Are progress tests and final achievement coefficient predictors of passing the medical residency?

Carlos Vinícius Pacheco dos Santos Guaraná[1] (iD), Taciana Barbosa Duque[2] (iD), Tereza Rebecca de Melo e Lima[3] (iD)

ABSTRACT

Introduction: the Progress Test (PT) is a longitudinal, end-of-course assessment that aims to track students' performance gains and assist in curriculum management. The predictive role of the PT in the selection processes at the end of medical school has been studied with great interest. **Objective**: to evaluate the association of longitudinal performance of medical students in the PT over a six-year period and the final course performance coefficient with approval in the selection for Medical Residency (MR). **Method:** a longitudinal study developed at Pernambuco Health College (PHC), where the trajectories of medical students who completed the course in 2018 and 2019 were followed in relation to performance in the PT and final income coefficient. The data were extracted from the PHC academic record database in the Lyceum system. Information about the performance and result in the MR selection process was obtained from the website of the organizing institution. For bivariate analysis Pearson's chi-square test and Fisher's exact test were used when applied, and T test was used to compare means. A significance level of 95% was considered. **Results:** 293 students were evaluated according to the inclusion/exclusion criteria. The mean age was 26.36 (±3.29) years, with a predominance of females (76%). It was observed that 96 (33%) students chose not to enter immediately after finishing the course in an MR program, and this behavior was more associated with the higher mean age at the time of course completion (P = 0.02). An association was observed between average PT and passing in MR (p<0.001), and no such association was observed with the final yield coefficient (p=0.71). **Conclusion:** this study showed an association between performance in the PT over the six years of medical school and passing the MR test. Such association was not identified with the overall course performance coefficient. We emphasize the importance of motivating the performance of the PT with increasing emphasis on its formative and primordial function in the learning process.

KEYWORDS: Medical education, Problem-based learning, Professional performance assessment, Curriculum.

INTRODUCTION

The Progress Test (PT) is a comprehensive knowledge assessment related to end-of-course objectives that track the student's learning trajectory throughout their education. Unlike the existing modular assessments in the curriculum, which generate an average coefficient at the end of the course, it is believed that the longitudinal aspect of the PT and repetitions, having a vast content, discourages memorization study for the test, stimulating deeper learning[1-4].

First applied in the 1970s at the Universities of Maastricht and Missouri, the PT has been widely used mainly in medical schools, either with inter-institutional collaboration or individual construction[5-9]. The progress test is applied at the same time to all students and reliability is related more to an increase in the frequency of application than to an increase in the number of questions[10]. Has a predominantly formative aspect where feedback directs learning and guides in following the curriculum[1-3].

In Brazil, the first PT took place at the State University of Londrina, in 1998, and was applied on an expanded basis in 1999, when the PT was carried out in 60 medical schools. In the early 2000s, some schools started to adopt the Progress Test individually or in inter-institutional cooperation. In 2014, the Brazilian Association of Medical Education, within the recently created ABEM Project 50 years/10 years of the National

Curricular Guidelines for the medical course, included among the actions for the qualification of medical education, the expansion and development of inter-institutional groups, the so-called consortiums for the Progress Test. This action resulted in the expansion from 3 to 11 consortia with the involvement of 80 medical schools and the realization of a National Progress Test in 2015[11-14]. In the year 2021, within the pandemic scenario per COVID 19, another National Progress Test was conducted, this one in an online format.

After the application of each PT, the student receives the overall results and by area, comparing them with the average of students in the same year, at the same school, or from other schools when it is done through the so-called consortia. The student can also track his or her progress during the course, identifying the areas that need improvement. This information is also important for schools to improve the curriculum and identify and help students with lower performance early on. The progress test can also be the main assessment of the course, with a summative aspect, and its use is suggested to define not only monitoring, but progression and approval[2,3,9].

Because of its self-assessment and progression characteristics, the predictive role of the progress test is of interest, whether in relation to certification exams in some countries or the selection process for Medical Residency (MR) in Brazil[15-17]. Selection for the MR can happen individually in each institution or unified for the Unified Health System network. Some processes have two stages, the first being a knowledge test followed by an OSCE model evaluation. Other selection processes for Medical Residency have a single stage with a knowledge test with multiple-choice objective questions[19].

This study aimed to evaluate the association of longitudinal performance of medical students in the progress test, the performance coefficient obtained over a six-year period and the result in the selection process for medical residency.

METHOD

A longitudinal study, analyzing two cohorts of medical students from the Pernambuco Health College (PHC) completing the years 2018 and 2019, with the exclusion criterion being the occurrence of failure during the six-year period planned for the course. At PHC, the systematic application of the PT in the medical course started in the first class, in 2006, in the online format. Since the second semester of 2013, it has been applied in a face-to-face format and cooperation with other medical schools. The PT is held twice a year for all students, on the same day and time, and is a formative test, with 120 multiple-choice questions in the best answer model, with four answer options and a maximum time of four hours for its resolution. The 120 questions are distributed in six areas: basic sciences, public health, pediatrics, gynecology and obstetrics, surgery, and clinical medicine.

The mean score in the PT and the final performance coefficient (PC) obtained from the averages of all assessments performed during the course were evaluated. The data were extracted from the Lyceum database, which hosts the institution's academic records, and were organized in a structured form with socio-demographic characteristics of the participants, participation in the PT, performance by test and PC in the course. The information about the performance and results in the selective process for medical residency was obtained through the information made available to the general public by the organizing institution of the competition. The selection process is unified for all UHS medical residency openings in the state of Pernambuco, consisting of a single test with multiple-choice questions distributed in the areas of: pediatrics, gynecology and obstetrics, clinical medicine, surgery, and public health.

The researchers guaranteed the anonymity and confidentiality of the information that was accessed. All results disclosed do not mention any identification by name and the information was saved using a code created for each participant.

The collected data was stored and organized in Excel® spreadsheet, with double data entry, with checking and verification of typing errors. The program used for statistical analysis was EpiInfo® version 7.1. The sample characterization by analysis of continuous variables was performed through the measures of central ten-

dency and dispersion. For bivariate analysis Pearson's chi-square test was used and Fisher's exact test, when applied. For comparison of means the Student's t-test was used. A significance level of 95% was considered.

The study was approved by the research ethics committee of the Pernambuco Health College under CAAE number 19432219.9.0000.5569.

RESULT

In 2018 and 2019, 297 students completed medical school, and 293 were included in the study. The average age of the completers was 26.36 (±3.29) years and women (76%) predominated. The average number of participation in the progress tests performed over the six years

of the course was 9 (±1.0) out of about 12 tests performed (Table 1).

Regarding the selection process for residency, it was observed that 96 (33%) students chose not to select for the residency program at the end of the course, and this behavior was more associated with a higher mean age at the end of the course (P = 0.02) (Table 2).

The mean scores in the Progress Tests and the PC at the end of the course were evaluated. An association was observed between the overall average of the Progress Tests and approval in the Medical Residency (p=0.0000); the same was not observed in relation to the average of the Progress Test considering only the internship period. Likewise, no association was observed between the course's PC and approval in the Medical Residency (Table 3).

Table 1
Demographic characteristics and participation in the Progress Test of PHC medical school graduates in the years 2018 and 2019.

	Graduates N= 293
Female n (%)	223 (76%)
Age in mean and Standard Deviation (SD)	26.36(SD3.29)
Average Progress Test (PT) taken in the course	09 (SD1.0)
Absent more than one PT during the internship period n (%)	95 (32%)

Table 2
Completion of the selection process for Medical Residency among PHC medical school graduates in the years 2018 and 2019.

	Graduates N=293*	Analysis[1]
Completion of the selection process for the Medical Residency at the end of the course		
Yes – age (Mean ± SD)	25.8 (± 3.5)	P=0.02
No– age (Mean ± SD)	27.5 (± 3.8)	

[1] Kruskal-Wallis * Except 96 who did not perform.

Table 3

Association between the averages in Progress Tests, overall performance coefficient and approval in medical residency among PHC medical school graduates in the years 2018 and 2019.

	Approval in Medical Residency		
	Yes	No	Analysis[1]
Overall Average of Progress Tests taken during the course	51.36 (7.90)	46.22 (6.10)	P=0.0000
Average Progress Tests taken during the internship period	69.99 (16.73)	69.07 (18.89)	P= 0.71
Average overall income coefficient	8.63 (0.44)	8.56 (0.34)	P= 0.13

[1]T Test

DISCUSSION

The correlation between the score on the progress test and other exams at the end of the course, whether for certification, revalidation, or residency, has been studied with interest. Variations in research design and analysis methodology still make more studies and the search for better evidence necessary[15-18].

Normam and colleagues (2010), in a study conducted at Macmaster University, analyzing a time series compared the average scores on the National certification exam in two sequential cohorts, before and after the implementation of a progress test with feedback and observed higher averages in the group that started taking the progress test with lasting consequences on the performance on the national exam[16].

More recently, Karay et al (2018) studied the results of schools that comprise the Berlin Progress Test group. These authors used a latent growth curve model and showed that higher starting scores and a steeper slope of this curve were positively related to better performance on certification exams at the end of the course. We believe that the use of initial scores in the analysis was made possible by the alternative "don't know" among the answer options, which, however, did not exist in the TP performed at the institution studied here[17].

In Brazil, Hamamoto et al. analyzed two cohorts of students who took a yearly progress test considering the accumulated score on the progress test as a function of the area on the students' performance curve, and evaluated the correlation of this score with the average obtained in the selection process for medical residency, and not the approval condition, observing positive correlation[18].

The selection for MR in the state of Pernambuco is made through a single test and without weight difference between the areas and we chose to analyze the pass/fail outcome, because the higher averages depending on the specialty chosen may not mean a positive outcome of approval. More studies are needed to evaluate the profile of correct answers per area of the test according to the specialty chosen that can justify this difference, in addition to the number of vacancies available.

This study demonstrated an association between the final progress test score and approval in medical residency. We used the overall mean score and separately the score of the residency period. The non-association observed with the mean score exclusively related to the internship period is noteworthy, since a study on the performance in the PT of final-year medical students in Brazil found a strong correlation with the performance in the multiple-choice test of the selection for MRI in the same institution[15]. Factors such as adherence to testing during the internship period may not have been sufficient to identify this association.

The students' adherence to the Progress Test, understood not only as the realization of the test, but also as the students' involvement with this formative assessment; although it is not the central scholar of this study, it should be a matter of attention. The low demand of stu-

dents for the feedback provided in the PT has been demonstrated and may be a window for approaching this aspect that may interfere in the analysis of the results[20,21].

The choice of the overall test average was used in this study considering the same criteria for obtaining the final performance coefficient. In the calculation of the PC, other assessment dimensions besides knowledge are included. However, the modular and transversal knowledge evaluations have an important weight in obtaining this score, which was not associated with passing the MR.

The association between the Progress Test and the selection process for MR is considered to be explained by the fact that both are knowledge assessments[18]. But, perhaps it is not the only explanation, or the most important one. Understanding how students transfer their learning during the study period to new situations at the end of the course is of theoretical and practical interest. The so-called transfer of learning described by Goldstone & Day deserves special attention in the training period, so that specific and validated strategies are guaranteed to facilitate this transfer, with assessment playing an important role in this process[22]. Larsen et al. showed that repeated multiple-choice tests led to improved recall weeks later, compared to an equivalent amount of time spent reviewing the material[23]. And about this, the paradigm of an evaluation with a longitudinal vision, and not only modular as the progress test has been advocated, making up one of the pillars of the so-called Programmatic Evaluation[3,21,22].

The association of the approval in the medical residency with the global average of the progress test in the six years of the course, observed in the present study, highlights the formative role of this evaluation, which can be a reinforcement to accompany the desired transfer of learning[23,25]. This study has limitations, among them, being a single institution and the nonseparation of the knowledge dimension of the PC, not allowing better identification of the role of the scores obtained in the modular evaluations on the outcome studied. The exclusion due to failure during the semester was very low, but we believe that it could compromise the final analysis if there were a higher number. However, we hope, with this study to contribute to the questions regarding the benefits of a longitudinal evaluation of knowledge in a periodic way, such as the progress test, which can also be translated into results of selective processes at the end of the course.

CONCLUSION

This study showed an association between performance in the PT throughout the six years of medical school and approval in medical residency. Such association was not observed with the overall course performance coefficient, perhaps due to the variability of components in this measure or even due to the modular and transversal aspects of its components. We highlight the importance of the progress test as one of the longitudinal assessments to compose the learning evaluation system in the medical course.

BIBLIOGRAPHIC REFERENCES

1. Van der Vleuten CP, Verwijnen GM, Wijnen WH. Fifteen years of experience with progress testing in a problem-based learning curriculum. Medical Teacher. 1996; 18(2):103-9.

2. Neeley, S.M., Ulman, C.A., Sydelko, B.S. et al. The Value of Progress Testing in Undergraduate Medical Education: a Systematic Review of the Literature. Med.Sci. Educ.2016 26, 617–622.

3. Van der Vleuten C, Freeman A, Collares CF. Progress test utopia. Perspect MedEduc. 2018;7 (2):136-138.

4. Albanese M, Case SM . Progress testing: critical analysis and suggested practices. Adv in Health Sci Educ 2016 ; 21(1): 221-234.

5. Blake JM, Norman GR, Keane DR, Mueller B, Cunnington J, Didyk N. Introducing progress testing in McMaster University's problem-based curriculum: psychometric properties and effect of learning. Acad Med. 1996;71:1002–7.

6. Churwirth L, Bosman G, Henning R, Rinkel R, Wenink A. Collaboration on progress testing in medical schools in the Netherlands. Med Teach. 2010; 32(6):476–9.

7. Reeman A, van der Vleuten CPM, Nouns Z, Ricketts C. Progress testing internationally. Med Teach. 2010; 32(6):451–5.

8. Nouns ZM, Georg W. Progress testing in German speaking countries. 2010. Med Teach. 32:467–470.

9. Bicudo AM, Hamamoto Filho PT, Abbade JF, Hafner MLMB, Maffei CM. Teste de Progresso em consórcios para todas as escolas médicas do Brasil. Rev Bras Educ Méd.2019; 43 (4) : 151-156.

10. Wrigley W, van der Vleuten CP, Freeman A, Muijtjens A. A systemic framework for the progress test: strengths, constraints and issues: AMEE Guide No. 71. Med Teach. 2012; 34(9):683-97.

11. Sakai MH, Ferreira Filho OF, Almeida MJ, Mashima DA, Marchese MC. Teste de progresso e avaliação do curso: dez anos de experiência da medicina da Universidade Estadual de Londrina. Rev Bras Ed uc Med. 2008; 32(2).

12. Maria Inês da Rosa et al. Progress testing as an indicator for improvements in a medical School. Revista Brasileira de Educação Médica. 2017. 41 (1): 58 –

13. Lampert JB, Bicudo AM. 10 Anos de Diretrizes Curriculares Nacionais dos cursos de graduação em Medicina. Rio de Janeiro/RJ: Associação Brasileira de Educação Médica, 2014.

14. Associação Brasileira de Educação Médica. Avaliação do estudante de Medicina: Contribuição do teste de progresso [Internet]. [cited 2019 Abr 21]. Disponível em: https://abem-educmed.org.br/acoes/avaliacao-do-estudante-contribuicao-do-teste-de-progresso.

15. Faccin, Mellysande Pontes. O teste do progresso como instrumento de avaliação da aquisição do conhecimento na graduação médica. 2004. 128 f. Tese (Doutorado em Ciências) – Escola Paulista de Medicina, Universidade Federal de São Paulo, São Paulo, 2005.

16. Norman G Neville A, Blake J, Mueller B. Assessment steers learning down the right road: Impact of progress testing on licensing examination performance. Medical Teacher. 2010 ,32: 496-9.

17. 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. Medical Teacher 2018 Jun28:1-7.

18. Hamamoto Filho, P.T., de Arruda Lourenção, P.L.T., do Valle, A.P. et al. The Correlation Between Students' Progress Testing Scores and Their Performance in a Residency Selection Process. Med.Sci.Educ. 2019, 29, 1071–1075.

19. Brasil. Ministério da Educação. Comissão Nacional de Residência Médica. Resolução CNRM n. 02 de 17 de maio de 2006. Dispõe sobre requisitos mínimos dos Programas de Residência Médica e dá outras providências Brasilia: MEC;2006.

20. Freitas, Rebeca Luiz. Duque, TB, Figueira, MAS. Teste de progresso para estudantes de graduação em uma faculdade especializada em cursos na área da saúde: avaliação da adesão e desempenho. 2015. Tese - Faculdade Pernambucana de Saúde.

21. Sylvia Heeneman, Suzanne Schut, Jeroen Donkers, Cees van der Vleuten & Arno Muijtjens (2017) Embedding of the progress test in an assessment program designed according to the principles of programmatic assessment, Medical Teacher, 2017 39:1, 44-52

22. Thompson, James and Houston, Donald, Programmatic assessment condensed: Introducing progress testing approaches to a single semester paramedic subject, Journal of University Teaching & Learning Practice. 2020, 17(3).

23. Goldstone, R. L., & Day, S. B. Introduction to "New conceptualizations of transfer of learning." *Educational Psychologist. 2012;47*(3), 149-152.

24. Larsen DP, Butler AC, Roediger HL. Repeated testing improves long-term retention relative to repeated study: a randomized controlled trial. Medical Education 2009; (43):1174–81.

25. Gorlich D, Friedericks H. Using longitudinal progress test data to determine the effect size of learning in undergraduate medical education - a retrospective, single-center, mixed model analysis of progress testing results. Med Educ Online.2021 Dec;26(1):1972505.

Corresponding author:
Carlos Vinícius Pacheco dos Santos Guaraná
viniciusguarana@hotmail.com

Editor:
Prof. Dr. Felipe Villela Gomes