From Infancy to Adolescence: The Kansas University School of Medicine–Salina: A Rural Medical Campus Story
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Abstract
The University of Kansas School of Medicine established a rural regional campus in Salina, Kansas, in 2011. The creation of a four-year medical campus of only 32 total students in a town of less than 50,000 inhabitants appeared to contradict all previous practices where medical schools have been situated in large metropolitan cities with student bodies frequently in the hundreds. The rationale to open the Salina campus was to attract medical students with a desire to train in a rural environment, hoping that many would eventually elect to practice primary care in rural Kansas. The authors evaluated the admission demographics, academic performance, campus satisfaction, and graduate medical education choices of students at Kansas University School of Medicine–Salina (KUSM-S) during its first four years of existence. To date, the Salina campus has succeeded in its mission to train students from rural communities in a rural environment to eventually become rural-based physicians. KUSM-S students have adjusted well to the rigors of medical school, have shown steady improvement in academic performance as measured by United States Medical Licensing Examination scores, and have been overwhelmingly positive about the Salina medical education program. The initial cohort of students has now successfully graduated and secured residency training positions, and most KUSM-S graduates are either continuing their training in primary care in Kansas or intend to return to Kansas to practice following residency training.

In July 2011, Kansas University School of Medicine (KUSM) opened a four-year rural regional medical campus (RMC) in Salina, a community of nearly 50,000 inhabitants in the predominately agricultural region of north central Kansas. The Salina RMC (eight medical students in each class) was established in response to the undersupply and poor distribution of physicians in Kansas, especially in primary care, reported in recent literature.1,2 The creation of the Salina campus addressed several recommendations of these reports: to increase the class size at medical schools that train rural physicians—in our case, KUSM; increase the number of medical students more likely to choose primary care, rural practice, and care of the underserved; and train medical students in rural areas.

The founding mission of KUSM–Salina (KUSM-S) was simple: to educate medical students in a rural environment, hoping that many graduates would eventually choose to practice in rural Kansas. Developing a medical school rural program is not novel to Kansas. In 2008, Rabinowitz et al3 identified six rural medical school programs in the United States and concluded that they produced a multifold increase in the rural physician supply; 26% to 92% of rural program graduates eventually practiced in rural communities compared with the 3% rate of students in nonrural programs. Of these described, none are located in Kansas. The authors argued that although small medical school rural programs might not substantially increase the absolute number of physicians trained, the impact of such programs producing a small number of physicians for rural areas cannot be overlooked; that is, adding one physician in a small rural community can have a dramatic impact on access to care for residents of these communities.3

Recently, Wendling and coauthors4 published their analysis of 30 years of outcomes from the Michigan State University College of Human Medicine Rural Physician Program. Features of the program included targeting rurally interested students, focusing on primary care, and providing substantial clinical training within a rural region. They found that the characteristic having the greatest benefit in fostering rural physician careers was location of the program in a rural region.4

The Salina RMC complements the urban main medical school campus in Kansas City, Kansas, and the urban RMC in Wichita, Kansas. With a total of 32 students across all four years, KUSM-S is the smallest four-year medical school campus in North America, and Salina is the smallest community in North America to host a full four-year allopathic medical school.5,6 The Salina campus was established without additional state funding, yet has remained financially stable because of low direct budgetary needs (yearly operating expense of $1.36 million), while sharing resources with the other KUSM campuses and, most important, receiving significant support from the local community health center.

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and other community institutions and individuals. The Salina campus does not have foundational science research facilities, but early in their first year Salina students are informed of opportunities and encouraged to engage in clinical and medical education research activities. All Salina students are exposed to research methods, health systems, and quality improvement initiatives in a required Population Health in Practice course, and to a variety of ethical topics during the required Issues in Clinical Medicine course. Although KUSM-S does not directly provide clinical services, students participate in the care of patients in private practice settings, a Federally Qualified Health Center (Smoky Hill Family Healthcare Center), and a regional hospital (Salina Regional Health Care Center).

Foundational science lectures in years 1 and 2 are predominately delivered to Salina students from Kansas City via live, interactive television and are also available as podcasts. All of the remaining educational content integral to lectures, such as small-group discussions, problem-based learning sessions, histopathology labs, gross anatomy labs, simulation exercises, and clinical skills labs, are conducted locally, facilitated by Salina faculty members. Required clinical clerkships and a wide variety of clinical electives are also provided locally. KUSM-S students typically work one-on-one with local clinical faculty during their clerkship experiences. The KUSM-S Faculty comprises a small group of KUSM-funded physicians (1 full-time and 22 part-time), 1 PhD-level foundational scientist, and a large group of physicians with volunteer appointments. Salina is also home to Smoky Hill Family Medicine Residency Program, and medical students work with residents on many of their clinical rotations.

The development of the Salina campus and required student support services has been previously described.7,8 Now that KUSM-S has graduated its first class of medical students (Class of 2015), it is timely to review the characteristics of the students who chose to attend this campus, how they performed, and their plans following graduation.

KUSM-S Student Demographics on Matriculation

A total of 824 students were admitted to all three campuses of KUSM for academic years (AYs) 2011 through 2014 (191 students in AY 2011 and 211 students in each of the three subsequent years). During this four-year span, 32 students were assigned to the rural Salina campus, 92 to the Wichita campus, and 700 to the main campus in Kansas City, Kansas. Students rank their campus choices, and KUSM attempts to fulfill that wish. Although qualified rural candidates are encouraged to consider the Salina campus, prospective KUSM-S students are neither required to be from a rural community nor required to commit to a primary care specialty or rural practice setting. During the first week on campus, Salina students are queried as to future career plans, and have universally voiced a desire to eventually practice family medicine in rural communities similar to their hometowns, a sentiment significantly related to future rural practice.9

Twenty-six of the 32 students (81%) to matriculate on the Salina campus from 2011 to 2014 were residents of Kansas, comparable to the 82% (650 of 792) of the students attending the Kansas City and Wichita campuses during this same four-year period. Twenty-three (72%) of the Salina students were from rural (nonurban) communities, as defined by the U.S. Census Bureau.10 In contrast, 25% (164 of 650) of the Kansas residents attending medical school on the Kansas City and Wichita campuses were from nonurban communities.

The mean undergraduate science GPA for all matriculants to U.S. allopathic medical schools from 2011–2014 was 3.63.11 The mean undergraduate science GPA of KUSM-S students was 3.62 (SD = 0.29). To compare the performance of Salina students on nationally administered standardized exams with national data and between different standardized exams (i.e., Medical College Admission Test [MCAT] and United States Medical Licensing Examination [USMLE] Step 1 and 2 Clinical Knowledge [CK] exams), the most recent total MCAT scores were converted to T scores (national mean = 50, standard deviation = 10) using the national cohort results based on when each student completed the exam.11 Because Step 1 and Step 2 CK raw scores are not directly comparable, as stated by the USMLE,12 these scores were also converted to T scores so they can be directly compared with each other and with the MCAT T scores. The MCAT T score for all Salina students starting their medical education between 2011 and 2014 was significantly lower (P < .05) than the average for all U.S. allopathic medical school matriculants and significantly lower than the T score for Kansas City students (Table 1).

A major pipeline for the Salina RMC is the Scholars in Rural Health program which encourages undergraduate students from rural Kansas to pursue careers in medicine and eventually practice in rural areas.13 Applying during their second semester of the sophomore year in college, up to 16 participants per year are assured of admission to KUSM on successful completion of program requirements. Between 2011 and 2014 there were 53 graduates of this program, of which 9 chose the Salina campus.

The Kansas Medical Student (KMS) loan program also promotes practice in rural and/or underserved Kansas. Students in this program receive loans from the state of Kansas covering the full cost of medical school tuition and providing students a monthly living stipend. Thirty KMS loans are offered to KUSM students each year (120 for the period 2011–2014). The total value of the loan taken over four years is approximately $200,000. The loan is forgiven if, after completion of residency training, the physician establishes a practice in primary care in rural and/or underserved Kansas. For each year of service in a qualifying community, one year of loan is forgiven. Nineteen of the 32 (59%) Salina students accepted KMS loans to finance all or part of their medical school education.

Performance in Medical School

All 8 of the first class of Salina medical students (Class of 2015) graduated in May 2015. One of the first 32 Salina students resigned from medical school. Twenty-two Salina students (Classes of 2015, 2016, and 2017) have taken the USMLE Step 1 exam, and all passed on their first attempt. Sixteen students participated in a KUSM-sponsored Step 1 prep course, while the remaining 6 studied independently. Step 1 scores were converted to T scores, analogous to the MCAT score conversions, using the national cohort data that
**Table 1**

Comparison of MCAT and United States Medical Licensing Examination Step 1 and Step 2 CK T Scores Across the Three Kansas University School of Medicine Campuses, 2011–2014

| T Score                  | Kansas City | Salina | Wichita | Total |
|-------------------------|-------------|--------|---------|-------|
|                         | No. | Mean (SD) | No. | Mean (SD) | No. | Mean (SD) | No. | Mean (SD) |
| **For those who completed the MCAT and Step 1** |       |         |        |        |       |         |       |         |
| MCAT total              | 500  | 44.57 (8.82) | 22   | 39.72 (8.32) | 64   | 42.67 (7.64) | 586  | 44.18 (8.74) |
| Step 1                  | 500  | 48.44 (9.31) | 22   | 45.51 (8.05) | 64   | 47.60 (8.23) | 586  | 48.24 (9.16) |
| **For those who completed both Step 1 and Step 2 CK** |       |         |        |        |       |         |       |         |
| Step 1                  | 224  | 49.18 (8.85) | 16   | 47.51 (8.39) | 110  | 47.96 (8.27) | 350  | 48.71 (9.29) |
| Step 2 CK              | 224  | 50.23 (10.79) | 16   | 51.39 (7.49) | 110  | 49.27 (8.36) | 350  | 49.87 (9.94) |

Abbreviations: MCAT indicates Medical College Admission Test; CK, Clinical Knowledge.

*National mean score = 50, SD nationally = 10. Salina MCAT total T score was significantly lower than the Kansas City MCAT total T score (39.72 < 44.57; $P < .05$).

Sample size increases for Step 2 CK on the Wichita campus because after taking Step 1 approximately 50 Kansas City students each year complete their clinical years on the Wichita campus.

**Correspondence to the Time Each Student Completed Their Initial Step 1 Exam.**

All campuses demonstrated significantly improved Step 1 performance above that expected from their MCAT scores alone (all paired $t$ test $t$ values > 3.04; all $P$ values < .05) (Table 1). Overall, KUSM students improved their Step 1 performance by 9% above that expected from their MCAT scores alone; Kansas City improved 9%, Wichita improved 11%, and Salina improved 15%. No significant campus differences emerged for Step 1 T scores.

All members of the KUSM-S Classes of 2015 and 2016 passed the USMLE Step 2 CK and Clinical Skills (CS) exams on their first attempt. All campuses demonstrated significantly improved Step 2 CK performance above that expected from their Step 1 scores alone (all paired $t$ test $t$ values > 2.03; all $P$ values < .05) (Table 1). Although the mean differences were statistically significant, the effect sizes associated with the differences were generally small (i.e., < 0.17), except for the Salina campus, which had an effect size of 0.49 which approached meaningfulness (i.e., effect size of 0.50 or more). Overall, KUSM students improved their Step 2 CK performance by 2% above that expected from their Step 1 scores alone; Kansas City improved 2%, Wichita improved 3%, and Salina improved 8%. No significant campus differences emerged for Step 2 CK T scores.

**Student Satisfaction**

At the end of each academic year, all KUSM students complete a survey inquiring about their general satisfaction with the medical school experience and specifically about the learning environment (Table 2). Response rates for these annual surveys range from 46% to 82%, with an average of 63%. Overall student satisfaction across campuses was high, as suggested by the majority of respondents (i.e., 86% or more) agreeing that KUSM provided them a supportive learning environment, and at least 78% agreeing that they would recommend KUSM to other students. It should be noted that across all four years, 100% of the Salina campus respondents indicated that they would recommend KUSM to others. Proportional analyses revealed that this was significantly larger than the 86% and 90% recommendations for Kansas City and Wichita respondents, respectively (both $z$ values > 2.49; both $P$ values < .05).

**Upon Graduation**

Salina students are encouraged to pursue residency training in the discipline of their own choosing. They are not required to choose a primary care residency. All 8 members of the KUSM-S Class of 2015 participated in the National Resident Matching Program (the Match) and secured residencies in the discipline of their choice: 3 in family medicine, 1 in internal medicine, 2 in pediatrics, 1 in obstetrics–gynecology, and 1 in pathology. Although 75% (6 of 8) of KUSM-S Class of 2015 graduates entered primary care residencies compared with 47% (81 of 172) of the graduates participating in the Match on the Kansas City and Wichita campuses, the difference was not significantly different ($z = 1.54, P = .12$). All of the KUSM-S graduates voiced a desire to stay in Kansas or return to Kansas to practice after completing residency.

Student medical school indebtedness has become an alarming problem, and higher debt levels may dissuade students from pursuing a career in primary care. Although 75% (6 of 8) of KUSM-S Class of 2015 graduates entered primary care residencies compared with 47% (81 of 172) of the graduates participating in the Match on the Kansas City and Wichita campuses, the difference was not significantly different ($z = 1.54, P = .12$). All of the KUSM-S graduates voiced a desire to stay in Kansas or return to Kansas to practice after completing residency.

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Table 2
Cumulative Data From Annual Surveys Regarding General Satisfaction and Learning Environment Issues for All Three Kansas University School of Medicine Campuses, 2011–2015

| Item                          | Year | No. (%): Kansas City | No. (%): Salina | No. (%): Wichita | Campus differences |
|------------------------------|------|----------------------|-----------------|------------------|-------------------|
| Supportive learning         | 1    | 421 (96)             | 24 (96)         | 59 (98)          | —                 |
|                              | 2    | 281 (92)             | 17 (94)         | 36 (94)          |                   |
|                              | 3    | 306 (86)             | 12 (100)        | 139 (92)         |                   |
|                              | 4    | 234 (86)             | 4 (100)         | 122 (83)         | KC < W            |
| Total                        |      | 1,242 (91)           | 57 (97)         | 356 (94)         |                   |
| Recommend school to other students | 1   | 421 (93)             | 24 (100)        | 59 (97)          | —                 |
|                              | 2    | 280 (86)             | 17 (100)        | 36 (89)          |                   |
|                              | 3    | 303 (83)             | 12 (100)        | 139 (90)         |                   |
|                              | 4    | 235 (78)             | 4 (100)         | 122 (86)         |                   |
| Total                        |      | 1,239 (86)           | 57 (100)        | 356 (90)         | KC, W < S         |
| Student diversity           | 1    | 197 (77)             | 13 (52)         | 36 (92)          | KC < W            |
|                              | 2    | 169 (76)             | 11 (82)         | 28 (82)          |                   |
|                              | 3    | 179 (70)             | 10 (70)         | 85 (74)          |                   |
|                              | 4    | 146 (63)             | 4 (75)          | 67 (84)          | KC < W            |
| Total                        |      | 685 (72)             | 38 (82)         | 216 (81)         | KC < W            |
| Opportunities for interprofessional learning | 1   | 197 (52)             | 13 (54)         | 35 (66)          | —                 |
|                              | 2    | 167 (78)             | 10 (40)         | 29 (72)          | KC < W            |
|                              | 3    | 90 (77)              | 6 (83)          | 35 (69)          |                   |
|                              | 4    | 57 (70)              | 4 (75)          | 34 (56)          |                   |
| Total                        |      | 511 (57)             | 33 (58)         | 133 (65)         | —                 |

Abbreviations: KC indicates Kansas City; W, Wichita; S, Salina.
*No. indicates number of students completing a specific year of medical school who responded to the survey (in Salina, a total of 32 students completed year 1, 23 completed year 2, 16 completed year 3, and 8 completed year 4); %, percentage of respondents who agreed with statement.
*Using proportional analyses, campuses listed were significantly different from each other at the .05 level. Because of sample size variances between the campuses, some differences may appear to be large enough to be significant (e.g., student diversity), but do not reach the .05 level.

from the initial day of disbursement of funds.

The mean yearly scholarship award to non-KMS recipients in the first four classes was $13,518 (SD = $6,165), potentially reducing graduation debt by approximately $50,000 for students receiving scholarship support for a full four years. For the first two KUSM-S graduating classes, the average debt of borrowers was $110,930, and the average debt for all 16 students was $97,063. For all KUSM graduates who borrowed money during medical school, the average debt was $155,241, while the average debt for all 2015 KUSM graduates, whether they borrowed money or not, was $133,884. Although not yet calculated, the average debt for all 2016 KUSM graduates is predicted to be similar.

Discussion
The Salina RMC matriculants to date were predominately from rural Kansas, and multiple studies have found that physicians that are raised in rural communities are more likely to practice in rural communities.20-23 Additionally, nearly one-third were graduates of the rural pipeline program (Scholars in Rural Health) designed to encourage talented college students from rural Kansas communities to attend medical school. Given their rural upbringing and interest in attending KUSM’s rural RMC, it is not surprising that nearly 60% of KUSM-S students elected to participate in the KMS loan program. This program serves two purposes: It limits medical school education indebtedness, and it requires recipient physicians to practice primary care in rural and/or underserved communities in Kansas or repay the loan.

Salina students tended to score lower on the MCAT compared with matriculants on the Kansas City campus, and scored a full standard deviation below the national mean for all accepted students. MCAT performance has been widely used as one factor for selecting medical students in the United States and Canada and has been cited as a predictor of success in medical school and performance on licensing exams.24-27 A study by Callahan et al28 confirmed the predictive validity of three versions of the MCAT in relation to students’ performance in medical school, the first year of residency, and scores on licensing exams. Interestingly, they found a steady decline throughout their study period in the MCAT’s capacity to predict students’ performance on USMLE Step 2. On the basis of MCAT scores, it would appear that Salina students might be less well prepared to undertake the academic demands of a medical school education and would score lower on the USMLE Step 1 exam than many students matriculating at other U.S. medical school campuses. One could question the wisdom of enrolling these students on a new rural RMC without easy access to foundational science faculty and the array of support services traditionally found on a large metropolitan campus. However, KUSM-S students scored higher on USMLE Step 1 than predicted by their prematriculation MCAT T score, suggesting that in our cohort of students the MCAT was not a true reflection of their academic abilities and/or that KUSM fostered success on Step 1 through question groups, Step prep courses, teaching to the test, and faculty engagement with struggling students. Although the MCAT may test the cognitive intelligence of the medical school candidate and may predict medical school performance, it is imperfect in determining which students will eventually succeed in medicine, as it ignores such factors as emotional intelligence and caring capabilities.29,30 As Koenig et al9 have suggested, there are other measures of success in the medical profession, including integrity, interpersonal skills,
KUSM-S student performance on the USMLE Step 2 exam was even more laudable, whereby students improved their scores 8% above that predicted by their Step 1 scores. It is doubtful that this improvement is the result of better physician teachers in Salina. KUSM-S faculty members are talented physicians but typically have participated in fewer formal faculty development activities than their peers on the main campus. Salina students also receive considerably fewer formal clinical lectures than the students on the main campus and therefore must actively discover core learning objectives and research these on their own. Factors possibly contributing to a strong performance on the Step 2 exam include the wide variety of clinical experiences KUSM-S students encountered in their clinical clerkships in the busy community hospital in Salina, the increased responsibilities given medical students working one-on-one with their attending physician—requiring more active learning—and the mentoring by physicians on these clinical services.

Securing a residency program position in the United States has become increasingly more competitive.32 A very important determinant in measuring the success of a medical school campus is successfully matching all of its graduates in residency programs in the discipline of the graduates' choosing. All KUSM-S graduates of the Class of 2015 matched for residency slots. Six of the eight students chose residencies in primary care (family medicine, pediatrics, and internal medicine). Four of the eight graduates matched at residency programs in Kansas, and two of the four who matched at out-of-state programs must return to Kansas to practice to fulfill their KMS loan forgiveness obligations.

The majority of Salina campus students are from rural communities and are satisfied with their educational experience at the Salina RMC. They are far more likely to participate in the KMS loan program, thereby reducing their medical school indebtedness and committing them to eventually practicing in a primary care discipline in rural Kansas. Many KUSM-S students underperformed, compared with the national average, on the MCAT, and may not have been considered for admission to many allopathic medical schools in the United States, yet have performed well on nationally administered licensing examinations—evidence that a rural RMC can adequately prepare students for this measureable indicator of success. Finally, the majority of our graduates are headed into primary care residencies and remain committed to eventually practicing in rural Kansas. It should be noted that the relatively small sample size for the Salina campus limits the interpretation of some of our findings. As more data accumulate over time, results will become more reliable and generalizable. KUSM-S will continue to track graduating students to determine if they actually end up practicing in rural communities.

In their previously cited report, Rabinowitz et al3 called for a widespread replication of rural medical school programs to increase the rural physician supply. KUSM heeded the call. The four-year Salina RMC was developed without additional state funding, operates on a lean budget, provides an excellent learning environment, facilitates student success, and graduates physicians ready for residency. Our RMC students have performed at the same level and competed for residency positions compared with students on large metropolitan campuses. Other regions plagued by similar challenges with physician undersupply and poor access to primary care (family medicine, pediatrics, and internal medicine). Four of the eight graduates matched at residency programs in Kansas, and two of the four who matched at out-of-state programs must return to Kansas to practice to fulfill their KMS loan forgiveness obligations.

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