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Uncovering the Overlap of Global and Domestic Rural Surgery for Medical Trainees



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Introduction: Medical trainees who participate in global rotations demonstrate improved cultural sensitivity, increased involvement in humanitarian efforts, and ability to adapt to limited resources. The global coronavirus pandemic halted global rotations for medical trainees. Domestic rural surgery (DRS) may offer a unique alternative. We aimed to understand medical students' perceptions of the similarities and differences between global surgery and DRS and how students' priorities impact career choices.

Methods: An electronic survey was administered at eleven medical training institutions in Indiana, Illinois, and Michigan in spring 2021. Mixed methods analysis was performed for students who reported an interest in global surgery. Quantitative analysis was completed using Stata 16.1.

Results: Of the 697 medical student respondents, 202 were interested in global surgery. Of those, only 18.3% were also interested in DRS. Students interested in DRS had more rural exposures. Rural exposures associated with DRS interest were pre-clinical courses ($P = 0.002$), clinical rotations ($P = 0.045$), and rural health interest groups ($P < 0.001$). Students interested in DRS and those unsure were less likely to prioritize careers involving teaching or research, program prestige, perceived career advancement, and well-equipped facilities. The students who were unsure were willing to utilize DRS exposures.

Conclusions: Students interested in global surgery express a desire to practice in low-resource settings. Increased DRS exposures may help students to understand the overlap between global surgery and DRS when it comes to working with limited resources, achieving work-life balance and practice location.

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Introduction

Medical trainee participation in global surgical rotations has many benefits. While expanding medical knowledge and skills, it also develops cross-cultural competency. Through participation in humanitarian efforts and a commitment to the underserved, it increases one's concept of social responsibility and volunteerism.¹⁻⁶ Global rotations provide broad exposure to advanced pathology and a variety of common surgical procedures.^{1-4,6} These rotations can facilitate development of cultural sensitivity and foster creative care, which leads to decreased attrition and increased grit.¹⁻⁴ These skills can be used in global settings and adapted for the underserved in high-income countries and transferred to resource-limited domestic medical environments.^{1-3,5-7} Due to the global COVID-19 pandemic, global rotations were halted with limited alternative options to cultivate these skills.

Although global surgery is used to describe equitable surgical care across international health systems, the term often explicitly focuses on low- and middle-income countries (LMICs). However, a recent trend has emerged to transition the term global surgery to also include local domestic surgery and develop a framework to provide equitable access to surgery globally.⁸ Specifically, rural surgery in the United States, or domestic rural surgery (DRS), may help develop similar trainee qualities inherent in surgical rotations in LMICs. DRS and surgery in LMICs share many characteristics that create similar learning environments. Much like surgery in LMICs, DRS encourages humanitarianism and commitment to communities in need, as rural communities tend to have lower health literacy, are often less insured, and have decreased disposable finances.^{1,2,6,9} Variations in population size affect community interactions and culture; as such, rural surgeons must adapt to fully understand and better care for patients within their own cultural context.² In addition, domestic rural surgeons require a broader base of skills than their peri-urban counterparts because of limited subspecialty providers in rural settings.¹⁰⁻¹² Hospitals in rural areas face systemic challenges and resource constraints similar to hospitals in international settings, such as difficulty in recruiting doctors.¹³⁻¹⁶ Only 12% of general surgeons in the United States practice in rural areas where 20% of the population lives.^{17,18} Introducing medical students to DRS may not only fill the training gap caused by limited international surgery rotations due to the pandemic but may also help address the well-documented domestic rural health crisis by enticing more medical trainees to enter the rural workforce.¹³⁻¹⁶

The primary aim of this study was to understand if students interested in global surgery, defined by the students primarily as surgery in LMICs, might also be interested in DRS based on preferences and priorities. The secondary aim was to understand if any educational interventions could facilitate expansion of interest in DRS. To accomplish this goal, medical students from 11 medical schools in the Midwest were surveyed with the assumption that mid-western students were more likely to remain in the region and serve its rural communities.¹⁹

Methods

Instrument development

The team developed a survey instrument based on review of existing literature involving student surveys of domestic rural healthcare and surgery. Experts at Indiana University School of Medicine assisted with survey design and ensured clarity of questions. Survey questions focused on information about demographics, understanding of rural healthcare, and interests within medicine, including global surgery and residency/career priorities. Four free-response questions were included in the survey; these questions focused on the definition, benefits, and challenges of DRS, as well as the similarities between DRS and global surgery.

The survey was initially piloted with 24 students from Indiana University School of Medicine. Feedback on question clarity and wording was used to refine the study survey prior to official survey dissemination. Responses collected during this initial pilot period were also included in final data analysis.

Ethics

This study was approved by the Indiana University Institutional Review Board (#10053). Additional institution-specific reviews of the survey project were addressed on a case-by-case basis, and approval from the department of student affairs was obtained at each institution prior to data collection. Students reviewed the informed consent prior to viewing questions on Research Electronic Data Capture.^{20,21}

Enrollment

Eighteen graduate medical training institutions in Indiana, Illinois, and Michigan were identified. Doctor of Medicine programs were found through the Association of American Medical Colleges, and Doctor of Osteopathic Medicine programs were found through the American Association of Colleges of Osteopathic Medicine. The deans of student affairs, surgery rotation directors, and surgery rotation coordinators were contacted for approval for participation in this study. Three instances of outreach were attempted at each institution before the school was removed as a potential participant.

Ultimately, 11 institutions agreed to participate. Student liaisons were identified to lead survey dissemination at their respective institutions. Surveys were available to medical students of all levels and specialty interests. The survey was administered from March through May 2021. Respondents were entered into a drawing to receive one of three \$25 incentives for completion of the survey. After the initial email to the student liaisons, three reminder invitations were sent with participation data for each school.

Data analysis

The survey data was collected via Research Electronic Data Capture. Only the subgroup of students interested in global

Table 1 – Respondent Demographics. The column entitled “Interested in Global Surgery” represents the entire subgroup analyzed. The 202 respondents were then stratified by interest in domestic rural surgery.

Demographics	Interested in global surgery	Interested in domestic rural surgery	Unsure interest in domestic rural surgery	Not interested in domestic rural surgery	P-value
Respondents n (%)	202 (100)	37 (18.3)	93 (46.0)	72 (35.6)	
Gender n (%)					
Male	89 (45.0)	14 (37.8)	45 (50.0)	30 (42.2)	0.39
Female	109 (55.0)	23 (62.2)	45 (50.0)	41 (57.8)	
Ethnicity n (%)					
White	110 (71.4)	21 (72.4)	53 (71.6)	36 (70.6)	0.65
Black	13 (8.4)	1 (3.4)	5 (6.8)	7 (13.7)	
Hispanic	21 (13.6)	4 (13.8)	12 (16.2)	5 (9.8)	
Other	10 (6.5)	3 (10.3)	4 (5.4)	3 (5.9)	
Age median (IQR)	26 (25, 28)	27 (26, 30)	26 (25, 28)	26 (25, 28)	0.46
Hometown n (%)					
Rural	33 (16.4)	13 (35.1)	16 (17.2)	4 (5.6)	0.001
Suburban	128 (63.7)	18 (48.7)	64 (68.8)	46 (64.8)	
Urban	40 (19.9)	6 (16.2)	13 (14.0)	21 (29.6)	
Relationship status n (%)					
Single	116 (57.4)	19 (51.4)	50 (53.8)	47 (65.3)	0.06
Partnered	59 (29.2)	8 (21.6)	31 (33.3)	20 (27.8)	
Married	26 (12.9)	9 (24.3)	12 (12.9)	5 (6.9)	
Other	1 (0.5)	1 (2.7)	0	0	
Dependents n (%)					
Yes	10 (5.0)	6 (16.2)	4 (4.3)	0	0.001
No	192 (95.0)	31 (83.8)	89 (95.7)	72 (100.0)	

surgery were included. Given this subgroup's declared interest in surgery, any questions relating to rural health were interpreted as relating to rural surgery. Global surgery is defined broadly as the multidisciplinary field aimed at providing equitable surgical access across international health systems; this study, however, relied on each student's understanding of the field to understand which types of experiences would be agreeable to the trainees.⁸ For the purposes of this study, the term global surgery will be used to capture international surgery, while DRS will be used to capture surgical care in rural United States. These students were stratified into three groups by interest in DRS. Descriptive statistics were calculated for all quantitative questions using Stata 16.1 (College Station, TX). Categorical variables underwent Pearson's chi-square testing, and numeric variables underwent Kruskal–Wallis testing. Results are presented as percentages with associated frequencies for categorical variables and medians with interquartile ranges (IQR) for numeric variables. We employed stepwise, multivariable logistic regression to calculate odds ratios. A P-value less than 0.05 defined statistical significance.

The qualitative data were analyzed using the principles of grounded theory. Two authors independently reviewed and provided initial memos for each response. Three authors met to integrate and refine the memos into larger themes which were led by the two authors who initially reviewed the data. The third author resolved any conflicts between thematic groupings. Ultimately, the three authors agreed on collective

major, minor, and micro-themes. The *a priori* saturation point was determined to be 100 responses within a minor theme.

Results

General demographics

A total of 697 students responded to the survey with 29.0% ($n = 202$) indicating interest in global surgery. The median age of students interested in global surgery was 26 y (IQR 25–28) (Table 1). These students were stratified into three groups by their interest in DRS: interested in practicing in a rural setting (18.3%, $n = 37$), not interested in a rural setting (35.6%, $n = 72$), and unsure of their interest in a rural setting (46.0%, $n = 93$). The 18.3% of students interested in DRS were more likely to have grown up in a rural area (35.1%, $P < 0.001$) and to currently have dependents (16.2%, $P < 0.001$) than the students unsure or not interested in DRS.

Medical school demographics

A majority (59.5%, $n = 120$) of responses came from four medical schools: University of Illinois, Indiana University, Marian University, and Western Michigan University. All years of medical school were well represented by the student respondents interested in global surgery (Table 2). Expectedly,

Table 2 – Medical School Demographics. Demonstrates medical school demographics of students interested in global surgery, which is then divided into three subgroups: interested in rural surgery, unsure of interest in rural surgery, and uninterested in rural surgery.

Medical demographics	Interested in global surgery	Interested in rural surgery	Unsure interest in rural surgery	Not interested in rural surgery	P-value
Respondents n (%)	202 (100)	37 (18.3)	93 (46.0)	72 (35.6)	
Medical school year n (%)					
MS1	67 (33.2)	10 (27.0)	31 (33.3)	26 (36.1)	0.97
MS2	51 (25.2)	9 (24.3)	26 (28.0)	16 (22.2)	
MS3	44 (21.8)	9 (24.3)	20 (21.5)	15 (20.8)	
MS4	35 (17.3)	8 (21.6)	14 (15.0)	13 (18.1)	
Other	5 (2.5)	1 (2.7)	2 (2.2)	2 (2.8)	
Specialty interest n (%)					
Surgery	144 (71.6)	31 (83.8)	64 (68.8)	49 (69.0)	0.32
OB	12 (6.0)	3 (8.1)	5 (5.4)	4 (5.6)	
Anesthesia	7 (3.5)	1 (2.7)	3 (3.2)	3 (4.2)	
Other	38 (18.9)	2 (5.4)	21 (22.6)	15 (21.2)	
Debt n (%)					
≤ \$150,000	132 (66.0)	27 (73.0)	61 (65.6)	44 (62.9)	0.57
> \$150,000	68 (34.0)	10 (27.0)	32 (34.4)	26 (37.1)	

students interested in global surgery were more likely to be interested in the surgery-related fields including surgery, anesthesia, and obstetrics/gynecology (SAO) when compared to the entire cohort.²² However, when further stratified by interest in DRS, students were equally likely to be interested in SAO fields.

Global surgery experience

A majority of the 202 students interested in global surgery preferred to spend 6 mo or less abroad practicing global surgery each year (Fig. 1). When asked specifically about their desired global setting, most students preferred to practice in a peri-urban setting, especially those without DRS interest. The students who wanted to practice DRS had a higher preference for selecting a rural global setting ($P < 0.001$). When asked to further narrow their setting by health facility type, students were either undecided (35.1%) or preferred a national hospital (33.7%). Overall, students unsure of their interest in DRS have priorities that aligned with those interested in DRS rather than those not interested in DRS.

Rural surgery understanding and exposure

Students were asked to provide the definition of rural surgery in the United States and delineate the benefits and challenges of the practice; only 20 (9.9%) of the respondents were confident in their answers. However, the students interested in DRS were ten times as likely to be confident in their answers when compared to those students who were unsure of their DRS interest ($P < 0.001$). A multivariable model predicted confidence in the definition of rural surgery was associated with growing up in a self-identified rural hometown ($P = 0.005$)

when compared to growing up in an urban or peri-urban hometown, corroborating the literature.²³

The subset of students interested in global surgery were more likely to be interested in a DRS experience during residency when compared to the entire cohort (51.0% versus 45.4%, $P = 0.01$). Students interested in global surgery but unsure of their interest in DRS were significantly more willing to complete a rural surgery rotation during residency when compared to the students with no interest in DRS (60.2% versus 22.2%, $P < 0.001$). Students were also asked if they had previous rural health exposures through pre-clinical courses in rural health, clinical rotations in rural health, placement in a rural health track, or rural health interest groups. Of the 202 students, only 78 had some form of rural health exposure (Fig. 2). Although these rural exposures did not increase confidence in the definition of rural surgery, the students who were interested in DRS had significantly more rural health exposures ($P < 0.001$). Rural exposures that were significantly associated with rural surgery interest were rural health interest groups ($P < 0.001$), pre-clinical courses ($P = 0.002$), and clinical rotations ($P = 0.05$).

Relationship between global and rural surgery

To better understand students' perceptions of DRS and global surgery, respondents were asked a free-response question to "describe the relationship between global and rural surgery." The responses were categorized into three major themes: similarities, differences, and unsure. Surprisingly, the micro-theme to obtain saturation was "unsure" as most students were unsure if there was a relationship between global and DRS.

Thirty-nine percent of students stated that global and rural surgery worked together in some regard.

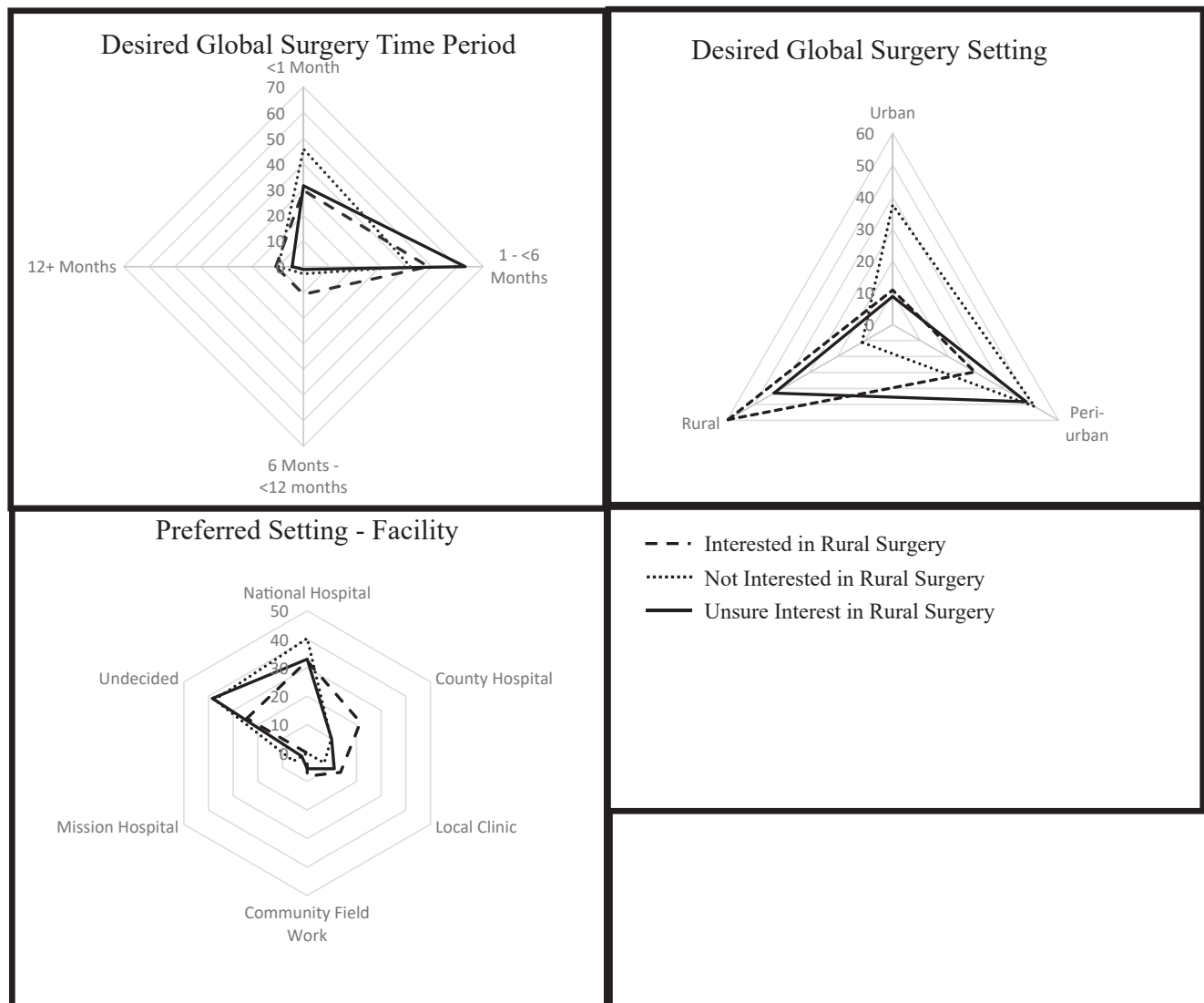


Fig. 1 – Overlap of Global Surgery Setting Preferences. Describes the desired global surgery environment stratified by interest in rural surgery. Those interested in rural surgery and those unsure in their interest in rural surgery demonstrate significant overlap in their global surgery setting preferences.

“Rural and global surgery probably share many common challenges, including availability of trained surgeons and limited resources.” – first year medical student, Indiana University.

Even while highlighting the similarities, some students emphasized their preferences or the preference of others.

“It is similar, but I prefer to help at home.” – fourth year medical student, Indiana University.

“Very similar field but people tend to choose global opportunities because it’s more exciting to serve rural populations abroad” – fourth year medical student, University of Illinois College of Medicine.

One student highlighted the relationship in training between rural and global surgery.

“...Participating in rural surgery would be the best preparation for global surgery you can get while in the US, because it would require me to adapt to a new setting and culture while practicing medicine knowing that referrals might be very difficult for my patients to go through with. It would also allow me to practice a wider variety of medical care.” – first year medical student, University of Illinois College of Medicine.

Many students acknowledged the similarities in resource limitations and that both settings may be better equipped to operate with fewer resources than urban hospitals in the United States. However, many stated the resource constraints were worse in the global surgery setting.

Major differences noted between global surgery and DRS were that global surgery required international travel, and global surgery was more variable depending on the location. A first year medical student from the University of Michigan

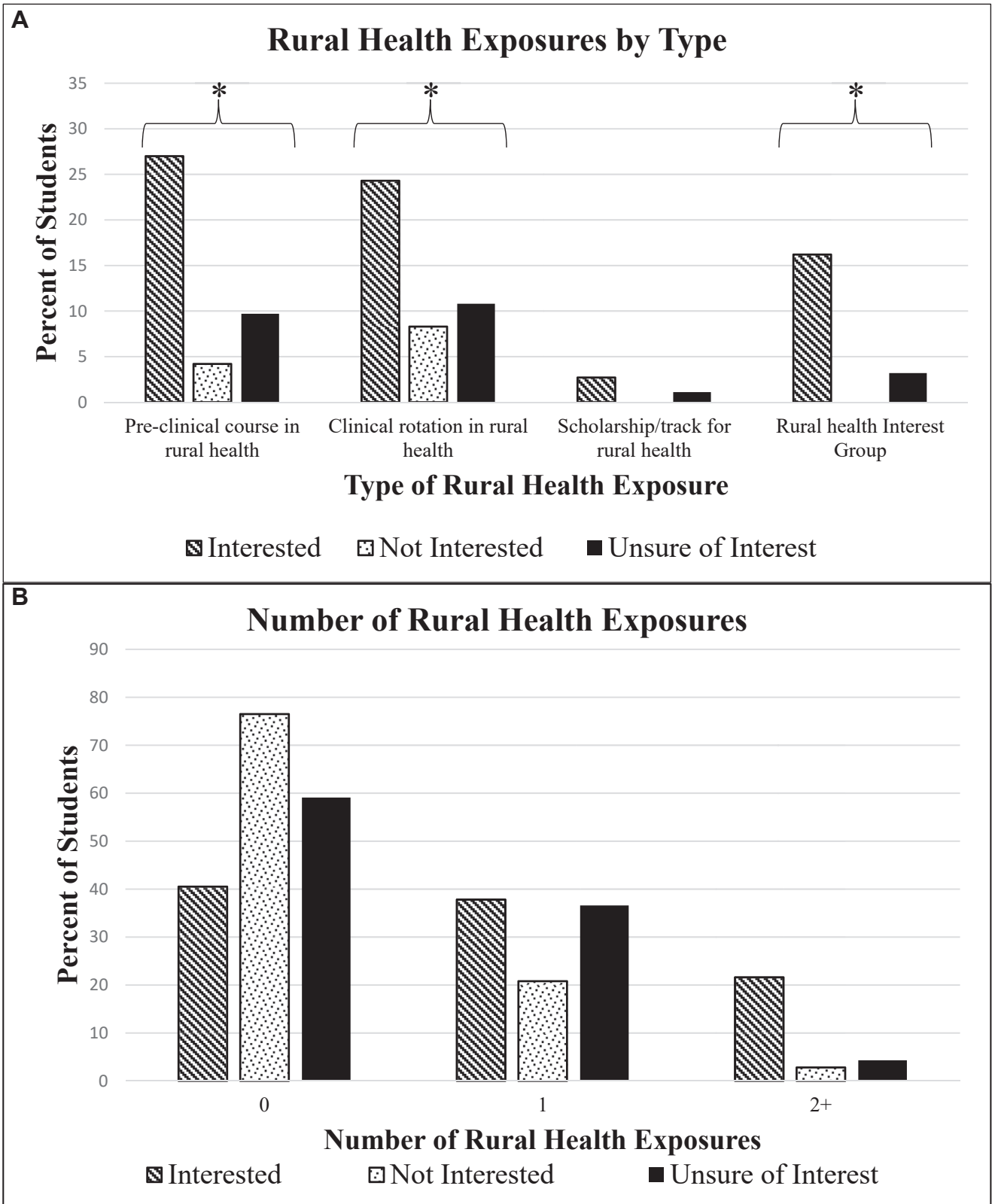
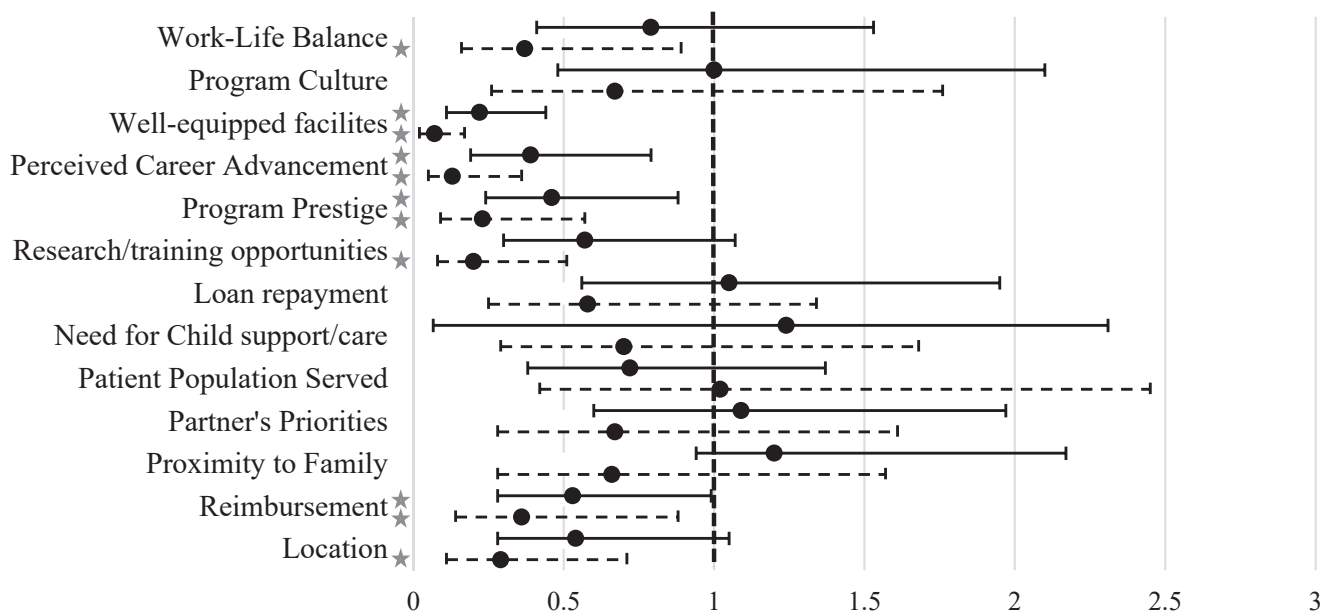
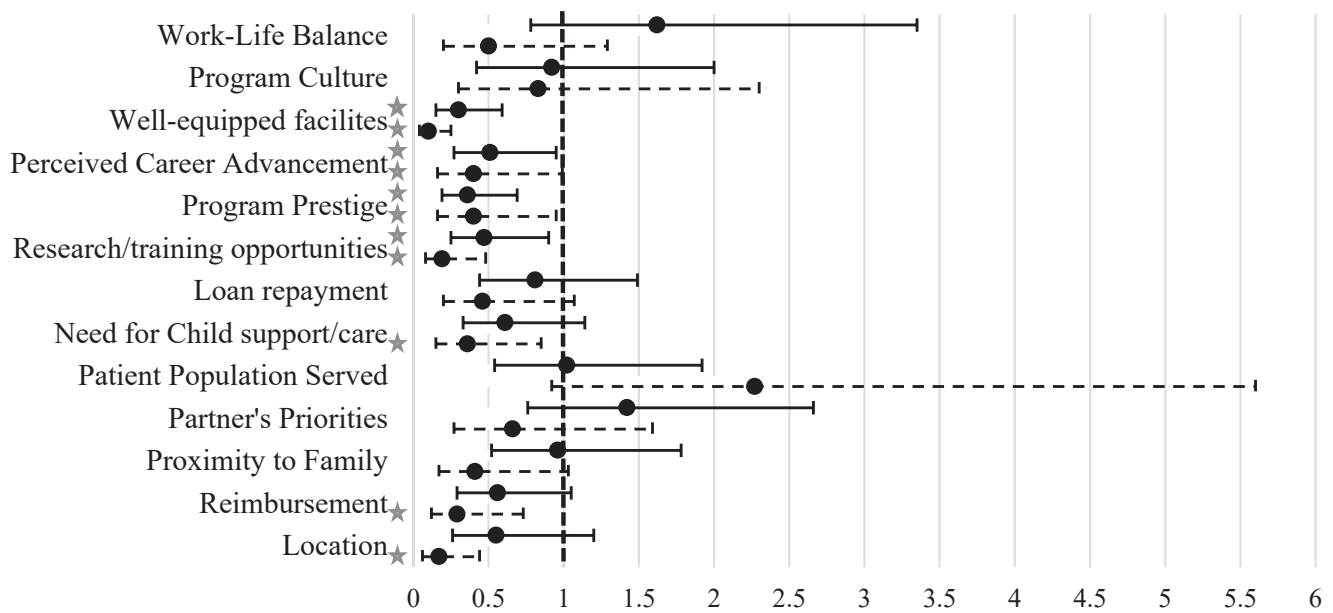


Fig. 2 – Rural Health Exposures. Panel A: The students interested in domestic rural surgery have more rural health exposures than those who are unsure or not interested in domestic rural surgery. All differences marked with an asterisk are significant ($P < 0.05$). **Panel B:** Students with increased number of rural health exposures was correlated with interest in rural surgery ($P < 0.0001$).

Odds Ratios of Priorities for Residency



Odds Ratios of Priorities for Career



- - - Interested in Rural Surgery — Unsure Interest in Rural Surgery

Fig. 3 – Odds Ratios of Residency and Career Priorities. Multivariable logistic regression of residency and long-term career priorities of students with interest in rural surgery and those unsure of interest in rural surgery in comparison with students without interest in global surgery. Significant odds ratios are marked with a gray star ($P < 0.05$).

School of Medicine was cautious about drawing too many conclusions about similarities because “each location in global surgery has its own unique set of challenges that

require understanding local economies, politics and culture.” This difference in setting also resulted in a difference in allure. A first year from Rush Medical College student believed “rural

surgery generally lack [ed] the resources and funding from major institutions” while a second year medical student from Marian University Osteopathic Medical School believed, “global surgery is more competitive.”

Residency and career priorities

Students ranked their residency and career priorities, underscoring important factors when choosing a career and setting location. Through logistic regression, odds ratios were calculated comparing those students not interested in DRS to the students who were interested in DRS and those unsure of their interest in DRS to identify which factors the students interested in DRS and the students unsure of DRS interest had in common. The odds ratios were adjusted for age, hometown, ethnicity, and dependency status. Those interested in DRS were less likely to prioritize location (OR 0.29, 95% CI 0.11-0.71), research/training opportunities odds ratio (OR 0.20, 95% CI 0.08-0.51), and work-life balance (OR 0.37, 95% confidence interval (CI) 0.16-0.89) when compared to students not interested in DRS (Fig. 3). The students interested in DRS and the students unsure of their interest in DRS had similar residency priorities including: less priority on research/training opportunities, less priority on program prestige, less priority on perceived career advancement, and less priority on well-equipped facilities. Additionally, both groups were willing to complete a rural surgery rotation during residency.

Through logistic regression, odds ratios were also calculated comparing students unsure of their interest in DRS with the students who were interested in DRS to understand which factors are different between the two groups. When the students who were unsure of their interest in DRS were compared directly to the students interested in DRS, the unsure students were more likely to prioritize work-life balance (OR 2.79, 95% CI 1.21-6.42), location of training (OR 2.76, 95% CI 1.23-6.15), equipment at the facility (OR 3.04, 95% CI 1.37-6.77), and their spouse or partner’s career (OR 2.27, 95% CI 1.01-5.08). These differences may highlight factors to emphasize in DRS experiences to capture those who are unsure of their interest.

To identify if these similar priorities existed when selecting a career, similar multivariable logistic regressions were performed for career priorities. Those interested and those unsure of their interest in DRS were still less likely to prioritize research/training opportunities, program prestige, perceived career advancement, or well-equipped facilities when compared with students not interested in DRS. Meanwhile those interested in DRS were less likely to prioritize location (OR 0.17, 95% CI 0.06-0.44), reimbursement (OR 0.29, 95% CI 0.12-0.73), and need for childcare (OR 0.36, 95% CI 0.15-0.85) when compared with students not interested in DRS.

Discussion

Nearly a third of the 697 surveyed students at mid-western medical schools declared an interest in global surgery. This increase in trainee interest has been matched by several general surgery residency programs developing international surgery electives.²⁴⁻²⁷ However, due to the global COVID-19 pandemic, trainees are unable to participate in these

rotations. To find a suitable alternative, students were asked to compare DRS and global surgery. Although several students highlighted the similarities in resource constraints, many students were not confident in their understanding of DRS. This was underscored by the fact that 46% of the students interested in global surgery were unsure of their interests in DRS. The students unsure about their interest in DRS were willing to participate in more rural surgery experiences which could increase confidence in their understanding of DRS and interest in serving those communities. To identify which qualities of DRS should be highlighted in these experiences, students ranked their residency and career priorities. The students interested in DRS and those unsure of their interest in DRS were less likely to prioritize reimbursement, program prestige, perceived career advancement, and well-equipped facilities when selecting a residency or long-term career. When comparing those who were unsure of their interest in DRS with those who were interested in DRS, the students unsure of their DRS interest were more likely to prioritize work-life balance and location of practice. The differences in priorities provide additional insight into which qualities of rural surgery to highlight in trainee experiences.

Students enrolled in this study highlighted the similarities between global surgery and DRS regarding limited resources; however, students were less likely to discuss differences in culture or health literacy. The lack of nuanced understanding when contrasting DRS and global surgery could be from a lack of confidence in the definition of DRS. Confidence in the understanding of DRS was related to interest in DRS, and interest in DRS was positively correlated with the number of clinical or nonclinical exposures to rural health similar to other studies.²⁸ Traditional medical school curricula rarely include rural surgery exposures, leading to lack of knowledge about DRS. Even in residency, only 27 of 268 general surgery residency programs in the United States require rural rotations, and an additional 10 offer elective rural rotations.^{29,30} The few medical schools that have implemented longitudinal rural health education programs for medical students have witnessed a multifold increase in the rural physician supply.³¹ Replication of these rural health programs can encourage further medical student engagement in rural settings and ultimately improve rural healthcare capacity.³²

The survey data demonstrate rural health exposures do not need to be specific, longitudinal programs but rather cumulative experiences of varying types to improve interest in DRS.²³ Experiences can be clinical or nonclinical but should introduce the principles of DRS. Clinical exposures can include shadowing during the nonclinical years and surgical rotations during the clinical years. Nonclinical exposures can include rural health interest groups, quality improvement initiatives, and research. Medical student research experiences in DRS can expose the challenges and benefits of DRS while underscoring the limited literature available.³³ Regardless of duration and type, rural health exposures geared towards trainees should establish specific and meaningful learning objectives to create a framework for addressing expectations, identifying challenges, and tracking shifts in perceptions. These collective experiences can improve interest in DRS and the likelihood of selecting and remaining in rural practice.³⁴

Exposures to DRS should focus on similarities between DRS characteristics and medical trainees' residency and career aspirations. The surveyed medical students interested and unsure of interest in DRS placed less emphasis on status factors, including perceived program prestige, perceived career advancement opportunities, and research or teaching opportunities. This is not to say that these opportunities do not exist in rural surgery; in fact, many rural hospital administrators underscore the importance of rural surgeons as leaders within the hospital.³⁵ However, these factors may not be essential to incorporate in the development of DRS exposures for medical students, as the students place less value on them.³⁶ A factor to incorporate into rural health exposures is improved quality of life. Students unsure in their interest in DRS and surgeons currently practicing in rural settings prioritize work-life balance and their partner's career.³⁶ An additional factor not assessed by the survey was access to DRS mentors who can provide insight into the field through their lived experience and patient stories. These mentors may also highlight quality of life benefits from living in rural America, including reasonable cost of living, decreased travel time for daily amenities, strong public education, and robust sense of community.¹⁵

To create these experiences for students, medical schools will need to invest resources and time into these rural communities. In many countries, the national governments dictate that medical trainees must allot a portion of their medical education to rural health. The trainees who attend public institutions are required to repay their debt through service at disadvantaged hospitals, often in rural areas.^{37,38} These opportunities are often organized by medical schools and teaching institutions. Engaging these large institutions in establishing relationships with rural healthcare facilities and communities should prevent development of a single-sided relationship solely benefiting the trainee. Medical schools can also partner with rural surgeons who already have developed long-standing relationships within the community to provide additional DRS exposures for medical students. In developing these opportunities for medical students, institutions should be mindful of the lessons learned from global surgery to prevent medical tourism and promote sustainable development.^{39,40}

The study has a few limitations. First, survey data has inherent limitations regarding difficulty in conveying true respondent emotions through survey responses and variability in interpretation of survey questions. Specifically, respondents were not able to elaborate on their rural health exposures. While there were a large number of respondents, the response rate was low, giving a possibility of nonresponse bias, which may lead to inaccurate conclusions. However, respondents were demographically similar to nonrespondents based on nationally-reported data of medical students. This suggests that the results are well-represented. The limited number of responses and number of involved medical schools in a singular geographic area may limit the generalizability of this study. However, medical trainees from the Midwest are the target population when developing initiatives to increase the rural workforce, which is a strength of the survey. Moreover, only a third of the cohort was interested in global surgery; thus, possible interventions to promote DRS

exposure may only be catered to those students interested in global surgery. Despite these limitations, the findings of this study highlight the relationship between global and DRS for medical students.

Conclusions

Students interested in global surgery prefer to work with the challenges of practicing in a low-resource setting. In the setting where international surgery rotations are unavailable to medical trainees, DRS can act as an alternative for similar skill development. Many students with an interest in global surgery had strong or unsure interest in DRS. The students who were interested in DRS were more likely to have an increased number and increased variety of rural health exposures. Over half of the students interested in global surgery would also be willing to participate in a DRS elective during their post-graduate training. These students may benefit from increased exposure to DRS to understand the overlap between global surgery and DRS regarding the challenges of limited resources, their priorities of work-life balance, and practice location in rural settings. As the definition of global surgery continues to develop, medical trainee exposures should continue to evolve to include many of the experiences both domestically and internationally. Ultimately, incorporating more exposures to DRS may result in an increased domestic rural surgical workforce.

Supplementary Materials

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.jss.2022.06.041>.

Author Contributions

The project idea was conceived by Helen Li. Helen Li, Alexandria McDow, Connie Keung, Tasha Joplin, and Manisha Bhatia developed and refined the survey tool prior to medical student responses. Chad Simon, Louis Darkwa, and Zachary Meade assisted with data collection. All authors were involved with manuscript creation and editing.

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REFERENCES

- Moris D, Karachaliou GS, Pawlik TM, Nwomeh B. Attrition in general surgery residency: can global and rural surgery shift the paradigm? *J Surg Res*. 2018;224:166–168.
- Kauffmann RM, Neuzil K, Koch R, Terhune KP. Global surgery electives: a strategy to improve care to domestic underserved populations? *J Surg Res*. 2020;255:247–254.
- Oliphant JL, Ruhlandt RR, Sherman SR, Schlatter MG, Green JA. Do international rotations make surgical residents more resource-efficient? A preliminary study. *J Surg Educ*. 2012;69:311–319.
- Gupta S, Ewbank C, Kushner AL. A letter to program directors: global surgery rotations are a plus. *J Surg Educ*. 2017;74:543–544.
- Bazemore AW, Goldenhar LM, Lindsell CJ, Diller PM, Huntington MK. An international health track is associated with care for underserved US populations in subsequent clinical practice. *J Grad Med Educ*. 2011;3:130–137.
- Farmer D. Rural surgery is global surgery: seeking solutions to the growing surgical workforce crisis. *JAMA Surg*. 2013;148:821–822.
- Rickard J, Onwuka E, Joseph S, et al. Value of global surgical activities for US academic health centers: a position paper by the association for academic surgery global affairs committee, society of university surgeons committee on global academic surgery, and American College of surgeons' operation giving back. *J Am Coll Surg*. 2018;227:455–466.e456.
- Bath M, Bashford T, Fitzgerald JE. What is 'global surgery'? Defining the multidisciplinary interface between surgery, anaesthesia and public health. *BMJ Glob Health*. 2019;4:e001808.
- Zahnd WE, Scaife SL, Francis ML. Health literacy skills in rural and urban populations. *Am J Health Behav*. 2009;33:550–557.
- Moesinger R, Hill B. Establishing a rural surgery training program: a large community hospital, expert subspecialty faculty, specific goals and objectives in each subspecialty, and an academic environment lay a foundation. *J Surg Educ*. 2009;66:106–112.
- Timmerman GL, Thambi-Pillai TC, Johnson MK, Weigelt JA. Initial and ongoing training of the rural surgeon. *Surg Clin North Am*. 2020;100:849–859.
- Hughes D, Cook MR, Deal SB, et al. Rural surgeons' perspectives on necessity of post-residency training are stable across generations. *Am J Surg*. 2019;217:296–300.
- Thompson MJ, Lyne DC, Larson EH, Tachawachira P, Hart LG. Characterizing the general surgery workforce in rural America. *Arch Surg*. 2005;140:74–79.
- Cogbill TH. Training surgeons for rural America. *Am Surg*. 2007;73:148–151.
- Zastrow AW. Dilemma of general surgery recruitment in rural America. *World J Surg*. 2006;30:269–270.
- Schein M. Editorial comment: surgery in rural America. *World J Surg*. 2006;30:271–272.
- Jaret P. Attracting the next generation of physicians to rural medicine | AAMC. 2020. Available at: <https://www.aamc.org/news-insights/attracting-next-generation-physicians-rural-medicine>. Accessed February 28, 2022.
- Staff AC. One in five Americans live in rural areas. 2017. Available at: <https://www.census.gov/library/stories/2017/08/rural-america.html>. Accessed February 28, 2022.
- Hughes D. *The Role of Community in Midwestern General Surgeons' Practice Location Decisions: Health Policy and Management*. Lawrence, KS: KU ScholarWorks, University of Kansas; 2019.
- Harris PA, Taylor R, Minor BL, et al. The REDCap consortium: building an international community of software platform partners. *J Biomed Inform*. 2019;95:103208.
- Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform*. 2009;42:377–381.
- Meara JG, Leather AJM, Hagander L, et al. Global Surgery 2030: evidence and solutions for achieving health, welfare, and economic development. *Lancet*. 2015;386:569–624.
- MacQueen IT, Maggard-Gibbons M, Capra G, et al. Recruiting rural healthcare providers today: a systematic review of training program success and determinants of geographic choices. *J Gen Intern Med*. 2018;33:191–199.
- Powell AC, Casey K, Liewehr DJ, Hayanga A, James TA, Cherr GS. Results of a national survey of surgical resident interest in international experience, electives, and volunteerism. *J Am Coll Surg*. 2009;208:304–312.
- Wilkinson KH, Bowder AN, Goldblatt MI, Olson L, Dodgion CM. General surgery applicants are interested in global surgery, but does it affect their rank list? *J Surg Res*. 2021;257:449–454.
- Jayaraman SP, Ayzengart AL, Goetz LH, Ozgediz D, Farmer DL. Global health in general surgery residency: a National survey. *J Am Coll Surg*. 2009;208:426–433.
- Fallah PN, Jayaram A, Hauser BM. Moving the needle on global surgery education in the US. *J Surg Educ*. 2021;78:1780–1782.
- Deal SB, Cook MR, Hughes D, et al. Training for a career in rural and nonmetropolitan surgery—A practical needs assessment. *J Surg Educ*. 2018;75:e229–e233.
- Mercier PJ, Skube SJ, Leonard SL, et al. Creating a rural surgery track and a review of rural surgery training programs. *J Surg Educ*. 2019;76:459–468.
- Avery D, Wallace J. Rural surgery training programs in the United States: a review of the literature. *Online J Rural Res Pol*. 2016;11:1.
- Rabinowitz HK, Diamond JJ, Markham FW, Wortman JR. Medical school programs to increase the rural physician supply: a systematic review and projected impact of widespread replication. *Acad Med*. 2008;83:235–243.
- Skube SJ, Thorndal N, Boulger JG, et al. Outcomes and influences of rural-focused integrated clerkship programs in general surgery. *Am J Surg*. 2020;219:355–358.
- Kassebaum DG, Szenas PL. Factors influencing the specialty choices of 1993 medical school graduates. *Acad Med*. 1994;69:163–170.
- Ogden J, Preston S, Partanen RL, Ostini R, Coxeter P. Recruiting and retaining general practitioners in rural practice: systematic review and meta-analysis of rural pipeline effects. *Med J Aust*. 2020;213:228–236.
- Doty B, Zuckerman R, Finlayson S, Jenkins P, Rieb N, Heneghan S. General surgery at rural hospitals: a national survey of rural hospital administrators. *Surgery*. 2008;143:599–606.
- Heneghan SJ, Bordley JT, Dietz PA, Gold MS, Jenkins PL, Zuckerman RJ. Comparison of urban and rural general surgeons: motivations for practice location, practice patterns, and education requirements. *J Am Coll Surg*. 2005;201:732–736.

37. Dunbabin JS, McEwin K, Cameron I. Postgraduate medical placements in rural areas: their impact on the rural medical workforce. *Rural Remote Health*. 2006;6:481.
38. Goel S, Angeli F, Bhatnagar N, Singla N, Grover M, Maarse H. Retaining health workforce in rural and underserved areas of India: what works and what doesn't? A critical interpretative synthesis. *Natl Med J India*. 2016;29:212–218.
39. Garba DL, Stankey MC, Jayaram A, Hedt-Gauthier BL. How do we decolonize global health in medical education? *Ann Glob Health*. 2021;87:29.
40. Sherif YA, Choudhury T, Makasa E, Rosengart TK, Davis RW, Kaseje N. Ethics of educating American global surgeons: an approach to conscientious training on the individual, departmental, and institutional levels. *J Am Coll Surg*. 2022;234:239–246.