# Influencing Residency Choice and Practice Location Through a Longitudinal Rural Pipeline Program

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## Abstract

### Purpose
The University of Missouri School of Medicine developed the Rural Track Pipeline Program (MU-RTPP) to increase the supply and retention of rural physicians statewide. The MU-RTPP features a preadmissions program for rural students (Rural Scholars), a Summer Community Program for rising second-year students, a six-month Rural Track Clerkship (RTC) Program for third-year students, and a Rural Track Elective Program for fourth-year students. The purpose of this study is to report the specialty choices and first practice locations of Rural Scholars, RTC-only participants, and Rural Track Clerkship Plus (RTC+) participants (students who participated in the RTC Program plus an additional MU-RTPP component).

### Method
The authors compared the residency specialty choices of 48 Rural Scholars (tracked since 2002) with those of 506 nonparticipants and the residency specialty choices of 83 RTC participants and 75 RTC+ participants (tracked since 1997) with those of 840 nonparticipants. The authors calculated the relative risk (RR) for the likelihood of participants matching into primary care compared with nonparticipants and analyzed first practice location.

### Results
Rural Scholars were more than twice as likely to match into family medicine (RR = 2.6; 95% confidence interval 1.5–4.4). RTC and RTC+ participants entered primary care, especially family medicine, at rates significantly higher than nonparticipants. Over 57% of students who participated in the RTC program (and potentially other MU-RTPP offerings) chose a rural location for their first practice.

### Conclusions
The longitudinal MU-RTPP successfully recruits students for rural and primary care practice to address the health care needs of Missouri.

The national physician shortage is growing worse, a trend that is exacerbating an already long-standing urban–rural maldistribution. The rural population is one of the largest physician-underserved populations in the United States[1]; whereas 20% of the U.S. population resides in rural areas, fewer than 9% of physicians practice in those communities.[2] Physician shortages in rural areas contribute to disadvantage and disparity in health status, health infrastructure, and economic vitality.[2] The future physician workforce will need to be shaped in an effort to address this inequity, yet recent research shows that only 3% of medical school matriculants plan to practice in rural areas and small towns.[3]

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Acad Med. 2011;86:000–000.
First published online
*doi: 10.1097/ACM.0b013e318230653f*

Missouri faces these same physician workforce shortages. Of the 114 counties in Missouri, 103 are designated rural.[4] This represents 97.4% of the surface area of the state and over a third of the population. Whereas 37% of the population lives in a rural county, only 18% of the state's primary care practices are located in one.[5] Further, 43 of the rural counties in Missouri do not have a hospital, and 28% of Missourians currently lack adequate access to health care.[5] According to the U.S. Department of Health and Human Services, an ideal population-to-primary-care-physician ratio is 2,000 to 1,[6] yet 30 rural counties in Missouri have a population-to-primary-care-physician ratio that exceeds 3,500 to 1,[5] which is the federal standard for Health Professions Shortage Areas. The paucity of rural physicians is a critical factor negatively affecting health services in rural Missouri.[5]

In this report, we describe the University of Missouri Rural Track Pipeline Program (MU-RTPP), which we developed in 1995 to address workforce issues in Missouri, and we report the residency specialty choices, residency locations, and first practice sites of MU-RTPP graduates.

When it became a four-year program in 1955, the University of Missouri School of Medicine (MUSOM) took on the special mission of training physicians for rural areas of the state. Although it could not single-handedly solve Missouri's rural health problems, the school had the unique potential to enhance the rural physician workforce because of its location away from the major urban areas of the state. In addition, the majority of MUSOM students are from Missouri, and they are more likely to practice in Missouri compared with graduates from other Missouri medical schools (unpublished data). To improve the MUSOM's effectiveness in addressing the shortage of physicians in rural Missouri, Dean Lester R. Bryant created the MU Area Health Education Center (MU AHEC) Program Office in 1994.[7] The MU AHEC Program Office is part of a statewide AHEC organization that consists of two additional program offices located at the A. T. Still University/ Kirksville College of Osteopathic Medicine and at Saint Louis University.



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These three medical schools administer Health Services Resource Administration (HRSA) grants that are awarded to seven regional AHEC centers statewide. The three program offices and seven regional centers constitute a strong, committed, effective statewide organization called the Missouri Area Health Education Centers (MAHEC). The mission of MAHEC is to enhance access to quality health care, particularly primary and preventive care, by growing and supporting Missouri's health care workforce.[8]

On the basis of other existing rural programs and their results,[3,9–11] the MUSOM developed the MU-RTPP as a "self-renewing pipeline" using the statewide MAHEC to support rural medical training for undergraduate (baccalaureate) and medical student education. The MU-RTPP's goal is to produce practicing physicians for rural and underserved areas of Missouri, especially physicians who will add to the pipeline by becoming community-based faculty for new students going through the program.

We have intentionally located the MU-RTPP in the Office of Medical Education, instead of in a particular department (such as family medicine), because the MU-RTPP is key to achieving the whole school's goals (including improving care for all Missourians and decompressing on-site clerkships). This organizational designation has incorporated the funding and infrastructure support for the program into general academic efforts of the MUSOM.

The MU-RTPP encompasses four distinct but related curriculum and clinical components. The sequential programs, which provide students with ongoing exposure to rural medicine, are the Lester R. Bryant Pre-Admissions (Rural Scholars) Program, the Summer Community Program, the Rural Track Clerkship (RTC) Program, and the Rural Track Elective Program. The medical school components of the MU-RTPP are funded by the MUSOM; by local, rural community health care systems; and by an HRSA grant.

The MU-RTPP's design followed our beliefs, based on published literature, that ongoing opportunities for rural training effectively influence medical students' choice of specialty and residency location, and that a more intense rural program (i.e., with multiple, longitudinal rural experiences) results in higher numbers of graduates entering rural practice.[1,3,9–11] Our program therefore focuses on admitting students from rural Missouri and providing them with training experiences in rural areas in an effort to increase the number of physicians practicing in rural Missouri.

## Program Components

### Rural Scholars Program

Students from rural backgrounds are substantially more likely to practice in rural areas when compared with their urban background counterparts, and programs with admissions processes that value a rural background have more success at placing graduates in primary care and rural practice.[1,12,13] Thus, we developed the Rural Scholars Program to attract students who have both a rural background and an interest in practicing rural medicine for preadmission to the MUSOM. Because these students tend, for economic and geographic reasons, to attend regional state universities and other colleges in their region, the Rural Scholars Program is a cooperative effort between six designated Missouri institutions and the MUSOM. Students meeting the minimum eligibility requirements (Table 1) interview for acceptance into the program following the completion of their freshman year in college. To improve our selectivity, we added (in 2009) focused interview questions that probe a student's rural identity and intent to practice rural medicine because the selection of students with these characteristics is highly predictive of eventual rural practice.[14,15] A Pre-Professional Scholars Program Committee, composed of MUSOM and community-based faculty, selects the Rural Scholars and monitors their progress toward matriculation.

Rural Scholars are offered acceptance into the MUSOM, conditional on their achievement of certain academic standards, their ongoing demonstration of professional conduct, and their participation in required activities. Rural Scholars must maintain a cumulative overall grade point average (GPA) of 3.3 and a cumulative math/science GPA of 3.3, and they must earn As or Bs in required courses specific to each participating institution. Rural Scholars are not currently required to take the Medical College Admissions Test (MCAT) for matriculation to the MUSOM, but these students must attend biannual retreats designed to assist with the transition to our problem-based learning curriculum and to promote discussion of topics relevant to rural medicine. Students are provided housing and a travel stipend to attend the retreats.

We require Rural Scholars to enter a mentoring relationship with a rural physician during their sophomore year in college. Students spend at least 20 hours a year with their mentor, most of which is in shadowing, but they also devote time to career guidance, professional development, etc., and the students write two reflection papers annually about their shadowing experiences. Additionally, we require Rural Scholars to log 20 hours of other health-related experiences and 8 hours of community service per year because service experiences in underserved rural areas prior to medical training further increase the likelihood of eventual rural practice.[16]

Because students who experience repeated exposure to and training in rural areas have increased interest in rural practice and remain in rural practice longer.[12] Therefore, upon matriculation into the MUSOM, Rural Scholars volunteer at our retreats, participate in the Summer Community Program for six to eight weeks, complete three of their seven required third-year clinical clerkships as part of the RTC Program, and—beginning with the graduating class of 2013—complete at least one fourth-year elective as part of the Rural Track Elective Program. Students who successfully complete all four of these medical school requirements receive a $2,000 scholarship during their fourth year in medical school. We have allowed exceptions for students facing academic, health, and/or family issues that preclude successful completion of a particular component.

### Summer Community Program

The Summer Community Program is an opportunity for the MUSOM's rising second-year medical students to participate in a clinical program in a rural community setting. A participating hospital or clinic sponsors students. Each student receives a stipend ($1,000–$2,000 based on the length of the experience) as well as room and board.



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Table 1

**The University of Missouri School of Medicine (MUSOM) Rural Track Pipeline Program (MU-RTPP) Components**

| Component | Goal—To | Eligibility and selection criteria | Number of participants | Faculty | Content |
|---|---|---|---|---|---|
| Lester R. Bryant Pre-Admissions (Rural Scholars) Program | • Encourage people from rural backgrounds to pursue a medical education and prepare them for rural practice<br>• Develop the skills and knowledge necessary to succeed at the MUSOM<br>• Provide multiple opportunities to maintain and strengthen rural connections<br>• Encourage and sustain student interest in rural practice | Freshmen undergraduate students that meet the following criteria:<br>• Composite score on the ACT examination of 30 or 1340 (critical reading + math) on the SAT<br>• High academic achievement during high school<br>• Minimum 3.3 cumulative and 3.3 math/science undergraduate (baccalaureate) grade point average<br>• Evidence of leadership and interest in a variety of extracurricular activities<br>• Missouri residence<br>• Graduation from a rural high school as defined by the National Center for Education Statistics<br>• Full-time enrollment at one of six participating institutions<br>• Expressed commitment to a career in rural medicine<br>• Possession of key characteristics expected of quality physicians[30] | Up to 15 students per year | • Designated Rural Scholar faculty advisor at student's home institution<br>• MU-RTPP staff<br>• MUSOM faculty | • Issues relevant to practicing medicine in a rural community<br>• Daily life and expectations of a medical student<br>• Biological and clinical sciences encountered in the medical school curriculum<br>• Familiarity with the MUSOM and the MU-RTPP |
| Summer Community Program | • Increase knowledge of rural practice<br>• Learn about the spectrum of specialties commonly available in rural communities<br>• Improve clinical skills in history taking, physical examination, assessment, and medical management<br>• Explore common acute and chronic clinical problems<br>• Compare medical practice in a community setting with practice in an academic health center | Any rising second-year medical student in good academic standing. Students with an expressed interest in rural practice are given preference. Required for Rural Scholars | 20 to 30 students per year | Rural Missouri physicians | • Rural practice<br>• Clinical medicine<br>• Lifestyle of rural physicians<br>• Rural life and culture |

(*Continues*)



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Table 1
(*Continued*)

| Component | Goal—To | Eligibility and selection criteria | Number of participants | Faculty | Content |
|---|---|---|---|---|---|
| Rural Track Clerkship (RTC) Program | • Explore and discover issues relevant to practicing medicine in a rural community<br>• Provide students with core clinical experiences<br>• Afford students the unique opportunity to live and work in a rural community<br>• Provide opportunities for service learning through community integration activities | Any third-year medical student in good academic standing. Students are given preference based on the following<br>• Academic record<br>• Professional behavior<br>• Status as a Rural Scholar<br>• Hometown/rural background<br>• Requests for three RTC clerkships<br>• Prior involvement in MU-RTTP opportunities<br>• Reasons for requesting rural rotations as communicated on the application<br>• Student flexibility in placement site<br>• Community integration interest<br>Required for Rural Scholars | 20 to 35 students per year | Community-based faculty located at 1 of the 10 designated rural training sites across Missouri. All RTC community-based faculty have an appointment with the MUSOM | • Rural practice<br>• Clinical medicine<br>• Lifestyles of rural physicians<br>• Rural life and culture<br>• Core clerkship content |
| Rural Track Elective Program | • Explore and discover issues relevant to practicing medicine in a rural community<br>• Provide students additional rural clinical experiences to help solidify their commitment to practicing rural medicine<br>• Afford students the unique opportunity to live and work in a rural community | Any fourth-year medical student in good academic standing<br>Required for Rural Scholars starting with the graduating class of 2013 | 5 to 7 students per year | Community-based faculty located at 1 of the 10 designated rural training sites across Missouri | • Rural practice<br>• Clinical medicine<br>• Lifestyles of rural physicians<br>• Rural life and culture<br>• Elective content |

The program is open to all first-year medical students in good academic standing; those with an expressed interest in rural practice are given preference. For traditional medical students (i.e., students who are not Rural Scholars), this program is the first opportunity to participate in the MU-RTPP. During the program, students work closely with physicians practicing in smaller Missouri communities for four to eight weeks (Rural Scholars are required to complete a minimum of six weeks). Students may work with one or more community-based physicians in a variety of specialties. Students experience the benefits and rewards of rural practice and perform appropriately focused medical histories and physical exams under the supervision of the physician (they may perform other clinical care tasks with supervision as appropriate). See Table 1 for a complete listing of program goals and content. During the experience, physicians provide students with frequent feedback incorporating personal observations and comments from patients, office staff, and hospital personnel. At the end of the summer, the physician completes a brief evaluation which is kept in the student's permanent files in the Office of Medical Education. Students do not receive a grade because the Summer Community Program is not part of the MUSOM's formal, required curriculum.

### The Rural Track Clerkship Program

Rural programs with greater intensity that include the opportunity for students to live and work in a rural community, which exposes them to the challenges of rural medicine and the joys of a rural lifestyle, result in a higher number of graduates entering rural practice.[16–18] Therefore, the RTC Program offers all third-year medical students the choice of completing one to three of their seven required core clinical clerkships in community-based rural training sites across Missouri (Table 1). For traditional students, this program may be their first exposure to the MU-RTPP.

We selected our 10 clerkship training sites (which may differ from Summer Community Program sites) based on the commitment of the community-based faculty, hospital support, funding, and geographic proximity to underserved rural areas. Students live in the community while completing their



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clinical rotations (of eight weeks each). The regional AHECs provide housing, in cooperation with local hospitals. We encourage students to remain in one location to more fully integrate into the community; however, some students request rotations at more than one site to experience a variety of rural settings. Another reason students may complete rotations at more than one training site is the availability of housing or community-based faculty.

All 150 community-based clerkship faculty have adjunct appointments with the MUSOM and voluntarily serve as primary teaching faculty. Additionally, local medical directors at each site facilitate the delivery of the curriculum, assist in community-based faculty recruitment, and help with local and regional faculty development seminars. The MUSOM supports a small portion of their time. Regional AHEC staff facilitate the scheduling, housing, didactics, and orientation of each student. In these busy rural settings, students have opportunities to care for a large number of patients and to develop continuity relationships with community-based faculty and patients.

To ensure that RTC participants have access to the same educational resources as their peers at the MUSOM, we record individual clerkship lectures on DVD or as podcasts available via the Internet. RTC participants also connect via video conference on a biweekly basis for seminars presented by community-based or MUSOM faculty. These seminars focus on essential topics for all third-year students (e.g., anxiety, amenorrhea, back pain, chest pain) as agreed on by the clerkship directors.

Clerkship directors monitor clinical experience, both off-site and on-site, using required electronic patient logs. Summative faculty assessments of students are online, and the assignment of grades and credit resides with the MUSOM and the clerkship departments. Grades and shelf examination results are indistinguishable between RTC and non-RTC students (unpublished data).

Good rural clinical experiences and learning opportunities are probably not enough to influence students' career decisions. Students should also have time and opportunity to acculturate into the rural lifestyle.[19] To provide this opportunity, we encourage students to participate in our Community Integration Program (CIP) as part of their RTC experience. CIP students complete health-related community service projects in an effort to learn more about and understand regional and local factors that affect rural health and rural health care systems. The CIP is a voluntary program; its goal is integrating students into rural communities so that they can develop an understanding of rural culture and quality of life and practice the ethic of service as an integral part of professional practice. Student projects have included organizing bone marrow donor drives; providing primary, middle, and high school health education programs; and completing a health needs assessment for a rural homeless population. Regional AHEC staff assist students in finding projects that not only interest them but also meet a community need. Students voluntarily work with various community agency partners and later reflect on their CIP project by writing and presenting a paper to their fellow RTC classmates and the MUSOM leadership. These types of experiences, designed to occur during a formative time in students' academic careers, are important for fostering students' interest in rural medicine, for improving their understanding of rural practice, and for nurturing in them a community perspective.[20]

### Rural Track Elective Program

In their fourth year, medical students may choose to complete a variety of required monthlong primary care or specialty electives developed and approved by the MUSOM's clinical departments at 1 of our 10 community-based rural clerkship sites. The Rural Track Elective Program provides students with an additional rural clinical experience at the end of their undergraduate medical training, which will help them explore and solidify their commitment to practicing rural medicine (Table 1). Community faculty provide summative assessments, but the assignment of grades and credit resides with the MUSOM and the clinical departments. Beginning with the graduating class of 2013, Rural Scholars will be required to take at least one rural fourth-year elective. The addition of this requirement aligns with studies demonstrating that longitudinal rural training experiences increase the likelihood of eventual rural practice.[3,9–11]

Pipeline programs like the MU-RTPP require a substantial investment by the medical school and other local institutions—in particular, the community-based faculty. Balancing that investment with results is important. We have tracked outcomes of our program and have enough data to compare outcomes of cohorts of students who have experienced different levels of exposure to the MU-RTPP with a control group of students who have not participated in any component of the MU-RTPP. The primary outcomes are graduates' specialty choice and first practice location, and a secondary outcome is the number of graduates staying in Missouri for residency.

## Method

We created three mutually exclusive cohorts of MU-RTPP students to help identify any potential dose–response associations. We defined Rural Scholars as students who were preadmitted to the MUSOM through the Dr. Lester R. Bryant Pre-Admissions Program. The first group of Rural Scholars was preadmitted in 1995 and graduated in 2002; we present data for graduation years 2002 through 2009. We defined RTC participants as any third-year medical student, excluding Rural Scholars, who completed one, two, or three core clinical clerkships at one of our rural training sites but took part in no other MU-RTPP components. Lastly, we defined Rural Track Clerkship Plus (RTC+) participants as any medical students, excluding Rural Scholars, who completed one, two, or three core clinical clerkships at one of our rural training sites through the RTC program, plus at least one additional component of the MU-RTPP (i.e., the Summer Community Program or the Rural Track Elective Program). The first group of students to participate in the RTC program completed their clerkships in 1995 and graduated in 1997; we present data for graduation years 1997 through 2009.

We tracked all participants of the MU-RTPP, maintaining a database of their postgraduate specialty training and their first, as well as subsequent, practice locations. We used information from the MUSOM Alumni Association database,



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the National Residency Match Program, and the American Board of Medical Specialties, as well as information gleaned from Internet searches and from personal correspondence with program participants, to populate our database. For graduates who certified in geriatrics, sports medicine, or adolescent medicine, we used their primary specialty. If we could not verify board certification using the American Board of Medical Specialties, we reported the participant's specialty as stated on the National Residency Match Program list. If a student had both a transitional year and another residency specialty listed on the match list, we used the residency specialty.

For a comparison group, we identified the cohort of students who did not participate in any part of the MU-RTPP (called nonparticipants). We were unable to obtain accurate first practice locations and fellowship training locations of nonparticipants.

We used first practice location (office address and county) to determine if a graduate was practicing in a rural county, based on the Rural–Urban Density Typology (RUDT).[21,22] The RUDT classification system uses the population density thresholds of the U.S. Census Bureau's classification system, the U.S. Office of Management and Budget's urban population nucleus requirements, and other criteria to classify counties as "rural," "mixed rural," "mixed urban," and "urban." We used the RUDT classification because it most accurately classifies rural counties for the purpose of our study and because it provides a standardized method of separating rural and urban counties. Because there is no single, universally accepted definition of rural, we also evaluated outcomes based on our previously used classification system, in which we defined rural as a town (a population of less than 50,000) at least 20 miles outside of a city (a population of 50,000 or more).

For all graduating classes since 1997, we calculated the percent of students matching into a primary care residency (family medicine, general internal medicine, general pediatrics, and internal medicine/pediatrics) or into other specialties. We also noted the location (in Missouri, out of state) of each graduate's residency program. We calculated relative risks (RRs) and 95% confidence intervals (95% CIs) comparing outcomes of Rural Scholars, RTC participants, and RTC+ participants with nonparticipants for matching in a primary care specialty, family medicine, and a residency program in Missouri. We calculated RRs and 95% CIs with the online calculator at StatPages.org.[23] The University of Missouri–Columbia health sciences institutional review board reviewed and approved this study.

Table 2

**Number of Lester R. Bryant Pre-Admissions (Rural Scholars*) and Non–Rural Scholar Participants† of the University of Missouri School of Medicine (MUSOM) Rural Track Pipeline Program (MU-RTPP) by Program Component, 1995–2009**

| Component | Rural Scholars, 1995–2009 | Non–Rural Scholar participants, 1995–2009 | Total, 1995–2009 |
|---|---|---|---|
| Summer Community Program | 84 | 212 | 296 |
| Rural Track Clerkship Program | 66 | 187 | 253 |
| Rural Track Elective Program | 4 | 47 | 51 |

* Rural Scholars indicates students who were accepted into the Lester R. Bryant Pre-Admissions Program.
† Non–Rural Scholar participants are any MUSOM student who participated in any component of MU-RTPP.

## Results

Since 1995, 344 (23%) of all MUSOM medical students, excluding Rural Scholars, have taken advantage of some component of the MU-RTPP. Since 1995, 109 Rural Scholars have participated in the MU-RTPP. Table 2 shows program participation numbers by component. Currently, 48 Rural Scholars are in the pipeline as medical students.

Table 3 shows match results for residency specialty choice and residency location of Rural Scholars since 2002. Rural Scholars, compared with nonparticipants, are as likely to match into a primary care specialty and more than twice as likely to match into family medicine. Table 4 shows the match results for residency specialty choice and residency location of RTC and RTC+ participants since 1997. Of note, RTC+ participants (who had at least one additional clinical experience with the MU-RTPP) chose family medicine at a rate substantially higher than the RTC participants (who participated only in the RTC program; RR = 1.63; 95% CI: 1.04, 2.58).

As of 2009, 20 Rural Scholars, 36 RTC participants, and 52 RTC+ participants had completed postgraduate training and started practice. As shown in Table 5, over half (57.4%) of the graduates from all three cohorts chose to practice in a rural or mixed rural county. Of the 20 Rural Scholars, 18 (90.0%) are practicing in Missouri. (When using our program's other accepted rural classification [town population of less than 50,000], the percentage of graduates practicing in rural areas is 43.5%.) We are not able to

Table 3

**Specialty Choice and Residency Location of Students at the University of Missouri School of Medicine (MUSOM) Who Participated in the Lester R. Bryant Pre-Admissions (Rural Scholars) Program, Compared With Nonparticipants, Who Graduated Between 2002 and 2009***

| Measure | No. (%) of 48 Rural Scholars | No. (%) of 506 nonparticipants | Relative risk (95% CI) |
|---|---|---|---|
| **Specialty choice** | | | |
| Primary care† | 22 (45.8) | 201 (39.7) | 1.15 (0.81–1.54) |
| Family medicine | 12 (25.0) | 48 (9.5) | 2.64 (1.48–4.44) |
| Total other specialty, not primary care | 26 (54.2) | 305 (60.3) | — |
| **Residency location** | | | |
| Missouri | 30 (62.5) | 185 (36.6) | 1.71 (1.30–2.10) |

* Rural Scholars indicates students accepted into the Lester R. Bryant Pre-Admissions Program. Nonparticipants indicates those students who did not participate in any component of the MUSOM Rural Track Pipeline Program.
† Primary care includes family medicine, general internal medicine, pediatrics, and internal medicine/pediatrics.



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Table 4

**Specialty Choice and Residency Location of Students at the University of Missouri School of Medicine (MUSOM) Who Participated in the Rural Track Clerkship (RTC) Program or the RTC Program Plus Other Rural Track Pipeline Program Components (RTC+), Compared With Nonparticipants, Who Graduated Between 1997 and 2009***

| Measure | No. (%) of 83 RTC participants | Relative risk (95% CI) | No. (%) of 75 RTC+ participants | Relative risk (95% CI) | No. (%) of 840 nonparticipants |
|---|---|---|---|---|---|
| **Specialty choice** | | | | | |
| Primary care† | 44 (53.0) | 1.35 (1.06–1.64) | 44 (58.7) | 1.49 (1.19–1.79) | 330 (39.3) |
| Family medicine | 21 (25.3) | 2.04 (1.34–3.02) | 31 (41.3) | 3.34 (2.39–4.50) | 104 (12.4) |
| Total other specialty, not primary care | 39 (47.0) | — | 31 (41.3) | — | 510 (60.7) |
| **Residency location** | | | | | |
| Missouri | 34 (40.9) | 1.04 (0.78–1.33) | 37 (49.3) | 1.25 (0.96–1.56) | 328 (39.0) |

* RTC participants indicates students (excluding Rural Scholars) who completed 1, 2, or 3 core clinical clerkships but did *not* participate in any other clinical component of the MUSOM Rural Track Pipeline Program (MU-RTPP). RTC+ participants indicates students (excluding Rural Scholars) who completed 1, 2, or 3 clinical clerkships in addition to one or more clinical components of the MU-RTPP. Nonparticipants indicates those students who did not participate in any component of the MU-RTPP.

† Primary care includes family medicine, general internal medicine, pediatrics, and internal medicine/pediatrics.

make practice comparisons with nonparticipants because their data are incomplete. A total of 13 MU-RTPP graduates are active, community-based faculty in one or more of the program components.

## Discussion and Conclusion

The MU-RTPP delivers, over the course of several years, a well-targeted sequence of interventions that are unique both for their duration and their position as an integral part of the medical curriculum at the MUSOM. In 2008, the Liaison Committee on Medical Education described the MU-RTPP in an unpublished report as follows:

> The Rural Track program provides students with excellent opportunities for education in rural communities. It is a highly sought after experience for students that has enhanced the collaboration between the school and rural communities, AHEC, and local health care providers. In addition to offering unique learning experiences, it is designed to help address the state's physician workforce needs in rural areas.

Several other medical schools across the country have rural track training programs.[9,24,25] Our program differs from many in the length of our pipeline, which stretches from preadmitting qualified college students into MUSOM, to exposing them early to rural practice, and culminating in providing clinical training experiences in rural, underserved communities. Our "self-renewing pipeline" loop is completed when our graduates then serve as rural, community-based faculty for subsequent medical students participating in MU-RTPP components.

Rural Scholars are more likely to stay in Missouri for residency compared with nonparticipants. Missouri has Accreditation Council of Graduate Medical Education–approved residencies in only two non-major-metropolitan areas, one being at the MUSOM. Because graduates tend to select practices near their residency,[26,27] we believe that retaining graduates for residency in Missouri will help us produce more Missouri rural physicians.

Even though our program was not designed to focus exclusively on primary care (or, in particular, family medicine), it is a common measure used to gauge success of rural training programs because students raised in rural areas who choose family medicine are more likely to practice in a rural setting.[25] Our outcomes demonstrate that MU-RTPP participants are between 2 and 3.3 times as likely to match into a family medicine program compared with nonparticipants. Other programs, such as the Rural Physician Associate Program and the Rural Medical Education Program, have demonstrated higher rates of rural program graduates entering family medicine: 68%[9] and 62%,[24] respectively. We recognize the need to produce generalist physicians for the rural and underserved areas of the state, regardless of whether they are traditional primary care physicians, general surgeons, general radiologists, or general ophthalmologists. We did not design the MU-RTPP to focus specifically on primary care or family medicine, perhaps accounting for our lower numbers. If we narrowed our focus, we might anticipate that, overall, the number of graduates choosing primary care specialties would increase. Our study does indicate that multiple, rural clinical experiences are associated with higher rates of students entering family medicine. Unfortunately, the lack of practice location data for nonparticipants, and the relatively small number of MU-RTPP graduates (comprising Rural Scholars, RTC participants, and RTC+ participants) to date limit our ability to test for a dose–response relationship with first practice location. However, because family medicine is the most common specialty in rural practice, we believe this finding supports the validity of our design: More episodes of rural-based training, at various stages in medical school, can increase the number of physicians in rural practice.

A recent systematic review demonstrated that the number of graduates from six well-established rural track training programs who practice in rural areas ranged from 53% to 64%.[3] These data, compared with the national average of 9% of physicians who practice in rural



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Table 5

**First Practice Setting of Students at the University of Missouri School of Medicine (MUSOM) Who Participated in the Lester R. Bryant Pre-Admissions (Rural Scholars) Program, the Rural Track Clerkship (RTC) Program, or the RTC Plus Other Rural Track Pipeline Program Components (RTC+) Who Graduated Between 1997 and 2006***

| RUDT[†] classification | Rural Scholars 2002–2006 | | | RTC Participants 1997–2006 | | | RTC+ Participants 1997–2006 | | | Total 1997–2006 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. (%) of students | Location of practice | | No. (%) of students | Location of practice | | No. (%) of students | Location of practice | | No. (%) of students | Location of practice | |
| | | Missouri | Out of state | | Missouri | Out of state | | Missouri | Out of state | | Missouri | Out of state |
| Rural and mixed rural: no. (%) | 10 (50.0) | 8 (40.0) | 2 (10.0) | 23 (63.9) | 14 (38.9) | 9 (25.0) | 29 (55.8) | 24 (46.2) | 5 (9.6) | 62 (57.4) | 46 (42.6) | 16 (14.8) |
| Mixed urban and urban: no. (%) | 10 (50.0) | 10 (50.0) | 0 | 13 (36.1) | 5 (13.9) | 8 (22.2) | 23 (44.2) | 9 (17.3) | 14 (26.9) | 46 (42.6) | 24 (22.2) | 22 (20.4) |
| Total: no. (%) | 20 (100) | 18 (90.0) | 2 (10.0) | 36 (100) | 19 (52.8) | 17 (47.2) | 52 (100) | 33 (63.5) | 19 (36.5) | 108 (100) | 70 (64.8) | 38 (35.2) |

* Rural Scholars indicates students who were accepted into the Lester R. Bryant Pre-Admissions Program. RTC participants indicates students (excluding Rural Scholars) who completed 1, 2, or 3 core clinical clerkships but did *not* participate in any other clinical component of the MUSOM Rural Track Pipeline Program (MU-RTPP). RTC+ participants indicates students (excluding Rural Scholars) who completed 1, 2, or 3 clinical clerkships in addition to one or more clinical components of the MU-RTPP. Practice information was not available for 20 students (7 Rural Scholars and 13 Rural Track Clerkship participants) who are still completing a residency or a fellowship program, are in the military, or are practicing out of the country. Data regarding these students are presented in Table 3 or 4 but are not included here.

† Rural–Urban Density Typology (RUDT)[21] identifies rural and urban counties based on the percent of the population that is rural or urban, the population in urban areas, and population density. Counties are classified rural, mixed rural, mixed urban, and urban.

areas, indicate the success of such programs. Our outcomes (57% of MU-RTPP graduates were practicing in rural areas) were similar to those demonstrated by the systematic review.

Our study has several limitations. We are unable to control for selection bias, as Rural Scholars and other MU-RTPP participants selected our program. Our study is also limited by the small number of Rural Scholar graduates. In addition, the MUSOM does not have complete data on the practice locations of nonparticipants. Knowing whether our MU-RTPP graduates locate in rural communities at a higher rate compared with nonparticipants would help us both gauge the overall success of the program and allow for comparisons with other published outcomes. We hope to work with the MUSOM alumni office to improve tracking of all graduates. We plan future studies on the influence of the MU-RTPP on the practice locations of participants compared with nonparticipants, and on the retention of participants practicing in rural areas.

We are committed to quality improvement and have continued to modify and update our program as new information and resources become available, paying particular attention to incorporating factors that increase physician retention in rural communities. Selecting appropriate students for the Rural Scholars Program is central to the goal that our program graduates select rural practice locations. We have modified our selection criteria, retreats, and support system to improve the selection and success of participants. The rate of attrition of Rural Scholars is higher than that of traditional students, so we will require Rural Scholars to take the MCAT, starting with the entering class of 2014. The MUSOM uses MCAT scores as a baseline measure to predict academic difficulty in the first and second years of medical school. Examining these scores will help us target early interventions as necessary. The Pre-Professional Scholars Program Committee will review students who do not receive the minimum MCAT score (set by the MUSOM) and may recommend that they be dismissed from the program prior to matriculation; however, we assess students holistically before making any such decisions. We have also found that the higher attrition



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rate for Rural Scholars is not always attributed to academics. Sometimes students decide not to pursue a career in medicine at all, or they face personal or family issues that interfere with completion of the program. Student selection precedes clinical practice by a minimum of a decade, a delay that limits our ability to estimate the benefits of our recent interventions at this time.

We have also tried to increase the students' interaction in rural communities by increasing the minimum number of clerkships from one to two, and by giving priority to those who take three. In addition, we have added CIP as an optional experience for RTC participants to increase community integration. Finally, we have begun to require the fourth-year elective requirement for Rural Scholars.

Although not directly part of the MU-RTPP curriculum, we have supported MAHEC's additional education programs (e.g., AHEC Career Enhancement Scholars, which help high school students learn about health careers). We have also added a noncurricular program called the Missouri Physician Placement Service, which helps place physicians in rural communities.

The Association of American Medical Colleges supports a 30% increase in U.S. medical school enrollment by 2015, but it has emphasized that this increase alone will not necessarily increase the supply of rural physicians because less than 3% of matriculating medical students report plans to work in small towns or rural areas.[28] Targeted rural track training programs can increase the supply and retention of rural physicians[3] and should be part of any recommendation or policy about physician supply.

Implementation efforts to increase the supply of rural physicians are necessary in most U.S. medical schools. A relatively minor change in the admissions process is probably easy to implement. Simply asking students during admission interviews about their intentions for practice could increase the number of those admitted who eventually practice in rural areas. Students who grow up in a rural area and communicate a desire to return to a rural area at the time of admission are more likely to choose a primary care specialty and eventual rural practice.[14,17] Other efforts to increase the rural physician workforce may be more challenging, yet they are necessary to improve access to quality health care. For example, curriculum changes can help students obtain more exposure to rural medicine. This increased exposure will improve preparedness for living and working in a rural area, especially for students with urban backgrounds.[29] Finally, medical schools can work to increase students' perceptions of the value of rural primary care medicine.[15]

In summary, the MUSOM has created a unique, comprehensive, and longitudinal program that successfully identifies and preadmits students with rural backgrounds and an interest in rural medicine. We believe that the specific strengths of the MU-RTPP include a longitudinal focus with multiple opportunities for learning clinical medicine in rural areas, location in the Office of Medical Education (instead of an academic department), and broad support for students to consider a variety of specialties for rural practice. Even without focusing on primary care, participation in the MU-RTPP is associated with more students entering a primary care residency, in particular family medicine. Notably, we found that multiple rural training experiences increase selection of primary care even further. These findings have important implications for the design of rural training programs and access to health care for rural populations.

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*Acknowledgments:* The authors would like to acknowledge Mary Lou Cole, MAE , instructional design specialist, University of Missouri School of Medicine, Columbia, Missouri, for reviewing years of residency data, and Nancy Franklin, coordinator, Area Health Education Center, Rural Track Pipeline Program, Department of Rural Health Programs, University of Missouri School of Medicine, Columbia, Missouri, for maintaining the data and creating tables. Their efforts, patience, and expertise were integral while conducting this study.

*Funding/Support:* The Health Resources and Services Administration (HRSA) provides a Model State–Supported Area Health Education Centers grant (U77HP01069-07-01) to Curators of University of Missouri–Columbia, Missouri, and the Missouri Foundation for Health provided a Missouri Physicians for Rural Missouri: A Self-Renewing Pipeline grant (03-0435-ADP-04) to Curators of University of Missouri–Columbia, Missouri, 2004–2008.

*Other disclosures:* None.

*Ethical approval:* The University of Missouri–Columbia Health Sciences institutional review board approved this study.

*Previous presentations:* The authors have previously presented some information from this report:

- University of Missouri–School of Medicine Rural Track Pipeline Program: A self-renewing pipeline for rural training, practice placement, and retention. Paper presented at: Central Group on Educational Affairs, Association of American Medical Colleges Spring Conference; April 2010; Chicago, Illinois.
- MU Rural Track Pipeline Program. Poster presented at: 35th Annual Society of Teachers of Family Medicine Predoctoral Education Conference; January 2009; Savannah, Georgia.
- Influencing residency choice and practice location through longitudinal rural clinical experiences. Poster presented at: National Area Health Education Centers Annual Conference; June 2008; Denver, Colorado.
- Influencing residency choice and practice location through longitudinal rural clinical experiences. Paper presented at: Fourth Annual Association of American Medical College Physician Workforce Research Conference; April 2008; Crystal City, Virginia.
- Influencing residency choice through rural clinical experiences. Paper presented at: National Rural Health Association Annual Conference; June 2006; Reno, Nevada.



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