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Interprofessional education's readiness among Brazilian medical students

Interprofessionelle Bildung: Bereitschaft unter brasilianischen Medizinstudierenden

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Abstract

The study examines the readiness for shared learning based on interprofessional education (IPE) among Brazilian medical students participating in preceptorship programs. A total of 642 students from all six medical courses across a state in Brazil completed the Readiness for Interprofessional Learning Scale (RIPLS) and a sociodemographic questionnaire. The results, analyzed across three RIPLS factors—teamwork and collaboration, professional identity, and patient-centered care—reveal a positive inclination toward collaborative learning, though each factor was influenced by different variables. Teamwork and collaboration (factor 1) were significantly associated with gender, medical program semester, prior teamwork experience, and current clinical practice. Professional identity (factor 2) was shaped by gender, prior bachelor's degree, type of university (public or private), and medical program semester. Patient-centered care (factor 3) showed significant relationships with gender, prior bachelor's degree, type of university, medical program semester, and current clinical practice. These findings highlight the importance of acknowledging various demographic and educational variables when assessing student readiness for shared learning. Such insights can help medical programs refine their curricula and develop educational strategies to promote IPE, fostering collaborative healthcare practice in alignment with both national and international guidelines.

Abstract

Die Studie untersucht die Bereitschaft zum gemeinsamen Lernen auf Basis interprofessioneller Bildung (IPE) unter brasilianischen Medizinstudierenden, die an Preceptorship-Programmen teilnehmen. Insgesamt haben 642 Studierende aus allen sechs Medizinkursen eines Bundesstaates in Brasilien die Skala zur Bereitschaft für interprofessionelles Lernen (RIPLS) sowie einen sozialdemografischen Fragebogen ausgefüllt. Die Ergebnisse, die über drei RIPLS-Faktoren – Teamarbeit und Zusammenarbeit, professionelle Identität und patientenorientierte Versorgung – analysiert wurden, zeigen eine positive Neigung zu kooperativem Lernen, obwohl jeder Faktor von verschiedenen Variablen beeinflusst wurde. Teamarbeit und Zusammenarbeit (Faktor 1) waren signifikant mit Geschlecht, Semester des Medizinstudiums, vorheriger Teamarbeitserfahrung und aktueller klinischer Praxis assoziiert. Die professionelle Identität (Faktor 2) wurde durch Geschlecht, vorherigen Bachelor-Abschluss, Art der Universität (öffentlich oder privat) und Semester des Medizinstudiums geprägt. Die patientenorientierte Versorgung (Faktor 3) wies signifikante Beziehungen zu Geschlecht, vorherigem Bachelor-Abschluss, Art der Universität, Semester des Medizinstudiums und aktueller klinischer Praxis auf. Diese Ergebnisse unterstreichen die Bedeutung der Berücksichtigung verschiedener demografischer und bildungsbezogener Variablen bei der Beurteilung der Bereitschaft der Studierenden für gemeinsames Lernen. Solche Erkenntnisse können Medizinstudiengänge dabei unterstützen, ihre Curricula zu verfeinern und Bildungsstrategien zu entwickeln, um IPE zu fördern und eine kollaborative Gesundheitsversorgung im Einklang mit nationalen und internationalen Richtlinien zu gewährleisten.

Keywords
Interprofessional collaboration – interprofessional education – medical students – sociodemographic factors

Keywords
Interprofessionelle Zusammenarbeit – interprofessionelle Bildung – Medizinstudierende – sozialdemografische Faktoren

INTRODUCTION

Social inequalities have challenged global health, the elderly population increase, the complexity of health problems, pandemics, and shortages of healthcare professionals (Axelsson et al., 2019; Pype et al., 2016). As a result, in the last decade, global health systems have been encouraged to change their healthcare models for more patient-centered and teamwork-based care (Khalili et al., 2014; Thistlethwaite et al., 2019; Topor et al., 2018). However, in order to improve the healthcare system, the health program's curriculum must be changed. Medical schools worldwide have been required to design courses with strategies to integrate patient-centered care and

teamwork (Alzamil & Meo, 2020; Milutinović et al., 2018; Visser et al., 2018).

To address global health challenges and improve the healthcare system (Guraya & Bar, 2018; Reeves et al., 2016) interprofessional education (IPE) has been intensified to train healthcare professionals in collaborative care skills (World Health Organization [WHO], 2010). Interprofessional education occurs when two or more professions learn about others, with others, and with each other for effective collaboration and improved outcomes in health (WHO, 2010). In addition, collaborative practice happens when health professionals from different areas and with different experiences work together with patients, families, and caregivers to provide high-quality services (WHO, 2010). Studies highlight the importance of IPE opportunities during health care programs to develop better communication skills in a real-life interprofessional team (Nelson et al., 2017). Health care professionals who had IPE opportunities in their courses are more likely to become collaborators at work (Lestari et al., 2016); they also have a better understanding of the roles and the importance of other professionals (Guraya & Bar, 2018; Mukhtar et al., 2018; Sollami et al., 2018; Williams et al., 2015). Gender, age, and different levels of exposure to IPE affect students' attitudes about interprofessional learning (Milutinović et al., 2018); no studies were found focusing only on students in the last years of the program, that is, while doing their internship.

The concept of interprofessional readiness (Parsell & Bligh, 1999) suggests the student's willingness to participate in the IPE (Visser et al., 2018). Student attitudes and expectations towards shared learning have been considered the most important predictors of successful implementation of IPE (Milutinović et al., 2018; Hojat et al., 2015; Sciascia et al., 2021). Several instruments to assess IPE readiness have been described; most of them lack psychometric methods, and many were used only once (Hojat et al., 2015; Edelbring et al., 2018). The Readiness Interprofessional Learning Scale (RIPLS), the Interdisciplinary Education Perception Scale (IEPS) (Sciascia et al., 2021; Lie et al., 2013; Peduzzi et al., 2015), and the Jefferson Scale of Attitudes Toward Interprofessional Collaboration (JeffATIC) (Hojat et al., 2015; Ward et al., 2008) are IPE scales with tested measurement support and are the most extensively used to detect differences in student's attitudes and curriculum impact (Hojat et al.,2015). Jefferson Scale of Attitudes Toward Physician-Nurse Collaboration and Scale of Attitudes Toward Physician-Pharmacist Collaboration (Hojat et al., 2015; Ward et al., 2008) are more specific to the target population of medical, nursing, and pharmacy but have not been adapted to be used with Brazilian students. RIPLS was the first tool to assess interprofessional learning and attitudes towards collaboration among health care professionals, and has been validated for different languages and cultures, including Brazil (Milutinović et al., 2018; Visser et al., 2018; Edelbring et al.,2018; Peduzzi et al., 2015; Cervantes-Sudio et al., 2021).

Based on the relevance of IPE for training health care professionals in accordance with health demands, this study seeks to contribute scientific evidence for the training of medical students in line with global health and national guidelines for interprofessional training.

Background

IPE dates back to the 1960s, with the first interprofessional teaching movements in Europe, North America, and Australia, each driven by different motivations. In 1973, the WHO convened a committee to review medical education and suggested that IPE could encourage holistic assistance and improve health team satisfaction and public appreciation (Barr, 2015; WHO, 1974). As a result, several global actions were developed in response to WHO guidelines, such as the foundation of the Center for the Advancement of Interprofessional Education (CAIPE) in 1987 and the recognition of IPE by the World Federation of Medical Education in 1988 (Barr, 2015).

The many benefits of using IPE in medical program initiatives around the world were confirmed in a meta-analysis which identified positive results for the development of cognitive knowledge, skills, and attitudes by students, especially in practical activities when offered by experts and with adequate resources (Guraya & Bar, 2018). In the Brazilian background, the results of the IPE initiatives have been published since 2011. Studies have shown that IPE learning occurs, especially in practical fields, when students live with students from different health care courses and professional fields. The experience enables them to recognize and reflect on their roles in the team, and enables perception of professional interdependence for comprehensive and patient-centered care. IPE also offers an opportunity to minimize prejudice and differences between professions (Camara et al., 2015; Toassi & Lewgoy, 2016).

Brazilian research suggested that being in a medical program (Oliveira et al., 2018; Prado et al., 2018) influences student readiness for interprofessional learning. Beginner students were highly committed to learning with IPE (Rocha et al.,2017; Prado et al., 2018) because they believed in sharing knowledge about the Brazilian health system (Rocha et al.,2017). Two studies have found that senior medical students may exhibit less readiness for IPE compared to their junior counterparts (Prado et al., 2018; Tompsen,2018). One study specifically compared attitudes toward pharmacist–physician collaboration among students. A parallel significant difference was

observed in the mean scores between first year (52.3) and final-year (49.5) medical students (p=0.007) (Prado et al., 2018). Another study evaluated IPE readiness among students from ten different healthcare programs, including medicine. Although the findings were not disaggregated by course, the study identified that senior students demonstrated lower readiness to collaborate (p=0.0052). The authors noted that the senior students were part of an older curriculum lacking opportunities for interprofessional learning, whereas the other students were enrolled in a new curriculum featuring integrative courses shared among different programs (Nuto et al., 2017).

On that note, it is important to inform the readers that by the time of this study, few students had completed their medical programs under the new medical curriculum implemented by the Government of Brazil in 2014, with a high concentration of practical activities (80%). So far, no studies have been found to assess Brazilian senior medical students' readiness for IPE, especially 1) under the new curriculum, which may facilitate IPE (Brazil Ministry of Education, 2014) and 2) during their internship with numerous opportunities to work collaboratively with other professionals. Finally, the present study aims to contribute to this lack of literature data.

The medical training model in Brazil

Brazilian medical courses last six years (12 semesters), with a four-year introductory course and two years for internship. During the introductory courses, instructors are encouraged to use active learning with practical activities with community partners. For the internship, students are engaged in public family medicine centers, urgent and emergency units, and hospitals. The Brazilian guidelines for medical school curricula propose: 1) student training must be aligned with the health care system; 2) training should encourage interprofessional learning to promote health care and teamwork ((Brazil Ministry of Education, 2014; Silva et al., 2015) and 3) 30% of the internship should happen in primary care settings and emergency services (Brazil Ministry of Education, 2014).

Brazilian universities have already advanced towards the implementation of the IPE in the first years of the course for the development of skills for collaborative practice (Santos et al., 2018; Rocha et al., 2017; Silva, 2011; Souto et al., 2014; Tompsen et al., 2018; Souza et al., 2021). There are still barriers in health services to inclusion of medical students in daily routines, and well-prepared preceptors for collaborative practice. Preceptors in primary care settings still have a strong medical professional identity based on competition rather than cooperative and collaborative relationships (Barbosa et al., 2021). A lack of scientific data on medical internships and collaborative skills focused on EIP suggests a gap that needs to be addressed. This study investigates the readiness for shared learning, based on EIP, and its associated variables among Brazilian medical students enrolled in the internships.

METHOD

Study Design

Cross-sectional quantitative study (Hulley et al., 2015) to measure medical students' readiness for shared learning.

Setting and Participants

The participants were Brazilian medical students enrolled in internships from the 9th and 12th semesters, invited from all medical schools in a Brazilian state, four public and two private universities. The inclusion criterion was students regularly enrolled in the course and semester. Of the 751 students who regularly attended internships, 642 agreed to participate in the study.

Instruments and Variables

The Brazilian version of the *Interprofessional Readiness Learning Scale* (RIPLS) (Peduzzi et al., 2015) was used in this study, which is composed of 27 items grouped into three factors: 1) teamwork and collaboration, 2) patient-centered care, and 3) professional identity. In the Brazilian RIPLS, the three factors were correlated with each other, with a factor-positive, direct, and proportional association between F1 and F3; F2 had an association negative and inverse with the other factors (Peduzzi et al., 2015).

The students also answered a sociodemographic questionnaire including age, gender, university and semester enrolled, current clinical practice, previous bachelor's degree and previous teamwork experience. The data were used to analyze variables associated with readiness for collaborative work.

Data Collection

Data collection took place between October 2019 and February 2020 by trained researchers and research assistants, to avoid power relation bias. Two independent research assistants typed all the answers into an Excel spreadsheet to ensure the reliability of the data. The missing data were addressed through mean imputation technique to ensure a complete dataset for analysis.

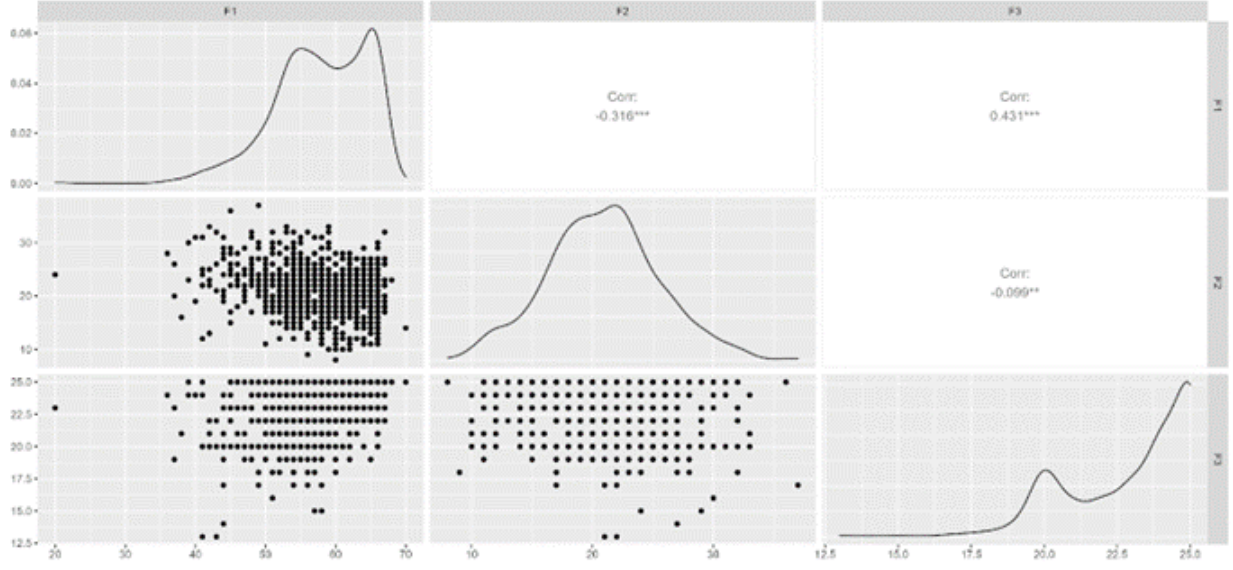
Statistical Analysis

The sociodemographic data and RIPLS responses were analyzed using descriptive statistical methods

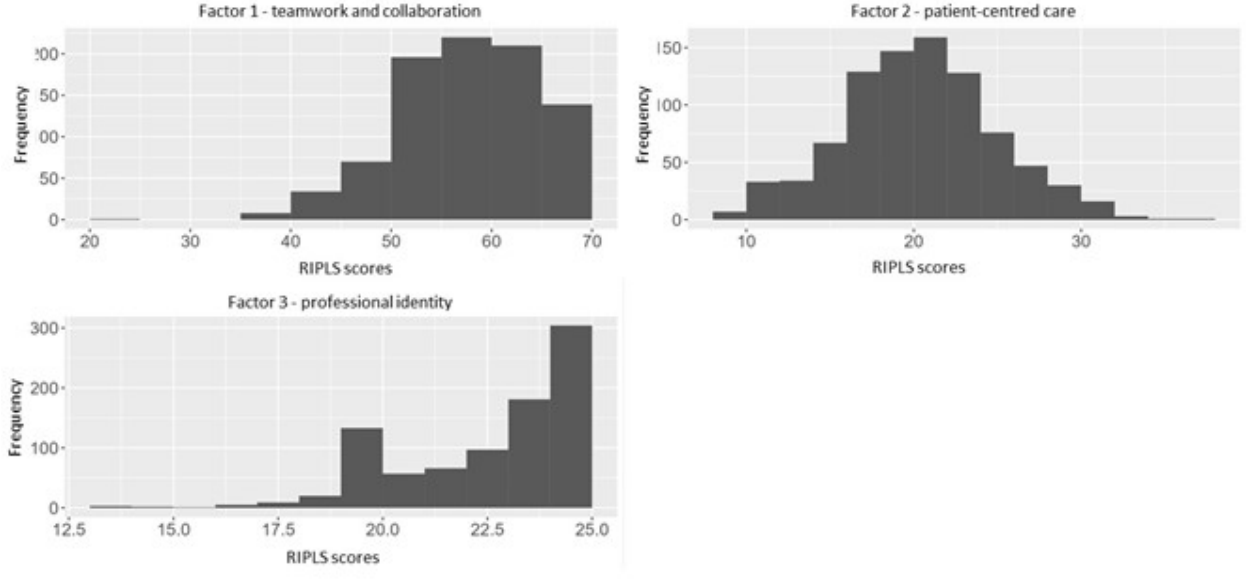
to summarize and present key characteristics of the sample population. This approach included calculating frequencies, percentages, means, and standard deviations to provide an overview of participant demographics and their responses to RIPLS items.

The Additive Models for Location Scale and Shape class – GAMLSS – was used (Stasinopoulos & Rigby, 2007). The GAMLSS class is suitable for modelling the response variable when it does not follow an exponential family distribution and in cases where the returnee exhibits heterogeneity, that is, when the scale or shape of the distribution of the response variable changes with the explanatory variables (Florencio, 2010). The RIPLS factors are continuous variables, with intervals respectively of [0.70], [0.40] and [0.25]. The independent variables were gender, prior college training, previous bachelor's degree, public or private university, medical program semester, previous teamwork experience, and current clinical practice. To assess the adequacy of the fitted models, a diagnostic analysis was made for each RIPLS's factor: residuals versus adjusted values, residuals versus order of observations, estimation of kernel density of residues, and a normal QQ of the waste (graphic 1).

Data for factors F1 and F3 did not show normal distribution, with two peaks (graphic 2); an unexpected pattern was observed for the corresponding value,



Graphic 1. Diagnostic analysis for F1, F2, F3 RIPLSs factors.



Graphic 2: F1, F2, F3 RIPLS's factors distribution.

according to the distribution for each factor. On factor F1, 117 respondents showed the same pattern of response: "I totally disagree" in question 12 and "I totally agree" in the 1 to 9, 10 and 11, and 13 to 16 questions; the participants were "transplanted" to the value 0. Analogous reasoning was performed for factor F3; 33 answers with results equal to 20 were observed, and the respondents marked answer 4 (Agree) on all five questions. For statistical data interpretation of F1 and F3, it considered the distributions of the "transplanted" data to 0; one of the fitted zero distributions for the factor F3 was also considered the truncation condition.

RESULTS

Out of 751 medical students from the five medical schools, 642 agreed to participate, representing an 85.48% response rate. Sociodemographic information is presented in Table 1.

Table 1: Brazilian medical students' personal information.

Variables		n. (%)
Age	Minimum	21
	Maximum	52
Gender	Female	355 (55,2%)
	Male	287 (44,7%)
Previous college education	Yes	72 (11.2%)
	No	569 (88.6%)
	Did not respond	01 (0.2%)
Previous bachelor's degree	Yes. completed	45 (7%)
	Yes. not completed	70 (10,9%)
	No	412 (64,2%)
	Did not respond	115 (17,9%)
Medical program semester	Ninth	136 (21,2%)
	Tenth	177 (27,6%)
	Eleventh	143 (22,2%)
	Twelfth	186 (29,0%)
Prior teamwork experience during the course	Yes	433 (67,4%)
	No	206 (32.2%)
	Did not respond	3 (0.4%)

Student availability for IPE

Scores on the availability of medical students for IPE were positive in each of the factors (Table 2). They are willing to work and collaborate in a team (F1) despite not showing interest in activities in small groups with students from other health professions (mean 3.83 - item 14). Students value their professional identity (F2) as important as other healthcare professionals and show concern in promoting patient-centered care (F3) (Table 2).

Table 3 shows the mean scores for each RIPLS factor and independent variables. Factor 1- Teamwork was significantly related to gender, the medical program semester, previous teamwork experience, and current clinical practice at the time of data collection. Factor 2-professional identity was significantly related to gender, previous bachelor's degree, type of university (public or private), and medical program semester. Finally, factor 3 - patient-centred care was related to gender, previous bachelor's degree, type of university (public or private), medical program semester, and current clinical practice.

DISCUSSION

We studied the Brazilian medical students' readiness for interprofessional education by considering a range of variables such as gender, university and work experiences, current clinical practice, previous bachelor's degree, and teamwork experience. The scores reflecting medical students' availability for interprofessional education were positive across all factors. This indicates a willingness to work and collaborate within a team, a value of their professional identity (F2) on par with other healthcare professionals, and a commitment to promoting patient-centered care (F3). The variables of gender and medical program semester seem to influence all RIPLS factors. Current clinical practice positively influenced medical students' teamwork (factor 1) and patient-centered care (factor 3). Previous bachelor's degrees and the type of university (public or private) had a significant impact on factor 2-professional identity and factor 3 - patient-centered care. Finally, previous teamwork experience seems to positively impact factor 1 - teamwork.

Females scored higher in teamwork (F1) and patient-centered care (F3) and lower in professional identity (F2). Similar results were found in other studies using RIPLS (Camara et al., 2015; Nuto et al., 2017; Judge et al., 2015; Wilhelmsson et al., 2011; Wong et al., 2016) and also with other scales (Wong et al., 2016; Hansson et al., 2010). The F2 factor is related to more competitive attitudes that impact patient-centered care. The F3 factor relates to the willingness to understand the patient's side of the problem based on relationships of trust and compassion. Thus, the factors present an inverse relationship (Peduzzi et al., 2015). These findings can also be associated with the social construction of communication and maternal attitudes related to the female gender (Prado et al., 2018; Wilhelmsson et al., 2011). Female students show greater receptivity to group work and cooperation with other professions than male students (Nuto et al., 2017; Wilhelmsson

Table 2: Mean scores of students by RIPLS factors and RIPLS items.

RIPLS	N	mean	SD	min	max
Factor					
F1 Teamwork	642	4.11	1.02	1.00	5.00
F2 Professional identity	642	2.50	0.12	1.00	5.00
F3 Patient-centered care	642	4.58	0.06	1.00	5.00
Items					
1- Learning with other students will help me become a more effective participant of a health care team	641	4.47	0.64	1.00	5.00
2- Patients ultimately benefit if health care professionals work together to solve patients' problems	642	4.54	0.63	1.00	5.00
3- Shared learning with other health care professionals will increase my ability to understand clinical problems	641	4.35	0.77	1.00	5.00
4- Learning with health care students from other disciplines before qualification would improve relationships after qualification	637	4.38	0.77	1.00	5.00
5- Communication skills should be learned together with health care professionals	639	3.92	1.01	1.00	5.00
6- Shared learning will help me to think positively about other health care students and professionals	640	4.18	0.81	1.00	5.00
7- For small group learning to work, students need to trust and respect each other	640	4.59	0.58	2.00	5.00
8- Teamwork skills are essential for all students to learn	640	4.53	0.65	1.00	5.00
9- Shared learning will help me to understand my own limitations	638	4.20	0.83	1.00	5.00
10- I don't want to waste my time learning with other health care students	639	1.62	0.83	1.00	5.00
11- It is not beneficial for undergraduate health care students to learn together	642	1.74	0.88	1.00	5.00
12- Problem-solving skills for clinicians should only be learned from students of my course	639	1.93	1.01	1.00	5.00
13- Shared learning with other health care students will help me to communicate better with patients and other professionals	639	4.15	0.87	1.00	5.00
14- I would welcome the opportunity to work on small-group projects with other health care students	639	3.83	0.96	1.00	5.00
15- Shared learning helps to clarify the nature of patient problems	641	4.11	0.79	1.00	5.00
16- Shared learning before qualification would help health care professionals become better team workers	640	4.37	0.67	1.00	5.00
17- The role of other health professionals is mainly to provide support for doctors	642	1.46	1.03	1.00	5.00
19- I have to acquire much more knowledge and skills than other health care students	638	3.13	1.22	1.00	5.00
21- I would feel uncomfortable if another health care student knew more about a topic than I did	642	2.06	1.03	1.00	5.00
22- Will I be able to use my judgment in my professional role	637	3.45	0.95	1.00	5.00
23- Reaching a diagnosis will be the main the function of my professional role	642	2.94	1.12	1.00	5.00
24- My main responsibility as a professional will be to treat my patient	640	3.63	1.04	1.00	5.00
25- I like to understand the patient's side of the problem	640	4.33	0.62	1.00	5.00
26- Establishing a relationship of trust with my patients is important to me	640	4.72	0.46	3.00	5.00
27- I try to communicate with compassion with my patients	640	4.56	0.57	2.00	5.00
28- Thinking about the patient as a person is important in getting treatment right	642	4.65	0.57	1.00	5.00
29- In my profession, one needs skills in interacting and cooperating with patients	642	4.67	0.59	1.00	5.00

et al., 2011; Wong et al., 2016; Hansson et al., 2010). Women are more likely to work with other people, prefer collaborative processes and friendship, and have a greater understanding of the point of view of others (Reynolds, 2003). In combination with other data from the literature, our findings demonstrate the need for intervention strategies with male students for motivation and receptivity to IPE.

The internship semester of the course influenced medical students' readiness for shared learning. Students at the end of the internship have greater scores in factor 1- teamwork and factor 3- patient-centered care and lower scores in factor 2 - professional identity than those who were starting their internship. Similar findings suggest that exposure to clinical practice may positively alter students' preferences concerning the interprofessional approach (Wong et al., 2016; Hood et al., 2014; Rajiah et al., 2016; Salih et al., 2019). Because the studied population was placed under the new medical curriculum (Brazil Ministry of Education, 2014), they were exposed to shared experiences throughout their degree; it may have contributed to the student's clarity about their role and skills within the interprofessional team and changed students' attitudes in favor of collaborative practice.

Table 3: Mean scores of students by RIPLS factors and independent variables.

RIPLS factor	Variables		N	Mean	SD	p-value
F1 Teamwork	Male		286	56.50	6.71	**<0.001**
	Female		354	58.18	6.44	
F2 Professional identity	Male		286	21.61	4.68	**<0.001**
	Female		354	19.97	4.46	
F3 Patient-centered care	Male		286	22.73	2.24	**<0.001**
	Female		354	23.04	2.03	
F1 Teamwork	Prior college training	Yes	72	57.06	6.40	0.2961
		No	568	57.46	6.66	
F2 Professional identity		Yes	72	20.21	4.57	0.484
		No	568	20.77	4.63	
F3 Patient-centered care		Yes	72	22.65	2.10	0.0735
		No	568	22.93	2.13	
F1 Teamwork	Previous bachelor's degree	Yes	522	57.41	6.42	0.592
		No	118	57.43	7.49	
F2 Professional identity		Yes	522	20.52	4.64	**0.0453**
		No	118	21.53	4.50	
F3 Patient-centered care		Yes	522	22.95	2.12	**0.0411**
		No	118	22.64	2.18	
F1 Teamwork	Public university	1	124	56.29	8.08	0.5043
		2	58	57.67	6.56	
		3	87	57.47	6.41	
		4	91	57.20	6.26	
	Private university	5	88	58.14	5.75	
		6	193	57.81	6.20	
F2 Professional identity	Public university	1	124	19.80	5.11	**<0.001**
		2	58	19.10	4.22	
		3	87	19.24	4.10	
		4	91	21.87	4.04	
	Private university	5	88	21.02	4.45	
		6	193	21.74	4.59	
F3 Patient-centered care	Public university	1	124	22.44	2.19	**<0.001**
		2	58	22.91	2.30	
		3	87	22.99	2.14	
		4	91	22.51	2.14	
	Private university	5	88	22.74	2.38	
		6	193	23.40	1.79	
F1 Teamwork	Medical program semester	9	136	58.65	5.94	**<0.001**
		10	176	57.03	6.38	
		11	143	57.03	6.32	
		12	186	57.17	7.43	
F2 Professional identity		9	136	19.71	4.77	**0.009**
		10	176	21.16	4.51	
		11	143	21.44	4.63	
		12	186	20.44	4.50	
F3 Patient-centered care		9	136	23.21	1.97	**0.0154**
		10	176	22.99	2.01	
		11	143	22.60	2.37	
		12	186	22.81	2.14	

Continued *Table 3: Mean scores of students by RIPLS factors and independent variables.*

RIPLS factor	Variables		N	Mean	SD	p-value
F1 Teamwork	Previous teamwork experience	Yes	489	57.74	6.48	**0.0231**
		No	145	56.39	7.03	
F2 Professional identity		Yes	489	20.59	4.68	0.0721
		No	145	21.06	4.46	
F3 Patient-centered care		Yes	489	22.96	2.11	0.099
		No	145	22.72	2.18	
F1 Teamwork	Current clinical practice	Primary Care	76	58.66	6.03	**<0.001**
		Acute care	541	57.28	6.66	
F2 Professional identity		Primary Care	76	20.51	3.83	0.1473
		Acute care	541	20.69	4.73	
F3 Patient-centered care		Primary Care	76	23.41	1.81	**0.002**
		Acute care	541	22.83	2.12	

Students previously exposed to teamwork experiences were more collaborative, with higher scores on the F1 (Wong et al., 2016; Rajiah et al.,2016). In the same way, students who had previously completed a healthcare program had lower scores on professional identity (F2) and higher scores on patient-centered care (F3); possibly, it is related to familiarity with the work environment or comfortable feelings in collaborative care (Ward et al., 2008). In our study, nursing (diploma/certificate or bachelor's degree) was the most frequent previous course completed by the participants. Previous professional training in health areas that move away from traditional biomedical models with a more holistic approach to care (Williams et al., 2011) could justify our findings with higher scores in the F3 – patient-centered care. However, there is no consensus in the literature about it. Two studies did not find a significant difference in EIP readiness among students who completed a previous course (Nuto et al., 2017; Barbosa et al., 2021); one study (Ward et al., 2008) showed students who had previous experience in health care had more positive attitudes.

We found a statistical significance in F2 -professional identity and F3 -patient-centered care among students enrolled in public and private universities. The lowest identity scores (F2) were found in the three medical courses that belonged to the same public institution but in three different cities. In this institution, the curriculum defines that medical students should be exposed early to interprofessional experiences, which may justify the lower results in the F2 -professional identity factor.

Students placed in primary care settings had higher F1 -teamwork and F3 -patient-centered care scores than those in hospital and emergency environments. The results can be explained by the essence of the multidisciplinary composition and teamwork of primary care, therefore it is a suitable place for the development of interprofessionality (Camara et al., 2015).

The present study has limitations that suggest directions for future implementations. First, even with the participation of more than 600 students, the data shows a local culture of IPE of six Brazilian medical schools. Second, most of the data collection was made "in loco" in the practical fields; it may interfere with students' focus on completing the RIPLS. Finally, this study used a cross-sectional approach that did not accompany the same student's progression throughout their internship. A follow-up of the interprofessional skills among medical students, following their progress during the internship, could demonstrate the gains and gaps in interprofessional training. We suggest further studies to continuously assess the student response to IPE actions throughout the course.

CONCLUSION

This study brings scientific evidence and practical contributions to the EIP theme among medical students, especially those in internships. It is the first study developed in Brazil that assesses medical students' readiness for interprofessional learning by identifying the different factors that can contribute to greater readiness.

Acknowledging the factors that influence the student's readiness for IPE allows medical courses to review their curriculum. In addition, the data can provide resources to develop actions that promote IPE alignment with national guidelines, and worldwide, in promoting collaborative practice. In a local context, this study is the first to analyze all courses in a Brazilian state, which can contribute to training policies in higher education and review of curricula, considering the health interests of local communities.

At the end of this study, we believe that IPE is a potent tool for transforming the training of medical students and meeting the current population health demands.

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ETHICAL APPROVAL

The Research Ethics Board Review from the Federal University of Mato Grosso – Brazil, number 20087319.4.000.8097, approved this study according to Brazilian ethical guidelines for Human Research. All participants were informed about the research purpose and signed a consent form.

CONFLICT OF INTEREST

There is no conflict of interest.

References

Alzamil, H., & Meo, S. A. (2020). Medical students' readiness and perceptions about interprofessional education: A cross-sectional study. *Pakistan Journal of Medical Sciences*, *36*(4), 693–698. https://doi.org/10.12669/pjms.36.4.2214

Axelsson, M., Jakobsson, J., & Carlson, E. (2019). Which nursing students are more ready for interprofessional learning? A cross-sectional study. *Nurse Education Today*, *79*, 117–123. https://doi.org/10.1016/j.nedt.2019.05.019

Barbosa, G. R., Sampaio, R. A. C., & Appenzeller, S. (2021). Readiness for interprofessional education in undergraduate courses based on active learning methods. *Revista Brasileira de Educação Médica*, *45*(3), e174. https://doi.org/10.1590/1981-5271v45.3-20200090

Barr, H. (2015). *Interprofessional education: The genesis of a global movement.* London: Center for Advancement of Interprofessional Education. Available from: https://www.caipe.org/resources/publications/barr-h-2015-interprofessional-education-genesis-global-movement

Brazil. Ministry of Education. (2014). *Resolution CNE/CES No 3, of 20 June 2014: Establishes the national curriculum guidelines for undergraduate medicine courses and makes other provisions.* Ministry of Education. http://portal.mec.gov.br/escola-de-gestores-da-educacao-basica/323-secretarias-112877938/orgaos-vinculados-82187207/20138-ces-2014

Camara, A. M. C. S., Grosseman, S., & Pinho, D. L. M. (2015). Interprofessional education in the PET-Health Program: Perception of tutors. *Interface (Botucatu)*, *19*(1), 817–829. https://doi.org/10.1590/1807-57622014.0940

Capozzolo, A. A., Imbrizi, J. M., Liberman, F., & Mendes, R. (2013). Experience, knowledge production and health education. *Interface (Botucatu)*, *17*(45), 357–370. https://doi.org/10.1590/S1414-32832013000200009

Cervantes-Sudio, M. G., Ganotice, F. A., & Navarro, A. T. (2021). Are Filipino students ready to collaborate? Comparing the readiness of healthcare students for interprofessional education in the Philippines. *Journal of Interprofessional Care*, *35*(5), 718–725. https://doi.org/10.1080/13561820.2020.1806215

Edelbring, S., Dahlgren, M. A., & Edström, D. W. (2018). Characteristics of two questionnaires used to assess interprofessional learning: Psychometrics and expert panel evaluations. *BMC Medical Education*, *18*(1), 40. https://doi.org/10.1186/s12909-018-1153-y

Florencio, L. A. (2010). *Engenharia de avaliações com base em modelos GAMLSS* [Dissertação, Universidade Federal de Pernambuco]. https://repositorio.ufpe.br/bitstream/123456789/6227/1/arquivo616_1.pdf

Guraya, S. Y., & Bar, H. (2018). The effectiveness of interprofessional education in healthcare: A systematic review and meta-analysis. *Kaohsiung Journal of Medical Sciences*, *34*(3), 160–165. https://doi.org/10.1016/j.kjms.2017.12.009

Hansson, A., Foldevi, M., & Mattsson, B. (2010). Medical students' attitudes collaboration between doctors and nurses a comparison between two Swedish universities. *Journal of Interprofessional Care*, *24*(3), 242–250. https://doi.org/10.3109/13561820903163439

Hojat, M., Ward, J., Spandorfer, J., Arenson, C., Winkle, L. J. V., & Williams, B. (2015). The Jefferson Scale of Attitudes Toward Interprofessional Collaboration (JeffSATIC): Development and multi-institution psychometric data. *Journal of Interprofessional Care*, *29*(3), 238–244. https://doi.org/10.3109/13561820.2014.962129

Hood, K., Cant, R., Baulch, J., Gilbee, A., Leech, M., Anderson, A., et al. (2014). Prior experience of interprofessional learning enhances undergraduate nursing and healthcare students' professional identity and attitudes to teamwork. *Nurse Education in Practice*, *14*(2), 117–122. https://doi.org/10.1016/j.nepr.2013.07.013

Hulley, S. B., Cummings, S. R., & Newman, T. B. (2015). Outlining cross-sectional and cohort studies. In S. B. Hulley, S. R. Cummings, W. S. Browner, D. G. Grady, & T. B. Newman (Eds.), *Outlining clinical research* (4th ed.). Artmed.

Judge, M. P., Polyfroni, E. C., & Zhu, S. (2015). Influence of student attributes on readiness for interprofessional learning across multiple healthcare disciplines: Identifying factors to inform educational development. *International Journal of Nursing Sciences*, *2*(3), 248–252. https://doi.org/10.1016/j.ijnss.2015.07.007

Khalili, H., Hall, J., & Deluca, S. (2014). Historical analysis of professionalism in Western societies: Implications for interprofessional education and collaborative practice. *Journal of Interprofessional Care*, *28*(2), 92–97. https://doi.org/10.3109/13561820.2013.869197

Lestari, E., Stalmeijer, R. E., Widyandana, D., & Scherpbier, A. (2016). Understanding students' readiness for interprofessional learning in an Asian context: A mixed-methods study. *BMC Medical Education*, *16*(1), 1–11. https://doi.org/10.1186/s12909-016-0704-3

Lie, D. A., Fung, C. C., Trial, J., & Lohenry, K. (2013). A comparison of two scales for assessing health professional students' attitude toward interprofessional learning. *Medical Education Online*, *18*(e21885), 1–10. https://doi.org/10.3402/meo.v18i0.21885

Madruga, L. M. S., Ribeiro, K. S. Q. S., Freitas, C. H. S. M., Pérez, I. A. B., Pessoa, T. R. R. F., & Brito, G. E. G. (2015). PET-Family Health and the education of health professionals: Students' perspective. *Interface (Botucatu)*, *19*(1), 805–816. https://doi.org/10.1590/1807-57622014.0161

Milutinović, D., Lovrić, R., & Simin, D. (2018). Interprofessional education and collaborative practice: Psychometric analysis of the readiness for interprofessional learning scale in undergraduate Serbian healthcare student context. *Nurse Education Today*, *65*, 74–80. https://doi.org/10.1016/j.nedt.2018.03.002

Mukhtar, J., Hussain, M., Perveen, K., Afzal, M., & Gilani, S. A. (2018). Students' perception and readiness towards inter-professional learning. *International Journal of Social Science Management*, *5*(3), 192–200. https://doi.org/10.3126/ijssm.v5i3.20610

Nelson, S., White, C. F., Hodges, B., & Tassone, M. (2017). Interprofessional team training at the prelicensure level: A review of the literature. *Academic Medicine*, *92*(5), 709–716. https://doi.org/10.1097/ACM.0000000000001435

Nuto, S. A. S., Lima Júnior, F. C. M., Camara, A. M. C. S., & Gonçalves, C. B. C. (2017). Assessment of availability for learning interprofessional study of health sciences students. *Rev Bras Educ Med*, 41(1), 50–57. https://doi.org/10.1590/1981-52712015v41n1RB20160018

Oliveira, V. F., Bittencourt, M. F., Pinto, I. F. N., Lucchetti, A. L. G., Ezequiel, O. S., & Lucchetti, G. (2018). Comparison of the readiness for interprofessional learning and the rate of contact among students from nine different healthcare courses. *Nurse Educ Today*, 63, 64–68. https://doi.org/10.1016/j.nedt.2018.01.013

Parsell, G., & Bligh, J. (1999). The development of a questionnaire to assess the readiness of health care students for interprofessional learning (RIPLS). *Medical Education*, *33*(2), 95–100. https://doi.org/10.1046/j.1365-2923.1999.00298.x

Peduzzi, M., Norman, I., Coster, S., & Meireles, E. (2015). Cross-cultural adaptation and validation of readiness for interprofessional learning scale in Brazil. *Revista da Escola de Enfermagem da USP*, *49*(spe 2), 7–15. https://doi.org/10.1590/S0080-623420150000800002

Prado, F. O., Rocha, K. S., Araújo, D. C., Cunha, L. C., Marques, T. C., & Lyra Junior, D. P. (2018). Evaluation of students' attitudes towards pharmacists–physician collaboration in Brazil. *Pharmacy Pract*, 16(4), 1277. https://doi.org/10.18549/pharmpract.2018.04.1277

Pype, P., & Deveugele, M. (2016). Dutch translation and validation of the readiness for interprofessional learning scale (RIPLS) in a primary healthcare context. *European Journal of General Practice*, *22*(4), 225–231. https://doi.org/10.1080/13814788.2016.1211104

Rajiah, K., Maharajan, M. K., Khoo, S. P., Chellappan, D. K., Alwis, R., Chui, H. C., et al. (2016). Suitability of the RIPLS and IEPS for discriminating attitude differences towards interprofessional education among students of the healthcare profession. *Education Research International*, *2016*, 1–6. https://doi.org/10.1155/2016/5946154

Reeves, S., Fletcher, S., Barr, H., Birch, I., Boet, S., Davies, N., et al. (2016). A BEME systematic review of the effects of interprofessional education: BEME Guide No. 39. *Medical Teacher*, *38*(7), 656–668. https://doi.org/10.3109/0142159X.2016.1173663

Reynolds, F. (2003). Initial experiences of interprofessional problem-based learning: A comparison of male and female students' views. *Journal of Interprofessional Care*, *17*(1), 35–44. https://doi.org/10.1080/1356182021000044148

Rocha, N. B., Silva, M. C., Silva, I. R. G., Lolli, L. F., Fujimaki, M., & Alves, R. N. (2017). Perceptions of learning about interprofessional discipline in dentistry. *Revista ABENO*, *17*(3), 41–54. https://doi.org/10.30979/rev.abeno.v17i3.383

Salih, S., Gameraddin, M., Kamal, S., Alsadi, M., Tamboul, J., & Alsultan, K. (2019). The readiness for interprofessional education (IPE) in the school setting among the internship students of applied medical sciences at Taibah University. *Advances in Medical Education and Practice*, *10*, 843–848. https://doi.org/10.2147/AMEP.S208870

Santos, L. C., Simonetti, J. P., & Cyrino, A. P. (2018). Interprofessional education in the undergraduate Medicine and Nursing courses in primary health care practice: The student's perspective. *Interface (Botucatu)*, *22*(2), 1601–1612. https://doi.org/10.1590/1807-57622017.0507

Sciascia, A., Christopher, K., Humphrey, C., Simpkins, L., Page, C. G., & Jones, L. G. (2021). Test/re-test reliability of the readiness for interprofessional education learning scale and interdisciplinary education perception scale in health science students. *Journal of Interprofessional Care*, *35*(1), 114–123. https://doi.org/10.1080/135

Silva, J. A. M., Peduzzi, M., Orchard, C., & Leonello, V. M. (2015). Interprofessional education and collaborative practice in primary health care. *Rev Esc Enferm USP*, 49(spe 2), 15–23. https://doi.org/10.1590/S0080-623420150000800003

Silva, R. H. A. (2011). Interprofessional education in health graduation: Evaluation aspects of its implementation in Marilia Medical School (Famema). *Educ Rev*, 39, 159–175. https://doi.org/10.1590/S0104-40602011000100011

Sollami, A., Caricati, L., & Mancini, T. (2018). Attitudes towards interprofessional education among medical and nursing students: The role of professional identification and intergroup contact. *Current Psychology*, *37*(4), 905–912. https://doi.org/10.1007/s12144-017-9575-y

Souto, T. S., Batista, S. H., & Batista, N. A. (2014). The interprofessional education in educational psychology: Student's perspectives. *Psycol Cienc Prof*, 34(1), 32–45. https://doi.org/10.1590/S1414-98932014000100004

Souza, M. P. de, USP, G. P. M., Alves, A. C. B., Pinto, M. P. P., & Riberto, M. (2021). Abordagem sobre o ensino interdisciplinar e interprofissional em uma Faculdade de Medicina Brasileira. *Medicina (Ribeirão Preto), 54*(2), e178780. https://www.revistas.usp.br/rmrp/article/view/178780

Stasinopoulos, D. M., & Rigby, R. A. (2007). Generalized additive models for location scale and shape (GAMLSS) in R. *Journal of Statistical Software*, 23(7), 1–46. https://doi.org/10.18637/jss.v023.i07

Thistlethwaite, J. E., Dunston, R., & Yassine, T. (2019). The times are changing: Workforce planning, new healthcare models and the need for interprofessional education in Australia. *Journal of Interprofessional Care*, *33*(4), 361–368. https://doi.org/10.1080/13561820.2019.1612333

Toassi, R. F. C., & Lewgoy, A. M. B. (2016). Integrated health practices I: An innovative experience through inter-curricular integration and interdisciplinarity. *Interface (Botucatu)*, 20(57), 449–461. https://doi.org/10.1590/1807-57622015.0123

Tompsen, N. N., Meireles, E., Peduzzi, M., & Toassi, R. F. C. (2018). Interprofessional education in undergraduate dentistry: Curricular experiences and student availability. *Rev Odontol UNESP*, 47(5), 309–320. https://doi.org/10.1590/1807-2577.08518

Topor, D. R., Dickey, C., Stonestreet, L., Wendt, J., Woolley, A., & Budson, A. (2018). Interprofessional health care education at academic medical centers: Using a SWOT analysis to develop and implement programming. *MedEdPORTAL*, *14*, 10766. https://doi.org/10.15766/mep_2374-8265.10766

Visser, C. L. F., Wilschut, J. A., Isik, U., Burgt, S. M. E., Croiset, G., & Kusurkar, R. A. (2018). The association of readiness for interprofessional learning with empathy, motivation and professional identity development in medical students. *BMC Medical Education*, *18*(1), 125. https://doi.org/10.1186/s12909-018-1248-5

Ward, J., Schaal, M., Sullivan, J., Bowen, M. E., Erdmann, J. B., & Hojat, M. (2008). The Jefferson Scale of Attitudes toward Physician-Nurse Collaboration: A study with undergraduate nursing students. *Journal of Interprofessional Care*, *22*(4), 375–386. https://doi.org/10.1080/13561820802190533

Wilhelmsson, M., Ponzer, S., Dahlgren, L. O., Timpka, T., & Faresjö, T. (2011). Are female students in general and nursing students more ready for teamwork and interprofessional collaboration in healthcare? *BMC Medical Education*, *11*(15), 1–10. https://doi.org/10.1186/1472-6920-11-15

Williams, B., Brown, T., McCook, F., Boyle, M., Palermo, C., Molloy, A., et al. (2011). A pilot study evaluating an interprofessional education workshop for undergraduate health care students. *Journal of Interprofessional Care*, *25*(3), 215–217. https://doi.org/10.3109/13561820.2011.544423

Williams, B., Brown, T., McKenna, L., Palermo, C., Morgan, P., & Brightwell, R. (2015). Students' attitudes toward interprofessional learning: A comparison between two universities. *Journal of Allied Health*, *44*(4), 201–207. https://pubmed.ncbi.nlm.nih.gov/26661698/

Wong, R. L., Fahs, D. B., Talwalkar, J. S., Colson, E. R., Desai, M. M., Kayingo, G., et al. (2016). A longitudinal study of health professional students' attitudes towards interprofessional education at an American university. *Journal of Interprofessional Care*, *30*(2), 191–200. https://doi.org/10.3109/13561820.2015.1121215

World Health Organization. (1974). *Continuing education for physicians*. Geneva: World Health Assembly. https://apps.who.int/iris/handle/10665/92346

World Health Organization. (2010). *Framework for action on interprofessional education & collaborative practice*. Geneva: World Health Organization. http://apps.who.int/iris/bitstream/handle/10665/70185/WHO_HRH_HPN_10.3_eng.pdf