8-1-2019

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ORIGINAL RESEARCH
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Pass/fail grading in medical school and impact on residency placement

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ABSTRACT

Objective: There is a trend toward using pass/fail (P/F) grading in the first 2 years of medical school as it has been noted to improve student well-being and academic performance is not negatively impacted. It is important that medical students are afforded the best medical education possible to prepare them for residency placement. Thus, the purpose of this study was to evaluate the impact of P/F grading in medical school on residency placement.

Methods: This study compared archival residency match data from two medical school classes. The Class of 2016 had tiered grading and the Class of 2017 had P/F grading in the first year of medical school. Doximity's Residency Navigator was used to rank the residency programs and an independent samples *t*-test was calculated to determine if residency rankings differed by class.

Results: The findings showed no statistically significant differences in residency placement when comparing a cohort of medical school graduates with tiered grading to a cohort with P/F grading in the first year of medical school.

Conclusion: These findings may be useful to medical education leaders when making decisions about grading systems. Medical education leaders should consider implementing P/F grading into the first year of medical school.

Introduction

Medical schools across the United States (US) are currently implementing curriculum reforms to ensure that all graduates are prepared for residency and in turn, are successful in their careers as physicians. One element of a successful medical school graduate is receiving a desirable residency placement. Spring et al. [1] stated that curriculum design and reform are often discussed in association with grading systems. Existing grading systems in medical schools across the US are inconsistent, and thus, assessment in this realm remains an issue in higher education.

Research has shown that implementing pass/fail (P/F) grading in medical school results in several positive benefits, including improved student well-being, a less competitive environment, and a greater focus on learning rather than studying only to receive high achievement scores [1–5]. Medical education leaders noted that by implementing P/F grading, students can focus less on memorization and more on conceptualization of the material [6]. There is significant importance in medical students receiving the best education possible to prepare them for their careers as doctors and allow them opportunities to successfully match into a residency position.

P/F grading was first used in medical schools in the 1960s because faculty were concerned that students were performing for a grade rather than learning to improve their knowledge [1]. Shortly after P/F grading was first implemented, research revealed no correlation between tiered grading and later clinical performance, supporting the use of the

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P/F grading system [1]. Multiple studies concluded that P/F grading did not have a negative impact on academic performance in medical school, including standardized test scores, such as the US Medical Licensing Exam (USMLE) Step 1 or USMLE Step 2 [1,3,5,7]. The advantages and disadvantages of P/F grading compared to other grading systems are widely debated among medical education leaders, as there are a variety of grading systems used in medical schools in the US, but little existing research has been conducted to assist leaders in deciding on the most efficient grading system. Furthermore, there is limited existing research regarding the impact of P/F grading in medical school on residency placement.

Given the trend toward P/F grading in the pre-clinical years of medical school and the benefits of this grading system, it is important that all aspects that could be impacted by a P/F grading system be studied, in particular residency placement. Spring et al. [1] discussed the need for a cohort study to be performed to evaluate the impact of P/F grading on actual residency placement data, which this study sought to do. The purpose of this study was to evaluate the impact of P/F grading in medical school on residency placement.

Methods

This quantitative study sought to answer the following overarching research question: Is there a difference in residency placement rankings among students graded using P/F grading in the first year of medical school when compared to students graded using a tiered grading system in the first year of medical school?

The following sub-questions were used to address the overarching question:

1.) Is there a difference in the percentage of students who receive a residency placement among students graded using P/F grading in the first year of medical school when compared to students graded using a tiered grading system in the first year of medical school?

2.) Is there a difference in the percentage of students who receive top specialty choices (Internal Medicine, Pediatrics, Emergency Medicine, Family Medicine, and Medicine-Preliminary) among students graded using P/F grading in the first year of medical school when compared to students graded using a tiered grading system in the first year of medical school?

The main hypothesis of this study was that there would be no difference in mean residency placement rankings between the two cohorts. The hypotheses to the sub-questions were that there would not be a difference in the overall percentage of students receiving a residency placement, nor would there be a difference in the overall percentage of students receiving top five specialty choices as defined by the National Resident Matching Program (NRMP) between the two medical school graduating classes. The hypotheses were based on the most recent existing literature review conducted by Spring et al. [1], which concluded that there were not any existing significant differences in residency programs obtained when comparing students with P/F grading in medical school to students with tiered grading.

Study design and sample

This retrospective cohort study examined two classes of medical school graduates at the Medical College of Georgia at Augusta University (MCG). One cohort was the last class to have tiered grading in the first year of medical school (Class of 2016) and the other cohort was the first class to have P/F grading in the first year of medical school at MCG (Class of 2017). This study was approved by Augusta University and Georgia Southern University's Institutional Review Boards. This study used archival match results data from the Class of 2016 and the Class of 2017 at MCG. Students who did not match through the official match process conducted by the NRMP, but matched later through the Supplemental Offer and Acceptance Program (SOAP) were included in all analyses. SOAP is a process in which unmatched residency positions are filled by unmatched residents during match week.

These classes completed the same set of courses and were similar in terms of age. Based on self-reported demographics, females in the Class of 2016 made up 37% of the class and the majority of the class reported that they were White (58%), 24% of the class self-reported that they were Asian, 5% were Black, 5% were Hispanic, and 9% did not fit in any of these ethnic groups. The Class of 2017 was slightly more diverse in terms of gender and ethnic group with 45% females and the majority of the class reported that they were White (56%), 25% of the class self-reported that they were Asian, 8% were Black, 4% were Hispanic, and 7% did not fit in any of these ethnic groups. Additionally, the classes were similar in terms of academic performance as an undergraduate. The undergraduate Grade Point

Average (GPA) for both classes individually was 3.7 out of 4.0. The students in the P/F cohort had a slightly higher Medical College Admissions Test (MCAT) scores upon matriculation into medical school (31.0 *vs.* 30.4).

Doximity's residency rankings were used to rank the residency programs obtained by the graduates in the Class of 2016 and Class of 2017. Doximity is a tool combining feedback from over 52,000 US physicians with objective data to rank residency programs in the US by specialty [8]. Doximity's residency rankings were created using results from a survey administered by Doximity to their physician network, in which current and former residents were asked to "Nominate up to five residency programs in your medical specialty that offer the best clinical training" [9, para. 11]. Data can be ranked by reputation, research output, size of program, percent to subspecialize, percent board certified, and alphabetically [8]. For the purposes of this study, data were evaluated using the reputation rankings, which have been statistically weighted to produce values that represent the opinions of all survey-eligible physicians [8]. Lower rankings are equivalent to higher rated programs since the top-rated program received a rank of one.

Data analyses

All statistical analyses were conducted using SAS 9.4 (SAS Institute, Inc., Cary, NC). The significance level was set at 0.05. Descriptive statistics (means, standard deviations, percentages, and frequencies) were calculated for all appropriate variables. The independent variable used in this study was type of grading in the first year of medical school (tiered or P/F) and the dependent variable was residency placement rank. The demographic variables included undergraduate GPA, MCAT scores, age at graduation, gender, and race.

The variables used in this study to answer the research questions included residency placement rank and two binary variables, which were whether or not graduates received a residency placement and whether or not graduates received a residency placement in one of the top five specialty choices. Age at graduation was included in the data as a continuous variable and was redefined as an ordinal variable with three categories. Gender was provided as either female or male. Ethnic group was a nominal variable with several categories and a few categories had small numbers and were grouped into a category noted as other. The ethnic groups included American Indian or Alaska Native, two or more races, and unknown. Undergraduate GPA and latest MCAT score were provided as continuous variables.

An independent samples *t*-test was calculated to determine if residency rankings differed for the Class of 2017 compared to the Class of 2016. Histograms and box and whisker plots of residency placement rank for both classes were produced to provide additional information about residency placement ranks in both classes. Additionally, a two-sample test of proportions was calculated to determine if the overall percentage of the students receive a residency placement (i.e., matching) was different for the two classes of graduates in this study. Finally, a two-sample test of proportions was calculated to determine if the overall percentage of students who received a top specialty choice differed among these two cohorts. Additionally, Cramer's *V* effect size was calculated when statistically significant differences were found due to the large sample size in this study.

Results
Participants

All on-track MCG students in the graduating Class of 2016 (*n* = 172) and Class of 2017 (*n* = 158) were included in this study. Students who did not graduate on time (4 years) were excluded from this study. A total of 21 graduates from the Class of 2016 and 13 graduates from the Class of 2017 were excluded from this study because they started medical school with a different class or at a campus other than the main campus in Augusta, Georgia. A total of 330 out of 364 graduates met inclusion criteria for this study. Additionally, one graduate from the Class of 2016 and six graduates from the Class of 2017 were excluded from the ranking analysis because three specialties (vascular surgery, thoracic surgery, and interventional radiology) did not have reputation rankings on Doximity's Residency Navigator.

Overall rank comparison

The main research question was "Is there a difference in residency placement rankings among students graded using P/F grading in the first year of medical school when compared to students graded using a tiered grading system in the first year of medical school?" and these findings can be depicted in Table 1.

The results of the independent *t*-test revealed that there was not a statistically significant difference in residency placement rank between the two classes used in this study (*p* = 0.382). Hence, the researcher

concluded based on the data used in this study that the mean residency placement ranks were not different for the Class of 2016 and Class of 2017.

Residency placement percentage

An additional research question used in this study was "Is there a difference in the percentage of students who receive a residency placement among students graded using P/F grading in the first year of medical school when compared to students graded using a tiered grading system in the first year of medical school?" and these findings can be depicted in Table 2.

The results of the two-sample test of proportions revealed a statistically significant difference in proportions receiving a residency placement rank (Table 2). Cramer's V effect size was calculated and the effect size was negligible ($V = 0.0031$). Although the percentage receiving a residency placement was statistically significantly higher for the Class of 2016 than the Class of 2017, the percentages were similar and the effect size was negligible. Thus, the statistically significant difference in percentages receiving a residency placement is likely due to the large sample size used in this study. However, future research is needed in this area to determine if this was due to an increase in applicants or other trends in the match data.

Top five specialty choice comparison

The last research sub-question used in this study was "Is there a difference in the percentage of students who receive top specialty choices (Internal Medicine, Pediatrics, Emergency Medicine, Family Medicine, and Medicine-Preliminary) among students graded using P/F grading in the first year of medical school when compared to students graded using a tiered grading system in the first year of medical school?" and these findings can be depicted in Table 3.

The results of the two-sample test of proportions revealed that there was not a statistically significant difference in the percentage of graduates receiving top five specialty choices between the two classes used in this study ($p = 0.449$). Hence, the researcher concluded based on the data used in this study that the proportion of graduates receiving top five specialty choices was not different for the Class of 2016 and Class of 2017.

Discussion

The findings from this study will add to the current literature on P/F grading in medical school. There are discrepancies in the existing literature on the impact of P/F grading on residency placement. Older studies found a negative impact, while newer studies did not report an impact of P/F grading on residency placement or performance [1,5,10]. This study addressed this gap in knowledge by comparing a cohort of P/F graded students with a cohort of tiered graded students and assessed residency placements as measured by Doximity's Residency Navigator's reputation rankings, which have never been used for this purpose.

Overall, the researchers concluded that there are no differences in residency placement when comparing a cohort of medical school graduates with tiered grading in the first year of medical school to a cohort with P/F grading in the first year of medical school. These results are consistent

Table 1. Descriptive statistics and independent *t*-test results for residency placement rank comparison.

Class	Residency placement rank				
	N*	Mean	SD	Range	p
2016	171	75.2	66.9	1–396	0.382
2017	152	81.9	70.2	4–465	

*Seven graduates were excluded from this analysis because the specialty they matched to did not have a Doximity ranking.

Table 2. Descriptive statistics and two sample test of proportion results for graduates receiving a residency placement.

Class	Received a residency placement			
	N	Frequency	Percent	p
2016	172	172	100	0.019
2017	158	153	96.8	

Table 3. Descriptive statistics and two sample test of proportion results for graduates receiving a top specialty choice.

Class	Received top specialty choice			
	N	Frequency	Percent	p
2016	172	91	52.9	0.449
2017	158	77	48.7	

with the results of a literature review conducted by Spring et al. [1], which concluded that P/F grading did not impact residency program directors' decisions in residency appointments; residency program directors believed that students with P/F grading in medical school performed at the same level as their peers in medical knowledge and skills; and no significant difference exist in residency programs obtained when comparing students with P/F grading in medical school to students with tiered grading.

Medical education leaders recognize the benefits of P/F grading in the first 2 years of medical school. However, with little existing research on the impact of P/F grading on residency placement, this study provides many implications that can be valuable to medical education leaders, residency program directors, current and future students, and residency applicants in that it provides supporting information regarding the use of P/F grading in medical school and the lack of a negative impact of P/F grading on residency placement. In order for P/F grading to be effective, it is important that leaders can confirm that medical students' opportunities are not hindered.

Medical education leaders can use the results of this study as supporting evidence that P/F grading does not have a negative impact on residency placement. Along with this new information and the existing literature, which reveals an improvement in medical student well-being and a non-negative impact on academic performance when P/F grading is used, medical education leaders should consider implementing P/F grading into the first 2 years of medical school [1–5]. Not only can leaders in medical education use this information when considering implementing P/F grading, but they can also provide these results to current and incoming medical students as supporting evidence that their residency opportunities will not be hindered because of attending a medical school with P/F grading.

Acknowledgements

Conflicts of interest

The authors report no conflicts of interest.

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