A Needs Assessment For Rural Health Education In United States Medical Schools

Kailey Carlson

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A Needs Assessment for Rural Health Education in United States Medical Schools

A Thesis Submitted to the Yale University School of Medicine
in Partial Fulfillment of the Requirements for the Degree of Doctor of Medicine

by

Kailey Carlson 2024
Abstract

A NEEDS ASSESSMENT FOR RURAL HEALTH EDUCATION IN UNITED STATES MEDICAL SCHOOLS

Kailey Carlson, Thomas Pointer, Carter McCaskill, Tracy Rabin, Linda Mayes, Nick Pumilia, Stephanie Sun, and Cynthia McNamara, Department of Internal Medicine, Yale University School of Medicine, New Haven CT

This study is a needs assessment for rural health education at United States medical schools. Health disparities between rural and urban populations are significant and worsening. Rural areas are home to 20% of Americans but just 11% of physicians, contributing to health inequity. Medical schools must produce more future rural physicians to meet the needs of the population. To understand the need for rural health education in medical schools, medical students were surveyed on attitudes toward living and working in rural areas and comfort with clinical competencies important in rural areas. The hypothesis was that medical students at schools focusing on rural health would have more favorable attitudes toward rural areas and feel more comfortable with competencies important in rural areas, underscoring the importance of rural health education in medical schools.

A novel online survey was developed to measure trainee attitudes toward rural areas and comfort and experience with skills important in rural practice. The instrument was distributed at six medical schools, three of which had a mission statement including a focus on rural health. Institutional representatives and research partners emailed students with an invitation to complete the survey with a gift card lottery incentive. Survey data was analyzed by chi-square, linear correlation, and student’s t-test to assess attitudes and competencies versus student hometown rurality, identity as rural or urban, institutional mission statement, and time spent in rural areas.

The average institutional response rate was 13.4%; a total of 287 students completed the survey. Of these, 131 indicated that they were in their first or second year (“pre-clerkship”) and 146 were in their third year or above (“clerkship”); the proportion was not statistically different between schools with and those without a rural focus, nor by student identity or time spent in a rural area. Student hometown rurality, rural identity, attendance at a school with a rural mission statement, or time spent in rural areas (collectively “rural learning”) were all positively associated with positive attitudes and negatively associated with negative attitudes toward rural areas; the inverse was true for students who self-identified as urban.

Pre-clerkship status was negatively correlated with comfort with all groups of competencies. Among all students, rural learning was positively associated with comfort formulating a plan for initial
care in urgent patient presentations in non-tertiary care settings, diagnosis and management of regionally endemic illnesses, and opportunity to develop comfort with an aggregate of elements of professional flexibility. Each element of rural learning was associated with greater exposure to several components of professional flexibility, a category including skills like improvisation, community engagement, and task-shifting, or taking on the role of other health professionals when necessary. Hometown rurality was associated with greater comfort with an aggregate of diagnosis and management categories and specifically with diagnosis and management of chronic diseases and acute infectious diseases. It was also associated with greater exposure to procedures in aggregate and specifically to skills in dermatology and imaging interpretation. Rural identity was positively associated with exposure to dermatologic procedures. Time spent in a rural setting was associated with greater exposure to gynecologic examination and procedures in aggregate, specifically dermatologic and musculoskeletal procedures. Attending a school with a rural mission statement was associated with greater comfort with musculoskeletal examination and exposure to reproductive health and dermatology procedures and with less exposure to point-of-care ultrasound. Of students at schools with no rural mission statement, 95.8% felt that rural health was not adequately incorporated into their curriculum, while 98.1% of those at schools with a rural mission felt it was adequately incorporated. Interest in dedicated rural health curricula was not significantly different between students at schools with and without rural mission statements.

Overall, as hypothesized, rural learning was associated with more favorable attitudes and self-reported comfort with competencies important in rural medical practice. In contrast to students at schools with rural mission statements, those with rural identities and past rural exposure had increased comfort with more skills important in rural settings. This underscores the importance of recruiting students with rural backgrounds. However, the current supply of rural students is inadequate to meet the workforce need; therefore, these results also reinforce the importance of incorporating rural health education in order to promote positive attitudes about and comfort with skills important in rural areas. These findings also suggest that medical schools without rural mission statements are not meeting student interest in rural health curricula. Finally, this work provides possible targets for educational development in the urban setting, including training in or increasing exposure to endemic illnesses, musculoskeletal examination and procedures, dermatologic procedures, reproductive health procedures, and professional flexibility.
Acknowledgements

This work would not have been possible without the faculty who helped with distribution of the survey, including Dean Melissa Held of University of Connecticut School of Medicine, Dean William Block of East Tennessee Quillen College of Medicine, Dean Catherine McCarty of the University of Minnesota Medical School, and Jessica Wingett of Ohio University Heritage College of Osteopathic Medicine. This work was also greatly helped by the prior work of Adams, Hollins, Dollard, and Petkov, whose validated attitudes survey was adopted into this work with their permission, as well as Gouveia, Brava, and Oliviera, whose research provided the basis of the competencies portion of our survey. The authors also appreciate Matthew Tobey’s feedback on survey design and John Encandela’s grant application review. This work was financially supported by the Lowe Endowment Fund and Yale University Department of Internal Medicine. The authors are grateful to Laura Crawford, who completed much of the administrative work required to provide participants their gift card compensation. The student author would also like to thank her research mentors for their immensely helpful guidance and unmatched support. Finally, this work would not have been possible without the students who generously shared their time and invaluable perspectives.
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Introduction

Disparities in Rural Health

There are many positive features associated with living and working in rural communities, as well as strengths that are unique to these communities. However, there is a persistent and worsening disparity in health outcomes between rural and urban populations. Rural Americans have higher rates of many chronic illnesses and are more likely to die from all of the five most common causes of death. According to the Centers for Disease Control and Prevention (CDC), many of these deaths are likely preventable.1 Rural populations have a greater age-adjusted mortality rate (AAMR), and this has been worsening over time. Between 1999 and 2019, the disparity in AAMR between rural and urban areas nearly tripled.2 Although urban populations have had an increase in average life expectancy in recent decades, the same is not true for rural populations.3 Many factors contribute to the disparities between urban and rural mortality; some of these include higher rates of chronic disease, differences in health-related behaviors, adverse social determinants of health, lower rates of preventative care and screenings, and limited access to healthcare providers.

People living in rural areas are more likely to report having multiple chronic conditions than their urban counterparts.4 Chronic disease is associated with four out of the five leading causes of death in rural areas. Rural populations tend to skew older, which increases risk of chronic disease.5 They also have more cardiovascular risk factors, including hypertension and diabetes.1 Rural Americans have a higher age-adjusted prevalence of chronic obstructive pulmonary disease (COPD), as well as a higher rates of hospitalizations and deaths due to COPD.6 Some health related behaviors are also less favorable in rural areas, including higher rates of tobacco use disorder and fewer individuals reporting that they meet recommendations for physical activity.7 Rural Americans have higher incidence rates of many types of cancer but are
less likely to receive routine screening, including screening for cervical, breast, colorectal, and lung cancer.\textsuperscript{8-11}

Many social factors contribute to poorer health outcomes in rural communities. Income and employment status affect eligibility for health insurance coverage, means to pay out-of-pocket costs, ability to attend medical appointments, and security of transportation to appointments; it is well established that lower income is associated with poorer health outcomes. In 2019, metropolitan counties had a poverty rate of 11.9%, while non-metropolitan counties had a rate of 15.4%.\textsuperscript{12} Additionally, 14.7% of rural households experience food insecurity, compared with the national rate of 12.8%. Rates are even higher for rural households with children, at 19.7%.\textsuperscript{13} The proportion of people without health insurance is higher in rural areas.\textsuperscript{14} Rural populations have less educational attainment; increased education is associated with healthier behaviors, higher use of preventative healthcare, and increased life expectancy, even when adjusted for socioeconomic status.\textsuperscript{15} Educational background and other demographic factors lead to significantly lower health literacy in rural areas.\textsuperscript{16}

These social constraints on health and wellbeing are often magnified for marginalized populations. More than 15% of rural individuals are members of racial or ethnic minority groups, and this percentage is growing.\textsuperscript{17} Rural members of racial or ethnic minority groups have higher burdens of chronic disease and less access to care than rural White patients.\textsuperscript{18} Three of five non-metropolitan White people live in Health Professional Shortage Areas (HPSAs), while three out of four people of color in non-metropolitan areas live in HPSAs. Differences in the ratio between physicians and population size favors counties with a greater proportion of White patients than patients of color.\textsuperscript{19} Additionally, rural gender and sexual minorities are less likely to seek routine or preventative care due to anticipated stigma and experiences with clinician bias or discrimination.\textsuperscript{20}
Despite evidence of poorer health and greater need for healthcare, access to care is limited in rural areas.\textsuperscript{21-27} Rural populations face unique challenges with distance and transportation; public transit infrastructure is less likely to be adequate, and individuals may need to travel long distances, particularly if subspecialist care or the use of specialized devices is needed. This can serve as a barrier to care for those without reliable transportation and for those who are unable to take significant time off of work. They are also less likely to have access to broadband internet, limiting access to telehealth services.\textsuperscript{28} Individuals may have concerns about social stigma or privacy in smaller close-knit communities, particularly if they identify with a group that is marginalized in their community. Finally, persistent healthcare workforce shortages and high physician turnover result in less availability of services, prohibitively long wait times, and decreased patient-clinician continuity. Nearly two thirds of HPSAs are located in rural communities.\textsuperscript{21} Recruiting and retaining a strong rural healthcare workforce is vital to managing the increased rates of chronic disease, consequences of social factors limiting health, and moving towards health equity for rural populations.

\textit{Disparities in Access to Medical Care}

There are several different measures of rurality; including but not limited to population size, density, commuting features, and distance to the nearest metropolitan center. By most measures, approximately one in five Americans lives rurally.\textsuperscript{1} Although 20\% of Americans live rurally, only 11\% of physicians practice in rural areas.\textsuperscript{21} Family physicians are most likely to be found in rural areas; 22\% of family medicine physicians practice rurally. Only 10\% of general internal medicine physicians and 8\% of general pediatricians practice rurally.\textsuperscript{23} Urban areas have 80 primary care physicians per 100,000 people; rural areas have 52 per 100,000.\textsuperscript{21} This disparity is even more dramatic for specialists; urban areas have 259 per 100,000 relative to 75 per 100,000 in rural areas.\textsuperscript{21} Rural emergency department visits have increased, now 50\% higher per capita
than in urban areas; it is thought that this is partly due to increased use of emergency department care in the absence of access to routine primary care.\textsuperscript{29}

The divide between patient/physician ratios in urban and rural areas is widening with the aging of the rural physician workforce.\textsuperscript{22,30} Between 2000 and 2017, the number of rural physicians under age 50 decreased by 25%, while in urban areas that number grew by 12%. More than half of rural physicians are over age 50, as opposed to 39% of urban physicians. Finally, more than 25% of rural physicians are over age 60, compared to just 18% of urban physicians. Due to the anticipated retirement of older physicians, supply of rural physicians is forecast to decrease 23% by 2030, resulting in rural areas having access to one third as many physicians per capita compared to suburban and urban areas.\textsuperscript{30}

The disparity has widened with increased rural hospital closures.\textsuperscript{26,27} Between 2005 and 2022, 186 rural hospitals closed. Rates of closure have increased over time, and over one fifth of rural hospitals are considered at risk of closing.\textsuperscript{31} The rural counties that have experienced hospital closures had higher rates of unemployment, greater economic inequality, and lower median household incomes compared to other rural counties. These counties also had higher proportions of non-White residents, exacerbating racial disparities.\textsuperscript{32} The proportion of rural counties lacking hospital obstetric services rose to 54% in 2014; this is due to both hospital closure and closure of obstetric units. These closures contribute to increased cost of emergency medical services and heighten issues with transportation for vulnerable groups.\textsuperscript{33} After a rural hospital closure, there is an annual average decrease in supply of all physicians of 9.2%, translating to the loss of roughly three rural physicians per year.\textsuperscript{27} This places additional demand on and further limits access to the limited number of remaining rural physicians.

Decreased access to specialists and to primary care have both been associated with population morbidity and mortality.\textsuperscript{34,35} In mixed-effects regressions, an increase of 10 primary care physicians per 100,000 members of the population was associated with an increase in
population life expectancy of over 50 days. This was also associated with reduced cardiovascular, cancer, and respiratory mortality. Similarly, an increase of 10 specialist physicians per 100,000 members of the population led to an increase in population life expectancy of 19.2 days. Additionally, specialist care has been associated with lower rates of mortality and preventable hospitalization. The disparities in access to both primary and specialty care are significant contributors to health disparities between rural and urban populations, and these divisions are projected to increase; training future rural physicians is a necessary step towards greater health equity.

**Urban & Rural Medical Students**

A robust body of evidence shows that students who were raised in rural areas are far more likely to return to a rural setting for their eventual medical practice. Rural students are also more likely to pursue careers in primary care. Since these represent two of the greatest areas of unmet workforce need, there have been calls for pipeline programs and other initiatives to help rural youth and young adults find a path to a career in medicine. However, the current supply of rural students is not nearly sufficient to meet the need for physicians in rural areas.

The number of medical schools has increased, as has the size of many medical school classes. The percentage of students interested in primary care has remained stable, and there has been an increase in interest in working with underserved populations, but a decrease in the percentage of students interested in rural practice. Only 3.7% of medical students graduating in 2021 reported plans to practice in a “rural area”, “small town”, or “town” (population <10,000). This is likely partly attributable to the decreasing proportion of applicants to medical school and medical students from rural backgrounds.

Between 2002 and 2017, the number of medical school applicants with rural backgrounds declined by 18%, while the number of urban applicants increased by 59%. During this same
period, the number of rural matriculants declined by 28%, and the number of urban matriculants increased by 35%. As of 2017, only 4.3% of all incoming medical students had rural backgrounds; fewer than 0.5% were rural URM students. To accurately resemble the distribution of the United States population, the number of students of rural backgrounds would have to more than quadruple, and an even greater increase would be required for rural URM students. After controlling for age, sex, Medical College Admissions Test (MCAT) quintile, grade point average, and highest parental education, urban applicants from racial and ethnic minorities underrepresented in medicine (URM), rural URM applicants, and rural non-URM applicants have higher odds of acceptance to medical school than urban non-URM applicants (by 70%, 79%, and 13%, respectively). However, this has not been sufficient to mitigate the decreasing number of rural applicants. In order to meet the workforce need, many students of urban backgrounds would need to consider medical careers in rural areas.

The Role of Medical Schools

There are significant differences in the proportion of physicians from different medical schools who elect to participate in rural practice. Some schools consistently have over 40% of their graduates practicing in rural settings, while others have less than 5%. The current supply of rural physicians is disproportionately reliant on a small number of medical schools; over a quarter of rural physicians are graduates of just 12 medical schools. Sixty one medical schools (over half of the number assessed) contributed less than 25% of the rural physicians.

Both public and private medical schools receive significant public funding. There are 89 Liaison Committee on Medical Education (LCME) accredited public medical schools; they received a total of $17.7 billion in government support and federal research grants in 2022. In the same year, the 59 LCME accredited private medical schools received a total of $15.4 billion. This equates to an average of $198 million for each public school and $279 million for each
private school. For this reason, it is incumbent upon all medical schools, public and private, to produce graduates who meet the needs of the public.

To address rural-urban health disparities and the declining rural physician workforce, it is increasingly important for medical schools to offer elements of rural health education. Some medical schools have sought to incorporate rural health throughout the curriculum, with a few explicitly adding rural health to their mission statement. Additionally, several medical schools have created programs or rural training tracks designed to increase the number of their graduates in rural practice. These often consist of either a rural emphasis in admissions or an extended rural health clinical curriculum. One systematic review found that between 53% and 64% of graduates of these programs do go on to work in rural settings, which is several times the number of physicians who otherwise would.\textsuperscript{46} The authors of this review stated that expanding these programs to ten students per class at 125 medical schools would more than double the projected rural physician supply over the next decade.

Outside of dedicated rural programs or tracks, there is also evidence that standalone rural rotations increase eventual rural practice among students and residents.\textsuperscript{47-58} However, many trainees never spend time in rural settings. Medical education disproportionately occurs in urban settings, where a greater number of resources are available. Only one medical school is located in a “mostly rural” county, and none are in “completely rural” counties.\textsuperscript{59} Urban settings have many unique features, including greater availability of comprehensive diagnostics and specialists. Physicians trained in urban areas may not feel prepared to practice in a rural setting where they may lack access to these resources.

In addition to seeking to address this health disparity and meet obligations to the public, institutions may also be motivated to offer rural health training education and experiences by evidence of trainee interest in such education or evidence that their trainees felt less prepared for rural practice relative to other institutions. Thus, comparing the attitudes of medical students
toward rural areas based on their background and educational experiences may also help inform these efforts. To the knowledge of the authors, no project has yet attempted to measure these factors.

**Statement of Purpose**

This study sought to examine whether student identity, rural experiences, and attending schools with a focus on rural health are associated with differences in attitudes toward rural areas and competencies important in providing healthcare in rural settings. First is described the development of a novel survey instrument, which assessed medical student interest in and attitudes toward living and working in rural areas, comfort or experience with competencies important to practicing in a rural setting, and perception of their ability to acquire these skills in their current training program. Student attitudes and competencies are then compared based on their urban or rural identity, whether they have had exposure to rural areas, and whether their medical school had a rural mission statement. The results identify specific areas of difference between schools with and without explicit rural mission statements and between students of different backgrounds. They also describe student’s perception of the adequacy of their rural health training and their interest in rural health education. Possible targets to improve medical school education about rural health, particularly at schools without a rural mission statement, are proposed.
Methods

Student Contributions

The student was fortunate to be involved in the inception of this project and shaping of its goals and methods. She reviewed the literature to identify what was already known about efforts to remedy the shortage of rural physicians. This review also enabled her to identify content that would inform the novel survey instrument (Appendix A). She corresponded with the authors of these other studies to obtain their permission for use or modification of their instruments. Her physician co-authors provided their insights on rural practice and thoughts on important survey elements. In collaboration with physician team members, she narrowed and combined a list of competencies identified by consensus of rural family physicians (Appendix B) from over 200 to a selection of 31 skills important for medical practice in rural areas. Carter McCaskill was responsible for migrating the survey content into Qualtrics. The student author collaborated with her physician mentors to secure exemption from the Institutional Review Board (IRB). Meanwhile, her physician mentors contacted medical schools at which the survey could be distributed. The student later identified and recruited further schools for participation. The student author wrote recruitment emails and helped encourage survey distribution. She also assisted with grant writing and other institutions’ IRB documentation. She applied for and secured the student Lowe Endowment Fund for the project, though much credit is due to her physician mentors for help securing a grant from Yale’s Department of Internal Medicine. The student author was responsible for ensuring gift cards were distributed appropriately to survey respondents. The student author worked with Carter McCaskill on data analysis in Statistical Package for Social Sciences (SPSS). Finally, Thomas Pointer assisted with composition of separate content for potential future publication and will be responsible for some future directions of the research, including analysis of focus groups and resident data.
**Ethics in Human Subjects Research**

Additional care is necessary in surveying medical students, as there is risk of students feeling undue pressure to participate due to the power dynamics present in medicine. For this reason, the survey was distributed by the student author where possible. Additionally, the survey was completely anonymous and was described to students as such. If participants wished to enter the gift card lottery, they would use a separate Qualtrics link to provide their contact information to ensure that their responses could not be linked to their identity. Therefore, it was felt that there was overall minimal risk to subjects. Approval was secured from Yale’s Committee to Review Student Participation in Research. The study was deemed exempt from full IRB review due to the anonymity of participants and the low risk associated with the data collected. The consent script was provided at the beginning of the survey. If students selected “I agree” in response to the first question on the survey, this indicated their consent to participate and enabled them to proceed with the survey.

**Survey Creation**

The first section of the survey collected demographic data. Questions included which medical school the respondent attended, their year in school (“M1”, “M2”, “M3”, “M4”, or “M5/Research year”), how they would describe the community in which they grew up (a city, a suburb, a small town, or a rural area), how much they identified as an urban or rural person (not at all, a little, somewhat, very, or completely), and whether they had spent more than one full month living in a rural setting.

The researchers felt that information about attitudes toward rural areas and comfort with competencies important in rural areas would both be instructive in understanding medical student prospects in rural medicine. There is currently little research on either of these categories for United States medical students. To measure attitudes, a validated attitudes questionnaire developed based on responses by Australian medical students was incorporated into the survey.
with permission of the authors. The wording of some questions was minimally edited to increase applicability of the instrument to a United States audience.

There were four “valences” assessed in the attitudes questionnaire. All questions were a Likert scale assessing agreement with statements about rural areas. The first valence, “Friendliness and support”, included statements about presence of supportive staff, friendly people, welcoming people, friendly workplaces, and sense of community. “Isolation and socialization” statements were negatively worded and included statements about professional isolation, limited socialization, poor recreational facilities, isolation from family, and isolation from friends. “Enjoyable aspects of rural life” included statements about the presence of things the respondent enjoyed doing in rural areas, people that one could be friends with, and that living in a rural setting provides an enjoyable lifestyle. Finally, “Work opportunities” included statements about the opportunity to practice a greater variety of skills in rural areas, more opportunity for career advancement, greater work autonomy, and that employment in rural areas is desirable.

To the author’s knowledge, there is not an existing competencies instrument. There have been several surveys of rural physicians in the United States and elsewhere regarding competencies they feel are important in rural practice.\textsuperscript{60,61} However, most of these identified character traits or other interpersonal skills that the authors felt may be challenging for students to self-assess.

A study from Brazil was identified; the authors there worked with rural family physicians to create a comprehensive list of skills important in rural and remote primary care (full list available in Appendix B). It included concrete technical skills in addition to some interpersonal skills and elements of professional flexibility, a category including skills like improvisation, community engagement, and task-shifting, or taking on the role of other health professionals when necessary. Google Machine Translation was used to translate the work from Portuguese into
English. The content was then edited for grammar and readability. The research team collaboratively identified several skills that were unique to the Brazilian context and would not apply for United States medical students (e.g., “Know the history of peasant movements in Brazil and the dispute for land”). Skills were further narrowed based on the research team’s perception of their relative importance in the rural United States context. Finally, they were grouped into categories (e.g., “Performing a pap smear”, “IUD/Nexplanon placement or removal”, and several more skills became “Women’s health procedures (pap smear, IUD/Nexplanon placement, microscopic examination of vaginal secretion”). Students were asked to rank their confidence in or exposure to the competencies on a Likert scale.

The competencies assessed spanned multiple domains, including physical examination (“Rate your comfort examining the following systems to diagnose common illnesses without assistance of imaging or other diagnostic modalities”), diagnosis and management (“Rate your comfort proposing diagnosis and management for the following without guidance from a specialist”), procedural skills (“How much exposure have you had to the following skills?”), and elements of professional flexibility (“How much opportunity have you had to develop comfort with the following?”).

In addition to these attitudes and competencies questions, a unique set of investigator-developed questions designed to assess trainees’ confidence addressing urgent medical issues (acute hypertension [220/130] and headache, altered mental status, and acute chest pain) in different settings with differing resources available was incorporated into the survey. Since it was anticipated that many respondents would not have exposure to more austere medical environments, the instrument provided specific examples of what resources might be available in each setting to help survey respondents more accurately assess their comfort proposing initial management for these patients.
Additional optional questions included whether respondents felt rural health was adequately incorporated into their curriculum, why they felt that way, whether they would be interested in dedicated rural health experiences, and, if so, what kind of experience. At the end of the survey, a link was provided for a separate survey form to provide contact information in order to sign up for the gift card lottery. Separating this form helped ensure anonymity for the student participants. A complete listing of questions may be found in Appendix A. The survey was administered and data collected through Qualtrics.

Survey Distribution

Institutions at which the survey was distributed included East Tennessee State University’s Quillen College of Medicine, University of Minnesota’s Duluth Campus, Ohio University Heritage College of Osteopathic Medicine, The University of Tennessee Graduate School of Medicine, Yale School of Medicine, and the University of Connecticut. The former three of these six have explicit rural mission statements, while the latter three do not. As critical appraisal of specific rural health curricula was beyond the scope of this project, rural institutional mission statements were used as a proxy for student education in and exposure to rural health. Initial partners were identified through convenience sampling of connections of the project’s physician mentors. Additional rurally-focused partners were contacted based on the recommendations of rural health interest groups at the Society of General Internal Medicine and the American Academy of Family Physicians.

The survey was emailed to student listservs by an institutional representative at each campus two to three times over the data collection period. The first round of recruitment was sent to all students at each program, as this occurred during the Spring semester, so researchers felt the first year students likely had sufficiently informed opinions on their access to training in the important competencies. Since the later round of emails was sent during the Fall semester, after a
new group of students started, this email was only sent to students in their second year and above. Overall, the possible sample size included over 2500 medical students.

**Statistical Methods**

Data were extracted from Qualtrics and analyzed within Google Sheets and SPSS using Chi-square, t-tests, and correlational analyses. Respondents who answered two or more “careless responding” questions incorrectly were excluded from the analysis. Independent variables included attendance at a school with a rural mission statement, student’s self-described hometown rurality, and student’s self identification as rural or urban. Dependent variables included perception of adequate rural health curriculum at their institution, interest in dedicated rural health curriculum, the four attitude valances, specific competencies, and groups of competencies assessed within the survey. Likert scale questions were recoded from text to numeric to enable correlational analysis.

**Results**

**Respondent Characteristics**

A total of 287 students completed the survey. Of these, 131 (45.64%) indicated that they were in their first or second year (“pre-clerkship”), 146 (50.87%) were in their third year or above (“clerkship”), and ten (3.48%) declined to answer this question. Divided by mission, 122 (42.51%) students were at schools with a rural mission statement, while 165 (57.49%) were at schools with no mention of rural health in their mission. There was no significant difference in the proportion of pre-clerkship and clerkship student respondents between schools with a rural mission statement and those without, nor with student identity or time spent in a rural area. Students attending schools with a rural mission statement were more likely to report having spent more than one month in a rural area. They were also more likely to describe their hometown as
more rural. Students at schools with a rural mission statement were more likely to think of themselves as a rural person and less likely to think of themselves as an urban person (Table 1).

Hometown rurality was weakly but significantly positively correlated with rural identity, \( r(277) = .241, p < .001 \). Hometown rurality was weakly but significantly negatively correlated with urban identity, \( r(277) = -.269, p < .001 \).

<table>
<thead>
<tr>
<th>Rural Institutional Mission Statement</th>
<th>No (%)</th>
<th>Yes (%)</th>
<th>Total (%)</th>
<th>Chi Squared (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All respondents</td>
<td>165 (57.49%)</td>
<td>122 (42.51%)</td>
<td>287 (100%)</td>
<td>n/a</td>
</tr>
<tr>
<td>“What year are you in?”</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-Clerkship</td>
<td>68 (41.21%)</td>
<td>63 (51.64%)</td>
<td>131 (45.64%)</td>
<td>1.65 (.199)</td>
</tr>
<tr>
<td>Clerkship</td>
<td>87 (52.73%)</td>
<td>59 (48.36%)</td>
<td>146 (50.87%)</td>
<td></td>
</tr>
<tr>
<td>No response</td>
<td>10 (6.06%)</td>
<td>0 (0.0%)</td>
<td>10 (3.48%)</td>
<td></td>
</tr>
<tr>
<td>“Have you ever spent more than one month in a rural area?”</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>68 (41.21%)</td>
<td>91 (74.59%)</td>
<td>159 (55.40%)</td>
<td>39.251 (&lt;.001)***</td>
</tr>
<tr>
<td>No</td>
<td>94 (56.97%)</td>
<td>23 (18.85%)</td>
<td>117 (40.77%)</td>
<td></td>
</tr>
<tr>
<td>No response</td>
<td>3 (1.82%)</td>
<td>8 (6.56%)</td>
<td>11 (3.83%)</td>
<td></td>
</tr>
<tr>
<td>“How would you describe the community where you spent the majority of the time when you were growing up?”</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A city</td>
<td>31 (18.79%)</td>
<td>6 (4.92%)</td>
<td>37 (12.89%)</td>
<td>52.239 (&lt;.001)***</td>
</tr>
<tr>
<td>A suburb</td>
<td>97 (58.79%)</td>
<td>36 (29.51%)</td>
<td>133 (46.34%)</td>
<td></td>
</tr>
<tr>
<td>A small town</td>
<td>22 (13.33%)</td>
<td>34 (27.87%)</td>
<td>56 (19.51%)</td>
<td></td>
</tr>
<tr>
<td>A rural area</td>
<td>14 (8.48%)</td>
<td>39 (31.97%)</td>
<td>53 (18.47%)</td>
<td></td>
</tr>
<tr>
<td>No response</td>
<td>1 (0.61%)</td>
<td>7 (5.74%)</td>
<td>8 (2.79%)</td>
<td></td>
</tr>
<tr>
<td>“How much do you think of yourself as a country or rural person?”</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td>63 (38.18%)</td>
<td>18 (14.75%)</td>
<td>81 (28.22%)</td>
<td>42.701 (&lt;.001)***</td>
</tr>
<tr>
<td>A little</td>
<td>55 (33.33%)</td>
<td>28 (22.95%)</td>
<td>83 (28.92%)</td>
<td></td>
</tr>
<tr>
<td>Somewhat</td>
<td>36 (21.82%)</td>
<td>32 (26.23%)</td>
<td>68 (23.69%)</td>
<td></td>
</tr>
<tr>
<td>Very</td>
<td>9 (5.45%)</td>
<td>29 (23.77%)</td>
<td>38 (13.24%)</td>
<td></td>
</tr>
<tr>
<td>Completely</td>
<td>1 (0.61%)</td>
<td>8 (6.56%)</td>
<td>9 (3.14%)</td>
<td></td>
</tr>
<tr>
<td>No response</td>
<td>1 (0.61%)</td>
<td>7 (5.74%)</td>
<td>8 (2.79%)</td>
<td></td>
</tr>
</tbody>
</table>
“How much do you think of yourself as a city or urban person?”

<table>
<thead>
<tr>
<th>Category</th>
<th>Pre-Clerkship</th>
<th>Clerkship</th>
<th>Diff (95% CI)</th>
<th>p- value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friendliness &amp; support</td>
<td>4.46 ± 0.81</td>
<td>4.42 ± 0.72</td>
<td>-0.04 (0.14 - -0.22)</td>
<td>.66</td>
</tr>
<tr>
<td>Isolation &amp; socialization</td>
<td>4.31 ± 0.91</td>
<td>4.16 ± 1.04</td>
<td>-0.15 (0.08 - -0.38)</td>
<td>.21</td>
</tr>
<tr>
<td>Enjoyable aspects of rural life</td>
<td>4.59 ± 1.07</td>
<td>4.52 ± 1.10</td>
<td>-0.07 (0.18 - -0.33)</td>
<td>.59</td>
</tr>
<tr>
<td>Work Opportunity</td>
<td>4.04 ± 0.75</td>
<td>4.17 ± 0.72</td>
<td>0.13 (0.04 - 0.30)</td>
<td>.14</td>
</tr>
</tbody>
</table>

Table 1. Student responses to questions about origin and identity. Students are divided based on institutional mission statements. Those designated “Pre-Clerkship” were self-described as “M1” or “M2”, while those described as “Clerkship” self-described as “M3”, “M4”, or “M5/Research Year”. * p < .05, **p < .01, ***p < .001.

Attitudes Toward Rural Areas

There was no significant difference between pre-clerkship and clerkship student attitudes toward rural areas (Table 2).

Table 2. Average Likert scores for students’ attitudes toward various aspects of rural life. Students are divided based on class year such that “Pre-Clerkship” were self-described as “M1” or “M2” and “Clerkship” self-described as “M3”, “M4”, or “M5/Research Year”. Likert scores range between 1 and 6 (1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = slightly agree, 5 = moderately agree, 6 = strongly agree).

Student attendance at a school with a rural mission statement and having spent time in rural areas were both significantly positively associated with positive attitudes and negatively associated with negative attitudes toward rural areas (Table 3).
Table 3. Average Likert scores for students’ attitudes toward various aspects of rural life. Students are divided based on institutional mission statements and whether they had spent more than one month in a rural area. Likert scores range between 1 and 6 (1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = slightly agree, 5 = moderately agree, 6 = strongly agree). * p < .05, **p < .01, ***p < .001.

<table>
<thead>
<tr>
<th>Attitude category</th>
<th>Rural Institutional Mission Statement</th>
<th>Time Spent in Rural Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Friendliness &amp; support</td>
<td>4.21 ± 0.73</td>
<td>4.76 ± 0.69</td>
</tr>
<tr>
<td>Isolation &amp; socialization</td>
<td>4.53 ± 0.93</td>
<td>3.80 ± 0.91</td>
</tr>
<tr>
<td>Enjoyable aspects of rural life</td>
<td>4.25 ± 1.06</td>
<td>5.01 ± 0.95</td>
</tr>
<tr>
<td>Work Opportunity</td>
<td>4.00 ± 0.68</td>
<td>4.30 ± 0.80</td>
</tr>
</tbody>
</table>

Student hometown rurality was significantly positively correlated with positive attitudes toward friendliness and support and enjoyable aspects of rural life. It was also negatively correlated with negative attitudes about isolation and socialization. There was a trend toward more positive perception of work opportunities, though it was not statistically significant. Rural identity was significantly positively correlated with all positive attitude groups and significantly negatively correlated with negative attitudes. The inverse was true for students who self-identified as more urban (Table 4). Urban identity was weakly negatively correlated with having spent time in a rural setting, r(280) = -0.164, p = .006.

Table 4. Pearson correlation between students’ attitudes toward various aspects of rural life and the self-described rurality of their hometown and student self-perception as either rural or urban. * p < .05, **p < .01, ***p < .001.
Competencies

As expected, pre-clerkship students were significantly less comfortable with all groups of competencies than clerkship students (Table 5).

<table>
<thead>
<tr>
<th>Skill category</th>
<th>Pre-Clerkship (avg ± st. dev)</th>
<th>Clerkship (avg ± st. dev)</th>
<th>Difference (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Exam</td>
<td>1.63 ± 0.53</td>
<td>2.05 ± 0.38</td>
<td>0.42 (0.31 - 0.53)</td>
<td>&lt;.001***</td>
</tr>
<tr>
<td>Diagnosis &amp; Management</td>
<td>1.59 ± 0.53</td>
<td>2.20 ± 0.47</td>
<td>0.61 (0.49 - 0.73)</td>
<td>&lt;.001***</td>
</tr>
<tr>
<td>Procedures</td>
<td>1.63 ± 0.42</td>
<td>2.23 ± 0.53</td>
<td>0.60 (0.48 - 0.71)</td>
<td>&lt;.001***</td>
</tr>
<tr>
<td>Professional Flexibility</td>
<td>1.95 ± 0.63</td>
<td>2.19 ± 0.64</td>
<td>0.24 (0.08 - 0.39)</td>
<td>.002**</td>
</tr>
<tr>
<td>Aggregate of All Categories</td>
<td>1.70 ± 0.20</td>
<td>2.17 ± 0.19</td>
<td>0.47 (0.42 - 0.51)</td>
<td>&lt;.001***</td>
</tr>
</tbody>
</table>

Table 5. Average Likert scores for students comfort with and exposure to select skills at their institution. Likert scores range between 1 and 3 or 4 (for comfort questions, 1=not comfortable, 2=somewhat comfortable, 3=comfortable; for exposure and opportunity questions, 1=no exposure, 2=some exposure, 3=sufficient exposure 4=a great deal of exposure). * p < .05, **p < .01, ***p < .001.

Students who attended a school with a rural mission statement reported significantly greater comfort with professional flexibility in aggregate and specifically had greater comfort performing functions normally fulfilled by other professionals, applying knowledge of local resources, and improvising with limited resources. Students at schools with rural mission statements also reported significantly greater comfort with musculoskeletal examination, comfort with diagnosis and management of regionally endemic illnesses, exposure to reproductive health and dermatologic procedures, and significantly less exposure to point-of-care ultrasound. Finally, students at schools with a rural mission statement were significantly more comfortable providing a plan for initial care for selected urgent illnesses in the rural outpatient setting than students at schools without a rural mission statement (Table 6).

Students who spent time in a rural setting reported significantly greater comfort with an aggregate of all skills. These students reported significantly more exposure to procedures in aggregate and specifically more exposure to dermatologic and musculoskeletal procedures. Students who had spent time in rural settings were significantly more comfortable with
gynecologic examination, diagnosis and management of regionally endemic illnesses, and
providing a plan for initial care for selected urgent illnesses in small community hospitals and in
the rural outpatient setting. Students who had spent time in rural settings were also significantly
more comfortable with professional flexibility in aggregate, performing functions normally
fulfilled by other professionals, applying knowledge of local resources, improvising with limited
resources, and learning local health behaviors and providing culturally sensitive care. There was a
trend toward greater comfort with community engagement about health outside the
hospital/clinic, but it did not reach statistical significance (p = .095). There was also a trend
toward greater exposure to reproductive health procedures (p = .076) and independent
interpretation of common imaging (p = .056) (Table 6).

<table>
<thead>
<tr>
<th>Rural Institutional Mission Statement</th>
<th>Time Spent in Rural Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Average comfort/opportunity score by skill category</td>
<td></td>
</tr>
<tr>
<td>Physical Exam</td>
<td>1.84 ± 0.46</td>
</tr>
<tr>
<td>Diagnosis &amp; Management</td>
<td>1.91 ± 0.54</td>
</tr>
<tr>
<td>Procedures</td>
<td>1.92 ± 0.53</td>
</tr>
<tr>
<td>Professional Flexibility</td>
<td>1.98 ± 0.61</td>
</tr>
<tr>
<td>Aggregate of All Categories</td>
<td>1.91 ± 0.54</td>
</tr>
</tbody>
</table>

Comfort with physical examination and diagnosis of listed systems…

<p>| Cardiovascular, respiratory, and abdominal | 1.95 ± 0.64 | 1.95 ± 0.68 | 0.00 (-0.15 - 0.15) | 1.94 ± 0.67 | 1.95 ± 0.64 | 0.01 (-0.15 - 0.17) | .900 |
| Neurologic, fundoscopic, and otoscopic    | 1.75 ± 0.61 | 1.78 ± 0.67 | 0.03 (-0.12 - 0.18) | .693 | 1.82 ± 0.67 | 1.71 ± 0.60 | 0.11 (-0.26 - 0.04) | .153 |
| Gynecological                            | 1.68 ± 0.69 | 1.75 ± 0.75 | 0.07 (-0.10 - 0.24) | .414 | 1.57 ± 0.66 | 1.80 ± 0.74 | 0.23 (0.06 - 0.40) | .008** |</p>
<table>
<thead>
<tr>
<th>Psychosocial</th>
<th>Imaging</th>
<th>normally</th>
<th>Other</th>
<th>Non-major</th>
<th>Improvising</th>
<th>Musculoskeletal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dermatologic</td>
<td>1.92 ± 0.71</td>
<td>1.80 ± 0.75</td>
<td>-0.12 (-0.29 - 0.05)</td>
<td>.168</td>
<td>1.81 ± 0.72</td>
<td>1.91 ± 0.73</td>
</tr>
<tr>
<td>Musculoskeletal</td>
<td>1.88 ± 0.67</td>
<td>2.05 ± 0.68</td>
<td>0.17 (0.01 - 0.33)</td>
<td>.036*</td>
<td>1.91 ± 0.68</td>
<td>1.97 ± 0.67</td>
</tr>
</tbody>
</table>

| Chronic diseases | 2.11 ± 0.67 | 2.07 ± 0.79 | -0.04 (-0.21 - 0.13) | .644 | 2.04 ± 0.66 | 2.13 ± 0.76 | 0.09 (-0.06 - 0.24) | .305 |
| Acute infectious diseases | 2.09 ± 0.74 | 2.04 ± 0.77 | -0.05 (-0.23 - 0.13) | .579 | 2.05 ± 0.73 | 2.08 ± 0.77 | 0.03 (-0.15 - 0.21) | .744 |
| Musculoskeletal disorders | 1.87 ± 0.74 | 2.01 ± 0.80 | 0.14 (-0.04 - 0.32) | .127 | 1.85 ± 0.76 | 1.97 ± 0.76 | 0.12 (-0.06 - 0.30) | .196 |
| Psychosocial challenges | 1.97 ± 0.73 | 1.81 ± 0.77 | -0.16 (-0.34 - 0.02) | .074 | 1.91 ± 0.69 | 1.89 ± 0.79 | -0.02 (-0.20 - 0.16) | .827 |
| Regionally endemic illnesses | 1.50 ± 0.64 | 1.76 ± 0.71 | 0.26 (0.10 - 0.42) | .001** | 1.44 ± 0.62 | 1.73 ± 0.70 | 0.29 (0.13 - 0.45) | <.001* ** |

| Exposure to selected skills related to… |
| Reproductive health | 2.03 ± 0.82 | 2.23 ± 0.85 | 0.20 (0.00 - 0.40) | .045* | 2.02 ± 0.83 | 2.20 ± 0.83 | 0.18 (-0.02 - 0.38) | .076 |
| Dermatology | 1.51 ± 0.76 | 1.90 ± 0.80 | 0.39 (0.21 - 0.57) | <.001 *** | 1.46 ± 0.65 | 1.83 ± 0.86 | 0.37 (0.18 - 0.56) | <.001* ** |
| Non-major trauma | 1.85 ± 0.77 | 1.96 ± 0.89 | 0.11 (-0.08 - 0.30) | .264 | 1.81 ± 0.75 | 1.95 ± 0.87 | 0.14 (-0.06 - 0.34) | .163 |
| Musculoskeletal | 1.70 ± 0.74 | 1.81 ± 0.82 | 0.11 (-0.07 - 0.29) | .236 | 1.61 ± 0.70 | 1.84 ± 0.81 | 0.23 (0.05 - 0.41) | .014* |
| Imaging interpretation | 2.13 ± 0.79 | 2.23 ± 0.85 | 0.10 (-0.09 - 0.29) | .306 | 2.06 ± 0.74 | 2.25 ± 0.86 | 0.19 (-0.005 - 0.38) | .056 |
| POCUS | 2.27 ± 0.78 | 1.96 ± 0.66 | -0.31 (-0.48 - -0.14) | <.001 *** | 2.17 ± 0.66 | 2.11 ± 0.81 | -0.06 (-0.24 - -0.12) | .512 |
| Other bedside skills | 1.95 ± 0.78 | 2.01 ± 1.00 | 0.06 (-0.15 - 0.27) | .569 | 1.96 ± 0.81 | 1.97 ± 0.92 | 0.01 (-0.20 - 0.22) | .925 |

| Opportunity to develop comfort related to… |
| Performing functions normally fulfilled by other professionals | 1.39 ± 0.57 | 1.70 ± 0.76 | 0.31 (0.16 - 0.46) | <.001 *** | 1.38 ± 0.56 | 1.62 ± 0.73 | 0.23 (0.07 - 0.39) | .005** |
| Applying knowledge of local resources | 2.04 ± 0.84 | 2.26 ± 0.88 | 0.22 (0.02 - 0.42) | .032* | 1.95 ± 0.79 | 2.26 ± 0.89 | 0.31 (0.11 - 0.51) | .003** |
| Improvising with limited resources | 1.66 ± 0.78 | 1.93 ± 0.88 | 0.27 (0.08 - 0.46) | .006** | 1.59 ± 0.72 | 1.91 ± 0.89 | 0.32 (0.12 - 0.52) | .002** |
Hometown rurality was associated with significantly greater comfort with diagnosis and management without specialist support in aggregate and specifically with management of chronic diseases, acute infectious diseases, and regionally endemic illnesses. It was also associated with significantly greater exposure to procedures in aggregate and specifically more exposure to dermatologic procedures and independent interpretation of common imaging. There was a trend toward greater exposure to management of non-major trauma (p = .054) and reproductive health procedures (p = .074), but these were not statistically significant. Hometown rurality was also significantly associated with professional flexibility in aggregate and with all elements of professional flexibility (performing functions normally fulfilled by other professionals, applying knowledge of local resources, improvising with limited resources, community engagement about health outside the hospital/clinic, and learning local health behaviors and providing culturally sensitive care). Finally, it was associated with greater comfort proposing a plan for management of urgent illnesses in a small community hospital and in a rural outpatient clinic (Table 7).

Rural identity was significantly positively associated with comfort with diagnosis and management of regionally endemic illnesses without specialist support. Like hometown rurality, it
was associated with greater exposure to dermatologic procedures. Rural identity was also significantly positively associated with professional flexibility in aggregate and with all elements of professional flexibility except performing functions normally fulfilled by other professionals (p = .081). Finally, rural identity was associated with greater comfort proposing a plan for management of urgent illnesses in a small community hospital and in a rural outpatient clinic (Table 7).

Urban identity was not significantly positively or negatively correlated with any competencies. There was a trend toward less comfort applying knowledge of local resources (p = 0.087) and less comfort proposing a plan for management of urgent illnesses in a rural outpatient clinic (p = 0.062), but neither reached significance (Table 7).

<table>
<thead>
<tr>
<th>Hometown Rurality</th>
<th>Rural Identity</th>
<th>Urban Identity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson (r)</td>
<td>p-value</td>
<td>Pearson (r)</td>
</tr>
<tr>
<td>Physical Exam</td>
<td>.023</td>
<td>.714</td>
</tr>
<tr>
<td>Diagnosis &amp; Management</td>
<td>.189</td>
<td>.002**</td>
</tr>
<tr>
<td>Procedures</td>
<td>.158</td>
<td>.013*</td>
</tr>
<tr>
<td>Professional Flexibility</td>
<td>.292</td>
<td>&lt;.001***</td>
</tr>
<tr>
<td>Aggregate of All Categories</td>
<td>.204</td>
<td>.001**</td>
</tr>
</tbody>
</table>

Correlation by skill category

Comfort with physical examination and diagnosis of listed systems…

| Cardiovascular, respiratory, and abdominal | -.048 | .441 | -.071 | .250 | -.015 | .807 |
| Neurologic, fundoscopic, and otoscopic | .054 | .386 | -.043 | .485 | .078 | .207 |
| Gynecological | .042 | .500 | .043 | .488 | .050 | .423 |
| Dermatologic | .025 | .686 | -.003 | .964 | .001 | .985 |
| Musculoskeletal | .006 | .917 | .057 | .358 | .039 | .526 |

Comfort with diagnosis and management (without specialist guidance) for…

| Chronic diseases | .165 | .008** | .105 | .090 | -.016 | .793 |
| Acute infectious diseases | .164 | .008** | .049 | .435 | .024 | .702 |
Table 7. Pearson correlation values for students’ comfort with and exposure to select skills at their institution and students’ self-described rurality of their hometown and self-perception as either rural or urban. * p < .05, ** p < .01, *** p < .001.

<table>
<thead>
<tr>
<th>Musculoskeletal disorders</th>
<th>.078</th>
<th>.207</th>
<th>.043</th>
<th>.491</th>
<th>.021</th>
<th>.739</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychosocial challenges</td>
<td>.096</td>
<td>.122</td>
<td>.101</td>
<td>.103</td>
<td>-.034</td>
<td>.586</td>
</tr>
<tr>
<td>Regionally endemic illnesses</td>
<td>.246</td>
<td>&lt;.001***</td>
<td>.156</td>
<td>.012*</td>
<td>-.095</td>
<td>.126</td>
</tr>
</tbody>
</table>

Exposure to selected skills related to…

<table>
<thead>
<tr>
<th>Reproductive health</th>
<th>.113</th>
<th>.074</th>
<th>-.028</th>
<th>.664</th>
<th>.072</th>
<th>.259</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dermatology</td>
<td>.159</td>
<td>.012*</td>
<td>.185</td>
<td>.003**</td>
<td>-.069</td>
<td>.281</td>
</tr>
<tr>
<td>Non-major trauma</td>
<td>.122</td>
<td>.054</td>
<td>.032</td>
<td>.613</td>
<td>-.046</td>
<td>.470</td>
</tr>
<tr>
<td>Musculoskeletal</td>
<td>.055</td>
<td>.387</td>
<td>-.079</td>
<td>.212</td>
<td>.078</td>
<td>.220</td>
</tr>
<tr>
<td>Imaging interpretation</td>
<td>.132</td>
<td>.038*</td>
<td>.040</td>
<td>.534</td>
<td>.044</td>
<td>.490</td>
</tr>
<tr>
<td>POCUS</td>
<td>.091</td>
<td>.152</td>
<td>-.070</td>
<td>.270</td>
<td>.017</td>
<td>.786</td>
</tr>
<tr>
<td>Other bedside skills</td>
<td>.088</td>
<td>.164</td>
<td>.058</td>
<td>.365</td>
<td>-.092</td>
<td>.146</td>
</tr>
</tbody>
</table>

Opportunity to develop comfort related to…

<table>
<thead>
<tr>
<th>Performing functions normally fulfilled by other professionals</th>
<th>.136</th>
<th>.033*</th>
<th>.111</th>
<th>.081</th>
<th>-.093</th>
<th>.145</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applying knowledge of local resources</td>
<td>.254</td>
<td>&lt;.001***</td>
<td>.231</td>
<td>&lt;.001***</td>
<td>-.109</td>
<td>.087</td>
</tr>
<tr>
<td>Improvising with limited resources</td>
<td>.253</td>
<td>&lt;.001***</td>
<td>.179</td>
<td>.005</td>
<td>.014</td>
<td>.825</td>
</tr>
<tr>
<td>Community engagement about health outside the hospital/clinic</td>
<td>.227</td>
<td>&lt;.001***</td>
<td>.163</td>
<td>.010*</td>
<td>.008</td>
<td>.906</td>
</tr>
<tr>
<td>Learning local health behaviors &amp; providing culturally sensitive care</td>
<td>.253</td>
<td>&lt;.001***</td>
<td>.139</td>
<td>.029*</td>
<td>-.067</td>
<td>.294</td>
</tr>
</tbody>
</table>

Comfort formulating a plan for initial care for select urgent illnesses in…

<table>
<thead>
<tr>
<th>A tertiary care center</th>
<th>.086</th>
<th>.178</th>
<th>.066</th>
<th>.302</th>
<th>-.001</th>
<th>.989</th>
</tr>
</thead>
<tbody>
<tr>
<td>A small community hospital</td>
<td>.161</td>
<td>.011*</td>
<td>.158</td>
<td>.013*</td>
<td>-.033</td>
<td>.605</td>
</tr>
<tr>
<td>A rural outpatient clinic</td>
<td>.179</td>
<td>.005**</td>
<td>.182</td>
<td>.004**</td>
<td>-.118</td>
<td>.062</td>
</tr>
</tbody>
</table>

Incorporation of and Interest in Rural Health Education

Students who attended a medical school with a rural mission statement were significantly more likely to feel that rural health was “adequately incorporated” into their curriculum. Students at schools without rural mission statements almost unanimously felt that rural health was not
adequately incorporated into their curriculum (only 4.2% felt that it was adequate), while those at schools with rural mission statements almost all felt that it was adequately incorporated (98.1%) (Table 8).

<table>
<thead>
<tr>
<th>Do you feel rural health was adequately incorporated into your curriculum?</th>
<th>Rural Institutional Mission Statement</th>
<th>No</th>
<th>Yes</th>
<th>Chi-Square (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td></td>
<td>6 (4.17%)</td>
<td>103 (98.09%)</td>
<td>217.67 (&lt;.001)***</td>
</tr>
<tr>
<td>No</td>
<td></td>
<td>138 (95.83%)</td>
<td>2 (1.90%)</td>
<td></td>
</tr>
</tbody>
</table>

Table 8. Frequency of reporting adequate inclusion of rural health into curriculum based on institutional mission statement (non-respondents excluded). * p < .05, **p < .01, ***p < .001.

When asked to explain their answer, students who felt rural health was not adequately incorporated into their curriculum most often attributed it to lack of exposure in their urban training environment or to it simply not being something that is discussed (“We're fortunate to learn and work in a high resource setting and we very rarely talked about what we would do if we did not have the resources available to us here”). Many also stated that it was not a priority of their institution (“Rural health is not aligned with the school's mission statement / not emphasized in the school's core values.”) and that they did not believe there was significant student interest at their institution (“In an urban setting, with few/no students interested in going into rural medicine”). Many stated that they felt that their didactics and clinical conversations were based on educators’ assumptions that they would always be practicing in a tertiary care center (“Talk about management of diseases always assumed we were at an urban or well resourced setting. For instance, we focused a lot on PCIs & tPAs for managing MIs. When I asked about tPAs the workshop facilitator said, [institution] has more than enough cath labs, don't worry about the tPA.”). Some reported that rural health education was not emphasized as it was not considered academic or prestigious enough (“It is not ‘prestigious’ and my school is very ivory-tower based.”). Several also mentioned a dearth of clinicians with rural experience (“My medical school is in an urban environment, and besides a few faculty members who've actually practiced rurally,
I had little exposure to knowledgeable clinicians who can instruct about rural medicine…”).
Finally, a small number of students reported a culture of negative regard toward rural medicine (“The faculty at [institution] have expressed their distaste for rural people/patients and look down on them, rural medicine, and practitioners of rural medicine.”), as well as feeling that there was not adequate time to incorporate rural health education into their curricula (“Not enough time to sufficiently cover the topics”) (Table 9).

<table>
<thead>
<tr>
<th>Explanation of Reported Inadequate Rural Health Education</th>
<th>Number of Students Who Reported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training in urban environment</td>
<td>41</td>
</tr>
<tr>
<td>Not discussed in didactic or clinical setting</td>
<td>40</td>
</tr>
<tr>
<td>Institutional deprioritization</td>
<td>14</td>
</tr>
<tr>
<td>No student interest at their institution</td>
<td>14</td>
</tr>
<tr>
<td>Institution/instructors assumed they would always be in a tertiary care environment</td>
<td>11</td>
</tr>
<tr>
<td>Rural medicine not academic/prestigious</td>
<td>7</td>
</tr>
<tr>
<td>No role models with rural experience</td>
<td>4</td>
</tr>
<tr>
<td>Negative regard toward rural medicine</td>
<td>3</td>
</tr>
<tr>
<td>Insufficient time</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 9. Number of students who mentioned each theme justifying inadequacy of rural health education.

Students who felt rural health was adequately incorporated into their curriculum most often attributed this to rural health being a priority of their institution (“It feels to be the basis of the curriculum. Multiple classes and opportunities to learn about rural health”). Many others cited regular clinical discussions, lectures, or specific courses dedicated to rural health topics (“Rural rotations at [sites]… rural-specific lectures like ‘farm equipment injuries’ and rural-specific tox lectures like organophosphate poisoning, etc.”). Many also reported that their participation in a dedicated rural track was responsible for the adequacy of their rural health education (“[Name of track] provides us with exposures to rural health starting in the first year of school.”). Other common responses included their rural training environment (“Every facet of doctoring asks us to
visualize our skills with the patient population we may see at [rural town]”), participation in specific or required rural rotations (“Being in a rural area our [core clinical experiences] allow us to be exposed to rural areas and how providers give care”), and working with role models in rural practice (“had docs that taught classes that worked in rural clinics and would explain how to workup and manage certain conditions or presentations but then explain how their clinic only has X and how they would go about the same issue at their clinic”). Finally, several cited student interest in the topic as motivating additional rural health focus (“...Many of my classmates were from rural communities and it felt like our curriculum was geared towards that at times.”), as well as positive regard toward rural medicine (“It is part of our mission and is celebrated in various ways and events across campus.”) (Table 10).

<table>
<thead>
<tr>
<th>Explanation of Reported Adequate Rural Health Education</th>
<th>Number of Students Who Reported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institutional prioritization</td>
<td>31</td>
</tr>
<tr>
<td>Specific discussions/lectures/courses</td>
<td>21</td>
</tr>
<tr>
<td>Participation in rural track</td>
<td>21</td>
</tr>
<tr>
<td>Training in rural environment</td>
<td>12</td>
</tr>
<tr>
<td>Participation in rural rotation</td>
<td>10</td>
</tr>
<tr>
<td>Role models in rural practice</td>
<td>8</td>
</tr>
<tr>
<td>Student interest</td>
<td>4</td>
</tr>
<tr>
<td>Positive regard toward rural medicine</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 10. Number of students who mentioned each theme justifying adequacy of rural health education.

When asked if they were interested in dedicated rural health training experiences, 68 students selected “yes”, 60 selected “maybe”, and 16 selected “no”. The number of students at both rural and urban institutions who selected “yes” exceeded those who selected “maybe” or “no.” (Table 11).
Table 11. Frequency of student responses indicating whether they had interest in participating in dedicated rural health experiences.

<table>
<thead>
<tr>
<th>Interest in Dedicated Rural Health Training Experiences</th>
<th>Rural Institutional Mission Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>No (12.05%)</td>
</tr>
<tr>
<td>Yes</td>
<td>Yes (9.84%)</td>
</tr>
<tr>
<td>Maybe</td>
<td>Maybe (12.05%)</td>
</tr>
<tr>
<td>Yes</td>
<td>Yes (9.84%)</td>
</tr>
</tbody>
</table>

Table 11. Frequency of student responses indicating whether they had interest in participating in dedicated rural health experiences.

Hometown rurality, time spent in rural areas, and rural identity were significantly positively associated with interest in dedicated rural health training experiences. Urban identity was associated with a trend toward less interest in rural health experiences, but this was not statistically significant. Attendance at a school with an institutional mission statement with a focus on rural health was not correlated with interest in dedicated rural health training experiences (Table 12).

Table 12. Pearson correlation values for student interest in rural health training experiences and the mission statement of their school, whether they had spent time in rural settings, their hometown rurality, and their own personal rural or urban identity. * p < .05, **p < .01, ***p < .001.

When asked what sort of rural training experiences they would be interested in, most participants (44) suggested clerkship or elective rotations in rural areas. Many also expressed interest in specific lectures or clinical discussions about management of issues within the rural setting (26). Seven expressed interest in more experience with procedures, six said they were unsure or would be open to any type of learning, four reported interest in seeing rural specialist care, and two suggested simulations related to rural medicine.
Discussion

Overall, as hypothesized, rural learning (attendance at a school with a rural mission statement, time spent in a rural area, hometown rurality, and self-identification as rural) was associated with more favorable attitudes toward rural areas and greater self-reported preparedness in some skills important in rural medical practice.

Attitudes Toward Rural Areas

The largest and most consistent differences identified in this survey were in attitudes toward rural areas. Students with urban identities had significantly lower agreement with positive statements about rural areas, including less agreement with statements about enjoyable aspects of rural life, friendliness and support in rural areas, and work opportunities present in rural areas. Students with urban identities were also more likely to report higher agreement with negatively worded statements about the risk of isolation and reduced opportunities for socialization in rural areas.

Rural identity, self-described rurality of one’s hometown, and attendance at a school with a rural mission statement were significantly positively associated with more positive perceptions of enjoyable aspects of rural life and friendliness and support in rural areas. They were also significantly negatively correlated with concerns about isolation and socialization. Rural identity and attendance at a school with a rural mission statement were also associated with greater perceived work opportunities in rural areas; this trend was present but not statistically significant for students with hometowns described as more rural.

The positive attitudes of those from rural backgrounds and with rural identities towards rural life and practice reinforce the importance of recruiting students with these backgrounds, as these attitudes will likely shape their career plans. This work cannot isolate the impact of attending schools with rural mission statements from the impact of rural identity or hometown, as
students with rural backgrounds were disproportionately common among the sample of students at schools with rural institutional mission statements. This may be due to their own self-selection of an environment that aligned with their own identity and goals. Additionally, this study is unable to isolate whether the effect of time spent in a rural setting is attributable to time spent in medical school or time prior to medical school.

Despite the aforementioned limitations, findings suggestive of rural medical education contributing to more positive student attitudes toward rural areas would be in alignment with past research demonstrating the impact of rural curricula and rotations. Several of these studies, including the one used to design the validated attitudes questionnaire adopted into this research, demonstrate an improvement in attitudes toward rural areas after students receive rural health education or complete rural rotations. This information in combination suggests that dedicated rural health training and time spent in rural settings may contribute to more favorable student attitudes toward rural areas.

Since urban identity was associated with less favorable attitudes and was also negatively correlated with having spent time in a rural area, one may suspect that rural rotations could help improve urban-identity student perceptions of rural areas, particularly for those students who have not spent time in rural settings. In fact, family physicians of urban backgrounds who choose rural practice often cite rural medical training as the most influential factor that contributed to their choice of rural practice. Overall, these findings underscore the importance of making rural rotations readily available to students and encouraging participation in these rotations. At many schools with rural mission statements, such rotations are a default or required component of the curriculum. However, many urban schools have limited, optional rural rotations. An opt-out rural rotation system or expansion of elective options and accessibility at some medical schools would likely greatly increase participation and consequently improve medical student attitudes toward rural areas.
**Competencies**

As expected, pre-clerkship status was negatively associated with comfort with all groups of competencies. There were slightly more pre-clerkship students among the sample of students at schools with rural mission statements, though this trend was not statistically significant. However, it is possible that this trend slightly reduced the relative competency scores of students at schools with rural mission statements. Despite this, overall, rural learning was associated with improved comfort with or exposure to a number of skills. Hometown rurality and time spent in rural settings were associated with greater comfort/opportunity scores for all skills in aggregate. The only skill that students at institutions with rural mission statements were less comfortable with was point-of-care ultrasound; this may represent an area for growth at these institutions. This disparity may be reflective of relatively less availability of ultrasound technology at rural clinical training sites and therefore may resolve itself over time as this becomes more affordable and widespread. Potential areas for growth for those without rural learning experiences are described for each skill category below.

*Physical Examination*

Students at schools with a rural institutional mission statement were significantly more comfortable with physical examination of the musculoskeletal system for diagnosis of common illnesses without imaging or other diagnostic modalities. This may be in part due to the lower availability of imaging technology in rural settings, resulting in greater emphasis on and practice of musculoskeletal examination. Thus, schools without rural emphasis may benefit from more dedicated training in musculoskeletal physical examination and diagnosis.

Students who had spent time in rural settings were more comfortable with gynecological examination for diagnosis of common illnesses without imaging or other diagnostic modalities. This may be attributable to the fact that, in rural settings, management of routine gynecological care and common gynecological concerns often takes place in the primary care setting. However,
in urban areas, these concerns are often managed by or referred to a gynecological specialist. Although students do commonly rotate with obstetrics/gynecology, they tend to spend less time on these services than they would in the primary care setting.67

   Hometown rurality, rural identity, and urban identity were not significantly correlated with any elements of comfort with physical examination. None of the independent variables (mission statement, time spent in rural areas, hometown rurality, or student rural or urban identity) were found to be associated with comfort examining the following groups of systems to diagnose common illnesses without imaging or other diagnostics: “cardiovascular, respiratory, and abdominal”, “neurologic, fundoscopic, and otoscopic”, and “dermatologic”.

Diagnosis & Management

All rural learning was associated with greater comfort proposing a diagnosis and management plan without guidance from a specialist for regionally endemic illnesses such as venomous animal bites or tick borne disease. This may be due to the greater prevalence of some of these illnesses in rural areas, particularly for tick-borne disease, due to increased exposure to tick habitats.68,69 Therefore, rural learners may have more frequent exposure to these illnesses. Additionally, schools with a rural emphasis often also emphasize care of local rural populations; this was true of the rural institutions sampled in this research. Therefore, it is possible that schools with a rural mission statement have a greater curricular emphasis on locally important endemic illnesses, while schools without a rural mission may also have less of a local focus and spend less time on regionally endemic illnesses. For students without rural learning experiences, this could potentially be mitigated by rural rotations, additional workshops, or case studies of regionally endemic illnesses. This may be most valuable if completed near where the student intends to ultimately practice to ensure they obtain experience relevant to the diseases they are most likely to encounter.
Hometown rurality was also associated with comfort proposing a diagnosis and management plan without specialist support for chronic diseases (such as diabetes, asthma, heart failure, and chronic obstructive pulmonary disease) and acute infectious diseases (pneumonia, upper respiratory tract infections, sexually transmitted infections, skin infections, and acute diarrhea). This trend toward greater comfort with chronic diseases diagnosis and management was also present for students with rural identity, but not statistically significant (\( p = 0.090 \)). This may be partly due to the greater likelihood of those with a rural background to pursue careers in primary care, thereby increasing their personal focus on learning these foundational elements of primary care. Hometown rurality was also associated with greater comfort with diagnosis and management in aggregate.

None of the independent variables (mission statement, time spent in rural areas, hometown rurality, or student rural or urban identity) were found to be associated with comfort proposing a diagnosis and management plan without specialist guidance for: “Psychosocial challenges (mood disorders, substance use disorder [including medication assisted treatment], food insecurity, intimate partner violence)”. However, there was a trend toward less comfort with diagnosis and management of psychosocial challenges among students at schools with a rural mission statement (\( p = 0.074 \)) and a trend toward greater comfort among students with a rural identity (\( p = 0.103 \)). The former may be partly attributable to the reduced availability of referral options available for psychosocial challenges in the rural setting, while the latter may be due to the greater comfort with improvisation, applying knowledge of local resources, and engaging with the community found among students who identify as rural, described further in the Professional Flexibility section. Additionally, no independent variables were associated with comfort with diagnosis and management of “Musculoskeletal disorders (joint pain, low back pain, rotator cuff injury, knee injury)”. This is interesting in light of the greater comfort with musculoskeletal examination among students at institutions with rural mission statements; it may
reflect that urban settings are initially more reliant on imaging for diagnostic determination, while management decisions do not differ as significantly between rural and urban settings.

**Procedural Skills**

Hometown rurality was associated with greater exposure to procedures in aggregate. All rural learning was associated with greater exposure to dermatologic procedures such as punch and shave biopsy, incision and drainage of abscesses, and canthoplasty. This may be attributable to the fact that these procedures are more common in rural primary care settings than in urban ones.\(^{64,70}\) Medical students very commonly spend time in primary care settings but do not always have dedicated time with dermatologic specialists,\(^{67}\) so it is likely that students in rural settings would have greater exposure to these procedures and to preceptors who are comfortable performing them.

Attendance at a school with a rural mission statement was also associated with greater exposure to procedures related to reproductive health, including pap smear, intrauterine device (IUD)/Nexplanon placement, and microscopic examination of vaginal secretion. This trend was present but not statistically significant for those who spent time in a rural setting (\(p = .076\)). This, as with dermatologic procedures, may be attributable to the fact that these procedures more commonly take place in a primary care setting in rural areas.\(^{64-66}\) As with gynecologic examination, although students commonly rotate with obstetrics/gynecology, they tend to spend less time on these services than with primary care.\(^{67}\) Hometown rurality was also associated with a trend toward greater exposure to reproductive health procedures (\(p = .074\)), but this was not statistically significant.

Hometown rurality was positively associated with exposure to skills in independent interpretation of common imaging, including computed tomography (CT) scans, x-rays, electrocardiograms (ECG), spirometry, and peak flow. This trend was present but not statistically
significant for time spent in rural settings (p = .056). This may be due to less radiologist availability leading to greater need for non-radiology providers to form an initial interpretation while awaiting a radiologic interpretation, leading to more teaching opportunities and greater preceptor comfort in teaching about imaging interpretation.\textsuperscript{71}

Having spent time in a rural setting was positively associated with exposure to musculoskeletal procedures such as arthrocentesis and local anesthesia. As above, this may be due to the greater scope of primary care in rural settings.\textsuperscript{64} Hometown rurality was also associated with a trend toward greater exposure to management of non-major trauma (p = .054), but this was not statistically significant. None of the independent variables (mission statement, time spent in rural areas, hometown rurality, or student rural or urban identity) were found to be significantly associated with exposure to “Management of non-major trauma (non-surgical dislocations and fractures, lacerations requiring sutures or staples)” or “Other bedside skills (intravenous line placement, intramuscular injections, bladder catheterization)”.

\textit{Professional Flexibility}

All \textit{rural learning} was associated with greater comfort with professional flexibility in aggregate. Students at schools with a rural mission statement, those who had spent time in rural settings, and those with more rural hometowns all reported greater comfort “performing support functions normally fulfilled by other professionals (e.g., delivering medications to a patient’s home)”; this trend was present but not statistically significant for students with rural identities (p = .081). This difference may be due to the frequent shortages of other professionals in rural settings, which broadens the scope of the professionals who are present there, including physicians.\textsuperscript{64} All \textit{rural learning} was associated with greater opportunity to develop comfort “applying knowledge of local resources for health promotion and disease prevention in the community (e.g., awareness of locally available foods and accordant adjustment of dietary
counseling); this may also be due to relatively lower availability of professionals like social workers who otherwise might manage these patient concerns. Urban identity was associated with a trend toward less opportunity to develop comfort applying knowledge of local resources, but this was not statistically significant (p = .087).

All rural learning was also associated with greater opportunity to develop comfort related to “improvising when dealing with limited human and material resources (e.g. splinting a finger without a splint available; helping a patient struggling with intimate partner violence find a safe place to stay when no shelter is available)”. This may be due to the relative shortage of many different types of resources in rural settings necessitating that students gain practice with improvisation during their training.

Rural identity and hometown rurality were associated with greater opportunity to develop comfort “engaging with the community about health issues in settings outside of the hospital or clinic”; this trend was present but not statistically significant for time spent in a rural area (p = .095). Prior research has found that rural physicians see engagement with the community as “central” to succeeding as a rural physician;72 therefore, this difference may be partly reflective of an unspoken curriculum about community engagement, or may be reflective of the level of community engagement that students see in their preceptors and role models.

Time spent in a rural area, hometown rurality, and rural identity were associated with greater opportunity to develop comfort “learning about the impact of local sociocultural contexts on health behaviors/beliefs of individual patients & providing care that is sensitive to these contexts and values.” This may be partly attributable to the less diverse nature of many rural environments. Although rural areas demographically differ extensively from each other, they have less internal diversity than very urban settings,73,74 which may enable a greater perceived understanding of the most prominent local cultures and beliefs. It may also be partly attributable
to the greater degree of community engagement of rural physicians. Unlike the other skill categories assessed, there were no elements of professional flexibility that were not associated with any of the independent variables.

*Comfort in Non-Tertiary Care Settings*

All rural learning was associated with greater comfort formulating a plan for initial care for selected urgent illnesses (acute hypertension [220/130] and headache, altered mental status, and acute chest pain) in a rural outpatient clinic. The inverse trend was present for urban identity, but was not statistically significant (p = .062). Hometown rurality, rural identity, and time spent in a rural area were also associated with greater comfort in a small community hospital; the trend was present but not statistically significant for students at schools with a rural institutional mission statement (p = .138). It is possible that students with rural learning experiences have had more exposure to formulating plans in resource-limited settings, contributing to their greater comfort with this competency. Additionally, based on the justifications students provided for why their rural health education was or was not adequate, it seems that conversations about how to manage complaints with varying levels of resources occur more often at institutions with rural mission statements. This may contribute to the greater comfort in these settings reported by students at these schools.

*Incorporation of and Interest in Rural Health Education*

When asked if they would be interested in dedicated rural health training experiences, the most frequent response from both students at schools with rural mission statements and those without rural mission statements was “yes”. As hypothesized, hometown rurality, rural identity, and time in rural settings was correlated with greater likelihood of expressing interest in these experiences; this again reinforces the importance of recruiting students of rural backgrounds. Students with urban backgrounds had a trend towards less reported interest but this was not
statistically significant. Interestingly, reported student interest in dedicated rural health education was not statistically significantly correlated with attendance at a school with a rural institutional mission statement. Since this study also found that students of institutions without rural mission statements were overwhelmingly less likely to report that rural health was adequately incorporated into their curriculum, this strongly suggests a mismatch between interest and availability. This runs counter to the perceptions of students at urban institutions who felt that rural health education was inadequate due to lack of peer interest in the subject. Thus, the urban institutions sampled here should consider inclusion of rural health education, not just as an intervention to improve health equity, but also as a way of meeting student interest.

Students who felt they did not have adequate rural health education attributed this to their urban training environment, lack of rural role models, insufficient discussion in the classroom and clinical setting, institutional de-emphasis, assumption of future urban practice, absence of student interest, lack of prestige in rural medicine, and a culture of dislike toward rural areas. The first two concerns may be addressed through rural rotations, while the other factors may require curricular or cultural changes. Conversely, those who felt rural health was adequately incorporated cited a rural training environment/rural rotations, rural role models, focused discussion in the classroom and clinical setting, institutional emphasis, presence of student interest, and a culture that encouraged future rural practice. Urban institutions could seek to integrate one or more of these factors into their medical education.

**Conclusion**

Rural physician supply is a significant and worsening health equity issue. United States medical schools have an ethical responsibility to train physicians capable and willing to meet the needs of the population, both urban and rural; doing so would necessitate significantly increasing the number of graduates who pursue rural practice. The characteristic that most strongly predicts eventual rural practice is rural background. Pipeline programs and scholarships have sought to
increase the number of applicants from rural areas, and many schools seek to recruit students from rural backgrounds, particularly schools with rural missions or rural tracks. These important efforts must be continued and expanded. However, the existing supply of students of rural backgrounds is currently not nearly adequate to meet the need for physicians in rural areas. Additionally, forecasts suggest an ongoing decline in the supply of rural medical students and declining interest in rural careers among medical students. Therefore, in order to meet the public need, an interest in rural medicine must also be fostered in students of urban backgrounds.

The greatest disparities identified by this work were in attitudes toward rural areas. Prior research has established that rural rotations can improve attitudes toward rural areas. Medical schools should consider adding new or upscaling existing rural rotations. Since low diversity in rural areas was a concern identified by two urban students, offering rotations in locations with greater racial or political diversity may make these rotations more approachable and appealing for students. Additionally, since students of lower socioeconomic backgrounds are more likely to practice in primary care, and primary care physicians are more likely to practice in rural areas, medical schools should provide students with financial support to maximize accessibility of these rotations. Some schools with a focus on rural health have included rotations in rural settings as a mandatory or opt-out element of their curriculum; this could be adopted by many more institutions, particularly those adjacent to rural populations, as this reduces the cost of transportation and need for lodging of students.

Specific areas for development of student competencies are identified; these may help students feel comfortable pursuing careers in rural settings, where they will not have the same institutional support as they receive at their medical school. In particular, students at schools with a rural institutional mission statement were more comfortable with physical examination and diagnosis of the musculoskeletal system and diagnosis and management of regionally endemic illnesses and reported more exposure to procedural skills in reproductive health and dermatology.
They also reported greater comfort with many elements of professional flexibility. Schools without a rural mission statement may benefit from optimizing or adding learning opportunities for these particular skills. Many differences in competencies are potentially attributable to the greater scope of primary care physicians in rural areas; student rotations with primary care physicians with a broad scope in either urban or rural settings may help improve these competencies in students without rural learning experiences. Additional competencies were found to be greater in students who had spent time in rural settings; this is a possible additional benefit of the aforementioned increase in rural rotations.

Students at schools without explicit rural mission statements overwhelmingly do not feel rural health was adequately incorporated into their curriculum. Many identified potential interventions, including rural rotations, discussions about management of different patient presentations in low resource settings, or lectures about concerns unique to rural health. A small number of dedicated lectures or case presentations may help bridge this gap. This could also be accomplished in small group discussions by adding a question about addressing the issue being discussed in a low-resource environment or how the issue may present differently in a rural context. Additionally, many students at urban institutions identified a lack of role models with experience in a rural setting as a factor limiting the adequacy of their rural health training. Medical schools could seek to identify preceptors with experience in rural settings to help remedy this perceived gap in student learning opportunities.

These learning experiences may foster interest in rural medicine and help trainees feel better prepared to pursue a future career in a rural setting. Ultimately, the authors hope this work will provide impetus for more medical schools to offer rural health education and training experiences.
**Future Research Directions**

This data is drawn from a limited number of medical schools; these results cannot be extrapolated to all United States medical schools. Future work could include distributing the survey at additional medical schools to see if the patterns found here persist. The authors are in the process of distributing the survey at rural and urban internal medicine residencies to conduct similar analysis and hopefully identify areas for educational growth. They are also conducting focus groups among students and residents at participating institutions to better understand trainees’ perspectives and lived experiences with rural health education and prevailing attitudes toward rural areas at their program.

Since the attitudes portion is not specialty-specific and the competencies are drawn from a list of skills important in family medicine, the survey could easily be modified to target skills important in family medicine, pediatrics, or obstetrics/gynecology for distribution among other types of residency programs. It could also be modified to assess other health professions training programs, such as Nurse Practitioner or Physician Associate programs. The survey is freely available for use by any program who wishes to assess how its own students compare to the data presented here.

The weak correlation between urban or rural identity and self-reported hometown rurality may speak to the fact that personal identity can evolve, and, while important, upbringing is but one factor influencing future identity and behavior. As rural identity and self-reported hometown rurality (regardless of rural identity) were correlated with a number of non-overlapping strengths, further research may help determine how best to define and target recruitment efforts for “rural” students in order to improve the rural physician workforce.

Rural rotations, classroom didactics, clinical skills training, or other initiatives meant to address some of the potential barriers to rural practice identified in this study should be assessed
for efficacy. The survey, or selected sections of it pertinent to the intervention being tested, could be used as a before-and-after instrument to assess intervention success.

**Limitations**

Several factors limit the conclusions that can be drawn from these findings. There are nearly 200 medical schools in the United States, but these findings were drawn from just six. Furthermore, these schools were identified through convenience sampling, which reduces randomness and increases the risk of bias in the sample. Although the authors do not believe the included medical schools are unique from other schools in a way that would bias the data in any particular direction, they recognize that the sample is limited. This amplifies the importance of the previously described future directions for research, including expansion to a wider group of medical schools and other health professions training programs.

Online survey participation was also completely optional; participants who elected to participate may have represented a population with a greater interest in rural health than those who did not, rendering them non-representative of medical students as a whole. The authors sought to mitigate this by offering a gift card lottery incentive, increasing interest among students regardless of their interest in rural health.

Additionally, a novel survey instrument was utilized. Although the authors were able to identify a validated attitudes questionnaire, no such instrument existed for competencies. The authors sought to construct questions as relevant as possible to rural practice based on their own experiences and previous research. However, this work is not known to predict actual preparedness for rural practice, nor likelihood of a career in rural practice. Although the authors recognized that student self-assessment of their confidence in different skills may not align with objective assessment of their skills, they decided that student confidence was likely a better
predictor of student ability to feel secure practicing in a lower-resource setting and thus odds of pursuing a career in that setting.

The nature of this data does not enable determination of a causative relationship or eliminate potential confounding variables. However, the findings presented here that have been previously researched are consistent with prior work. The authors believe the connections presented here are also highly plausible. Furthermore, regardless of the true underlying cause, the differences identified are present and significant and therefore may still be useful in considering educational improvements at urban medical schools.

Finally, every member of the research team has either lived or worked in rural settings and each has an interest in rural health, so none are able to bring an unbiased lens toward this work.

**Dissemination**

There are multiple conferences and journals to which these results may be of interest. An abstract has been submitted to the Society of General Internal Medicine for its meeting in May 2024. This work could also be presented at the annual Rural Training Track Collaborative Conference or Rural Health Conference. The authors anticipate submitting a manuscript to Academic Medicine, Journal of General Internal Medicine, Medical Education, or the Journal of Rural Health.
References


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Appendix A - Survey Content

Demographics

1. Year in Medical School: (MS1, MS2, MS3, MS4, MS5/Research year)
2. Intended Specialty: (drop down list with “other” and “undecided”)
3. How would you describe the community where you spent the majority of the time when you were growing up? (A city/A suburb/A small town/A rural area)
4. How much do you think of yourself as a country or rural person? (Not at all/A little/Somewhat/Very/Completely)
5. How much do you think of yourself as a city or urban person? (Not at all/A little/Somewhat/Very/Completely)
6. Have you ever spent more than one full month living in a rural setting? (Y/N)

Interest

Rate your agreement with the following statements comparing working in rural areas to working in other types of communities (1 - strongly disagree, 2 - moderately disagree, 3 - slightly disagree, 4 - slightly agree, 5 - moderately agree, 6 - strongly agree)

1. Working in a rural area provides more opportunity to practice a variety of skills
2. There are good opportunities for employment in rural areas in my profession
3. There are more opportunities for career advancement in rural areas
4. Staff are more supportive of each other in rural areas
5. Professional isolation is a problem when working in rural areas
6. Rural practice provides greater opportunity for autonomy in work practice
7. Employment in a rural area is very desirable
8. There are things I enjoy doing in rural areas
9. There are people in rural areas that I could be friends with
10. There are limited places to go to socialize in rural areas
11. There are poor recreational facilities in rural areas
12. People in rural areas are very friendly
13. In rural areas, new people are welcomed into the community
14. Rural workplace settings are friendly environments
15. Living in a rural area provides an enjoyable lifestyle
16. There is a great sense of community in rural areas
17. Working in a rural area means being isolated from family
18. Working in a rural area means being isolated from friends

Competencies

Rate your comfort examining the following systems to diagnose common illnesses without assistance of imaging or other diagnostic modalities (1=not comfortable, 2=somewhat comfortable, 3=comfortable)

1. Cardiovascular, respiratory, and abdominal examination
2. Neurologic, fundoscopic, and otoscopic examination
3. Gynecological and proctological examination
4. Dermatologic exam
5. Musculoskeletal examination

Rate your comfort proposing diagnosis and management for the following without guidance from a specialist (1=not comfortable, 2=somewhat comfortable, 3=comfortable)
6. Chronic diseases (diabetes, asthma, heart failure, chronic obstructive pulmonary disease)
7. Acute infectious processes (pneumonia, upper respiratory tract infections, sexually transmitted infections, skin infections, acute diarrhea)
8. Musculoskeletal disorders (joint pain, low back pain, rotator cuff injury, knee injury)
9. Psychosocial challenges (mood disorders, substance use disorder [including medication assisted treatment], food insecurity, intimate partner violence)
10. Regionally endemic illnesses (venomous animal bites, tick borne disease)

Rate your comfort formulating a plan for initial care for the listed cases in the following settings.
(1=not comfortable, 2=somewhat comfortable, 3=comfortable)

In a tertiary care center
- Access to CXR, POCUS, spirometer, glucometer, CT, MRI, CBC, CMP, UA, EKG, toxicology, troponins, thrombolytics, and PCI
11. A patient with acute severe hypertension (220/130) and headache
12. A patient with altered mental status
13. A patient with acute chest pain

In a small community hospital (<25 inpatient beds, >35 miles to another hospital)
- Access to CXR, POCUS, spirometer, glucometer, CT, CBC, CMP, UA, EKG, and thrombolytics
- No access to MRI, troponins, toxicology, PCI
14. A patient with acute severe hypertension (220/130) and headache
15. A patient with altered mental status
16. A patient with acute chest pain

In a rural outpatient clinic
- Access to POCUS, spirometer, glucometer, POCT UA, EKG
- Next day CXR, CBC, CMP
- No access to CT, MRI, toxicology, troponins, PCI, or thrombolytics
17. A patient with acute hypertension (220/130) and headache
18. A patient with altered mental status
19. A patient with acute chest pain

How much exposure have you had to the following skills? (1=no exposure, 2=some exposure, 3=sufficient exposure 4=a great deal of exposure)
20. Women’s health procedures (pap smear, IUD/Nexplanon placement, microscopic examination of vaginal secretion)
21. Dermatologic procedures (canthoplasty & other ingrown toenail treatments, incision & drainage of abscesses, punch & shave biopsy)
22. Management of non-major trauma (non-surgical dislocations and fractures, lacerations requiring sutures or staples)
23. Musculoskeletal procedures (arthrocentesis, local anesthesia including field & digital blocks)
24. Independently interpreting tests and imaging (CT scans, X-rays, ECGs, spirometry, peak flow)
25. Performing and interpreting point of care ultrasound
26. Other bedside skills (intravenous line placement, intramuscular injections, bladder catheterization)

How much opportunity have you had to develop comfort with the following?
(1=no opportunity, 2=some opportunity, 3=sufficient opportunity 4=a great deal of opportunity)

27. Performing support functions normally fulfilled by other professionals (e.g., delivering medications to a patient’s home)
28. Applying knowledge of local resources for health promotion and disease prevention in the community (e.g., awareness of locally available foods and accordant adjustment of dietary counseling)
29. Improvising when dealing with limited human and material resources (e.g. splinting a finger without a splint available; helping a patient struggling with intimate partner violence find a safe place to stay when no shelter is available)
30. Engaging with the community about health issues in settings outside of the hospital or clinic
31. Learning about the impact of local sociocultural contexts on health behaviors/beliefs of individual patients & providing care that is sensitive to these contexts and values

Next Steps

1. Do you feel that rural health was adequately incorporated in your curriculum? (Yes/No)
2. Why or why not?
3. Have you had exposure to rural health training outside of medical school or residency? (Yes/No)
4. If so, what was it?

Additional Opportunities

5. Would you be interested in participating in dedicated rural health training experiences? (Yes/No/Maybe)
6. What sort of training experiences would you be interested in?
If you would be willing to participate in a 30 minute focus group about rural health and training opportunities at your program, please follow this link to a separate page to provide your contact so we may preserve the anonymity of your previous answers.

7. Name:
8. Medical School/Residency Program:
9. Preferred Email:
Appendix B - Original Competencies by Gouveia et al.

The publication had six “domains” containing multiple “core” competencies with subsets of “secondary” competencies. These are formatted in the list below as follows:

Domain
1) Core Competency
   a) Secondary competencies

Technical
1) Demonstrate a higher level of clinical acumen to make diagnoses in a scenario where complementary exams are scarce and access to the specialist is difficult
   a) Mastering and valuing the completion of a complete history, paying attention to details of the clinical and family history and directed symptomatological interrogation
   b) Mastering and valuing the techniques of physical examination of the cardiovascular system
   c) Mastering and valuing the techniques of physical examination of the respiratory system
   d) Mastering and valuing the techniques of physical examination of the thyroid
   e) Mastering and valuing the techniques of physical examination of the abdomen
   f) Mastering and valuing the technique of physical examination of the musculoskeletal system
   g) Mastering and valuing the techniques of gynecological examination
   h) Mastering and valuing the techniques of obstetric examination
   i) Mastering and valuing the techniques of dermatologic examination
   j) Mastering and valuing the techniques of the oropharyngeal exam
   k) Mastering and valuing the techniques of rhinoscopy
   l) Mastering and valuing the techniques of proctological examination
   m) Mastering and valuing the techniques of otoscopy
   n) Mastering and valuing fundoscopy techniques
   o) Mastering and valuing neurological examination techniques
   p) Perform visual acuity assessment using the Snellen chart
   q) Perform semiological tests with tuning fork for deafness assessment
2) Perform low-risk humanized childbirth
   a) Demonstrate in-depth knowledge of the physical and psychological benefits of natural childbirth for mother and baby
   b) Demonstrate knowledge of the meaning of childbirth for the local culture
   c) Apply science-based medicine evidence for decision making and during childbirth care
   d) Support the pregnant woman during labor, conveying safety and comfort
   e) Handle the technique of assistance to labor with the least possible interventions
   f) Identify warning signs during labor
   g) Handle more frequent complications
   h) Recognize its limitations and refer the patient in time, when necessary
   i) Suture the perineum
   j) Perform neonatal resuscitation
k) Know the history and work of traditional midwives
l) Guide the patient in relation to breastfeeding and first care for the baby

3) Carry out necessary procedures to act in a scenario where the access to the specialist is difficult
   a) Perform loco-regional anesthesia – infiltrative local anesthesia, field block, digital block
   b) Perform suturing
   c) Perform insertion of Intrauterine Device
d) Perform canthoplasty and other ingrown toenail treatments
e) Perform Otological lavage
f) Perform Ring Removal
g) Perform Trapped Zipper Removal
h) Perform Foreign Body Removal in the external ear
i) Perform abscess drainage
j) Perform subcutaneous foreign body removal
k) Perform removal of foreign body in oropharynx
l) Perform nasal foreign body removal
m) Perform hemorrhoidal thrombosis drainage
n) Perform hook removal
o) Perform venipuncture
p) Perform bladder catheterization
q) Perform nasogastric tube insertion
r) Administer vaccines
s) Perform joint infiltration
t) Perform paracentesis
u) Administer IM and IV medications
v) Perform microscopic examination of vaginal secretion
x) Perform Orotracheal Intubation

2) Use Peak Flow
   aa) Demonstrate skill in managing ostomies
   ab) Perform wound debridement
   ac) Perform rapid testing for HIV, syphilis, and hepatitis
   ad) Carry out a screening test for the “Olhinho”
   ae) Carry out surgical removal of lipomas and cysts
   af) Carry out venous blood collection
   ag) Manage the care of non-surgical dislocations and fractures

Cognitive
1) Develop strategies for continued self-directed study, using distance education to keep up to date and with skills relevant to the rural setting
2) Use technology to communicate and exchange information with distant colleagues, with the purpose of continuing education and matrix support
3) Critically analyze the influence of cultural, social, historical, political and economic conditions in the health conditions of rural populations
a) Have general knowledge about the history of the concepts of culture and identity, as well as their various definitions.
b) Have general knowledge about the discussions of philosophy and anthropology of science
c) Have knowledge about herbal medicines and traditional/folk medicine
d) Knowing the history, culture and health conditions of the quilombola peoples
e) Knowing the history, culture and health conditions of indigenous peoples in Brazil
f) Knowing the history, culture and health conditions of immigrants in Brazil
g) Knowing the history, culture and health conditions of peasants participating in the Landless Movement
h) Knowing the history of peasant movements in Brazil and the dispute for land
i) Know the existing health policies for quilombola, indigenous and rural and forest peoples

4) Understand community participation in rural and remote health practice
   a) Knowing how social control works in the SUS
   b) Knowing how social control is carried out by the community
   c) Identifying social groups that can influence the health situation of the community: local health council, group of anonymous alcoholics, group of teachers, religious leaders, and others

5) Know the sources of resources, the support network in the region and the administrative barriers to access

Relational
1) Communicate effectively with the sick person, the community and the health team
   a) Establish a positive and effective relationship with the patient and the team, showing respect and being understanding with views and values different from their own
   b) Participating in local health council meetings
   c) Carrying out activities in group, educational and therapeutic, with the community

2) Demonstrate empathy for the patient and the community
   a) Perform a person-centered approach
   b) Participate in traditional community activities
   c) Follow the daily life of a family in the local community
   d) Reflect on literary texts and other art forms that address rural theme

3) Demonstrate flexibility and willingness to work in a team, in a participatory way, sometimes taking on a role that in another context would be that of another professional
   a) Have knowledge about transport and packaging of biological material and medicines
   b) Have knowledge and training on dispensing medicines
   c) Have knowledge and training on the technique of administering vaccines and medicines
   d) Treat your teammates as equals in human value, with respect and affection - knowing how to respect differences
   e) Knowing how to delegate functions
   f) Knowing how to manage conflicts
   g) Collaborating in a participatory way with the team
h) Valuing the opinion of other group members

**Affective**
1) Reflect on your own strengths, weaknesses, values, attitudes and priorities, maintaining a balance between your responsibilities personal, social and professional, in managing isolation
2) Reflect on your own beliefs, values and emotional reactions to the provide care to a population of the countryside and the forest, respecting the local culture
3) Analyze the positive and negative aspects of life and medical practice in a rural setting
4) Show special attention to confidentiality and privacy issues, ethics and professionalism

**Contextual**
1) Plan the service, aiming to meet the demand, in a effective and equitable manner, considering particular difficulties and challenges the geographic, cultural and socioeconomic context of rural patients
   a) Consider climatic conditions at the time of planning, such as periods of rain and drought associated with flooding of rivers or food shortages in the region
   b) Have knowledge about the physical and human geography of the place
   c) Have general knowledge in cultural anthropology and health anthropology
   d) Use your understanding of different beliefs, values and priorities in the community when providing culturally appropriate assistance
   e) Provide flexibility of schedules
2) Conduct situational and community health diagnosis
   a) Identify micro-areas at risk and with greater vulnerability to the occurrence of tragedy
   b) Identify the water and sanitation conditions of the community
   c) Identify the socioeconomic profile of the community
   d) Identify the most common diseases
   e) Identify families that need more attention in care through the assessment of risk factors
   f) Carry out a Participatory Rural Diagnosis of the community
3) Demonstrate resoluteness, independence and resilience when working effectively in geographic, social and professional isolation

**Integrative**
1) Demonstrate diagnostic and therapeutic skills for a evidence-based, ethical and effective patient care within the limitations of the rural context, safely managing the most prevalent problems
   a) Demonstrate knowledge of the principles and practice of evidence-based medicine
   b) Know how to apply evidence to patient care within a rural context
   c) Diagnose and manage cases of acute poisoning, subacute and chronic diseases caused by pesticides and other chemicals
   d) Diagnose and manage cases of intoxication by heavy metals
   e) Diagnose and manage cases of skin cancer
   f) Diagnose and manage accidents with venomous animals
   g) Conduct properly work-related accidents
   h) Diagnose and manage cases of Musculoskeletal Disorder
i) Work Related
j) Provide initial care to a drowning patient
k) Perform first care to the polytraumatized
l) Carry out care for a burned patient
m) Diagnose and properly manage Acute Coronary Syndromes
n) Diagnose and manage patients with Chagas Disease
o) Perform diagnosis and treatment of Yellow Fever
p) Perform diagnosis and treatment of Leishmaniasis
q) Perform diagnosis and treatment of Trachoma
r) Perform diagnosis and treatment of Cutaneous Leishmaniasis
s) Diagnose and manage patients with Visceral Leishmaniasis
t) Perform Diagnosis and treatment of Malaria
u) Perform diagnosis and treatment of Tuberculosis in adults and children
v) Diagnose and manage patients with Schistosomiasis
x) Diagnose and manage patients with Malnutrition
z) Conduct care of the smoker patient
aa) Conduct the care of the Alcoholic patient
ab) Perform diagnosis and treatment of Acute Diarrhea
ac) Perform diagnosis and treatment for Heart Failure
ad) Perform diagnosis and treatment for disease chronic obstructive pulmonary disease
ae) Perform diagnosis and treatment of Diabetes
af) Perform diagnosis and treatment of SAH
ag) Perform diagnosis and treatment of Pneumonia and Upper Respiratory Tract Infections
ah) Perform diagnosis and treatment of sexually transmitted infections
ai) Perform diagnosis and treatment of skin infections
aj) Perform diagnosis and treatment of asthma
ak) Provide initial care to the psychotic patient
al) Diagnose and conduct cases of rheumatic fever
am) Diagnose and treat intestinal parasitosis
an) Carry out care for patients with mood disorders

2) Apply epidemiological knowledge for health promotion and disease prevention in the community
3) Identify and handle cases of domestic and sexual violence
4) Demonstrate creativity, using improvisation when dealing with limitations of human and material resources
5) Demonstrate advanced skills in interpreting complementary exams without expert report in:
   a) Radiography
   b) Spirometry
   c) Peak Flow
   d) Blood count
   e) Biochemistry
   f) Urine analysis I and II
   g) Reagent Strip of Urinalysis
h) Electrocardiogram
6) Provide home care in a resolute, ethical and compassionate manner
   a) Knowing about the different purposes of home visits: discovering and addressing problems, diagnosis, active search, disease prevention, health promotion
   b) Interacting with the person, the family and the caregiver in a participatory manner, carrying out a set of programmed activities, as needed
   c) Planning a visit in advance, outlining objectives, accessing medical records and verifying the necessary material for better care delivery
   d) Knowing how to manage time, identifying the cases that need a specific home visit, a follow-up at home and those that can be done on an outpatient basis
   e) Know the criteria that justify home care, as well as criteria for dismissal or discharge
   f) Evaluate the situation of the sick person in a comprehensive, individual, family and social context
   g) Enlighten the family about health problems and build a care plan for the sick person
   h) Take cases to the team for discussion
   i) Promote and participate in the periodic evaluations of the follow-up plan
   j) Know when to indicate hospital admission and medical discharge
   k) Verify and certify the death
   l) Have knowledge about palliative care
   m) Knowing how to deal with bereavement situations
7) Consider cost, storage, security issues and socioeconomic status of the patient when prescribing
8) Demonstrate awareness of your own limitations in a setting rural area and knowledge about when, how and where to send the patient