

HEALTH POLICY

The Rural Medical Scholars Program Study: Data to Inform Rural Health Policy

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Introduction: Medical education to produce rural physicians hinges on the characteristics of students, educational programs, and rural experiences. Family physicians are key components of rural medicine. This study tested the effectiveness of multiple, combined strategies of the Rural Medical Scholars Program to produce family medicine residents.

Methods: We compared the relative effectiveness of the Rural Medical Scholars Program, family medicine-oriented branch campuses, and a traditional urban campus to produce family medicine residents using a prospective quasi-experimental design. Logistic regression was used to account for covariates.

Results: The relative effectiveness of 3 educational modalities to produce family medicine residents was examined: Rural Medical Scholars Program (44.0%; odds ratio [OR], 15.6), family medicine-oriented branch campuses (18.9%; OR, 5.8), and a traditional urban campus (3.9%; OR, 1). These differences were significant ($P < .05$) after controlling for sex, race, Medical College Admission Test scores, and graduation rate.

Conclusions: The findings are consistent with the literature, which recommends multiple strategy interventions to produce rural physicians (e.g., admit rural students who have an interest in family medicine, use family medicine faculty, and provide rural experiences). Further study will determine whether rural practice follows training in family medicine among Rural Medical Scholars. (J Am Board Fam Med 2011;24:93–101.)

Keywords: Evaluation, Family Medicine, Health Policy, Residency Choice, Rural Medical Education, Rural Medicine

Current health policy deliberations have emphasized the shortage of primary care physicians in the United States,¹ which is a great concern in rural locales. Massachusetts created a sentinel event in health care policy by enacting universal health insurance that exposed the inadequate supply of primary care physicians needed to meet public demand.² Nine percent of physicians are located in

rural areas where 20% of the population resides,³ and only 3% of current medical school graduates plan to enter rural practice.⁴ The increasing demand for primary care in populous areas brought about by broader insurance coverage promises to exacerbate this rural disparity. In 2005, Whitcomb⁵ forecasted the challenge to rural medical education (RME), while urban primary care physicians were also in short supply. RME includes purposeful efforts to produce rural physicians or an understanding of rural practice through adaptations in administration, policies, structures, faculty, and students, as well as programs of admission, financial aid, teaching, research, service, and outreach. A current policy question is: To what degree can RME be expected to alleviate the shortage of rural primary care physicians?

Literature Review

RME literature has increased since the 1970s, revealing multiple viewpoints and important factors,

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especially students' rural background,⁶⁻⁹ family medicine role models,¹⁰⁻¹² community-based educational experiences,¹³⁻¹⁶ and combinations of these influences.¹⁷⁻²⁰ Six research teams from 4 countries have provided literature reviews^{4,21-25} that help judge the relative potency of these influences. Table 1 summarizes the focuses of these reviews and factors considered; "X" indicates factors stressed as "established" or "important" and "x" indicates those factors acknowledged as "probably influential." Special admissions selecting for a rural background was found to be an established factor. There was a consensus that curriculums providing rural experiences were probably influential. Four of 6 reviews found admission of students interested in family medicine or primary care to be somewhat influential. Five of 6 indicated the value of simultaneously employing multiple strategies, whereas 3 stressed this bundled approach as important. Two reviewers assessed family medicine faculty and family medicine or primary care preceptors as important.

Scientific data to specify the relative significance of each factor are rare. Ranmuthugala et al's²⁴ review assessed special admissions policies focusing on rural background and interest in primary care and family medicine as being solidly established, but they did not find the same support in the literature for providing a special rural curriculum or locating training in rural locations. Hsueh et al²³ analyzed data from Rabinowitz et al's⁸ multistrategy program to estimate that teaching a special rural medicine curriculum produced one extra rural physician per every 17 students, but using special admissions criteria for rural students produced one extra rural physician per every 6 students. Most reviewers included in Table 1 recommended bundling rural background with other factors in a maximal effort to produce rural physicians. Observational data support this approach. Rabinowitz et al's⁴ review found that 6 such undergraduate RME programs produced 53% of rural physicians from admitted students compared with 3% from students admitted to traditional medical school

Table 1. Summary Findings from Review Articles of Rural Medical Education*

Focus	Factors Discussed	References					
		Geyman ²¹	Curran ²²	Hsueh ²³	Ranmuthugala ²⁴	Rabinowitz ⁴	Henry ²⁵
Program wide	Mission	x	x			X	
	Decentralization		x	x	x		
	Rural location		x				
	Telehealth	x	x				
Premedical	K through college		X				X
	Exam preparation		X				
	Rural background	X	X	X	X	X	X
	FM/PC interest	x	X	X	X		
Predoctoral	FM/PC preceptors	x	X	X			
	FM faculty	X		X			
	Faculty support				x		
	Rural experience	x	x	X	x	X	X
	Rural focus		x	X		X	
	FM focus			x			
	PBL		x				
Obstacles	Funding	x	x				
	Accreditation	x					
	Urban influence		x				
	Specialist influence		x				
Evaluation issues	Selection bias	x					
	Confounders				X	x	
Recommendations	Multiple interventions	X	X	X		x	x

*Limited to preresidency topics.

FM, family medicine; K, kindergarten; PBL, problem-based learning; PC, primary care; x, factor discussed; X, factor emphasized.

programs. In a national ecological study, Wheat and colleagues²⁶ found that medical schools reporting a broader array of RME strategies produced a greater percentage of graduates in rural practice. The Rural Medical Education Program (RMED),²⁷ which addresses multiple factors noted in Table 1, was assessed in 2008 to show that RMED students performed adequately in medical school and that 99 of 159 RMED graduates (62%) entered family medicine residencies. This literature provides a rationale for conducting an intervention study to test the hypothesis that bundling rural medical education strategies increases the production of physicians who choose to train in family medicine in preparation for rural practice. We designed the University of Alabama Rural Medical Scholars Program (RMSP) study to test this hypothesis and provide data to support RME policymaking.

Rural Medical Scholars Program

Intervention

The RMSP, presented in more detail elsewhere,²⁸ is an incremental step in the University of Alabama School of Medicine's commitment to produce rural primary care physicians. In the 1970s the school increased class size and created 2 clinical branch campuses oriented to family medicine. In 1996 the dean authorized the RMSP as an experiment to be conducted on a branch campus, replacing 10 regular medical students with Rural Medical Scholars. Student choice determined campus assignment at the main and branch campuses; specially selected Rural Medical Scholars were assigned to the same branch campus.

Table 2 details the intervention components of the RMSP, comparing the main and branch campus programs. The RMSP components are (1) a family medicine medical director; (2) special recruitment, admissions, and curriculum; and (3) Master of Science and Medical Doctor degree programs. Very few Rural Medical Scholars would have been admitted through the regular admissions process, which places higher emphasis on Medical College Admission Test (MCAT) scores.

The Master's Degree program culminates in the Master of Science in General Studies in Human Environmental Sciences with specialization in Rural Community Health. Students must complete the 30 semester hour curriculum and obtain the

Table 2. Intervention Components of the Rural Medical Scholars Program (RMSP)

Program Component	Track of Study		RMSP
	Main Campus	Branch Campus	
FM medical director			X
Pipeline recruitment programs*			X
Admissions programs			
Regular committee	X	X	
Rural subcommittee†			X
Special requirements			
8 years in rural Alabama			X
FM/PC intent			X
GPA and MCAT thresholds‡			X
Rural values/identity§			X
Prematriculation Masters program			
Biochemistry			X
Rural Community Health¶			X
Rural FM preceptor			X
Medical school location			
Preclinical in Birmingham	X	X	X
Clinical in branch campus**		X	X

*Rural Health Scholars Program for high school students and Rural Minority Health Scholars Program for college students.

†Composed of one-third rural family physicians, one-third minority health professionals, and one-third branch campus faculty. A candidate is interviewed by one of each.

‡Thresholds for grade point average (GPA) and Medical College Admission Test (MCAT) are 3.3 and 24, respectively.

§Values and identity are assessed through interview.

||Two semesters of Biochemistry are included.

¶Courses include Rural Occupational and Environmental Health, Rural Community Clinical Process, Biostatistics, Epidemiology, Health Care Management, Behavioral Medicine, and Masters Major Paper.

**The 2 branch campuses emphasize family medicine (FM); the Birmingham campus emphasizes subspecialties and bench research.

PC, primary care.

degree or, in special cases, a certificate of completion to proceed into medical school. The Master's Degree program classes are composed almost entirely of Rural Medical Scholars in an effort to establish a small, supportive peer group. The Master's curriculum strengthens premedical preparation, provides an understanding of community health and research, and connects students with rural Alabama physicians, health facilities, schools, farmers, and other health professionals. On rare occasions, inadequate performance during the Master's year has precluded matriculation to medical school. The medical school curriculum for Rural Medical Scholars is the same as for other med-

ical students choosing a branch campus: 2 years at the main campus and 2 years at the branch campus.

Evaluation Study Plan

We devised an evaluation plan with the program plan in 1996. The RMSP is a “large” bundled experimental intervention for comparisons with the “moderate” intervention of branch campuses (eg, regular admissions but self-selection to a family medicine-centered branch campus for the clinical years) and the “minimal” intervention of the urban-based medical education of the main campus. These comparisons test the proposition that students participating in the larger bundled intervention would perform adequately in medical school, choose family medicine residencies, and locate in a rural practice more frequently than their peers in the other educational tracks.

We reported previously that Rural Medical Scholars performed satisfactorily (eg, grade point average and US Medical Licensing Examination) and completed medical school within 4 years at a rate equivalent to or better than their peers in a traditional program (95% vs 85%).²⁸ As of 2009, 9 RMSP classes with a total of 84 students had made residency selections, providing a study group large enough to test the hypothesis that the RMSP produces more family medicine residents than the branch and main campus programs.

Methods

Design

We tested the hypothesis using a prospective quasi-experimental design with a nonrandomized intervention and control groups before intervention and after intervention.²⁹

Intervention

We exposed Rural Medical Scholars, the intervention group, to the bundled RME strategies shown in Table 2. Students on the main campus with minimal exposure and branch campuses with moderate exposure were control groups.

Population

The 1132 US-born students (838 on the main campus and 294 on the branch campuses) who matriculated into medical school during 1989 to 1996 comprised the control groups before RMSP intervention, as shown in Table 3. The 1136 students

(840 on the main campus and 296 on the branch campuses) who matriculated during 1997 to 2005 comprised the control groups after RMSP intervention. The final column in Table 3 shows the RMSP intervention group ($n = 84$). Table 3 also displays key characteristics of each group. We included 3 foreign-born RMSP students because they grew up in rural Alabama. We excluded other foreign-born students because their rural or urban upbringing could not be determined.

Data Source

We extracted data from institutional data files maintained by the Office of Medical Student Services at the medical school, as previously described.³⁰

Variables

Family medicine residency choice was the outcome variable. We measured the cumulative family medicine residency selection rate as the percentage of medical students for 8 years before and 9 years after the RMSP began in 1997. RMSP participation was the large-level intervention for comparison with branch campus (moderate) and main campus (minimal) interventions. We included control variables to approximate the conceptual model of Newton, Grayson, and Whitley,³¹ who described 3 broad categories of predictors of primary care career choice used in their regression model developed from questionnaire data: medical student demographics, student-rated influences, and medical school. We used student demographic variables (age, race, sex, and rural background at entry to medical school); student performance characteristics (MCAT, rate of graduation from medical school in 4 years); and medical school factors (campus attended, RMSP participation). We bifurcated race as white and non-white based on self-descriptions supplied to the medical school as white versus all other self designations (eg, black, Mexican American, Hispanic, Native American, Puerto Rican, Filipino, Asian American, and Indian American). Non-white students were distributed as follows: group before intervention, $n = 145$ (12.8%); group after intervention, $n = 196$ (17.3%); and RMSP, $n = 8$ (9.5%).

The MCAT was revised in 1992. The data files we used contained 36 people who took both versions of the MCAT. We found a correlation between the 2 tests of 0.805 ($r^2 = 0.645$). From this

Table 3. Level of Rural Medical Education (RME), Family Medicine Effect, and Student Characteristics Before and After Rural Medical Scholars Program (RMSP) Intervention

Campus/Track of Study	Before RMSP Intervention (1989–1996)			After RMSP Intervention (1997–2005)			Before/After <i>P</i> * (a:b)	RMSP Intervention† (1997–2005)
	Main Campus	Branch	Total (a)	Main Campus	Branch	Total (b)		
RME level‡	Minimal	Moderate		Minimal	Moderate			Large
N	838	294	1132	840	296	1136		84
Age (mean years)	24.0	23.8	24.0	23.9	24.0	23.9	.81	24.7
Race (% white)	88.4	83.7	87.2	83.8	79.7	82.7	.003	90.5
Sex (% male)	65.8	66.0	65.8	60.5	58.1	59.9	.003	64.3
Rural (%)	16.3	20.7	17.5	15.1	22.3	17.0	.75	43.2
MCAT (mean score)	29.2	28.4	29.0	30.1	29.2	29.9	<.001	25.7
4-year graduation rate (%)	85.8	84.7	85.5	88.7	87.8	88.5	.04	90.5
FM choice (%)	9.7	24.1	13.4	3.9	18.9	7.8	<.001	44.0
FM effect (odds ratio)§				1.0	5.8			15.6

*Variables with significant pre/post differences were candidates for control variables in the analysis.

†The intervention was the RMSP, explained below as a large-level intervention.

‡RME level represents the incremental commitment to rural medical education on the separate campus tracks: “Minimal” for the main campus, “Moderate” for the family medicine–oriented branch campuses, and “Large” for the RMSP with a special admissions program and a prematriculation masters degree on a family medicine–oriented branch campus.

§These odds ratios, adjusted for sex, race, MCAT score, and graduation rate, compare the odds of a student choosing to become a family medicine resident after having completed tracks of study at campuses/programs offering different levels of RME. The RMSP odds ratio is significantly greater ($P < .001$) than the others, and the odds ratio for the family medicine–oriented branch campuses is greater than for the main campus ($P < .001$).

FM, family medicine; MCAT, Medical College Admission Test.

correlation, we converted MCAT scores before 1992 (MCATold) to a post-1991 (MCATnew) equivalency with the following equation: $MCAT_{new} = 8.531 + 0.397 \times MCAT_{old}$. Rural background is of interest because it appears in the data as both (1) a descriptor of students using the imprecise Office of Management and Budget definition of rural as a county that is not designated as part of a metropolitan area,³² and (2) an eligibility component for the RMSP using the rural admissions subcommittee’s qualitative assessment of rural based on location and lifestyle characteristics and intention to practice rural primary care.²⁸

Analysis

We first calculated pre-RMSP intervention (1989–1996) rates of family medicine residency selection and determined other characteristics of students on the main and branch campuses. We next determined the post-RMSP intervention (1997–2005) rates and student characteristics for these campuses during the period that the RMSP was conducted but excluded Rural Medical Scholars. Then, comparisons of the before and after intervention vari-

ables were done using t test and χ^2 statistics. Student characteristics showing trends before and after intervention were candidates for control variables in the subsequent analysis, which compared these campus programs to the RMSP (Table 3 summarizes these data). We further analyzed student characteristics by their contribution to a logistic regression model explaining the trend in family medicine residency choice among main and branch campus students before and after intervention.

We examined the 1997 to 2005 rates for RMSP choice of family medicine residency and student characteristics, as shown in the last column of Table 3. The last 2 rows demonstrate comparisons of family medicine residency selection on the main campus, branch campuses, and the RMSP using percentages and odds ratios.³³

Tests of significance utilized t test and χ^2 statistics. We employed the 2 independent sample t test for comparisons of the MCAT scores and age before and after intervention. Sample sizes were equivalent. For the MCAT, assumptions of normality and equivalent variances were met. Age demonstrated non-normality and unequal vari-

ances, but none of the unequal variance *t* test, nonparametric Mann-Whitney test, or the appearance of age histograms reversed the findings of the *t* test, substantiating the conclusion that the ages of the 2 groups are almost identical (eg, means, 23.96 and 23.92). When we found significant differences ($P < .05$), we included student demographic and performance characteristics in a logistic regression model to determine whether the differences remained in the adjusted odds ratio or if other variables accounted for the difference.³⁴ We used SPSS software (SPSS, Inc., Chicago, IL) for the analyses.

Results

Data from Table 3 show the anticipated difference in family medicine residency selection rates between the branch and main campuses. Excluding Rural Medical Scholars, the overall family medicine residency selection rate fell almost by half between the 2 time periods, from 13.4% during 1989 through 1996 to 7.8% during 1997 through 2005. The decline was present among students choosing to attend the main campus (9.7% to 3.9%) and the branch campuses (24.1% to 18.9%). There were also changes in the percentages of students by race, sex, MCAT score, and 4-year graduation rate. However, the drop in family medicine residency choice before and after intervention remained significant ($P < .001$) after controlling for these student characteristics and campus.

The hypothesis that the RMSP produces more family medicine residents than the branch and main campus programs was supported as shown in Table 3. Concurrent with the RMSP, the main campus produced a rate of 3.9% family medicine residents, a low percentage compared with the branch campuses (18.9%) and with the national average of 9.4% (2001–2006).^{35,36} Forty-four percent of the RMSP participants selected family medicine residencies, which was highly significant. The RMSP family medicine residency selection rate was 2.3 times greater ($P < .001$) than that of the branch campuses and 11 times greater ($P < .001$) than that of the main campus.

We expressed the relative effect on producing family medicine residents as odds ratios and adjusted for the influence of control variables. Race was the only significant covariate in the logistic models, with the odds ratio of whites selecting family medicine residency being 2.7 (95% CI, 1.4–

5.8) compared with non-whites ($P = .005$). The differences in adjusted odds ratios for choosing family medicine residency remained significant ($P < .001$) with the odds of the RMSP (15.6) > branch campuses (5.8) > main campus (1.0).

Discussion

Strengths

One strength of the RMSP study is that the literature provided a rationale for the hypothesis and analytic strategy. The study's major strength is the quasi-experimental design³⁷ with an a priori hypothesis, a purposefully planned and applied intervention, and a prospective collection of outcomes and key characteristics data from intervention and control group participants. The intervention differentiates the groups and precedes the outcome. The 3 levels of the RME intervention lend weight to a causal analysis by suggesting the operation of a dose-response relationship. Sampling error and information bias are not an issue because virtually all students were included and the dataset was derived from standard information required of all medical students. The collected data conformed sufficiently to assumptions that justified use of the statistical procedures employed.

There is some indication that the results can be generalized. The studied medical school conforms to universal standards set by the accrediting body, students in the control group exhibited the same decline in family medicine residency selection rate as witnessed nationally,³⁸ and the findings are consistent with reports from other study designs and student populations.^{4,26,27}

Limitations

The major weakness of the quasi-experimental design is an inability to account for the effects of unmeasured control variables, in contradistinction to true experiments with randomized application of intervention and control status. Thus, we could only control for those potential confounding variables that were included in the study. These were limited to those available in the institution's dataset and by the small size of the intervention group, which required few control variables in the statistical models to maintain statistical power. Consequently, as suggested by other researchers,^{4,24} unmeasured factors could be present.

Selection bias is accounted for in this study as part of the bundled intervention. As shown in the literature review, selection of students is the strongest factor in the purposeful production of rural physicians. The RMSP selects students based on rural background, family medicine interest, and other potential predictors of rural practice. As yet, too few minority students from rural Alabama have accessed the program to yield a meaningful study of the RMSP effect among rural minority students.

To summarize the study, the RMSP showed a strongly positive effect on family medicine residency choice that persisted after considering selected demographic, campus, and performance variables. The best models for explaining the variation in the production of family medicine residents included a campus/program variable and race. The branch campuses increased the rate of production of family medicine residents over the rate of the main campus. Adding the RMSP to a branch campus markedly increased this effect.

We cannot separate the effect on family medicine residency choice based on the components of the intervention (eg, selection, curriculum, campus location, and role models). Rabinowitz et al⁸ suggest that 80% of the impact of RME programs resides in the selection of students. Through personal observation, we believe that the Master's Degree also has a significant effect but, again, that effect cannot be determined with these data. Family medicine centered branch campuses had an effect compared with the main campus. That effect may be the result of self-selection by students who were admitted through the regular admissions process and who find the branch campuses attractive. However, the work by Rosenblatt et al,¹⁴ Boulger,¹⁵ and Brokaw et al¹⁶ suggest that the branch campus may be an important tool in the production of rural physicians. Were it practical, one might randomly assign students to different medical education tracks to determine the track effect while controlling for other influences. However, the ethics of assigning to a large urban health sciences center a rural student who desires to train for rural medical care on a campus close to home are problematic.

With the literature cited, this study strengthens the basis for a causal analysis relating a bundled RME strategy to an increase in family medicine residents who might locate in rural practice. Applying Hill's criteria for a causal relationship,³⁹ this study adds support for:

1. A temporal relationship with the RME intervention preceding the outcome of family medicine residency selection.
2. Strength of association with increased family medicine selection by RME participants.
3. A dose-response relationship with increasing levels of RME being associated with increases in rate (odds ratio) of choosing family medicine residency.
4. Findings consistent with previous studies, including literature reviews,^{4,21–25} and findings from programs evaluated through institutional case reports,²⁷ retrospective cohort designs,⁴ and ecological studies.²⁶
5. A plausible mechanism by which RME affects the choice of family medicine specialty based on literature review that suggested components of the RMSP intervention.

Additionally, some alternative explanations were accounted for as control variables in the study.

Conclusion

This study of the RMSP, which is modeled on older RME programs,²⁸ supports the contention that replicating special rural programs and tracks among medical schools will augment the supply of primary care physicians for rural practice.⁴ For example, in the studied medical education system, to produce one additional family medicine resident per year required the addition of 26 students to the main campus, 5 to 6 to a branch campus, or 2 to 3 to the RMSP. Given the propensity of family physicians to practice in rural areas,¹² the impact of increasing the use of multistrategy interventions like the RMSP and others reported in the literature has relevance in today's health policy environment. A hypothesis for further study is that the RMSP increases the distribution of physicians into rural practice. However, we agree with Rabinowitz et al⁴ that the accumulated data are strong enough at present to support the use of special RME programs to meet primary care workforce needs in much of rural America. Locally, we anticipate adding to the RMSP study components designed to accommodate the particular needs of a more diverse population of rural students representing communities burdened by a high prevalence of health disparities.

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