 0.359, $p \leq 0.05$, respectively). By contrast, in Porto Alegre, only the *Perspective taking* score at year 1 had an effect on empathy in year 4 (b = 0.949, $p \leq 0.001$).

Discussion

This study aimed to investigate the determinants of empathy in medical students at the start and after four years of training, within two geo-sociocultural contexts. We found that the personality trait *openness to experience* was associated with higher empathy scores in both sites at both time points. However, other predictors of empathy varied significantly between the two sites, regardless of the year of training. Additionally, we found that empathy levels at year 1 influenced levels at year 4 in both Geneva and Porto Alegre, although not in the same way across the two locations.

The empathy scores of students in both Geneva and Porto Alegre (around 113 and 118 points, respectively) were higher than the minimum empathy scores found in the study by Hojat et *al* [45]. (95 to 100 points) and were consistent with other results published to date [29]. However, when comparing empathy scores between students from both sites in descriptive analyses, we observed that, in both years, empathy levels in Geneva were significantly lower compared to Porto Alegre. This difference was primarily due to a substantial gender gap in Geneva, where male students scored lower on the JSE scale. Regression analyses further confirmed that being male was specifically associated with lower empathy scores in Geneva for both years. This finding aligns with results reported by Dehning et al [46] who compared medical students between two countries and found that male from Jimma (Ethiopia) exhibited higher empathy levels than those from Munich (Germany), even though female students had higher empathy scores than their male counterparts at both sites. The authors proposed that the lower empathic dispositions among Munich males might be due to cultural norms where emotional behavior and displays of affection among men are traditionally less accepted than in Jimma. Similarly, we believe that cultural norms for men in Brazil and Switzerland differ in ways that could influence the observed results. In Brazil, greater acceptance of emotional expressiveness and interpersonal sensitivity among men may contribute to higher empathic dispositions in Brazilian male medical students compared to their Swiss peers. Furthermore, we consider whether factors beyond the geo-sociocultural context, such as local educational systems or individual experiences, might influence the relationship between gender and empathy, as conflicting results can be found in the literature. For example, while male gender was not associated with lower empathic dispositions in medical students from Porto Alegre, it was in a previous Brazilian study [14]. Similar discrepancy was found in other reports regarding medical students: in Iran, Khademalhosseini et al. [47] found males to have lower empathy than females, while Benabbas et al. [11] did not; and in China, lower empathy in males was found in a study by Wen et al. [48] but not in a study by Li et al. [49] It is important to note that comparing p-values from analyses with different sample sizes requires caution, as significance at one location suggests a gender-based difference, while non-significance elsewhere may simply reflect insufficient sample size. Thus, the association between

gender and empathic behaviors in medical students appears to be rather complex and context dependent. More studies are needed to explore interactions between gender and contextual variables on empathic attitudes.

Another potential explanation for the higher empathy levels observed in Brazilian medical students compared to their Swiss peers could be the cultural emphasis on religiosity and spirituality in Brazil. Approximately 95% of the Brazilian people reported adherence to a religion [50], and it is reasonable to assume that the level of religiosity among Brazilian medical students reflects that of the general population. In line with this hypothesis, a recent study conducted in Brazil found that medical students with high levels of spirituality (encompassing both religious and non-religious aspects) scored significantly higher in empathy compared to their peers with lower spirituality levels [51].

The socioeconomic disparity between Porto Alegre and Geneva may also contribute to differences in empathic dispositions among medical students in the two sites. Brazilian students are often more exposed to individuals facing poverty-related health challenges, which may foster a greater sense of compassion and empathy. Although we did not find studies directly linking socioeconomic disparities to empathy, Ponnamperuma et al. [32] reported higher JSE scores among medical students in Brazil (121) compared to those in the USA (115), suggesting that socioeconomic factors could influence empathy levels in the context of medical education.

Regarding the association between personality traits and empathy, we found that *openness to experience* was the only mutual predictor of empathy in both sites across both years. This aligns with prior research that has consistently linked *openness to experience* with high empathy as measured not only by the JSE [18, 24–27] but also by other assessment tools such as the Empathy Quotient [9] and the Interpersonal Reactivity Index [52]. Our study extends this understanding by showing that the impact of *openness to experience* occurred primarily in *Perspective taking*, a subdomain linked to the cognitive dimension of empathy. This association was especially evident in year 1 at both sites. The association between *openness to experience* and *Perspective taking* may be explained by the fact that, by definition, individuals high in *openness to experience*tend to be more adaptable, understanding, and receptive to different ideas and values [53]. Thus, it is reasonable to think that they have an ability to understand and appreciate others' perspectives—a core element of *Perspective taking*. However, we noted that, as the training progressed, the relationship between *openness to experience* and the *Perspective taking* subdimension in Porto Alegre shifted to an inverse association, which did not occur in Geneva. We speculate whether this change in Porto Alegre could be due to students with high *openness to experience* becoming more hesitant about adopting empathy-driven behaviors during their clinical years. This hesitation may be attributed to two main factors. First, students in Porto Alegre are likely more exposed to patients suffering during clinical years. These experiencies can be emotionally overwhelming, leading some students to distance themselves as a coping mechanism. Second, the clinical training environment often prioritizes technical skills over emotional skills, which might lead students to perceive empathy as a vulnerability, causing them to suppress empathetic tendencies.

The correlation between specialty preferences and empathy varied depending on the site. In Geneva, students who preferred person-oriented specialties had higher empathy scores in both years. In Porto Alegre, however, the link between specialty preference and empathy depended on the year. While in year 1 there was no association between empathy and specialty preference, by year 4, having any specialty preference (either person- or non-person-oriented) was associated with higher empathy. Previous studies on this topic have produced conflicting results, with some [9, 14, 16, 49] reporting a direct link between preference for person-oriented specialties and empathy, while others did not [18, 19, 11, 12, 20–23]. While it might seem logical that more empathic students would lean toward specialties involving more patient interaction, as seen in Geneva, research by Guilera et al [9] suggests that students with the highest empathic dispositions sometimes avoid person-oriented specialties to reduce the stress of emotional involvement with patients, which might explain our findings in Porto Alegre.

In our study, the associations between motives for studying medicine and empathic dispositions were also site-dependent. In Geneva, *prestige* (a security-related motive) was associated with lower empathy in both years, while *academic interest* (a science-related motive) was associated with higher empathy by year 4. In Porto Alegre, no significant associations were found in year 1, but by year 4, both security- and person-oriented motives were linked to lower empathy. These results suggest that motives for studying medicine were not consistent predictors of empathy in our study. Indeed, previous studies in different countries have shown only weak or no associations between empathy levels and motives for studying medicine [54–56]. It is possible that, in places where people face greater economic challenges, like Porto Alegre, even empathic students might prioritize security-related motives for pursuing a medical career.

Our study found that baseline empathy levels in year 1 influenced empathy levels in year 4 in both sites. This suggests that factors affecting empathy when

students enter medical school continue to influence their empathic attitudes later on. However, our findings also indicate that there are differences in the way baseline scores of the empathy subdimensions influence future empathic dispositions, varying by geo-sociocultural context. As such, empathy in year 4 was mainly predicted by the year 1 *Compassionate care* score (emotional component) in Geneva and the *Perspective taking* score (cognitive component) in Porto Alegre. These differences could be influenced by cultural and societal values. We hypothesize that in Porto Alegre, where there is a strong emphasis on community and collectivism, the emotional component of empathy (Compassionate care) may be already well-developed from the outset, and the cognitive component (Perspective-taking) could become a key differentiating factor in students'empathic dispositions over time. Moreover, in Porto Alegre, *Perspective taking* scores increased significantly from year 1 to year 4. Conversely, in Geneva, no significant changes in empathy were observed over the course of medical training. This may suggest that training in Porto Alegre might be more effective in reinforcing cognitive empathy compared to Geneva. Alternatively, students in Porto Alegre might be more comfortable developing the cognitive component of empathy as opposed to the emotional one.

Our study has several strengths: (1) it includes students from two very distinct geo-sociocultural contexts but employs the same methodology and research tools for their evaluation, which allows for a more reliable comparative analysis; (2) the use of well-established instruments to measure the outcome and independent variables, which increases credibility and reliability of the data; and (3) the use of multivariate analyses, which allows for controlling the effect of confounding variables. Despite these strengths, the study has some limitations. First, only about 50% of the students who were initially enrolled in year 1 participated in year 4, and this could impact the representativeness of the data. Second, the sample size in Geneva was larger than in Porto Alegre, and this could also influence the representation of the respective populations. However, we observed low standard deviations in empathy scores across both locations and years. This suggests that, despite the differences in participation rates and sample sizes, the empathy scores were consistent and similar, indicating that the samples were homogeneous and can still be considered representative of the study populations. Another limitation of our study was the relative discrepancy in the timing and method of data collection between the two study sites. In Geneva, students were recruited in 2011–2012, while in Porto Alegre, data were collected later, in 2015–2017. Additionally, part of the Brazilian data was collected during the COVID- 19 pandemic using online questionnaires, whereas all Swiss data were collected before the pandemic using physical questionnaires. It is possible that the method of data collection, as well as heightened social awareness during the covid pandemic, may have influenced empathic behaviors or the way it was reported by the participants of the study.

Conclusions

Our study provides evidence that the determinants of empathy, including personality traits, gender, motives for studying medicine and specialty preferences on self-reported empathy – either the total scores or the subdomains – differ according to the geo-sociocultural context, with *openness to experience* being the sole consistent predictor of empathy across sites. To the best of our knowledge, this is the only study addressing an expressive number of relevant individual characteristics to assess the determinants of empathic dispositions, which may impact on the development of this key ability for clinical practice during medical studies. Our findings underscore the importance of the cultural context for designing medical education interventions to improve students' empathic attitudes. Tailored training approaches, considering the unique socio-cultural characteristics of each location, are crucial for enhancing empathic dispositions and attitudes in future health professionals.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12909-025-07109-7.

Supplementary Material 1

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Authors' contributions

FB participated in the collection, analysis and interpretation of the data, and wrote the manuscript. LV analyzed and interpreted the data, contributing to the writing and revision of the manuscript. SG analyzed and interpreted the data as the senior statistician, also contributing to the writing and revision of the manuscript. MK contributed in the analyses and interpretation of data, and the revision of the manuscript. RF contributed in the analyses, interpretation of data and revision of the manuscript. AB and MWG conceived and coordinated the study, wrote the protocol and participated in the collection of data, analysis and interpretation of results, as well as contributed to the writing of the manuscript. All authors read and approved the final manuscript.

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Data availability
The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
The study project was submitted to the Chair of the Geneva Cantonal Commission for Ethical Research (CCER) and designated as exempt from formal review. The study was approved by the Ethics Committee of Research in Humans from the Federal University of Health Sciences of Porto Alegre (protocol number 1.151.091). Informed consent was obtained from all subjects participating in the study.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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