Investigation of the Admission Profile of Medical Residency in Brazil: An Observational Study

Isabela Daher Anbar, João Pedro Daher Anbar, Toufic Anbar Neto, Denise Daher Anbar, Idiberto José Zotarelli Filho*

Medical School of Sao Jose do Rio Preto, São José do Rio Preto, SP, Brazil

Email: *dr.idibertozotarelli@faceres.com.br

Abstract

Background: Medical Residency (MR) started in 1889, at the Department of Surgery at John's Hopkins Hospital, in the United States, to assist the development of medical specialties. In Brazil, it was implemented in the 1940s at the Hospital das Clínicas of the Faculty of Medicine of the University of São Paulo, but it was only in the 1970s that its true expansion took place; however, the admission criteria (AC) in the MR are heterogeneous in this country. **Objective:** It was to analyze the main AC in MR in Brazil, in order to know the main differences between them and to highlight the most important AC. **Methods:** An observational study (STROBE rules) was carried out on the evaluation of twenty-seven (27) AC for RM adopted or not by ten (10) institutions in Brazil. As an evaluation criterion, the terms "1 = yes" and "0 = no" were adopted in relation to the adoption of competences. Descriptive statistical analysis, ANOVA-One-Way Test ($p < 0.05$ with a statistical difference), multivariate analysis and ANOVA-Equality of variances were performed. **Results:** Table 1 shows the numerical and percentage data of the occurrence of types of admission criteria in medical residency programs. There was a difference between the averages of each Institution in terms of absolute values, as well as a statistically significant difference in relation to the AC of each MR, with $p = 0.000$ (Table 2). Figure 1 shows the distribution of the mean values and standard deviations for each criterion around zero (0) to one (1). Figure 2 shows the degree of similarity between the results of the criteria, providing a more accurate relationship between them. **Discussion and Conclusion:** It was observed that there are differences in the adoption of AC among the ten MR institutions, making it necessary to establish standardization measures between them, in order to improve medical specialization.

Therefore, these findings allowed knowing the admission profile of ten medical residency services in Brazil, working as a pilot study. From these results, it is possible to envision possible improvements to achieve the improvement of medical qualification in the near future.

Keywords

Medical Residency, Admission Criteria, Medical Education, Standardization Measures

1. Introduction

The major criteria for admitting physicians to medical residency programs began at Medical Residency (MR) in 1889, at the Department of Surgery at John's Hopkins Hospital, in the United States, to assist the development of medical specialties (Grierson, Mercuri, & Brailovsky, 2017). In Brazil, it was implemented in the 1940s at the Clinical Hospital of the Faculty of Medicine of the University of São Paulo, but it was only in the 1970s that its true expansion took place (Antunes Dos Santos & Nunes, 2019).

Thus, training in some specialty is required, progressive acquisition of responsibility for professional acts, development of the capacity for initiative, judgment, evaluation, and internalization of ethical standards. The Canadian accreditation system of the Royal College of Physicians and Surgeons of Canada does not differ much from that practiced in Brazil; however, the admission criteria (AC) in the MR are heterogeneous in this country (Silva, Rosa, Brandão, Oliveira, Oliveira, & Sousa, 2011).

In this context, the transition from undergraduate medical education (UME) to graduate medical education (GME) is the most important transition in a physician's educational journey (Dezee, Artino, Elnicki, Hemmer, & Durning, 2012). The assessment during this phase is intended to generate information and skills that facilitate the success of the medical student's progression to the resident. However, there is an information gap on the types of admission criteria used by residency programs in Brazil that would be successful to better contribute to professional career progression (Silva, Rosa, Brandão, Oliveira, Oliveira, & Sousa, 2011).

So to achieve a meaningful transition for these medical students, the assessment must be reliable to predict success in the specialty and specific residency program for each student's affinity, including medical knowledge, clinical, professional reasoning and demonstrated ethical, interpersonal behavior and skills communication, academic work and effective patient care (Radabaugh, Hawkins, & Welcher, 2019).

In this sense, assessments of the criteria for admission to residency programs should provide information about these skills, as well as the traditional compe-

tencies that correspond in matching between the student and the program. It can also identify the areas of the student's highest and lowest skills, thus supporting continued professional growth (Radabaugh, Hawkins, & Welcher, 2019; Gibson & Elrod, 2018).

Thus, as an example in the USA, the preferences of program directors (PDs) for classifying candidates correspond to five main factors for 1208 PDs, which are the candidate's interaction with the faculty during the interview and visit (96%); interpersonal skills (95%), interactions with house staff during the interview and visit (91%), feedback from current residents (86%); and United States Medical Licensing Examination (USMLE) Step 1 or Comprehensive Osteopathic Medical Licensing Examination (COMLEX) Level 1 (78%) (American Medical Association, 2020).

Therefore, the present study analyzed the major admission criteria in medical residency in Brazil, in order to know the main differences between them and to highlight the most important.

Study Model

The present study followed a systematic review model. After literary search criteria using the MeSH Terms that were cited in the item below on "Search strategies", a total of 48 clinical studies were compared and submitted to the eligibility analysis and, after that, 21 studies were selected, following the STROBE rules (Strengthening the Reporting of Observational studies in Epidemiology—https://www.strobe-statement.org/index.php?id=strobe-home) (Elm, Altman, Egger, for the STROBE Initiative, 2007).

Search Strategy and Information Sources

The search strategy was carried out in the databases PubMed, Embase, Ovid and Cochrane Library, Web Of Science, ScienceDirect Journals (Elsevier), Scopus (Elsevier), OneFile (Gale) followed the following steps: —search by MeSH Terms: *Medical residency. Admission criteria. Medical education. Development of medical education*, and use of Booleans "and" between mesh terms and "or" among historical findings.

Statistical Analysis

The statistical analysis of the data was performed by Dr. Idiberto José Zotarelli Filho and interpreted by the principal investigator. For data analysis, a database was built on the Microsoft Excel spreadsheet which was exported to the Minitab 18® statistical program (version 18, Minitab, LLC, State College, Pennsylvania, USA) (Minitab®) and also to the OriginPro® 9 (DPR Group, Inc., Northampton, Massachusetts, USA). A common descriptive statistical analysis was performed, obtaining the values of total n, mean and standard deviation, confidence interval (CI), and percentage for all the variables. One-Way test (ANOVA), Multivariate analysis and ANOVA-Equality of variances performed were applied, adopting the α-level less than 0.05 with a statistical difference for 95% CI. The R-sq (R^2) value was also analyzed. As an evaluation criterion, the terms "1 = YES" and "0 = NO" were adopted in relation to the adoption of competences.

2. Results

Twenty-seven (27) admission criteria were evaluated in 10 medical residency programs in Brazil, 8 in the State of São Paulo, 1 in Brasília-Distrito Federal and 1 in Goiânia/GOIÁS. The CA analyzed were Success during the course, Scientific research, Articles in Journals, Progress Test, Congress Work, Higher education assessment, Higher education assessment, Primary care internship, Participation in events, Monitoring, League, Mentoring, Student representation, Internship Duration, Extension Projects, Stages, Foreign language, Extra-medical Activities, Extracurricular activities, Home educational institution, Prerequisite—Institution, Advanced Cardiovascular Life Support/Advanced Trauma Life Support (ACLS/ATLS) certifications, Objective Structured Clinical Examination (OSCE), University Hospital/Teaching, Scholarship, 3 levels of health care, Performance during Internship and Assistance activities. **Table 1** shows the numerical and percentage data of the occurrence of types of admission criteria in medical residency programs.

Table 1. Numerical and percentage data (%) of the occurrence of types of admission criteria in medical residency programs.

Success during the course	Count	Percent	Scientific research	Count	Percent	Articles in Journals	Count	Percent
0	3	30.00	0	2	20.00	0	4	40.00
1	7	70.00	1	8	80.00	1	6	60.00
N =	10		N =	10		N =	10	

Progress Test	Count	Percent	Congress Work	Count	Percent	Higher education assessment	Count	Percent
0	5	50.00	0	5	50.00	0	8	80.00
1	5	50.00	1	5	50.00	1	2	20.00
N =	10		N =	10		N =	10	

Primary care internship	Count	Percent	Participation in events	Count	Percent	Monitoring	Count	Percent
0	8	80.00	0	5	50.00	0	4	40.00
1	2	20.00	1	5	50.00	1	6	60.00
N =	10		N =	10		N =	10	

League	Count	Percent	Mentoring	Count	Percent	Student representation	Count	Percent
0	8	80.00	0	9	90.00	0	6	60.00
1	2	20.00	1	1	10.00	1	4	40.00
N =	10		N =	10		N =	10	

Internship Duration	Count	Percent	Extension Projects	Count	Percent	Stages	Count	Percent
0	7	70.00	0	7	70.00	0	9	90.00
1	3	30.00	1	3	30.00	1	1	10.00
N =	10		N =	10		N =	10	

Foreign language	Count	Percent	Extra-medical Activities	Count	Percent	Extracurricular activities	Count	Percent
0	7	70.00	0	9	90.00	0	5	50.00
1	3	30.00	1	1	10.00	1	5	50.00
N =	10		N =	10		N =	10	

Home educational institution	Count	Percent	Prerequisite -Institution	Count	Percent
0	7	70.00	0	9	90.00
1	3	30.00	1	1	10.00
N =	10		N =	10	

ACLS/ATLS certifications	Count	Percent	OSCE	Count	Percent	University Hospital/Teaching	Count	Percent
0	8	80.00	0	9	90.00	0	8	80.00
1	2	20.00	1	1	10.00	1	2	20.00
N =	10		N =	10		N =	10	

Scholarship	Count	Percent	3 levels of health care	Count	Percent	Performance during Internship	Count	Percent
0	9	90.00	0	9	90.00	0	9	90.00
1	1	10.00	1	1	10.00	1	1	10.00
N =	10		N =	10		N =	10	

Assistance activities	Count	Percent
0	9	90.00
1	1	10.00
N =	10	

There was a difference between the averages of the ten (10) Medical Residency (MR) Institutions in terms of absolute values, as well as a statistically significant difference in relation to the Admission Criteria (AC) of each Institution, with $p = 0.000 < 0.05$ (Table 2).

Figure 1 shows the distribution of the mean values and standard deviations for each criterion around zero (0) to one (1). Figure 2 shows the degree of similarity
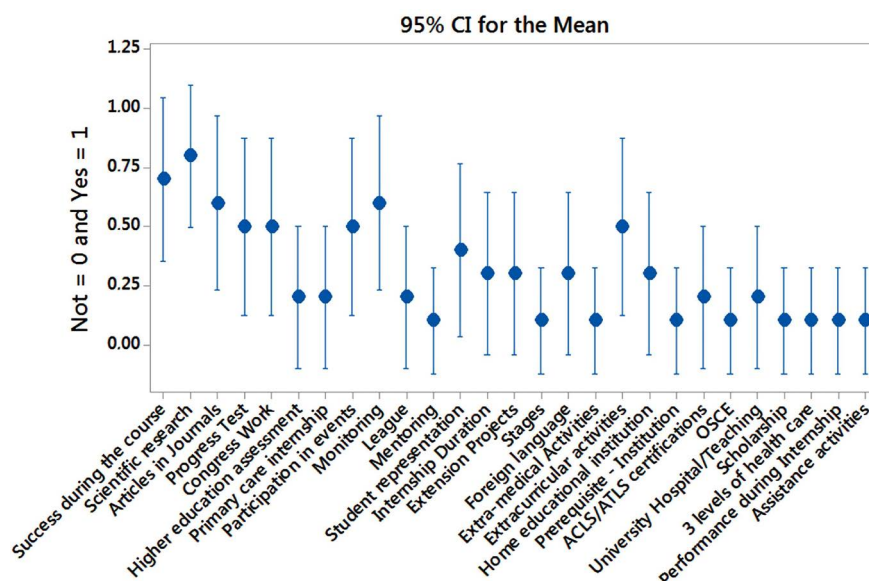
Figure 1. Distribution of the mean and standard deviation values of the evaluation criteria (Not = 0 and Yes = 1) by Dot-Plot model (CI 95%).
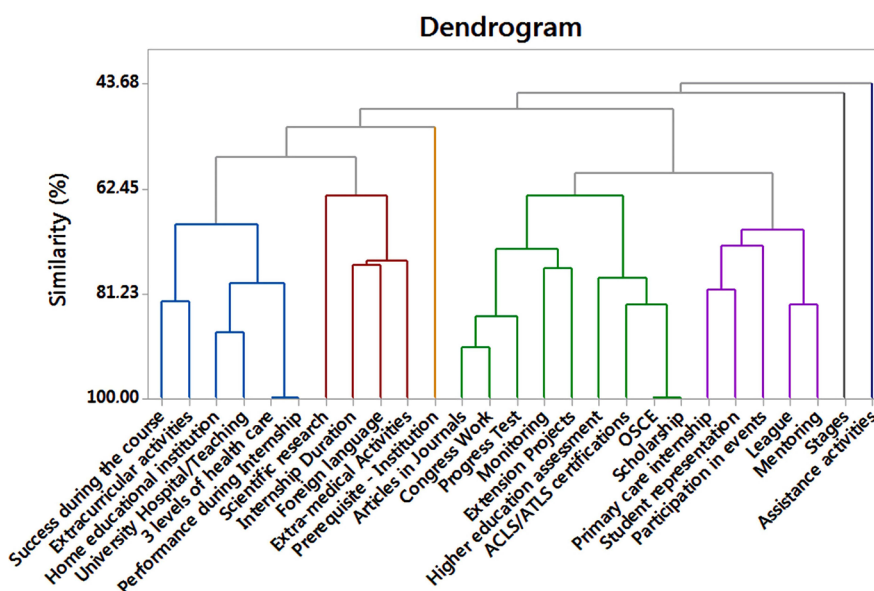

Figure 2. Multivariate analysis showing the degree of similarity between the admission criteria in percentage.

Table 2. Admission criteria in MR, showing values of mean, standard deviation, p-value, R^2 and confidence interval (95% CI), with $p < 0.05$ with statistical difference.

Admission Criteria	N	Mean (Not = 0 and Yes = 1)	StDev	95% CI
Success during the course	10	0.700	0.483	(0.431; 0.969)***
Scientific research	10	0.800	0.422	(0.531; 1.069)
Articles in Journals	10	0.600	0.516	(0.331; 0.869)***
Progress Test	10	0.500	0.527	(0.231; 0.769)***

Continued

Congress Work	10	0.500	0.527	(0.231; 0.769)***
Higher education assessment	10	0.200	0.422	(−0.069; 0.469)***
Primary care internship	10	0.200	0.422	(−0.069; 0.469)***
Participation in events	10	0.500	0.527	(0.231; 0.769)***
Monitoring	10	0.600	0.516	(0.331; 0.869)***
League	10	0.200	0.422	(−0.069; 0.469)***
Mentoring	10	0.100	0.316	(−0.169; 0.369)
Student representation	10	0.400	0.516	(0.131; 0.669)***
Internship Duration	10	0.300	0.483	(0.031; 0.569)***
Extension Projects	10	0.300	0.483	(0.031; 0.569)***
Stages	10	0.100	0.316	(−0.169; 0.369)
Foreign language	10	0.300	0.483	(0.031; 0.569)***
Extra-medical Activities	10	0.100	0.316	(−0.169; 0.369)
Extracurricular activities	10	0.500	0.527	(0.231; 0.769)***
Home educational institution	10	0.300	0.483	(0.031; 0.569)***
Prerequisite-Institution	10	0.100	0.316	(−0.169; 0.369)
ACLS/ATLS certifications*	10	0.200	0.422	(−0.069; 0.469)***
OSCE**	10	0.100	0.316	(−0.169; 0.369)
University Hospital/Teaching	10	0.200	0.422	(−0.069; 0.469)***
Scholarship	10	0.100	0.316	(−0.169; 0.369)
3 levels of health care	10	0.100	0.316	(−0.169; 0.369)
Performance during Internship	10	0.100	0.316	(−0.169; 0.369)
Assistance activities	10	0.100	0.316	(−0.169; 0.369)

*Advanced Cardiovascular Life Support/Advanced Trauma Life Support (ACLS/ATLS) certifications. **Objective Structured Clinical Examination (OSCE). ***$p = 0.000 < 0.05$ in relation to each type of AC in each MR program. ****$p = 0.000 < 0.05$ and **$R^2 = 1.83\%$ between all types of AC.

(%) between the results of the admission criteria, providing a more accurate relationship between them.

3. Discussion

It was observed that there are differences in the adoption of AC among the ten MR institutions, making it necessary to establish standardization measures between them, in order to improve medical specialization.

The present study showed that the admission criteria for greater adherence in Brazil are Success during the course (mean = 0.7), Scientific research (mean = 0.8), Articles in Journals (mean = 0.6) and Monitoring (mean = 0.6), is that the closer to 1.0 the greater the frequency of adoption of these criteria, according to Table 1. Thus, it is necessary to encourage greater adherence by medical students and MR services in other activities as well, in order to achieve greater

probabilities professional qualification, as well as to establish a high standard of MR in Brazil.

Based on these results, in order to achieve a constructive transition for the student, the MR and AC program must provide meaningful information about the candidate's characteristics, academic performance, and competence that lead to an appropriate match between the student and the residency program. As a model, in the United States, an element of reliable assessment data is provided that can inform judgments about the student's likelihood of success at home (National Resident Matching Program, 2020). However, students' abilities in areas other than those traditionally valued, such as life experiences, community involvement, language skills, and leadership attributes, do not receive the same level of influence when making candidate selections (Association of American Medical Colleges, 2018; Stephenson-Famy, Houmard, Oberoi, Manyak, Chiang, & Kim, 2015; Lievens, 2015).

In this context, evaluation strategies in accordance with the AC to the RM programs are being developed, in order to facilitate the approaches and selection of candidates. Thus, a study evaluated the practices and perceptions of directors of residency programs in the USA and candidates for residency with reference to the use of social media and Internet resources in the selection process of resident physicians. A survey was distributed by e-mail (SurveyMonkey®) to 2592 program PDs in 22 specialties accredited by the Accreditation Council for Graduate Medical Education. A separate survey was distributed to all residency candidates who applied for first-year postgraduate positions (PGY1). A total of 1200 (46.3%) PDs completed the survey. Overall, 16.3% (n = 196) of respondents reported visiting Internet resources to obtain more information about candidates, 38.1% (74 of 194) of whom rated a candidate as the lowest result (Go, Klaassen, & Chamberlain, 2012).

In addition, several factors affect the performance of medical students during the clinical phase. Identifying these factors would help guide weak students and select residency programs. Thus, a study assessed the impact of pre-admission criteria and pre-clinical average (CP) on the performance of undergraduate medical students during the clinical phase. A significant correlation was observed between the clinical CP and the preclinical CP ($p < 0.05$). This significant correlation was not observed with other variables under study. A regression analysis was performed, and the only significant predictor of the students' clinical performance was the CP ($p < 0.001$). However, there was no significant difference between the clinical and pre-clinical students for both cohorts ($p > 0.05$). Preclinical GPA is strongly correlated and can predict the performance of medical students during clinical years. Therefore, it is necessary to assess students' academic performance in the preclinical years before moving on to the clinical years in order to identify weak students to guide them and monitor their progress. In addition, applicants are often unaware of the implications that their online activity can have in selecting for residency. Content guideline programs that raise awareness about the possible impact of social media on the home re-

cruitment process are necessary and should be presented at the beginning of medical education (Salem, Al-Mously, AlFadil, & Baalash, 2016).

Other authors aimed to determine whether there is an association between highly different curricular requirements and pre-medical admission criteria and performance of the medical school and residency. The cohorts studied included all Liberal Medical Education Program (PLME) (n = 295) and traditional pre-medical (TPM) students (n = 215) who graduated from the Brown University (MAS) Warren Alpert School of Medicine. Outcome variables consisted of various measures of medical school performance, including standardized multiple-choice exam grades and honors and placement. TPM students achieved marginally, but statistically, higher average scores on standardized multiple-choice exams than their PLME colleagues. The number of undergraduate courses in pre-medical sciences completed by PLME students represented less than 4% of the variation in the main performance metrics of the medical school. These findings suggest that the association between medical school performance and placement of residency and undergraduate curricular and pre-medical admission requirements is weak. Further studies are needed to determine students' ideal pre-medical preparation (George, Park, Ip, Gruppuso, & Adashi, 2016).

In addition, previous research has shown that more than 50% of residency programs indicate that inappropriate Facebook posts may be grounds for rejecting an MR candidate. Thus, a study sought to understand the opinions of medical students on the impact of their Facebook posts on the residency admission process. A national survey was conducted with 7144 medical students enrolled in US medical schools. The students were introduced to a hypothetical scenario of a residency committee searching on Facebook and finding inappropriate photos of a student and were asked how the committee should consider these photos. The response rate was 30% (2109/7144). The majority of respondents (63.5%) indicated that the photos should be considered together with other factors, but they should not support the automatic rejection. One third (33.7%) believed that images should not influence. A small minority of respondents (2.8%) considered that the images should serve as a basis for the automatic rejection of the request (George, Green, Navarro, Stazyk, & Clark, 2014).

In addition, a study in the Netherlands showed three Dutch graduate medical students addressing CV creation. In addition, a survey was conducted among the heads of 160 residency programs in the Netherlands. Based on this, it was analyzed whether the main considerations of students and DPs correlate to admission to residency programs. The influences of today's millennials' worldview and medical culture are included in the discussion, leading to the conclusion that substantial mental and cultural change is needed at several levels to significantly change the way medical students approach the creation of resumes (Corazolla & Knotnerus, 2018).

In addition, in Kuwait, 21 residency training programs were offered in 2011, however, there are no data available on the criteria for selecting medical students for these programs. Thus, a study with 108 participants provided information on

the importance of these AC, applying a questionnaire to collect data from members (for example, presidents, directors, assistants, etc.) of residency programs in Kuwait. They were asked to assess the level of importance (scale 1 to 5) of the criteria that can affect a candidate's acceptance of their residency programs. The average scores were calculated for each criterion. Of the 108 members invited to participate, only 12 (11.1%) refused to participate. The performance of the interview was classified as the most important criterion for the selection of residents (average grade: 4.63/5.00), followed by the average grade (average grade: 3.78/5.00) and honors during the medical course (average grade: 3.67/5.00). The receipt of disciplinary actions during medical school and the failure in a required internship was considered the most worrying among other criteria used to reject candidates (average scores: 3.83/5.00 and 3.54/5.00, respectively). Small differences in relation to the level of importance of each criterion were observed in different programs (Marwan & Ayed, 2013).

In addition, a study provided evidence of the validity of the Standardized Assessment Letter for Pediatrics as a measure of the skills expected of a doctor as part of a pediatric residency admission process. The Narrative Recommendation Letter is a tool frequently used in the residency admission process, despite having low reliability among the evaluators, lacking relevant content and not correlating with the performance of the residency. A more recent tool, the Standardized Charter, showed evidence of content validity and reliability among reviewers in other specialties. One hundred and fourteen teachers completed 142 standardized Evaluation Letters for 71 candidates. Evidence of validity supports the use of the Pediatric Evaluation Letter. However, future studies should refine items to improve predictive validity and explore the best way to integrate the Assessment Letter into the residence admission process (Bajwa, Yudkowsky, Belli, Vu, & Park, 2018).

A review study examined the most common and highly rated factors used to select interview candidates. The residency program directors identified 12 factors that contribute substantially to the decision to invite candidates for interviews. Although Step 1 of the United States Medical Licensing Examination (USMLE) is often used as a comparative factor, most studies do not demonstrate its predictive value for resident performance, except in the event of a test failure. It has also been found that structured letters of recommendation for a specialty have increased benefits when compared to generic letters (Hartman, Lefebvre, & Manthey, 2019).

Like other information, Germany employs an integrated medical curriculum that normally starts right after high school and consists of a 2-year pre-clinical segment of basic science teaching and a 4-year clinical segment-leading medical student to practical aspects of medicine. On the other hand, education in the USA is a two-step process. Upon successful completion of a bachelor's degree in college, an American student undergoes a 4-year medical program, covering 2 years of basic science and 2 years of clinical training (Zavlin, Jubbal, Noé, & Gansbacher, 2017).

In this sense, in order to manage an increasing number of residency applications and identify more qualified candidates, DPs in the USA are relying on screening measures that allow comparison of medical students. As USMLE Step 1 and COMLEX Level 1 scores are convenient and quantitative, they have by default become the predominant screening method for selecting interviews (Radabaugh, Hawkins, & Welcher, 2019). However, success in residency should not be measured only by the degree program but, on the contrary, contributing to a competent and compassionate workforce that meets the needs of society, improving the existing academic workforce, providing focused care in the patient in functioning interprofessional teams, and the interests related to the mission of the support institutions. In addition, attention should be paid to well-founded knowledge and clinical skills. Thus, a more comprehensive and fair approach to the selection of residents is necessary.

4. Conclusion

Therefore, these findings allowed us to know the admission profile of ten medical residency services in Brazil, working as a pilot study. From these results, it is possible to envision possible improvements to achieve the improvement of medical qualification in the near future.

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Conflicts of Interest

The authors declare no conflict of interest.

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