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Preparing Physicians for Rural-Based Primary Care Practice: A Preliminary Evaluation of Rural Training Initiatives at OSU-COM

Denna L. Wheeler, PhD

Jeffrey B. Hackler, JD

From the Oklahoma State University Center for Health Sciences in Tulsa.

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Address correspondence to Denna L. Wheeler, PhD, Oklahoma State University Center for Health Sciences, 1111 W 17th St, Tulsa, OK 74107-1886.

E-mail: denna.wheeler@okstate.edu

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The physician shortage in Oklahoma coupled with geographic maldistribution of primary care physicians limits access to care in rural and underserved areas. One of the most effective strategies to recruit and retain physicians in rural areas is to create undergraduate and graduate medical education training sites in these locations. Oklahoma State University Center for Health Sciences College of Osteopathic Medicine has implemented a rural training program that begins with early recruitment of rural high school students, introduces medical students to rural practice options through rural clinical training opportunities, and provides opportunities to remain in rural Oklahoma for residency training through ongoing graduate medical education development. The purpose of this article is to provide a case study of the development of the college's Rural Medical Track. Preliminary findings indicate that rural-based clinical training for third- and fourth-year students strengthens performance on standardized tests.

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The Oklahoma State University Health Sciences Center College of Osteopathic Medicine (OSU-COM) mission statement emphasizes training osteopathic physicians for service in rural and underserved areas of Oklahoma. Osteopathic medical schools in general and OSU-COM in particular have a strong history of producing physicians that practice in rural areas. In a 2010 study, Chen et al¹ ranked OSU-COM sixth overall in production of rural-based physicians based on the practice locations of physicians who graduated between 1988 and 1997. Among osteopathic medical schools, OSU-COM was second only to West Virginia School of Osteopathic Medicine.¹

The importance of a robust primary care workforce in terms of overall population health is well documented.² Oklahoma has one of the lowest rates of primary care physician access in the nation.³ This general physician shortage, coupled with geographic maldistribution of primary care physicians, further limits access to care in rural and underserved areas of the state. One of the most effective strategies to recruit and retain

physicians in rural areas is to expand existing and create new undergraduate medical education and graduate medical education (GME) training sites in these locations.

Building on previous commitments and success, OSU-COM implemented a robust rural training program in 2011 that includes early recruitment of rural high school students, introduces medical students to rural practice options through rural clinical training opportunities, and provides opportunities to remain in rural Oklahoma for residency training through ongoing GME development. The purpose of this article is to provide a case study of the efforts of OSU-COM's mission-driven comprehensive programming, which is designed to recruit and train primary care physicians for rural and underserved areas of Oklahoma. Federal grant funding from the US Health Services and Resources Administration (HRSA) was used to develop a rural-focused elective curriculum characterized by both didactic courses and rural-based clinical training. The 5-year, pre-doctoral, primary care training program grant started in September 2011 and ended in 2016. The program tested the hypotheses that early rural-focused and rural-based training would be associated with increased numbers of OSU-COM graduates who selected a primary care specialty and who selected a rural-based residency training site in Oklahoma.

Background

The most severe health care access gaps occur in rural areas. Overall, only 11% of physicians practice in rural areas, but 18% of osteopathic physicians practice in rural areas.¹ Primary care specialties, especially family practice, represent the greatest physician shortages in rural areas.⁵ Although medical schools with rural training programs often focus on recruiting students with a rural background, evidence has shown that rural-based clinical experiences and other curricular components

can significantly influence student practice choice.^{6,7} A number of predictors of a physician choosing a rural practice location are directly related to characteristics of the medical school he or she attended. These factors include a rural-focused mission statement, osteopathic medical education, and rural-focused curricular and clinical training components.⁶

The most salient factor associated with rural-based practice choice is extended rural-based clinical rotations.⁷ If rural-based rotations are carefully structured to provide positive educational and social experiences, they not only strengthen a predisposition toward rural practice but can also produce "life- and career-changing experiences" for those not predisposed to rural practice.^{7(p7)}

A 2005 survey of rural physicians noted that 39% of respondents were raised in cities with populations greater than 100,000. These physicians from urban backgrounds reported that rural-based training was the most influential factor on practice location decisions.⁸ Tolhurst et al⁹ interviewed medical students from urban areas who expressed interest in rural practice to determine factors associated with students' practice decisions. These students had predisposing characteristics for rural practice that included a high degree of altruism, interest in primary care, and enjoyment of rural-based leisure activities (eg, hiking, fishing). They became committed to rural-based practice through exposure to a variety of rural practice settings during clinical training. These findings were affirmed by Chen et al,¹⁰ who produced a comprehensive report on medical student and resident practice choices. They specifically recommended shifting more clinical training for students and residents to rural areas because "rural...clerkships and electives are associated with profound changes in students' ultimate specialty and location of practice."^{11(p51)}

Rural background is the most frequently mentioned predictor in rural physician recruitment, yet the strongest predictor of physician retention in rural areas is

rural-based residency training.⁵ More than a decade of published studies consistently demonstrated that rural-based residency training was associated with rural-based practice locations. A large-scale study of the American Osteopathic Association Masterfile data found that 50% of osteopathic medical graduates (1988-1997) who trained in a rural-based residency program were practicing in rural areas as of 2005.¹⁰

Similarly, a national survey of rural-based physicians indicated that rural-based residency experiences were associated with increased preparation for rural practice, preparation for small-town living, and longer retention.¹² Similar results have been confirmed in smaller-scale surveys of practicing physicians. For example, analysis of a variety of residency programs in Massachusetts found that graduates participating in rural residencies were not only more likely to select an initial rural practice location but also to report currently practicing in a rural location.¹³ Collectively, these studies provide support for rural training programs that begin early in medical school and provide for extensive rural-based clinical training during undergraduate clinical rotations and, perhaps more importantly, during residency training.

Process

Rural Medical Track Development

Nearly a decade ago, OSU-COM began plans for more intentional rural physician recruitment and training. The OSU Center for Rural Health (CRH) used funding from the HRSA to develop an elective curriculum for medical students that formed the Rural Health Option (RHO). Key features of the RHO included the following: (1) a pair of 1-credit elective courses, “Perspectives in Rural Health” and “Rural Medical Care,” that required participation in a rural health student organization (Students for Osteopathic Rural Medicine [StORM]), and included membership to the National Rural Health Association (NRHA); (2) a 3-week clinical experience with a rural-based physician between the first and second year of training;

(3) required rural-based clinical rotations during the third and fourth years; and (4) opportunities to develop leadership skills through participation in state and national rural health conferences. To support rural-based training, a strong network of rural-based training sites and preceptors was developed (*Figure 1*). In addition, trained individuals served as regional coordinators in rural areas of the state to work as liaisons among the medical school, rural-based preceptors, and rural-based medical students. One regional coordinator was located in each of the shaded regions noted in *Figure 1*.

Rural GME Development

As OSU-COM enhanced its rural medical education curriculum, it made a concurrent commitment to develop GME training opportunities in rural areas of the state. In 2009, OSU and its affiliated Osteopathic Postdoctoral Training Institute, the Osteopathic Medical Education Consortium of Oklahoma (OMECO), began work to expand the opportunities for rural-based GME training. By July 2009, 3 rural-based residency training programs existed in Oklahoma. With passage of the Patient Protection and Affordable Care Act in 2010, Congress created the Teaching Health Center GME Program to expand community-based, primary care GME training programs in underserved settings.¹⁴ Partnerships were developed between OMECO and primary care clinics in northeastern (Tahlequah) and southeastern (Talihina) Oklahoma to apply for funding through the Teaching Health Center GME Program (*Figure 2*).

In 2012, these programs started residencies in internal medicine and family medicine, respectively. With the development of these rural-based GME programs, OSU-COM graduates had expanded rural GME opportunities, with a total of 62 osteopathic residency slots. Most recently, OSU and OMECO worked with McAlester Regional Hospital in 2013 (*Figure 2*) to begin a residency program in family medicine, bringing the total number of rural osteopathic residency slots for OSU-COM graduates to 71. Both OSU and OMECO are working on developing rural-based

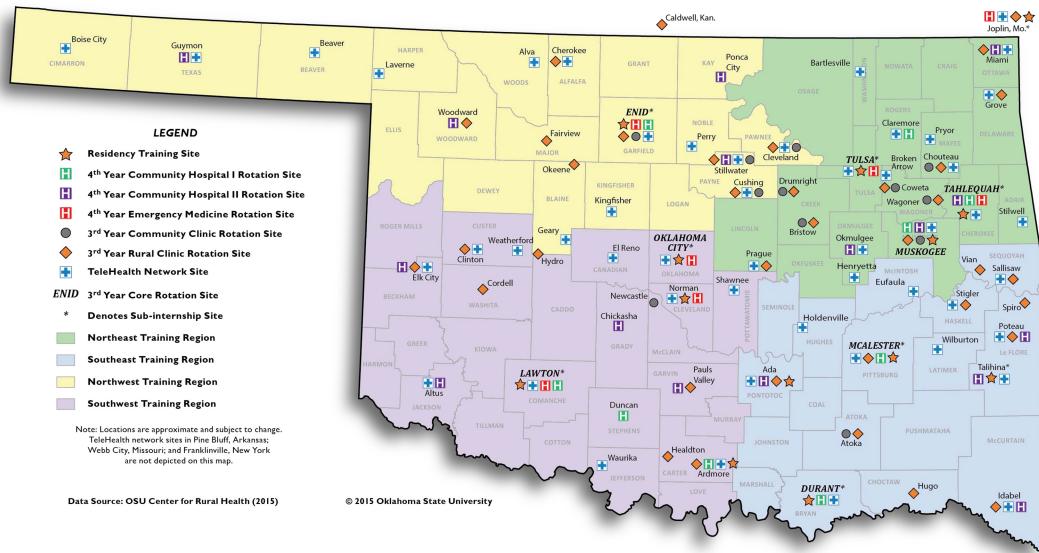


Figure 1.

All clinical training sites as of 2015 for Oklahoma State University Health Science Center College of Osteopathic Medicine. One regional coordinator was located in each of the shaded regions. Map produced by the Oklahoma State University Center for Rural Health on March 31, 2015. Printed with permission from Oklahoma State University.

residency programs in hospitals located in Ada, Ardmore, and McAlester.

Program Growth

Enrollment in the elective curriculum demonstrated continued growth. The first course, "Perspectives in Rural Health," tripled from 12 students in spring 2009 to 36 students in spring 2012. The second elective course, "Rural Medical Care," nearly doubled from 17 students in fall 2009 to 31 students in fall 2012. Class sizes at OSU-COM ranged from 79 to 93 students during this time, and RHO course enrollment represented between 15% and 39% of the total class enrollment. Student course evaluations were consistently positive. A total of 38 students fulfilled all requirements for the RHO, and 62 completed 1 or more of the elective course components of the RHO.

The popularity of the RHO program and strong commitment from OSU-COM leadership inspired the Center for Rural Health to establish a more focused rural-based training program. In 2011, OSU-CRH used

additional HRSA funding to replace the RHO with the Rural Medical Track (RMT). The RMT's primary goals are to produce primary care physicians for rural practice and to ensure that these physicians have additional opportunities to develop skills to be effective community leaders and rural health advocates.

Now in its fourth year, the RMT program has doubled from 12 students in the initial cohort (class of 2014) to 24 students in the current cohort (class of 2017). *Table 1* presents a demographic profile of RMT students, program growth, and graduates by cohort. Key features of the RMT program include rural-based clinical training that begins with a rural physician shadowing experience after the first year of medical school, rural-based core and other required rotations during the third year, and a structured fourth-year curriculum. Students in the RMT program complete their third-year clinical core rotations at 1 of 5 community-based training sites located outside the state's 2 largest metropolitan areas (*Figure 1*). Students enrolled in the traditional curriculum complete the majority of their

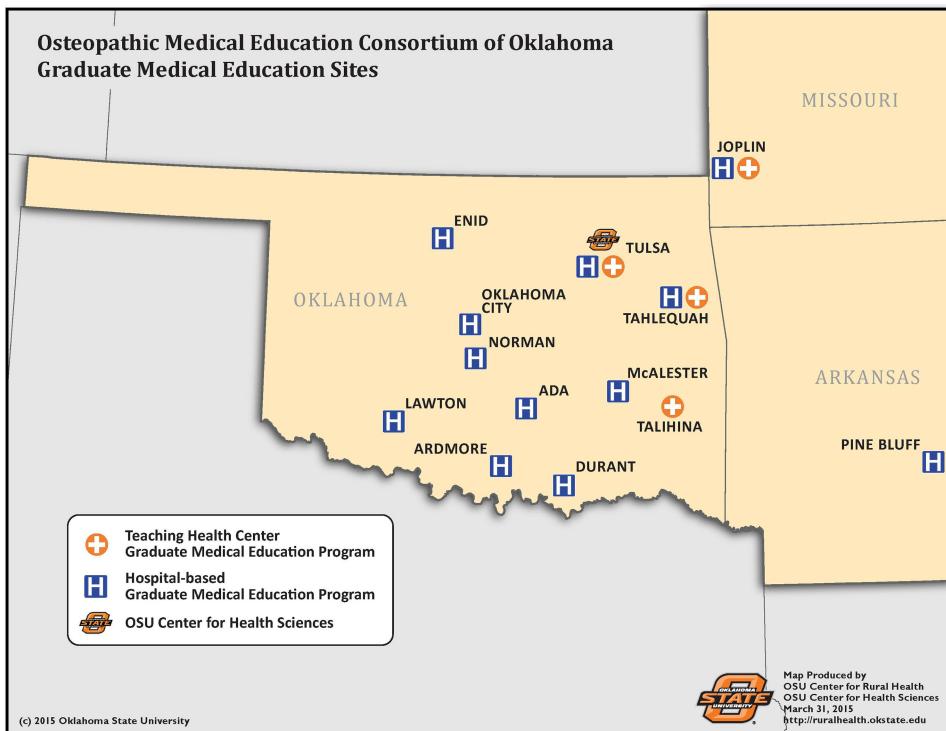


Figure 2.

Locations of residency sites in the Osteopathic Medical Education Consortium of Oklahoma. Map produced by the Oklahoma State University Center for Rural Health on March 31, 2015. Printed with permission from Oklahoma State University.

clinical training in a large metropolitan area. Furthermore, RMT students have the opportunity to complete most of their remaining required and elective clinical education at rural training sites surrounding these rural-based residency training hubs across the state.

Outcomes of RMT Students

Methods

A nonexperimental design was used to evaluate the quality of new rural-based clinical training sites. Academic performance measures were used to compare RMT participants with their respective non-RMT OSU-COM student population cohorts. Baseline performance was established using medical school admission measures, including undergraduate overall grade point average (GPA), undergraduate science GPA, and

Medical College Admission Test (MCAT) scores. At key points in training, RMT participants were compared with their non-RMT peers during preclinical training on the performance of 7 required Comprehensive Osteopathic Medical Achievement Test (COMAT) scores. Mean differences between the 2 groups were assessed using the Mann-Whitney U test. Although the data met the assumption of normality, there was a violation of the homogeneity of variance assumption for at least 2 COMAT comparisons. Additionally, the sample sizes were markedly unequal, so the more conservative Mann-Whitney U offered protection against a type 1 error (ie, rejected the null hypothesis when no effect exists). A P value of .05 or less indicated statistical significance. Effect sizes were computed using the Cohen r and interpreted using the common criteria: small=0.1, medium=0.3, and large=0.5.

Table 1.
Demographics of Participants in the OSU-COM Rural Medical Track by Graduating Year

Demographics	Graduating Year				Total
	2014 ^a	2015	2016	2017	
No.	12	9	20	24	65
Women, No. (%)	9 (75.0)	5 (55.6)	13 (65.0)	15 (62.5)	42 (64.6)
Age, mean, y	31.8	28.3	28.1	27.6	28.6
Rural, No. (%)	8 (66.7)	8 (88.9)	17 (85.0)	19 (79.2)	52 (80.0)
URM, No. (%) ^b	2 (16.7)	3 (33.3)	5 (25.0)	6 (25.0)	16 (24.6)

^a Students in the 2014 cohort were also enrolled in the Rural Health Option.

^b Underrepresented minorities (URM) represents total participants who identified as a race/ethnicity that is historically underrepresented. In this study, 11 of 16 URM participants (69%) were Native American.

Abbreviation: OSU-COM, Oklahoma State University Health Science Center College of Osteopathic Medicine.

Results

Academic Performance

Students who participated in the RMT are academically similar to the general student population. Complete preadmission and COMLEX-USA Level 1 data were available for students enrolled between 2010 and 2012 (N=150). A mean comparison for each of these measures was conducted using a conservative nonparametric Mann-Whitney *U* test because of the small and unbalanced sample size. No statistically significant mean differences were noted on preadmissions criteria (Table 2). Performance on COMLEX-USA Level 1 was somewhat lower for RMT students vs other OSU-COM students, and RMT students had a first-time failure rate of 15% compared with 7% for non-RMT students.

To form a more objective assessment of the quality of training at rural-based core rotation sites, we examined the average performance on the National Board of Osteopathic Medical Examiners COMAT. Students at OSU-COM are required to pass COMAT examinations as part of 7 core third-year clinical rotations. Overall, the RMT students performed significantly better than non-RMT students in family medicine, obstetrics/gynecology, osteopathic manipulative medicine, pediatrics, and surgery. Scores were slightly higher but not statistically different for internal medicine and

psychiatry (Table 3). Effect sizes as measured by the Cohen *r* were small.

Qualitative Student Feedback

Students' experiences with rural-based preceptors have been extremely positive, with most reporting more responsibility and more hands-on medical procedure training as reflected in comments from student evaluations, including the following:

The rural physicians were very open to students working with them, and [they] gave me many opportunities that my fellow non-[RMT] students did not have. I participated in many surgeries and procedures and was given responsibilities that were a surprise to me.

The biggest benefit of the rural medical track was the opportunity to do all our rotations outside of the major cities. This gave us the ability to work one-on-one with our attendings without going through the hierarchy of [] residents and students. We were able to learn much more, not only about medicine, but also about running an office, than if we were always in larger clinics/hospitals.

[W]orking one-on-one with the physicians on core [rotations]... made me develop quicker as a student doctor.

[D]eveloping personal relationships with the various physicians on core and the other rotations... was another

Table 2.
Mean (SD) Outcome Measures Between RMT and Non-RMT Osteopathic Medical Students at OSU-COM

Outcome Measure	Mean (SD)			
	RMT (N=28)	Non-RMT (N=214)	z Score ^a	P Value
Undergraduate overall GPA	3.64 (0.20)	3.63 (0.22)	0.154	.88
Undergraduate science GPA	3.53 (0.29)	3.56 (0.27)	0.566	.57
MCAT score	8.05 (0.58)	8.24 (1.16)	0.945	.35
COMLEX-USA Level 1 score	487.89 (75.45)	512.36 (86.00)	1.280	.20

^a Results of a Mann-Whitney *U* test of ranked data.

Abbreviations: COMLEX-USA, Comprehensive Osteopathic Medical Licensing Examination-USA; GPA, grade point average; MCAT, Medical College Admission Test; OSU-COM, Oklahoma State University Health Science Center College of Osteopathic Medicine; RMT, Rural Medical Track.

significant benefit of my rural experience. Being able to see not only the professional side of these physicians' lives, but also the personal side of life helped me to decide if the career path I chose would be [an] appropriate lifestyle for my family. All the procedures I was allowed to do helped me become more proficient at them as a third year, so in my fourth year auditioning at residency programs and rotating through private physician's offices I was allowed to do more and the physicians were willing to teach at a higher level.

In contrast to the fourth-year clinical training schedules at OSU-COM that consist primarily of elective rotations, RMT students complete at least 2 subinternships at rural-based primary care residency sites and a sequence of *selectives*, which are electives that are designed to optimize skills identified as complementary and as highly desirable to enhance primary care practice skills (eg, dermatology, infectious diseases, cardiology, pulmonology). Students viewed these selectives as an important part of the curriculum. For example, one student wrote,

One of the most positive aspects of the RMT program was the requirement for selectives. Because these were required, I had the benefit of working with specialists that, quite honestly, I would not have had the opportunity to do so if not for the RMT

program. This was invaluable and such a great experience.

In addition, RMT students have the opportunity to develop leadership skills through participation in StORM. The club provides students with service opportunities and an advocacy platform. StORM members are provided student membership status in the NRHA, and StORM officers have the opportunity to attend the NRHA events, such as the NRHA Policy Institute in Washington, DC, to meet with Oklahoma legislators and discuss rural health policy issues.

Graduates

To date, the RMT has produced 21 physicians in residency training programs in Oklahoma. Fifteen graduates (71%) are training in family medicine residencies, 4 (19%) in emergency medicine, 1 (5%) in obstetrics and gynecology, and 1 (5%) in general surgery.

About half of the 21 graduates (n=11) are training outside the urban centers of Tulsa and Oklahoma City, and 8 of these are in rural-based residency training. Although the focus of the RMT is on training primary care and especially family medicine physicians for rural-based practice, the program has encountered students in each cohort who make the case for rural-based

Table 3.
Median Comparison on NBOME COMAT Examinations for OSU-COM Students by RMT Participation Status

COMAT Subject	RMT		Non-RMT		z Score ^a	P Value	Cohen <i>r</i>
	Score, Mean (SD)	n	Score, Mean (SD)	n			
Family medicine	103.1 (8.4)	63	99.8 (10.6)	347	2.627	.009	.130
Internal medicine	102.1 (9.2)	45	100.3 (10.3)	351	1.579	.114	NA
Obstetrics/gynecology	100.4 (7.8)	50	96.4 (10.7)	359	2.689	.007	.133
OMM	103.5 (8.6)	65	99.1 (9.8)	347	3.586	<.001	.177
Pediatrics	103.4 (7.5)	63	98.4 (10.5)	350	3.949	<.001	.194
Psychiatry	100.2 (10.4)	62	97.9 (10.7)	353	1.348	.178	NA
Surgery	99.7 (10.2)	52	94.9 (11.8)	356	2.430	.015	.120

^a Results of a Mann-Whitney *U* test of ranked data.

Abbreviations: COMAT, Comprehensive Osteopathic Medical Achievement Test; NA, not applicable; NBOME, National Board of Osteopathic Medical Examiners; OMM, osteopathic manipulative medicine; OSU-COM, Oklahoma State University Health Science Center College of Osteopathic Medicine; RMT, Rural Medical Track.

specialty practice. The graduates in emergency medicine, general surgery, and obstetrics and gynecology residencies argued that these specialties are desperately needed in rural areas. One student commented on this issue in a course evaluation:

... Rural areas need specialists other than solely family medicine doctors. Therefore, these students should be encouraged to be in the RMT... Developing two RMTs might be beneficial with one for family medicine and one less structured for other specialties.

Discussion

OSU-COM has developed a comprehensive rural physician pipeline that begins with early student recruitment programs delivered in rural communities across the state. The program has been embraced by the medical community and has demonstrated clear growth in numbers over the 5 years that it has been in existence. The positive response to the RMT program at OSU-COM is similar to that documented by Barrett et al.¹⁷ Their systematic review of 72 studies indicated that rural-based training programs positively influence

students toward primary care specialties and rural-based practice. In response to questions surrounding the quality of clinical training in rural areas, they noted students in rural-based clinical training perform as well or better than their urban-trained counterparts. Similarly, Schauer and Schieve¹⁵ conducted a study comparing student performance on standardized assessments including MCAT, US Medical Licensing Examinations Step 1 and Step 2, and National Board of Medical Examiners subject examinations based on student enrollment in traditional urban- vs rural-based clerkships. They found no difference based on clerkship location. However, they noted that rural-trained students had significantly higher clinical proficiency based on preceptor assessments.¹⁵ The current study also found that RMT students performed as well or better on COMAT examinations taken at the conclusion of several third-year rotations despite having slightly lower MCAT and COMLEX-USA Level 1 scores. Assuming COMAT scores reflect, to some extent, the quality of clinical training, these results provide evidence of the high-quality training provided by OSU-COM's rural-based preceptors.

Rural-based training experiences are a key component of programs that are successful at producing rural-based primary care physicians. It is the quality of these training experiences rather than the location that leads to strong clinical skill development. Students who commented on the value of one-on-one training experiences indicated that a more personal relationship with the attending physician resulted in not only high-quality clinical training but a better understanding of how the physician managed his or her personal life, community responsibilities, and clinical practice. Students also commented that they were able to learn more about the health care system and its effects on clinical care during rural-based rotations, in part because staff working in these small practices and clinics wear multiple hats. Responsibilities for billing and coding, reimbursement, and case management are not necessarily distinct functions. Roseamelia et al¹⁶ noted similar findings in interviews with rural-track students. They found that rural-track students received “unparalleled, focused attention—similar to an apprenticeship [and] clinical lessons were supplemented by informal lessons unique to providing care in today’s social and financial climate, including business management tips, issues related to serving under-resourced patients, and working within the confines of health insurance programs.”^{16(p262)}

Rural-based training programs at OSU-COM were designed to both reinforce previous interest in rural-based practice for students with rural backgrounds and to introduce students from urban backgrounds to the potential desirability of a rural lifestyle. Similar to studies that examined the factors that influence students from urban areas to pursue rural practice,^{7,8} the current study found that students could be influenced to consider rural-based primary care through a combination of informational and experiential learning opportunities.

Only 2 cohorts of RMT program participants have graduated, but early indications based on specialty choice (71% family medicine) and residency location (38% at limited rural-based residency sites) suggest that these students remain committed to rural-based practice locations.

Previous research indicates that only 26% to 64% of rural track graduates across the United States enter rural practice.¹⁶ Based on in-depth interviews and focus groups, Roseamelia et al¹⁶ found that a number of possible factors influenced resident practice decisions (eg, loan repayment options, spouse/family considerations, work/life balance). These factors contribute differently to rural-based physician recruitment vs long-term retention in rural areas. Educators need to know more about the salience of these factors in physician practice decisions. To better understand the decision-making process, we are conducting annual follow-up surveys of RMT participants through residency regarding eventual practice commitments and decision priorities. We are also participating in a national pilot project to collect data from multiple medical schools with rural-based training programs. We hope that these efforts will contribute to a better understanding of effective characteristics of rural-based training programs on physician recruitment and retention.

Conclusion

The OSU-COM programs described in this article are in the early stages of implementation, and no longitudinal data are currently available to determine program efficacy as measured by the number of physicians who establish a rural-based practice. However, the programs have experienced substantial growth in participation, and early evaluation data indicate that rural-based clinical training has a positive effect on students’ academic performance as measured by NBOME standardized tests.

It is unclear whether rural-based training simply affirms a predisposition to rural practice or successfully motivates students without predisposing factors to practice in rural areas.¹⁷ More work must be done to better understand the factors that facilitate primary care selection and rural and underserved practice commitments. Along with 8 other institutions, OSU-COM is participating in a pilot project to establish a National Rural Track Database. Program data collected from participants, alumni, and residents will be used to inform both state and national efforts to increase the

recruitment and retention of physicians in rural and underserved areas.

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Author Contributions

Both authors provided substantial contributions to conception and design; Dr Wheeler acquired, analyzed, and interpreted the data; both authors drafted and revised the article content; Dr Wheeler gave final approval of the version of the article to be published; and both authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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