A COMPARATIVE PERFORMANCE OF MEDICAL STUDENTS AT UNIVERSITY OF ARIZONA, COLLEGE OF MEDICINE – PHOENIX IN RURAL AND URBAN CLINICAL ROTATION SITES

A thesis submitted to the University of Arizona, College of Medicine – Phoenix in partial fulfillment of the requirements for the Degree of Doctor of Medicine

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ABSTRACT

BACKGROUND: Despite many recent developments of rural programs in medical education, there are still very few published data comparing the academic performances of medical students who are learning in rural settings with their traditional urban counterparts.

PURPOSE: To determine whether the academic performance of medical students at the University of Arizona, College of Medicine – Phoenix partaking in clinical learning experiences at rural rotation sites differ from their corresponding colleagues rotating in the traditional urban clinical settings.

METHODS: Comparison of performances, assessed based on clerkship evaluations and shelf scores, between medical students with rural clinical rotation sites (n=64) and those with urban clinical rotation sites (n=177) for the 2017 (n=81), 2018 (n=80), 2019 (n=80) graduating classes.

RESULTS: Medical students with rural clinical rotations performed at least as well as their urban counterparts across all shelf examinations as well as clerkship evaluations. Notably, students with rural Internal Medicine clinical rotations obtained higher clerkship evaluation scores (p=0.012) compared to their urban peers.

CONCLUSION: This study provides evidence that students with rurally-trained clerkships at the University of Arizona, College of Medicine – Phoenix performed at least as well as their traditional urban peers on shelf examinations and clerkship evaluations. The broader implications of this study lie in the high-quality training in rural communities, evidenced specifically by clerkship performance in Internal Medicine.

INTRODUCTION

Rural healthcare is the study, practice and delivery of medical care to rural environments, and for decades, there has been increased attention to the wide discrepancy gap in healthcare outcomes that exists between rural and urban populations. The rural population differ from urban population in various aspects, including socioeconomic conditions, education, lifestyle, healthcare funding and resource availabilities. These factors, in turns, contribute to the observed differences in the basic healthcare demands and subsequent outcomes of rural residents compared to their urban or suburban counterparts.

It should not come as a surprise that one major area of healthcare discrepancies is the shortage of physicians in rural regions, where 20% of the U.S. population reside in rural areas, but only 10% of physicians practice in rural areas.[1,2] With increasing demands for rural physicians, several recruitment and retention strategies were developed to increase incentives for rural trainings, but how effective are rural tracks in training future physicians to practice in rural settings? Are rural trainings comparable to traditional urban trainings in preparing future physicians?

A prior study conducted by the University of Queensland School of Medicine compared performance for students in their 2nd and 3rd (prior to rural exposure) to students in their 4th year (after rural exposure) and found no statistically significant differences between rural and urban students, with the exception of Year 4 clinical examination scores, in which rural students scored higher than their urban counterparts.[3] Similarly, a study from McMaster University School of Medicine compared progress test, OSCE, pre- and post-clerkship scores and evaluations for students enrolled in rural education program and students in traditional non-rural rotation sites, showing no statistically significant differences in performances between the two groups, with the exception of post-clerkship OSCE scores, in which students in the rural education program scored higher than their counterparts who remained in Hamilton for rotation.[4]

If students are to spend a significant amount of their clinical trainings in rural settings, it is important to determine their academic performances under these conditions. However, few published data compare the performances of medical students learning in rural settings with those in urban settings, specifically in the United States. The purpose of this study was to provide a comparison between medical students at the University of Arizona, College of Medicine – Phoenix with rural clinical participations to their corresponding counterparts in urban clinical settings.

METHODS

SETTING: We collected demographic and performance data from The University of Arizona, College of Medicine – Phoenix medical students for the Classes of 2017, 2018, and 2019. Demographic data include age, gender, race. Baseline performances prior to medical school admission including undergraduate GPA and MCAT score, as well as baseline performance during Year 1 and Year 2 including block scores and Step 1 score. Rotation sites were collected for each of the required core rotations during Year 3 and Year 4, along with clinical performance data which includes clerkship shelf scores, and clerkship evaluation scores. Rotation sites, whether rural or urban, was by student choice. There was no obligation to partake in rural rotations. Our study has been waived by the IRB as it does not pertain any human research.

ANALYSIS: We compared the academic and clinical performances of medical student participating in rural clinical rotations and urban clinical rotations during Year 3 and Year 4 for the 2017, 2018, and 2019 graduating classes. Comparisons included performances on shelf examinations and clinical clerkship evaluations for required core rotations during Year 3 and Year 4. Analyses with non-parametric Wilcoxon Rank Sum to compare continuous variables, chi-squared analysis and Fisher's Exact to compare categorical variables, and 2-sided P-values with $p<0.05$ for statistical significance, with linear regression adjusting for age, gender, race, graduating class, MCAT, and Step 1 scores.

RESULTS

Differences Between Students with Rural Sites and Traditional Students with No Rural Site

Table 1 demonstrates demographics and other characteristics of both groups of students. Overall, both groups of students were similar in baseline performance, such as the means for undergraduate GPA, MCAT score, STEP 1 score, as well as Year 1 and Year 2 block scores. There was no significant difference in gender between the two groups (p=0.41). Despite that the difference in race between the two groups was not statistically significant, it is notable that amongst African American students, there were more rural participation than none at all (15.6% with rural sites vs. 6.78% without, n=0.091), and the opposite observation seen for students racially identified as Others (9.38% with rural sites vs. 18.6% without). Notably, there were statistically significant differences in the age break-down between the two groups. In the age group consisting of students 25 years or younger, we noted significantly more rural participation (48.4% with rural rotation sites vs. 31.1% without any rural site, p=0.041). In contrast, there was less rural participation in the 25 to 30 years age group (39.1% with rural rotation sites vs. 55.4% without any rural rotation site, p=0.041). This difference was not otherwise observed in age group 30 years and older. There was a statistically significant difference when comparing rural participation between the 2017, 2018, and 2019 cohorts, in that more rural participation was observed in the Class of 2019 in comparison to the Classes of 2018 and 2017 (45.3% compared to 31.3% and 23.4%, respectively, p=0.04).

Table 2 summarizes core clerkship evaluations and shelf scores for both groups of students, with calculated beta for regression and p-values for these beta calculations. Notable is the evaluations for Internal Medicine clerkship, in which there was a statistically significance in the positive regression from the mean in evaluation scores for students with rural Internal Medicine rotation sites compared to their colleagues in traditional urban setting for Internal Medicine (beta 0.07, p=0.012). And while OB/Gyn clerkship does not show a p-value of statistical significance, a similar positive regression is observed (beta 0.05, p=0.086). No differences noted between the two groups for other core clerkships, such as Family Medicine, Pediatrics, Surgery, or Psychiatry. No statistically significant difference in shelf scores were noted between students with rural rotation sites compared to those without.

Table 3 compares core clerkship evaluations and shelf scores in students without rural rotations to those with one, two, three or more rural rotations during Year 3 and Year 4. Notable is the significant difference in the positive regression from the mean evaluation scores in Internal Medicine rotation with more rural rotations (beta 0.05, p=0.014). No significant differences noted in evaluations for other core clerkships in students with more rural rotations. No statistically significant difference in shelf scores were noted in students with more rural rotations.

DISCUSSION

Our findings demonstrate that medical students who participate in rural clinical rotation sites are not at an academic disadvantaged compared to their counterparts in urban clinical settings. Specifically, we have shown that in 3 consecutive cohorts of students at the University of Arizona, College of Medicine, Phoenix, all with similar undergraduate GPA, MCAT, STEP 1, as well as Year 1 and Year 2 block scores (to suggest academic comparability at baseline), achieved similar evaluations and shelf scores in Year 3 and Year 4. This suggests qualitative as well as quantitative comparability in those with rural rotations and those without, and it may be used as a fair assessment to judge the efficacy of rural rotations in preparing medical students just as well, if not better, compared to the traditional students without rural rotations. This is evident by the significant finding specifically in Internal Medicine evaluation scores, in which students with rural IM rotations achieved higher evaluation marks compared to their corresponding colleagues. This difference was also demonstrated in the number of rural clerkships a student partakes, in which more rural IM rotations corresponded to higher evaluation marks.

Although there is discussion in the literature regarding training of medical students in rural settings, there are limited published data comparing the academic outcomes. Our findings, however, support findings from few similar studies previously published which demonstrated significant difference in academic performance in favor of rural participants, despite the different programs (in various states and countries) and markers (such as OSCE scores or clinical examination scores) set to measure academic performance. We speculate that this is the case for rural participants due to the greater breadth of conditions that students may experience in the rural settings that allow them to participate, assist in or perform in more procedures compared to their urban counterparts. Additionally, rural clinical settings allow students to be form closer interactions with patients, be more exposed to different patient population, as well as have the flexibility and autonomy in managing various common and rare or complicated conditions.

One limitation to our study is the inability to account for the chronological order of the rural clerkships. For example, in Table 3, the total number of rural clerkships is given for Year 3 and Year 4, but it does not account for when the shelf for that corresponding clerkship was taken (whether the shelf was taken prior to partaking in 3 or more rural clerkships), thus we could not attribute the difference in clerkship evaluations and scores to the number of rural clerkships taken.

Despite limitations in the aforementioned discussion, this study serves evidence that rural-based medical education is effective. It is also encouraging that students participating in rural settings are at least not disadvantaged in comparison, and hopefully serves as to promote rural health professions program and its efficacy in preparing medical students to succeed.

Table 1. Demographics of students without rural rotations and students with at least 1 rural rotation.

Variables	Overall N=241	No Rural Sites N=177	Yes Rural Sites N=64	P-value
Age, n (%)				0.041*
< 25	86 (35.7)	55 (31.1)	31 (48.4)	
25 - ≤ 30	123 (51.0)	98 (55.4)	25 (39.1)	
≥30	32 (13.3)	24 (13.6)	8 (12.5)	
Gender, female (%)	128 (53.1)	91 (51.4)	37 (57.8)	0.41
Race, n (%)				0.091*
White	127 (52.7)	94 (53.1)	33 (51.6)	
AA	22 (9.13)	12 (6.78)	10 (15.6)	
Hispanic	53 (21.9)	38 (21.5)	15 (23.4)	
Other	39 (16.2)	33 (18.6)	6 (9.38)	
Class, n (%)				0.04*
2017	81 (33.6)	66 (37.3)	15 (23.4)	
2018	80 (33.2)	60 (33.9)	20 (31.3)	
2019	80 (33.2)	51 (28.8)	29 (45.3)	
Total GPA (mean, SD)	3.71 (0.25)	3.71 (0.24)	3.71 (0.26)	0.92
High MCAT (mean, SD)	508.9 (5.88)	508.7 (5.71)	509.5 (6.33)	0.39
STEP 1 (mean, SD)	224.1 (21.3)	224.5 (20.8)	222.8 (22.5)	0.59
MBLD (mean, SD)	82.8 (5.57)	82.7 (5.67)	83.1 (5.32)	0.68
Anatomy (mean, SD)	81.2 (11.6)	81.5 (11.1)	80.7 (12.9)	0.62
MSNS (mean, SD)	82.8 (5.64)	82.7 (5.64)	82.9 (5.67)	0.76
NLS (mean, SD)	84.1 (5.10)	84.2 (4.99)	83.8 (5.40)	0.60
CVH (mean, SD)	83.1 (6.46)	83.0 (6.22)	83.4 (7.12)	0.68
PRAB (mean, SD)	82.2 (6.54)	82.1 (6.62)	82.5 (6.34)	0.70
GIMDO (mean, SD)	81.9 (6.34)	81.7 (6.68)	82.4 (5.27)	0.43
REBLS (mean, SD)	81.8 (4.67)	81.8 (4.56)	81.6 (4.97)	0.71
ONC (mean, SD)	84.6 (5.18)	84.6 (4.87)	84.3 (5.99)	0.72

Table legend: MBLD- Molecular Basis of Life and Disease, MSNS- Musculoskeletal and Nervous System, NLS- Nervous System, CVH- Cardiovascular-Hematology, PRAB- Pulmonary, Renal, Acid-Base, GIMDO- Gastrointestinal System, Metabolism, Diabetes and Obesity, REBLS- Reproductive, Endocrine, and Behavior Through the Lifespan, ONC- Oncology. Wilcoxon Rank Sum to compare continuous variables. Chi-squared Analysis / Fisher's Exact to compare categorical variables.

Table 2. Comparison of student performance.

Clerkship Evaluation Scores

Evaluations	Overall N=241	No Rural Sites N=177	Yes Rural Sites N=64	Beta (95% CI)[1]	p-value
Family Medicine	2.79 (0.19)	2.79 (0.18)	2.79 (0.20)	-0.008 (-0.06, 0.05)	0.75
Internal Medicine	2.62 (0.19)	2.61 (0.18)	2.67 (0.18)	0.07 (0.02, 0.13)	0.012*
Pediatrics	2.67 (0.19)	2.66 (0.19)	2.67 (0.17)	-0.01 (-0.07, 0.05)	0.71
Ob/Gyn	2.65 (0.19)	2.63 (0.19)	2.68 (0.19)	0.05 (-0.007, 0.11)	0.086*
Psychiatry	2.74 (0.17)	2.73 (0.15)	2.76 (0.13)	0.02 (-0.02, 0.06)	0.37
Surgery	2.63 (0.18)	2.63 (0.17)	2.63 (0.19)	0.009 (-0.04, 0.06)	0.72

[1]Linear Regression adjusting for age, gender, race, graduating class, MCAT and Step 1 scores. Values presented are mean with standard deviations for clerkship evaluation scores, on a scale from 0 to 3.

Shelf Scores

Shelf	Overall N=241	No Rural Sites N=177	Yes Rural Sites N=64	Beta (95% CI)[1]	p-value
Family Medicine	77.0 (7.01)	76.7 (6.95)	77.8 (7.17)	1.20 -0.92, 3.33)	0.27
Internal Medicine	77.4 (7.38)	77.3 (7.82)	77.4 (6.01)	0.61 (-1.65, 2.87)	0.59
Pediatrics	78.9 (7.25)	78.5 (7.81)	79.7 (5.41)	1.27 (-0.93, 3.48)	0.26
Ob/Gyn	79.5 (6.92)	79.2 (6.95)	80.5 (6.82)	1.35 (-0.78, 3.49)	0.21
Psychiatry	82.6 (6.86)	82.4 (6.82)	83.2 (6.99)	0.62 (-1.46, 2.70)	0.56
Surgery	76.4 (7.34)	76.3 (7.63)	76.8 (6.53)	0.59 (-1.68, 2.88)	0.61
Emergency Medicine	75.3 (7.13)	75.4 (7.36)	75.2 (6.48)	0.05 (-2.74, 2.83)	0.97
Neurology	80.3 (6.20)	80.2 (6.65)	80.6 (4.75)	0.67 (-1.72, 3.05)	0.58

[1]Linear Regression adjusting for age, gender, race, graduating class, MCAT and Step 1 scores. Values presented are shelf scores with standard deviations.

Table 3. Comparison of student performance relative to total number of rural sites.

Clerkship Evaluation Scores

Total # of Rural Sites	0 N=177	1 N=46	2 N=12	3 or more N=6	Beta (95% CI)[1]	p-value
Family Medicine	2.79 (0.19)	2.78 (0.22)	2.82 (0.12)	2.78 (0.21)	-0.002 (-0.04, 0.03)	0.92
Internal Medicine	2.62 (0.19)	2.67 (0.19)	2.70 (0.14)	2.68 (0.16)	0.05 (0.009, 0.08)	0.014*
Pediatrics	2.67 (0.19)	2.67 (0.16)	2.65 (0.19)	2.70 (0.27)	-0.009 (-0.05, 0.03)	0.60
Ob/Gyn	2.65 (0.19)	2.68 (0.19)	2.65 (0.23)	2.68 (0.13)	0.03 (-0.01, 0.06)	0.19
Psychiatry	2.74 (0.17)	2.76 (0.13)	2.80 (0.13)	2.76 (0.15)	0.007 (-0.02, 0.03)	0.59
Surgery	2.63 (0.18)	2.64 (0.18)	2.56 (0.21)	2.70 (0.13)	0.006 (-0.03, 0.04)	0.74

[1]Linear Regression adjusting for age, gender, race, graduating class, MCAT and Step 1 scores. Values presented are mean with standard deviations for clerkship evaluation scores, on a scale from 0 to 3.

Shelf Scores

Total # of Rural Sites	0 N=177	1 N=46	2 N=12	3 or more N=6	Beta (95% CI)[1]	p-value
Family Medicine	76.7 (6.95)	77.7 (7.24)	80.7 (5.12)	73.0 (8.21)	0.49 (-0.94, 1.93)	0.50
Internal Medicine	77.3 (7.82)	77.9 (5.93)	73.7 (5.09)	80.3 (6.65)	0.37 (-1.19, 1.94)	0.64
Pediatrics	78.5 (7.81)	80.2 (5.16)	78.2 (6.57)	78.0 (5.47)	0.51 (-0.99, 2.02)	0.51
Ob/Gyn	79.2 (6.95)	80.4 (6.55)	80.2 (6.33)	81.4 (11.0)	0.86 (-0.57, 2.29)	0.24
Psychiatry	82.4 (6.82)	83.4 (6.76)	81.9 (7.09)	83.4 (10.1)	0.24 (-1.15, 1.64)	0.73
Surgery	76.3 (7.63)	77.2 (6.88)	75.8 (5.04)	74.8 (6.09)	0.03 (-1.50, 1.56)	0.97
Emergency Medicine	75.4 (7.36)	74.4 (6.46)	80.2 (5.35)	74.0 (6.37)	0.33 (-1.50, 2.16)	0.72
Neurology	80.2 (6.65)	79.9 (4.53)	81.6 (5.32)	84.0 (5.29)	0.98 (-0.58, 2.56)	0.22

[1]Linear Regression adjusting for age, gender, race, graduating class, MCAT and Step 1 scores. Values presented are shelf scores with standard deviations.

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