

CAN MEDICAL RESIDENCY ENTRANCE EXAMINATION PREDICT ACADEMIC PERFORMANCE FOR POSTGRADUATE?

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Abstract: Entrance examinations for postgraduate students are used by institutions to value their capacity to perform during their studies and excel in professional practice. The medical field leverages this practice for postgraduate students to select the best candidates to enter a rigorous program where participants are responsible for patients outcomes. Therefore, it is important to analyze the quality and predictability of those examinations. The objective of this study was to analyze the predictability of the medical residency entrance examination for academic performance. As part of the analysis, we correlated the academic performance of the 2018 generation of graduates in thirteen medical specialties at Tecnológico de Monterrey, with 64 students' test scores. Academic performance was divided into students who graduated with honors and excellence (scores ≥ 90) and without honors. The admission test score has an 800-points total and was classified as high (≥ 600) and standard (≥ 550). The results show that from the participants, 37 had high entrance scores, of those 92% graduated with honors and excellence, and from the other 27 graduates which had a standard entrance score, 78% graduated with honors and excellence. The predictive positive value was 92% and the negative predictive value was 22%, whereas sensibility and specificity were calculated as 62% and 66%, respectively. Tecnológico de Monterrey's admission test had a predictive value in medical specialties academic performance whereas not in negative predictive value, which could evidenciate that the formation in the academic program itself contributed to students' professional and personal development. Factors like this might affect the sensibility and specificity values, further students would integrate more elements of performance scores to have added specificity and sensibility to assess and document performance

Keywords: higher education, educational innovation, medical education, academic performance, residency programs, admission test.

Introduction

Residency programs

Medical residency refers to the training of a postgraduate degree in medicine. It implies a serious commitment to transform into a medical specialist with an excellent approach in different aspects, not only academic but also in the social and communicative realms of professionalism. Residents spend on average three to five years of hands-on training in a complex work environment where the individual decisions that they made to match a program, such as career choices, are tested (Lakoff, Howse, Cofie, Heeneman & Dalgarno, 2020). Several factors influence the experience of students in the program, some are class size, available funding, residency affiliation, and the enrollment of

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minority students (Whittaker, Smith & Shan, 2017). Some participants consider the flexibility of the programs to complete their training upon demonstration of early mastery of relevant competencies, rather than the time spent in one hospital (Hoff, Frenkel, Imhof & ten Cate, 2018). Factors that influence their decision of even matching said program.

Other factors that are crucial for the experience are more of a personal source, such as the confirmation of expectations that they had about the program, and the compatibility that the program provides to have a fulfilling personal life outside the program, and meaningful relations with their mentors and peers. If a participant decides to leave the program in the middle of their training, the program loses. Not only loses a valuable human resource counted in the system to provide patient care, but it loses a colleague in the profession and a peer for the future. The process of selecting the most appropriate and qualified candidates to fill these positions remains challenging (Khasawneh, Obeidat, Albiss & El-Salem, 2020). For these reasons, it is very important to design mechanisms and integrate different aspects in the selection of candidates to make a wise decision, for candidates will be able to successfully complete their residency.

Admission to postgraduate in medicine

There are different criteria that universities take into account in the selection of candidates, among these are their curriculum, language skills, national selection, interview, and postgraduate admissions exams. Some have greater weight than others, but in general, these parameters try to select the best candidates. Regarding academic performance and awards, programs consider average final qualification represents the performance of the resident throughout the residency. Averages the grades of all subjects described in the academic program of each specialty, on a score of 0 to 100. Many Universities give awards for Honors and Academic Excellence to students with high scores based on their grading method.

Some studies provide an overview of selection exams at the national level but they are separate from the admission tests of each faculty (Gaxiola-García, 2021) (Singh, Modi, Kumar, Dhaliwal, Gupta, Sood, 2017). It is not the only parameter that is evaluated during the admission process of students, but as Powis (2015) points out, “the power to identify students with greater academic potential continues to be a debate”. Other admission criteria included in our residency program include an interview process, National Assessment for Applicants for Medical Residency, Toefl test, psychometric test, medical school curricula, and extracurricular activities. Each of these parameters to be evaluated is weighted to obtain a total score and establish the ranking of the students

Entrance examinations for postgraduate students are used by institutions to value their capacity to perform during their studies and excel in professional practice. The medical field leverages this practice for postgraduate students to select the best candidates to enter a rigorous program where participants are responsible for patients outcomes. Therefore it is important to analyze the quality and predictability of those examinations (Barr, 2010). It emphasizes the need to report if the examinations can predict the academic performance of residents.

Postgraduate Studies Admission Test

In the Tecnológico de Monterrey, the Postgraduate Studies Admission Test (PAEP) is used as an admission requirement (Tecnologico de Monterrey, 2020). The PAEP was designed in 1991 as a project where professors from different schools and campuses participated, the lead of the project was the technical director of the College Board (VAIE, 2010). This test is used as an instrument to assess aptitudes, skills, and general knowledge of the candidates to ingress, and is divided into five areas: Mathematical Reasoning, Cognitive Ability, Writing, Development of composition, and English. It targets three components Academic aptitude in verbal and mathematical reasoning skills, Cognitive ability, and Academic knowledge.

This admission test is made of 170 items, in which the total score lies between 200-800 with partial scores. The test is used as a requirement to assess the ability of students to complete postgraduate studies. Studies have been conducted to observe the predictive validity of this test mainly in the areas of administration, engineering, and education

Objective

The objective of this study was to analyze the predictability of the medical residency entrance examination for academic performance, trying to respond to the question if a high PAEP value predicts that the student will have a high academic performance (High grades, Honors or Excellence).

Methods

Regarding the design of the study, a descriptive correlational design was utilized, we used a mixed qualitative and quantitative method to substantiate the numerical data. The study was set in a private university Tecnológico de Monterrey in Mexico. In relation to the ethical consideration and principles in this research, the procedures were conducted according to the Declaration of Helsinki.

For the study, the considered sample refers to a group made up of all the residents from the graduating class in 2018 (n=64) of all the thirteen medical specialties at Tecnológico de Monterrey

The variable that is expected to predict the students' performance will be the admission test score. Which has an 800-point total score and for this study we classified it as high ≥ 600 points, considering this as a positive value to predict a high performance, and standard ($\geq 550 < 600$ points) as a negative value to predict the normal performance.

The variable that determines academic performance, was divided into students who graduated with high grades, honors, and excellence, and those without honors or a lower average. The students with scores ≥ 90 were considered as a positive value (of higher performance) and those with scores < 90 were considered as a negative value (normal performance). [Table 1]

Table 1: Relationship between High PAEP score and High academic performance (criteria)

	High performance (≥ 90)	Normal performance (< 90)
High PAEP ≥ 600 points	TP	FP
Standard PAEP $\geq 550 < 600$ points	FN	TN

The positive predictive value (PPV) was calculated using the classic formula where PPV is equivalent to the division of the True Positives (TP) between the sum of true and false positives (TP + FP).

The negative predictive value (NPV) was calculated using the classic formulas where NPV is equivalent to the division of the True Negatives (TN) between the sum of True and False Negatives (VN + FN).

Specificity and sensitivity were calculated according to the following formulas. Specificity results from the division of true Negatives between the sum of false positives and true negatives. Sensitivity is calculated by the division of true positives between the sum of true positives and false negatives.

Results

The results show that from the 64 participants, 37 had high entrance admission test (PAEP) scores, 92% (n=34) of them graduated with honors and excellence (final score ≥ 90), from these 37, 30% had even higher final scores ≥ 95 (table 2).

Table 2: Results in correlating Residents with High PAEP score and High academic performance

	High performance (≥ 90)	Normal performance (<90)
High PAEP ≥ 600 points (n=37)	92% (n=34)	8% (n=3)
Standard PAEP $\geq 550 < 600$ points (n=27)	78% (n=21)	22% (n=6)

Of the other 27 graduates that had a standard entrance score, 78% (n=21) graduated with honors and excellence, while only 18% had final scores ≥ 95 (Figure 1).

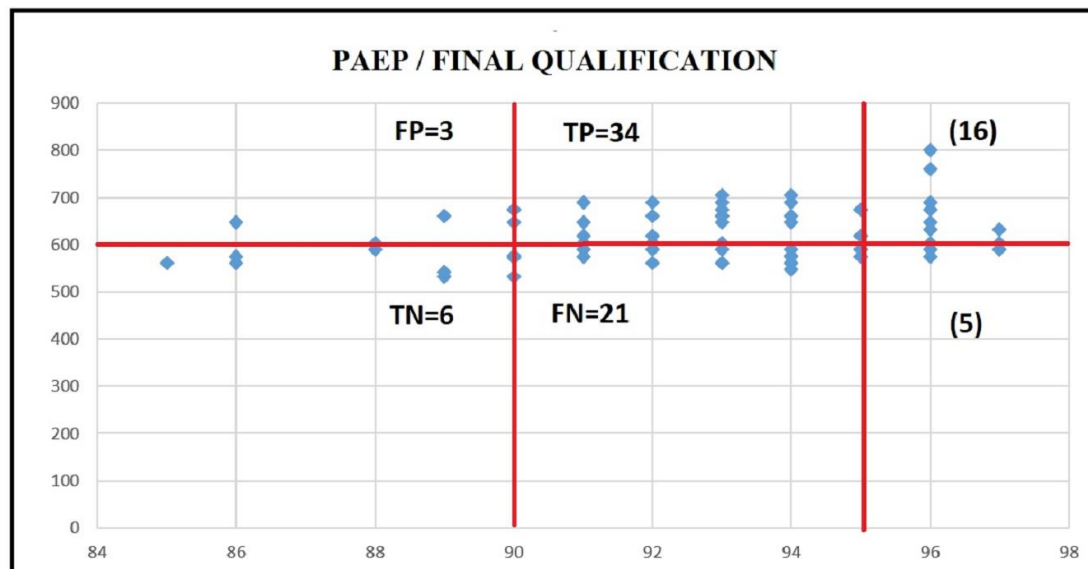


Figure 1. Dispersion diagram showing results in correlating residents' PAEP scores and final qualification (academic performance). Red lines represent the criteria established as high PAEP scores and high performance (excellence, honors).

According to the results obtained with the formulas described above to correlate the students with the highest PAEP scores (> 600), through the averages of Honorable Mention and Excellence (final ≥ 90), we have that The predictive positive value was calculated in 92% and the negative predictive value was calculated in 22%, whereas sensibility and specificity were calculated as 62% and 66%, respectively.

Analysis

Analyzing our principal objective of the study for a 92% of Positive Predictive Value means that the students who left with high PAEP, 92% would have the probability of achieving Honorable Mention and this value is even higher if we compare with higher scores of academic performance as shown in figure 1. This value is very important, because this exam is one of the methods used to select good candidates for residencies and we proved that it has its utility in predict the academic performance, but the lower value in negative predictive value means that applicants with a normal entry PAEP value have a 22% probability of not achieving the Honorable Mention and a 78% probability of probably achieving it after the training acquired during the residency. This result could make us study further perhaps by analyzing the components of the test to determine its usefulness as an entry requirement. In other terms according to sensitivity and specificity, the results prove that of all the students with Honorable Mentions, 62% had a high PAEP and of all students who did not achieve a Mention, 66% had normal PAEP.

Conclusion

Tecnologico de Monterrey's admission test had a high positive predictive value in medical specialties academic performance, and this is even more marked when we take as a parameter a higher final grade average, whereas the low negative predictive value obtained, could evidenciate that the formation in the academic program itself contributed to students' professional and personal development. Factors like this might affect the sensibility and specificity values, as in this study, further students would integrate more elements of performance scores to have added specificity and sensibility to assess and document performance.

This study was made in only one generation, it would be interesting to study the same parameters in other generations and compare results and analyze different components of the test to see if there is a more specific profile for these specialties.

We need to consider a wider perspective of postgraduate admission methods and study how they can predict the academic performance of the applicants. The different admission tests have an area of research to study to verify their usefulness.

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