Relationship between performance on the progress test and selection for medical residency

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Research article

Keywords: Educational Measurement; Medical Education; Internship and Residency

Posted Date: October 28th, 2019

DOI: https://doi.org/10.21203/rs.2.10638/v2

Abstract

Background: The Progress Test (PT) is a formative evaluation used to analyze student progress throughout medical undergraduate studies. Further, classificatory summative assessments are carried out by graduates of medical programs worldwide, either to acquire a practicing license or to obtain a vacancy in the Medical Residency (MR) selection processes. We aimed to identify whether PT performance is related to performance in the MR selection process. Methods: Physicians who attended and graduated from a public university in the state of São Paulo, Brazil, between 2011 and 2014 were assessed on the basis of voluntary participation in the PTs throughout their undergraduate program, performance in the PT in their last year, performance in the multiple-choice test of MR, convocation in the first classificatory list, and approval for the MR selection. Descriptive statistics and comparison of scores were performed using student's t-test for independent and paired samples and the Pearson correlation coefficient. Results: Of the 424 students, 374 participated in the PTs throughout their undergraduate program and in the MR selection process. These graduates performed better in the PT than the 22 who did not go on to MR ($p < 0.05$). Students who participated in all the PTs throughout their undergraduate program demonstrated superior performance in MR than those 22 who did not participate regularly ($p < 0.0001$). Among the 374 trainees, the average performance level for the PT was lower than that for their multiple-choice test for MR, both overall ($p < 0.05$) and separately by year ($p < 0.0001$); moreover, there was a strong correlation between PT performance and performance on the multiple-choice test. There was greater approval in MR among graduates whose mean score on the multiple-choice test was above that in the PT ($p < 0.0001$). Conclusions: PT performance was related to performance in the MR selection process for the study period; there was a strong correlation between student performance in the PT and the multiple-choice test in MR. Students with multiple-choice test results for MR that were below the average performance level in the PT were less frequently approved in the MR selection process.

Background

The student learning assessment process should permit students to identify their difficulties in order to help them overcome their shortcomings. This process should also allow teachers to use student performance as a tool to improve instruction to meet their students' needs [1]. In this context, there are three ways of evaluating the teaching and learning process [2]. The first is the diagnosis, or pre-test, performed to obtain the cognitive dimensions of learning that students possess before starting an educational process, and this defines whether students have the basic knowledge and cognitive ability that are necessary to pursue new learning [2].

The second form of assessment is summative and is applied at the end of the subject or course of study to identify whether students have acquired the skills necessary for the new stages of learning [3]. Summative assessment is traditionally performed by means of tests or discursive questions [3].

The third kind of evaluation is formative, is carried out during a teaching period, and includes the teacher's feedback on the student's performance [4]. It aims to verify whether students understand each

stage of the educational process by identifying the difficulties and learning possibilities in the cognitive construction of knowledge throughout the undergraduate program [5]. This is the evaluation stage in which instructors can learn from students' learning results that can help them make changes to their own teaching strategies.

In the medical field, the Progress Test (PT) is a formative assessment tool focused on clinical reasoning, which seeks to identify the student's progress throughout the undergraduate program [6, 7]. This assessment allows students to have the necessary feedback about their progress, while identifying the difficulties and providing the educational institution with input for the evaluation of the curricular model used [8-10]. The questions are drafted in accordance with and in the context of medical practice, and their purpose is to evaluate whether students meet the expected levels of knowledge for the practice of medicine and to assess their ability to apply complex principles of reasoning, reflection, and judgment in resolving the questions, thereby avoiding the sole measurement of memorized information [11]. The PT, as a mechanism for improving student performance, establishes new teaching and self-evaluation strategies. It is widely recognized and utilized internationally by medical schools with different teaching and learning methodologies [4, 12].

This instrument is an important complement for the assessment of students in different teaching and learning methodologies, from the perspective of a longitudinal approach. The PT is performed at fixed intervals, ranging from one to four times per year [6, 7]. It focuses on the evaluation of students' knowledge and competencies over the years and is conducted at the same time by students of different schooling levels. Moreover, the PT can also be used for summative purposes [6, 7].

The PT was produced through a collaborative and multicentric approach, intended to be administered by medical schools worldwide. Through simultaneous application in different partner schools, the PT promoted increased efficiency and reduced test administration costs [6, 7]. When the PT is performed multicentrically—in a consortium of several medical schools from the same or different countries—an extensive database of evaluations is created [6-8]. Database consortia such as these provide larger datasets from which educators can detect patterns and create new instructional methodologies to meet students' needs. These robust databases can be used to provide students with important feedback regarding their strengths and weaknesses in terms of their knowledge [8, 9]. The partnership among schools has contributed to the development of high-quality questions because question writers, reviewers, and test administrators can share their expertise to develop a more comprehensive set of questions [11].

The number of questions used in the PT depends on the consortia designing and implementing them. The Dutch and German consortia, among others, include 200 questions. Others, such as the Canadian consortia, use 180; 120 questions are included on the PT in the United Kingdom. The number of questions varies according to the frequency with which the tests are administered, and, since they are very short, they may underrepresent the curriculum contents, thereby reducing the content validity of the PT [6, 7]. In Brazil, these tests generally consist of 120 multiple-choice questions, each with four alternative answers of which only one is correct. The total resolution time is four hours [13].

However, after completing the course of study, graduates worldwide are faced with summative assessments of a classificatory nature; that is, assessments that enable the successful students to acquire the right to practice the profession or to fill a vacancy in the selection processes, such as Medical Residency (MR) [14]. MR, as a required postgraduate program for physicians, unfolds with in-service training, and is the most important model for the training of specialists [15]. It is considered the gold standard of medical specialization education, directed toward the development of medical skills and professional abilities in a qualified work environment [16].

In Brazil, the program accredited by the National Commission on Medical Residency provides the doctor who performs the training with the title of specialist in the area in which he or she has worked [17]. The average annual workload is 2,880 hours, for a number of years that varies according to the resident's specialty. There are more than one hundred accredited programs, with some allowing direct access, while others require previous training [15, 16]. As a large number of recent graduates seek to join MR, there are relatively few vacancies in reputable institutions in comparison to the number of trainees [18, 19]. In certain fields, including neurosurgery, dermatology, ophthalmology, and imaging diagnosis [18], openings for the position are highly coveted by candidates. In other areas, there are more vacancies offered than are filled by demand from graduates, such as family and community medicine [19].

Thus, when considering MR as the primary training program for specialized medical practice, one must recognize the fact that, over the years, there has been an increase in competition in the selection processes in general. Therefore, it is crucial to verify during the medical course of study whether there is any indication of particular student performance areas or scores that correlate with successful performance in the selection process for MR.

Moreover, considering the current importance of the PT in the pedagogical context of medical schools and the test's characteristics, from the form of construction to its application, it is necessary to determine the relationship between these two evaluations. One evaluation is formative, as the PTs are performed throughout the medical course of study, and the other is summative, focusing on the selection processes for MR, and both evaluate fundamental concepts at the conclusion of the medical course. Therefore, the objective of this study is to identify whether student performance in the PT of their final year of study is related to performance in the MR selection process. Specifically, we focus on the possible correlation between students' PT performance and their performance on the multiple-choice test (MC) leading to selection in MR.

Methods

The present study's quantitative research can be characterized as an analytical and cross-sectional study, in which all students from the undergraduate medical school of a public university in the state of São Paulo, Brazil, during the years 2011 to 2014, were analyzed. Students' performance data for the PT and the selection test for MR were requested from those responsible for the information, and the data were stored ethically and confidentially with prior authorization of the participating institution.

The data regarding students' performance in the PT were obtained from the coordinating body of the interinstitutional consortium, which was constituted at that time by nine medical courses of study. The PT of this consortium is applied once a year, and the participation of students is not mandatory. It consists of 120 multiple-choice questions in the areas of general surgery (GS), internal medicine (IM), gynecology and obstetrics (GO), pediatrics (PE), public health (PH), and basic science (BS), with the questions divided equally among the areas of medical knowledge (20 questions each).

For the present study, the general performance of students in the PT during the last year of the course of study and the performance on the questions of each of the five major areas—GS, IM, GO, PE, and PH—were considered. The performance in BS was not considered since the study correlated the data of the PT with the MR selection test, which did not have specific questions on BS content. Data on the performance of the MR test were obtained from the coordinating body of the institution's Medical Residency committee.

These selection processes were prepared by professors at the institution itself and consisted of a test composed of multiple-choice questions, similar to the PT, as well as an essay test and a practical test on the five major areas. The multiple-choice test consisted of 80 questions, the essay test of 20 questions, and both sets were divided among the common areas chosen for study. The practical test consisted of one station from each area, totaling five stations of practical simulations [20].

The first phase consisted of two tests (MC and essay), with a total weight of 50, distributed as 25 for each. The second phase (practical) test had a weight of 40. The third phase, with a weight of 10, consisted of analysis and argumentation of the students' curriculum vitae [20]. To participate in the essay test and all other phases, candidates who occupied the first positions in the MC were selected at a ratio of five candidates to one vacancy in each program [20].

In the period studied, the summative tests of the selection processes for direct access to MR chose candidates for the available vacancies among the following specialties: anesthesiology, general surgery, medical clinic, dermatology, medical genetics, infectious disease, family and community medicine, occupational medicine, nuclear medicine, preventive and social medicine, neurosurgery, neurology, obstetrics and gynecology, ophthalmology, orthopedics and traumatology, otorhinolaryngology, pathology, clinical pathology/medicine laboratory, pediatrics, psychiatry, radiology and diagnostic imaging, and radiotherapy [20].

This study focused on students' performance on the MC since it has characteristics similar to those of the PT. The data were analyzed from the viewpoint of overall performance, as well as the specific performance in each of the major areas. We identified the number of correct answers in the questions of the five major areas of the PT in the last year of medical training and those of the MC of the MR selection; then, these numbers were converted into scores from zero to ten to facilitate the understanding and comparison of performances.

The data of this study were analyzed by means of descriptive statistics, comparison of scores by means of student's t-tests for independent and paired samples, and the Pearson correlation coefficient, using the statistical *GraphPad* and the *Statistical Package for the Social Sciences* (*SPSS*) to present the data. This research was evaluated and approved by the Research Ethics Committee of the State University of Campinas.

Results

From 2011 to 2014, 424 physicians graduated from the medical school of the institution where this study was conducted. Of these, 374 students (88.2%) participated every year in both the PT course and the institution's MR selection process. Twenty-two students (5.2%) participated in the entire PT undergraduate program but did not participate in the institution's MR selection process. An additional twenty-two students (5.2%) did not participate in the six PTs but did participate in the MR selection process. Six students (1.4%) did not participate in all six of the PTs, and they also did not participate in the selection process for MR upon graduation (Fig. 1).

Initially, the performance means on the PT were compared between students who participated in the MR test when graduating (mean = 6.65) and those who did not participate (mean = 6.20). It was observed that students who participated in the MR test performed better on the PT than those who did not participate in MR ($p < 0.05$) (Fig. 2).

The same comparison was made regarding student performance on the multiple-choice test for MR, between students who participated in the six PTs (mean = 7.36) and those who did not participate regularly in the PT during the course of study (mean = 6.35). Students who regularly participated in the PT performed better on the multiple-choice test for MR, compared to those who did not regularly participate in the six PTs ($p < 0.0001$) (Fig. 3).

The descriptive analysis of the sample is presented in Table 1, considering the general performance in the five major areas.

Table 1. Descriptive analysis of students' performances on the Progress Test and Medical Residency

	Progress Test					Multiple-Choice Test for Medical Residency				
Year	n	Min	Max	Average	Standard Deviation	n	Min	Max	Average	Standard Deviation p>
2011	91	4.5	8.3	6.7	0.7239	91	4.8	8.5	6.8	0.8173
2012	94	3.6	8.6	6.1	1.0440	94	5.6	9.5	7.6	0.9091
2013	93	4.7	8.3	6.6	0.7370	93	5.1	8.9	7.3	0.8302
2014	96	5.2	8.4	7.1	0.6847	96	4.6	9.0	7.5	0.9435

As Fig. 4 illustrates, the average performance on the PT of all students in the outgoing classes from 2011 to 2014 was significantly lower than the average performance on the MR multiple-choice test ($p < 0.05$).

It is also possible to observe that the mean PT performance of all students in this sample was significantly lower than the mean performance on the MC test of MR ($p < 0.05$), when analyzing the data on outgoing classes from 2011 to 2014 separately (Fig. 5).

Next, the Pearson correlation coefficient was used to identify whether there was a correlation between students' performance on the PT and the multiple-choice test for MR. A regression analysis of the correlation of these data was also performed, and the results showed that there was a statistically significant correlation ($p < 0.001$) between these variables (Fig. 6).

Subsequently, the same data correlation analysis was performed separately for each outgoing class from 2011 to 2014, as shown in the correlation matrix in Table 2.

Table 2. Correlation matrix between performance on the Progress Test and the multiple-choice test for Medical Residency

	2011	2012	2013	2014
r (Pearson)	0.5884	0.6097	0.6705	0.4756
95% CI	0.4352 to 0.7085	0.4645 to 0.7230	0.5406 to 0.7691	0.3042 to 0.6173
R squared	0.3462	0.3718	0.4495	0.2262
P (two-tailed)	<0.0001	<0.0001	<0.0001	<0.0001
N pairs	91	94	93	96

We observed a correlation between the overall performance on the PT and on the multiple-choice test for MR in all groups from 2011 to 2014. We also conducted an analysis of the performance of students in the outgoing classes from 2011 to 2014, in each of the five major areas of medical knowledge—GS, IM, GO, PE, and PH—in order to identify whether the correlation between the assessments also occurred among the questions specific to the areas of knowledge.

Fig. 7 provides a comparison of the means obtained from the PT questions and the MR multiple-choice test, in each of the five major areas.

Table 3 presents a descriptive analysis of the performance of students in undergraduate classes from 2011 to 2014, by area of medical knowledge, in the PT and the multiple-choice test for MR.

Table 3. Descriptive analysis by area on the Progress Test and the multiple-choice test for Medical Residency

	GS		IM		GO		PE		PH	
	PT	MR	PT	MR	PT	MR	PT	MR	PT	MR
Average	6.7	7.0	6.1	7.3	6.6	6.9	6.5	7.9	6.3	7.5
Standard Deviation	1.396	1.250	1.367	1.518	1.321	1.337	1.486	1.223	1.373	1.213
Minimum	1.5	2.5	2.0	3.1	1.5	3.8	2.0	3.8	1.5	2.5
Maximum	9.5	10.0	9.0	10.0	9.5	10.0	9.5	10.0	9.0	10.0

Table 4 presents the correlation matrix for the performance of students in the outgoing classes from 2011 to 2014 by area of knowledge in the PT and in the multiple-choice test for MR.

Table 4. Performance correlation by area on the Progress Test and the multiple-choice test for Medical Residency

	GS	IM	GO	PE	PH
r (Pearson)	0.0700	0.1648	0.1426	0.3710	0.2541
95% CI	-0.0316 to 0.1702	0.0644 to 0.2618	0.0418 to 0.2405	0.2801 to 0.4553	0.1567 to 0.3466
R squared	0.0049	0.0271	0.0203	0.1376	0.0645
P (two-tailed)	=0.1766	=0.0014	=0.0057	<0.0001	<0.0001
N pairs	374	374	374	374	374

The analysis of the questions by area of medical knowledge shows that the correlation between the areas does not repeat the results found between the general performance of students in the sample in the PT and in the MR multiple-choice test, nor does it repeat the results between the classes of 2011 to 2014 separately, as shown in Table 2. In all areas of knowledge, the Pearson correlation coefficient (r) is weak.

The performance of students in the PT sample was then analyzed in relation to those performances gathered in the first classification list that were considered approved (having passed the test), and the sample was also analyzed in relation to those who failed in the MR selection process for graduation. As can be seen in Fig. 8, most of the failures demonstrated below-average performance on the PT.

In general, the PT sample students who performed well on the PT also performed well on the MC questions of the MR test upon graduation. Of the 374 physicians who were selected for MR and who had taken the six PTs, 253 who obtained a mean on the multiple-choice test greater than or equal to that of the PT were approved, and 38 failed. Of those who obtained the lowest average, 30 were approved, and 53 were unsuccessful. There was a statistically significant difference among the performances on the PT, on the multiple-choice test for MR, and on the selection test for MR ($p < 0.0001$).

Discussion

Similar to other parts of the world, the selection process for accessing available posts for MR is very competitive in Brazil, especially in renowned institutions. Finding an evaluative parameter for the medical course of study that correlates with the performance on the MR selection test is relevant for training institutions. This study correlates the performance on the PT with the selection test for MR. The analysis

was performed primarily by correlating the scores obtained in the five major areas of the PT with the multiple-choice test for MR, because both evaluate knowledge in the specialty fields of GC, IM, PE, GO, and PH through objective questions.

Although the PT and the MR selection test have different purposes (the first is primarily formative, and the second is summative and classificatory), the two tests aim to evaluate the general training of the physician. A large majority of graduates in the classes included in this study (93.4%) participated in the process for access to MR vacancies at the institution itself, which is considered one of the best in the country. Of these, moreover, only 5.2% did not take the PT every year. This significant level of participation benefitted the analyses presented in the study.

In any institution where the PT is administered, the aim is to assess the effectiveness of the structure and content of medical curricula, as it is important to identify how students' knowledge progresses during their medical training. However, a German study [21] longitudinally and transversally observed the various impacts on the acquisition of cognitive knowledge among the curricula that use the PT; the study correlated the evolution of the tests with the serial exams necessary to obtain a professional license. The study showed that medical students who demonstrated ascending growth through administrations of the PT during the undergraduate course of study also had better performance on national exams at the end of the licensing training cycles for the medical profession. The correlation with the PT was established, even though there were oral tests at the end of the first and last of the three evaluation cycles for licensing but no oral tests as part of the PT [21].

According to the German study [21], the importance of PT should be valued in the construction and development of students' knowledge. However, the authors highlight other influences on high levels of success in such exams, such as the training school, the influence of teachers in knowledge construction, and the efficiency of the school curriculum.

Among the expectations and practical aspects of the PT is the reduction of student anxiety before the summative evaluations [7]. This element was initially highlighted in a study conducted at McMaster's University. This study evaluated the stimulus that undergraduates presented when studying continuously to prepare for the medical exams held at the end of the course of study, as well as to prepare for the licensing exams for becoming professionals (which are given in several countries) [7]. There is no documentation of the same effect on the performance of screening tests for MR, although our results point to better performance on the MR multiple-choice test among students who took their PT regularly throughout the course of study. Future research could investigate anxiety reduction as a feature of regularly participating in the PTs.

Our study also demonstrates that there was a correlation between the interinstitutional tests prepared by teachers of nine medical schools and the tests for selection into MR prepared by teachers of the testing institution. This study was conducted in a Brazilian medical school and shows that students who participated regularly in the PT, consisting of 88.2% of the graduates of the four groups studied, had superior performances on the multiple-choice test for MR, compared to those who did not participate

regularly. Those with regular participation showed higher means on the MR multiple-choice test when compared with the PTs, even when compared according to specialty areas, corroborating the German study that refers to the influence of the PT on performance for exams taken afterward. It is likely that other factors, such as greater dedication to selective evaluation and dedication to studies in the period between the PT and the selection process for MR, are also related to better performance on the multiple-choice test for MR.

Another relevant aspect of this study was that students who annually performed in all the PTs presented higher means and better performances on the multiple-choice test for MR, which highlights the importance of regular participation in this evaluation, even if it is voluntary. Most students who failed the MC test had below-average performance on the PT, with a strong statistical difference between them. The correlation of observed performance on the PT with the selection test for MR highlights the potentially summative character of the PT. Correlating performance between the PT and the MR test may also contribute to the improvement of curricular education, as both tests are intended to assess the general training of the physician.

Conclusions

The performance on the PT in the last year of medical training by students who had participated in this evaluation regularly throughout the course of study was related to their performance in the MR selection process. There was a strong correlation between overall student performance on the PT and the MR multiple-choice test, with students who demonstrated below average performance on the PT being less successful in the MR selection process.

Abbreviations

BS: basic science; GO: gynecology and obstetrics; GS: general surgery; IM: internal medicine; MC: multiple-choice; MR: medical residency; PE: pediatrics; PH: public health; PT: progress test; SPSS: Statistical Package for the Social Sciences

Declarations

Ethics approval and consent to participate

This study was conducted according to the procedures of Resolution No. 466/2012 of the National Health Council of Brazil. The study was evaluated and approved by the Ethics Committee in Research involving student data of the institution where it was developed—CEP/UNICAMP, with the Certificate of Presentation for Ethical Assessment: 41375614.2.0000.5404, opinion 1,017,046, and dated April 2, 2015, and with proper approval of the use of secondary data of students, authorized by the Faculty of Medical Sciences of UNICAMP. To verify the information, please access the following link: http://plataformabrasil.saude.gov.br/login.jsf

Consent for publication

Not applicable

Availability of data and material

The data that support the findings of this study are available from the School of Medical Sciences (FCM), University of Campinas (UNICAMP), but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of UNICAMP.

Competing interests

The authors declare that they have no competing interests.

Funding

None

Authors' contributions

All authors contributed equally in the conception of the work, the interpretation of the data, the analysis of the data, and the writing of the work, and all approved the final version submitted for publication.

Acknowledgements

We would like to thank Editage (www.editage.com) for publication support.

References

1. Hadji C. Demystified evaluation. Porto Alegre: Editora Artmed; 2001.
2. Depresbiteris L. The challenge of learning evaluation: from the fundamentals to an innovative proposal. São Paulo: Editora Epu; 1989.
3. Zeferino AMB, Passeri SMRR. Evaluation of student learning. Notebooks Abem. 2007;3:39-43.
4. Allal L, Cardinet J, Perrenoud P. Formative assessment in a differentiated teaching. Coimbra: Livraria Almedina; 1986.
5. Moreno LR, Batista NA. Evaluation of learning in medicine: conceptions and teaching practices. In: Batista NA, Batista SH, Abdalla IG, editors. Health education: visiting concepts and practices. 1st ed. São Paulo: Arte & Ciência; 2005. p. 303-16.
6. Wrigley W, Van der Vleuten CPM, Freeman A, Muijtjens A. A systemic framework for the progress test: strengths, constraints and issues: AMEE Guide No. 71. Med Teach. 2012;34:683-97.
7. Van der Vleuten CPM, Schuwirth LWT. The use of progress testing. Perspect Med Educ. 2012;1:24-30.

8. Swanson D, Holtzman K, Butler A, Langer MM, Nelson MV, Chow JW, et al. Collaboration across the pond: the multi-school progress testing project. Med Teach. 2010;32:480-5.
9. Verhoeven BH, Verwijnen GM, Scherpbier AFFA, Van der Vleuten CPM. Growth of medical knowledge. Med Educ. 2002;36:711-17.
10. Holmboe ES. Faculty and observation of trainees' clinical skills: problems and opportunities. Acad Med. 2004;79:16-22.
11. Schuwirth L, Bosman G, Henning RH, Rinkel R, Wenink AGC. Collaboration on progress testing in medical schools in the Netherlands. Med Teach. 2010;32:476-9.
12. Norman G, Neville A, Blake JM, Mueller B. Assessment steers learning down the right road: impact of progress testing on licensing examination performance. Med Teach. 2010;2:496-9.
13. Sakai MH, Ferreira Filho OF, Almeida MJ, Mashima DA, Marchese MC. Progress test and course evaluation: ten years of medical experience from Londrina State University. Rev Bras Ed Med. 2008;32:254-63.
14. Archer J, Lynn N, Coombes L, Roberts M, Gale T, Price T, et al. The impact of large scale licensing examinations in highly developed countries: a systematic review. BMC Med Educ. 2018;16:212.
15. Leite IGC, Teixeira MTB, Neves HS, Oliveira LRS, Garcia LAO, Cunha PHM. Evaluation of the effectiveness of the preparatory courses for medical residency. Rev Bras Educ Med. 2008;32:445-51.
16. Hamamoto Son PT, Zeferino AMB. Preparatory courses for medical residency: reflections on possible causes and consequences. Rev Bras Educ Med. 2011;35(4):550-56.
17. National Council of Medical Residency. In: Brasília: Resolution CNRM No. 3, of 16 September 2011. 2019. http://portal.mec.gov.br/index.php?option=com_docman&view=download&alias=8950-res-cnrm-03-2011&category_slug=setembro-2011-pdf&Itemid=30192. Accessed 19 May 2019.
18. Silva SM, Rosa VF, Brandão PRP, Oliveira AC, Oliveira PG, Sousa JB. Preparatory courses for an old doctor: vision of medical students. Revista do Colégio Brasileiro de Cirurgiões. 2011;38:349-54.
19. Sheffer M, Cassenote A, Guilloux AGA, Biancarelli A, Miotto BA, Mainardi GM. Medical Demography in Brazil 2018. 1st ed. São Paulo: FMUSP, CFM, Cremesp; 2018.
20. Unicamp Vestibular Commission. In: Campinas: Unicamp Medical Residency Program Catalogs. https://www.fcm.unicamp.br/fcm/residencias-em-saude/residencia-medica/catalogos-dos-programas (2018). Accessed 17 Aug 2018.
21. Karay Y, Schauber SK. A validity argument for progress testing: examining the relation between growth trajectories obtained by progress tests and national licensing examinations using a latent growth curve approach. Med Teach. 2018; doi:10.1080/0142159X.2018.1472370.

Figures

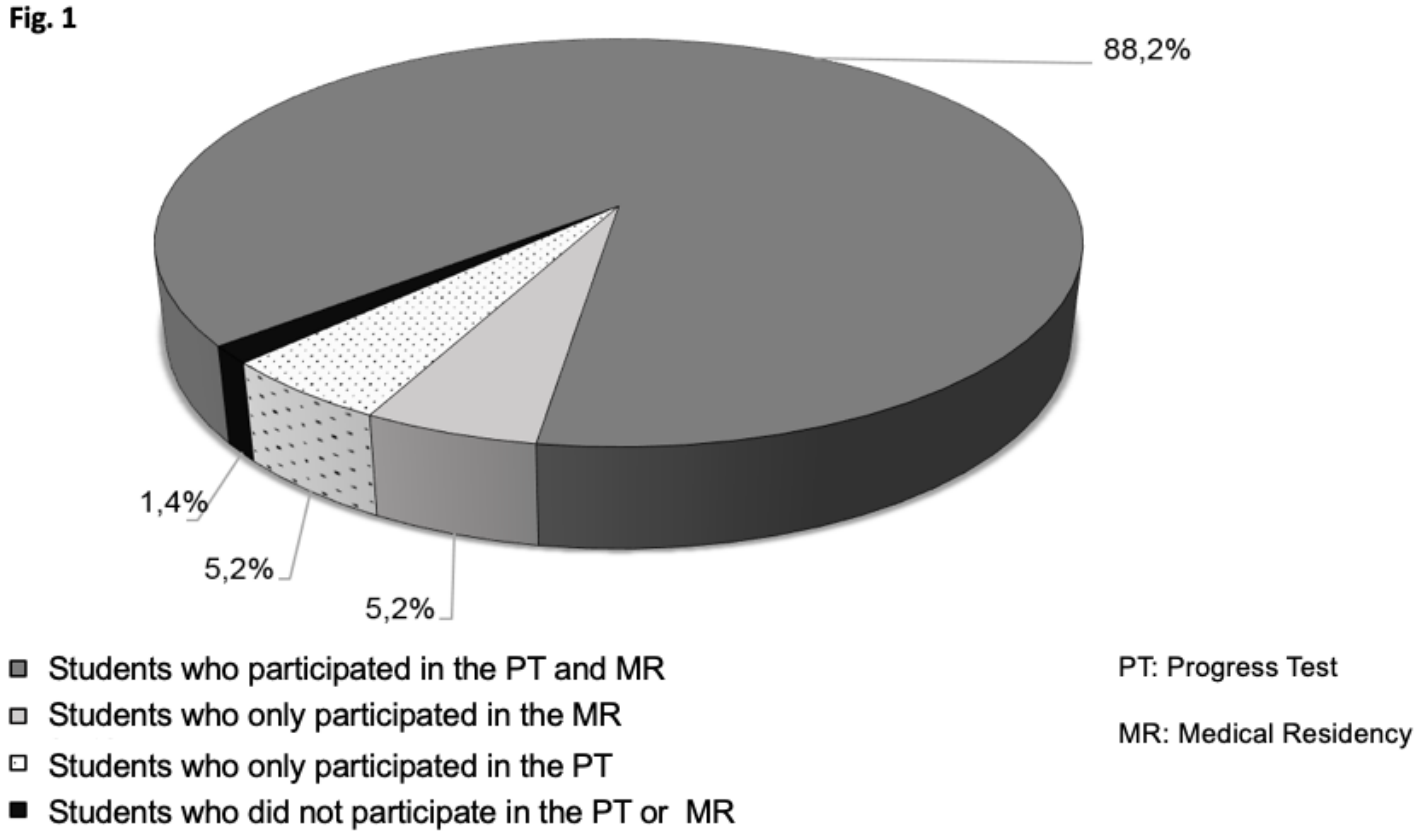

Figure 1

Distribution of Progress Test participants and/or the selection process of the institution's Medical Residency program

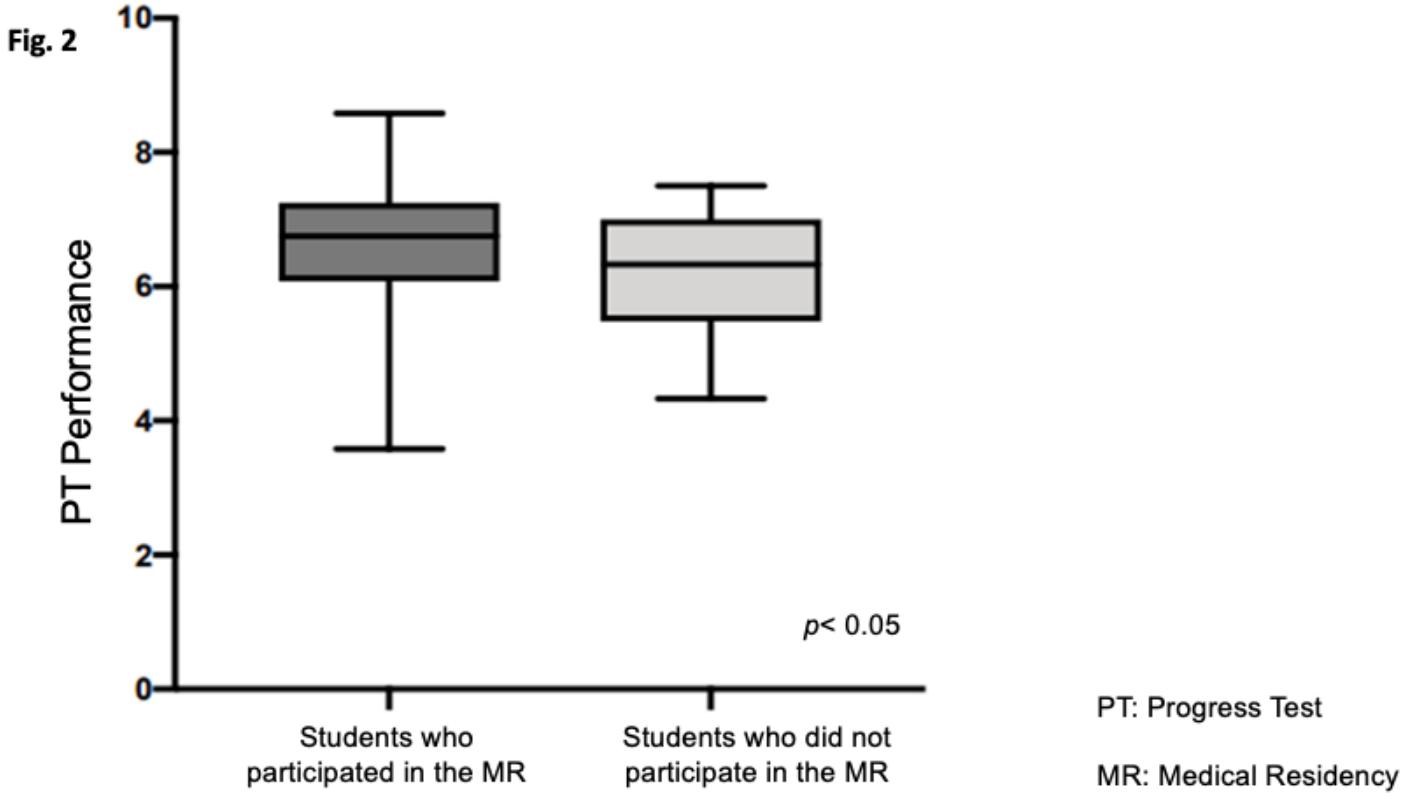

Figure 2

Progress Test performance among students who did or did not participate in Medical Residency selection

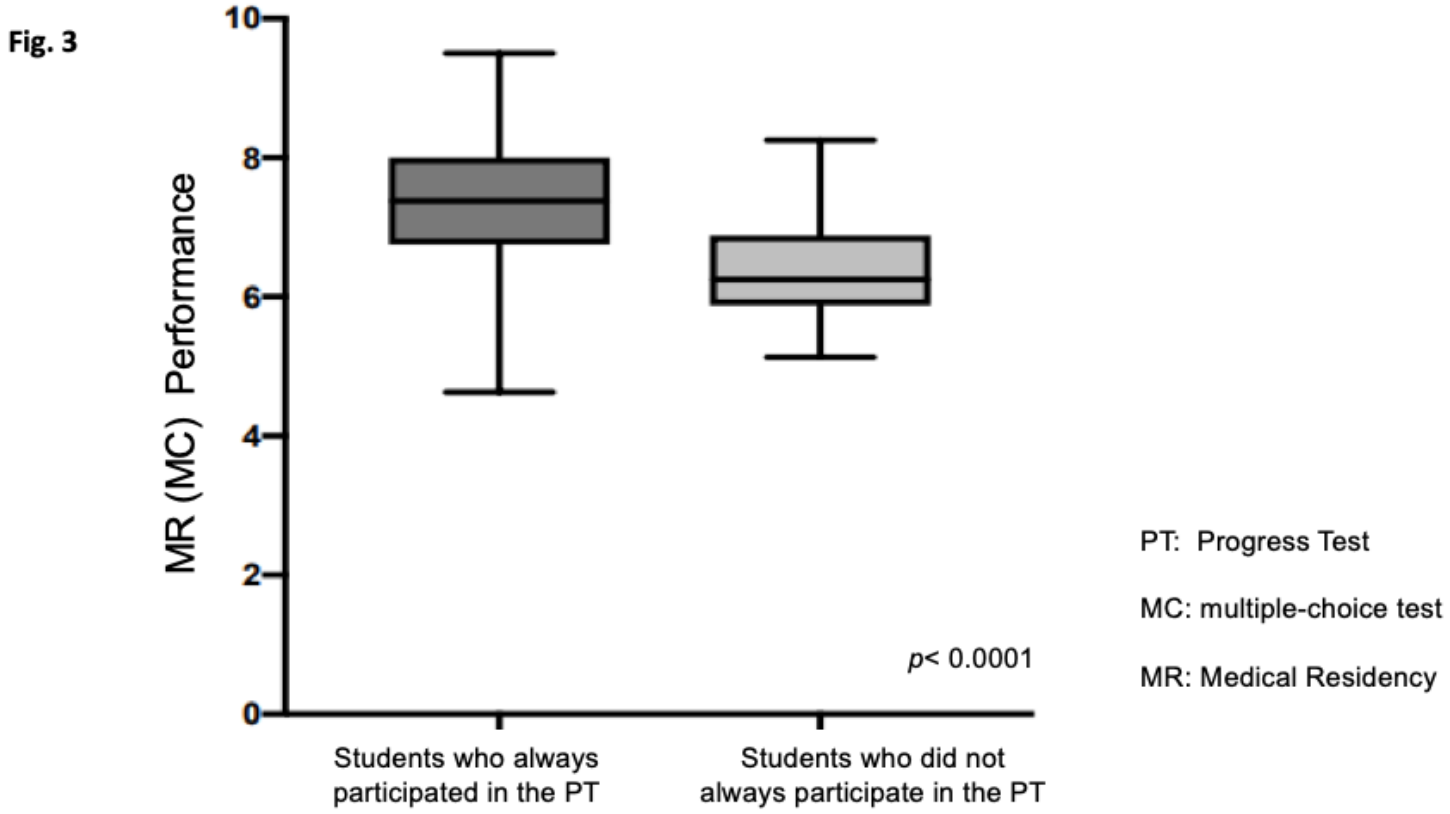

Figure 3

Performance on multiple-choice exams and Progress Test participation throughout the course of study

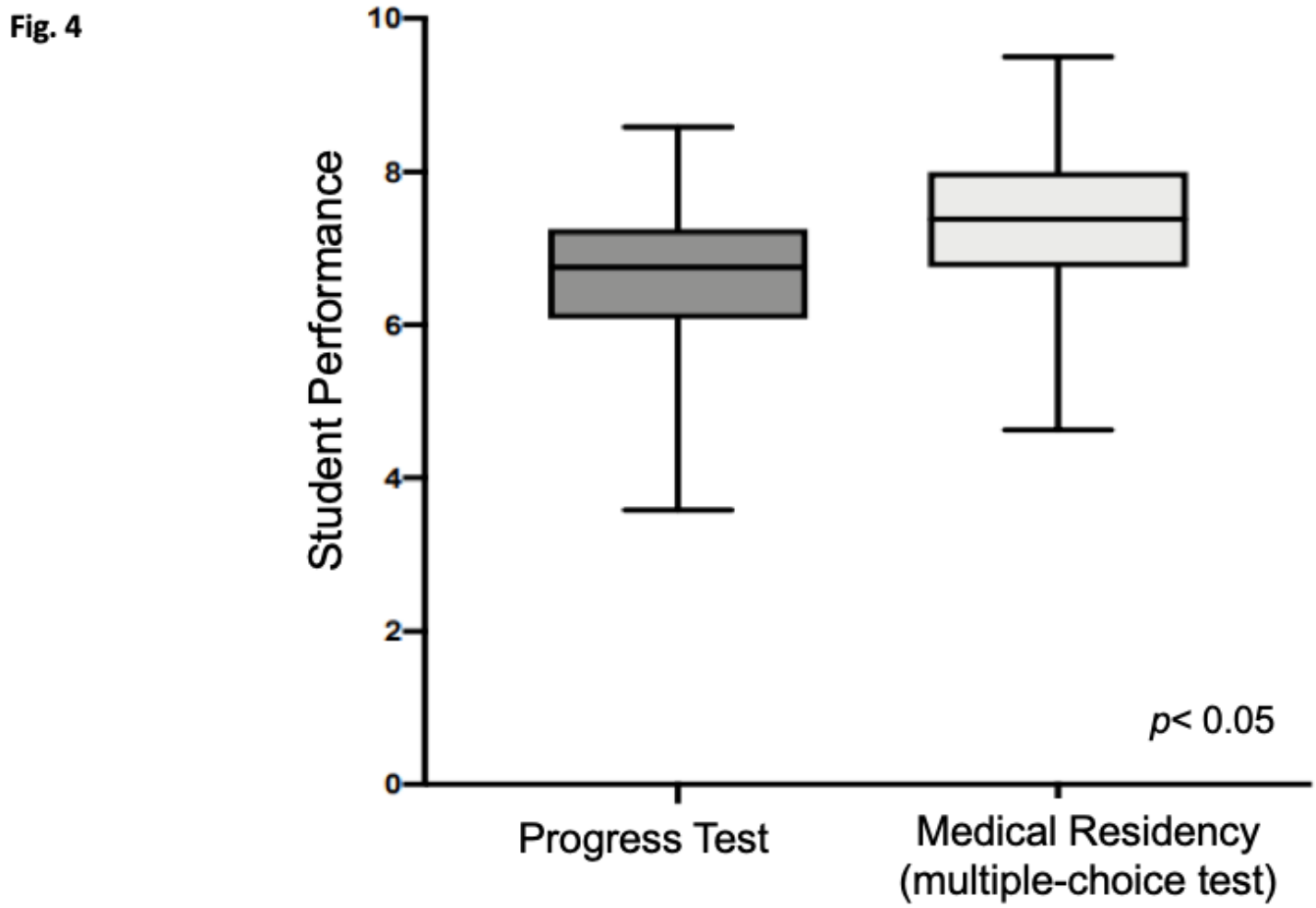

Figure 4

Comparison of performance on the Progress Test and multiple-choice test for Medical Residency

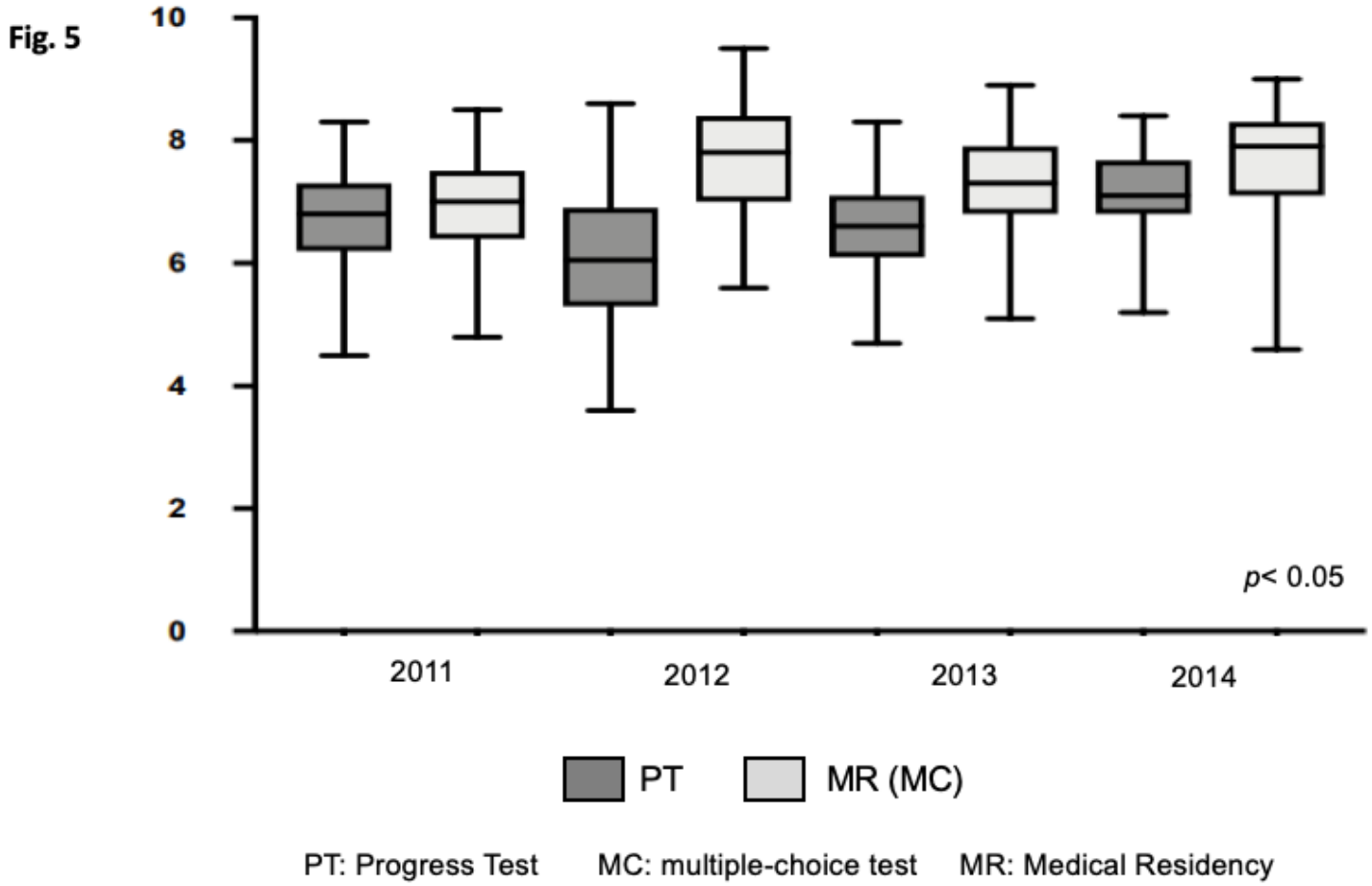

Figure 5

Annual performance on the Progress Test and the multiple-choice test for Medical Residency

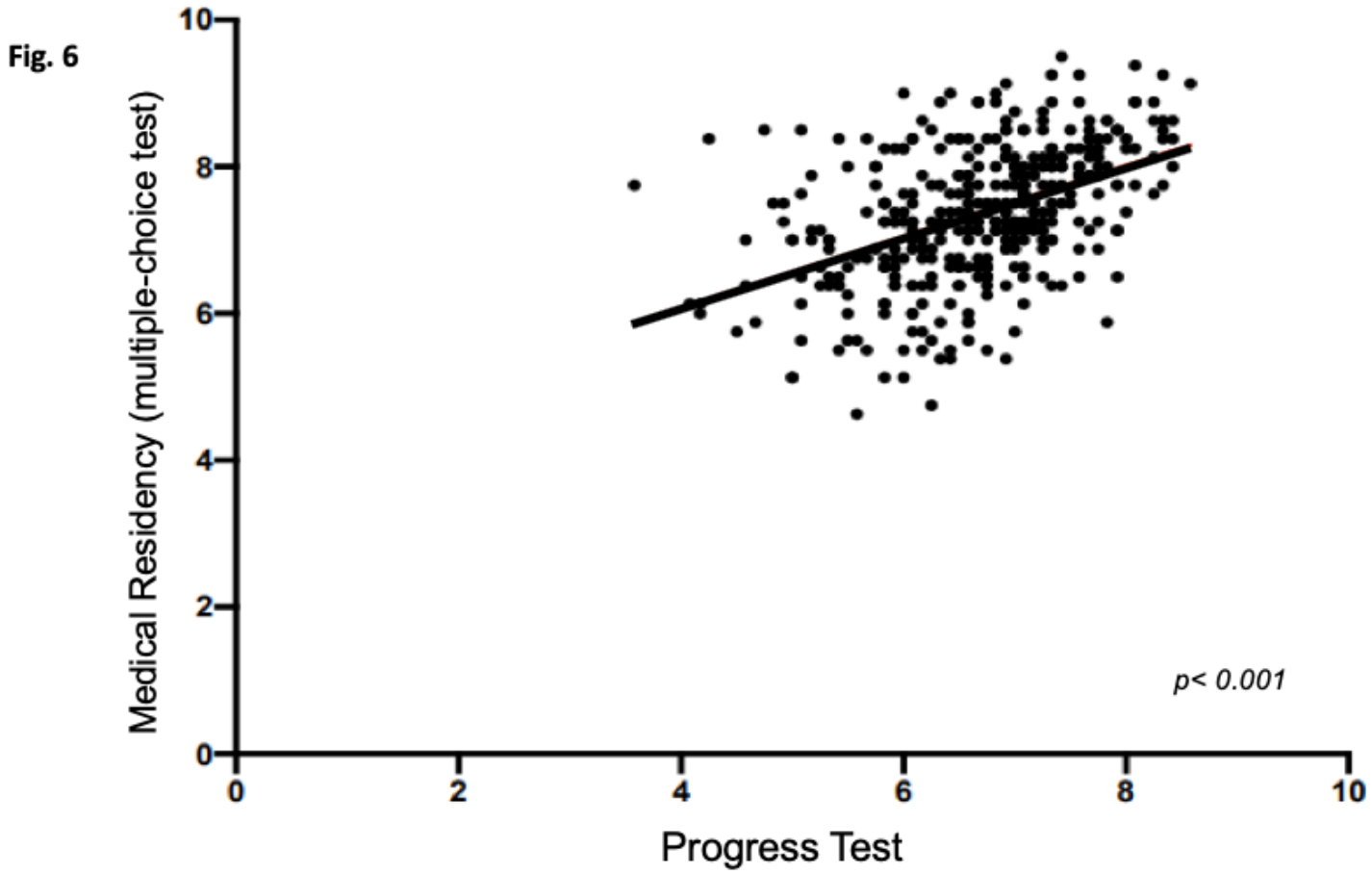

Figure 6

Regression between students' performance on the Progress Test and the multiple-choice test for Medical Residency

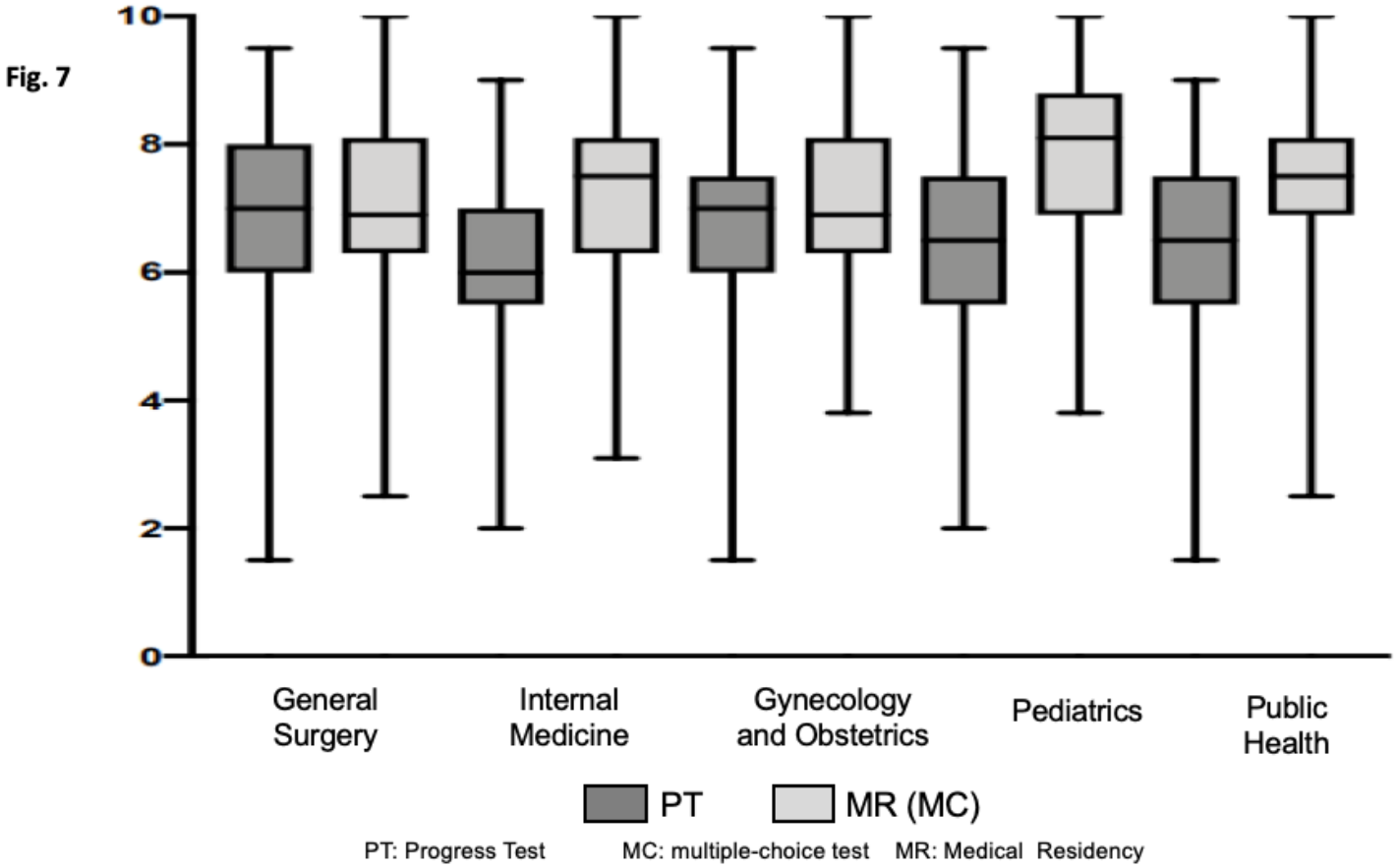

Figure 7

Performance by area in the Progress Test and multiple-choice test for Medical Residency

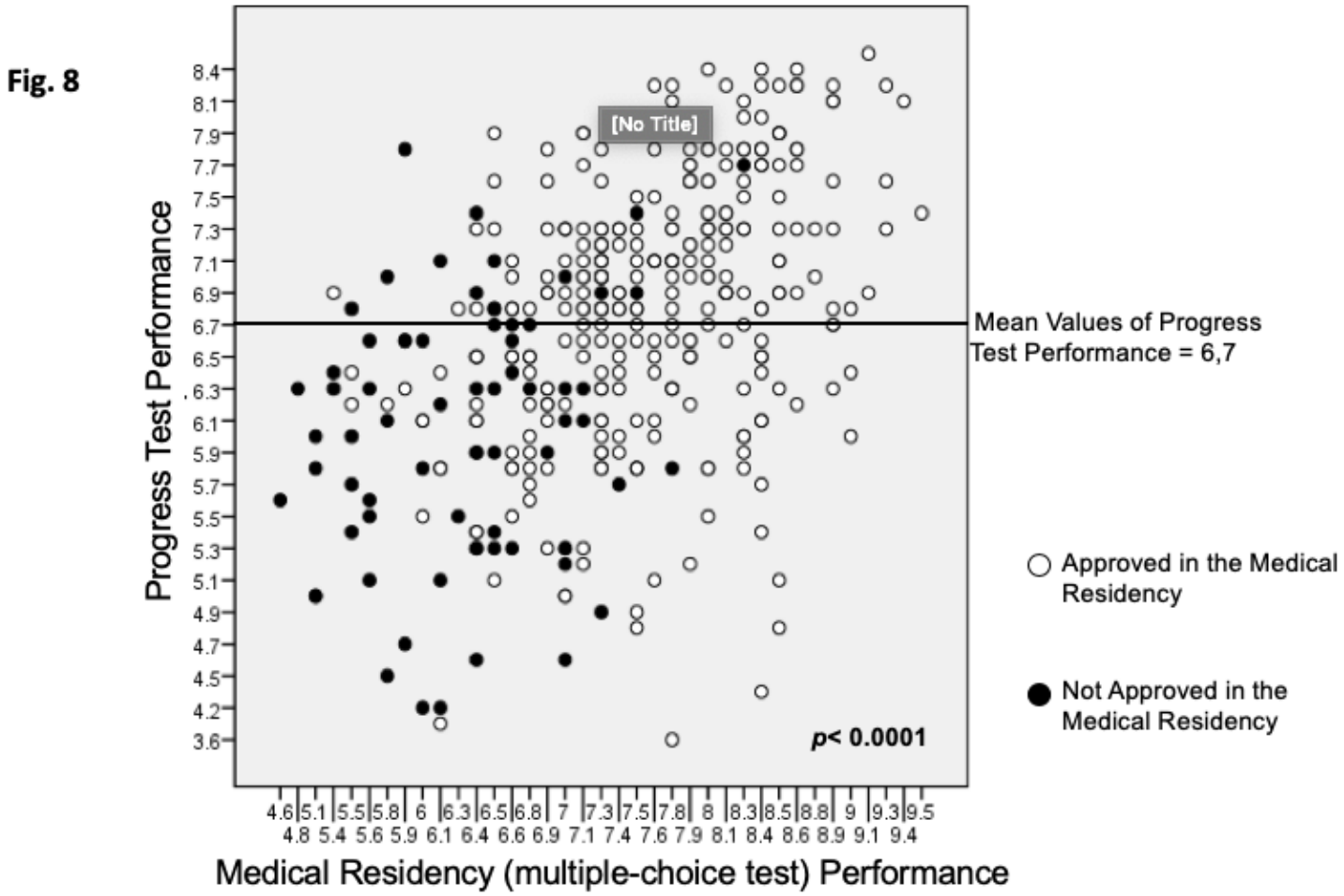

Figure 8

Progress test and multiple-choice test performances among those who passed or failed residency tests