Demographic and medical school characteristics associated with urban versus rural dermatology practice: A national cross-sectional study

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Abstract

There are significant disparities in access to dermatologists in rural areas relative to urban areas. We examined the associations between demographic and medical school characteristics and entry into dermatology practice in urban versus rural counties. All dermatologists who graduated from U.S. allopathic or osteopathic medical schools in the 2020 Centers for Medicare & Medicaid Services Physician Compare Database were assessed. Dermatology practice locations were coded as metropolitan or non-metropolitan according to the Rural-Urban Continuum Codes. Of 10,076 dermatologists, 543 (5.4%) practiced in non-metropolitan counties. Male gender (odds ratio [OR] 1.48, 95% CI 1.23-1.77), public medical school attendance (OR 1.94, 95% CI 1.61-2.34), DO degree (OR 1.84, 95% CI 1.32-2.51), medical school location in a non-metropolitan county (OR 5.41, 95% CI 3.66-7.84), and medical school rural track program (OR 1.57, 95% CI 1.07-2.26) were associated with higher odds of non-metropolitan dermatology practice. Our findings highlight that male gender, graduation from a non-metropolitan or public medical school, DO degree, and rural tracks are associated with higher likelihood of non-metropolitan dermatology practice. These results can inform efforts within the field of dermatology to strengthen the rural dermatologist workforce and suggest that rural educational experiences during medical school may increase recruitment of rural dermatologists.

Keywords: medical education, rural, urban, healthcare disparities, dermatologist workforce, healthcare delivery, disparities in dermatology, specialist access

Introduction

Rural populations across the United States (U.S.) face significant disparities in access to dermatologists. In 2013, the density of dermatologists in urban counties was nearly 50 times higher than in rural counties (4.11 versus 0.085 dermatologists per 100,000 individuals, respectively), [1]. Owing to dermatologist shortages in rural areas, studies have shown that rural residents travel longer distances to see specialists, experience longer wait times, and suffer higher mortality rates from melanoma and Merkel cell carcinoma compared with urban residents [1–4]. In turn, longer travel distances to dermatologists lead to decreased treatment adherence and higher non-attendance rates [5]. Recent data have highlighted that younger dermatologists are increasingly practicing in urban settings, suggesting that the urban-rural workforce gap will continue to widen if strategies to recruit rural dermatologists are not implemented [1].

One strategy for recruiting more rural dermatologists is to identify future physicians who are most likely to practice in rural settings [6–12]. One of the strongest predictors of rural physician practice is growing up in a rural hometown, which is associated with an approximately five-fold increase

in the likelihood of practicing primary care in rural settings [6–10]. Enrollment in public service loan repayment programs, specialty preference towards family medicine, and rural clinical experiences during medical school and residency also increase the likelihood of physician practice in rural settings [9–14]. However, nearly all these studies have focused on identifying predictors of rural practice only among primary care specialties [10]. Few studies have examined whether there are variables associated with rural dermatologist practice, which in turn, may shape policies and recruitment strategies aimed towards strengthening the rural dermatologist workforce.

Therefore, we sought to determine the factors associated with the likelihood of working in rural settings as a dermatologist. Our primary aim was to examine the association between demographic and medical school characteristics and dermatologist practice in urban versus rural counties. Our secondary aim was to identify the medical schools that produce the highest rates of dermatologists practicing in rural settings.

Methods

A cross-sectional study of all U.S. dermatologists listed in the 2020 Centers for Medicare and Medicaid (CMS) Physician Compare Database was performed [15]. Dermatologists who graduated from an allopathic or osteopathic medical school and practiced in the 50 states or Washington, D.C. were included in the study. Data on gender, medical school name, medical school graduation year, and practice ZIP code were obtained from the CMS database. Dermatology residents, identified as graduating medical school 2016 onwards, were excluded because their practice ZIP codes reflect residency program locations and not eventual practice locations.

Centers for Medicare and Medicaid data were linked to institutional information from the Association of American Medical Colleges and American Association of Colleges of Osteopathic Medicine [16,17]. Rural track programs, which are programs designed to increase medical student exposure and interest in practicing in rural areas, were identified in the Rural Training Track Collaborative's directory and verified by searching medical school websites [18]. The Rural-Urban Continuum Codes (RUCC)—a nine-point classification system that ranks counties based on population size, degree of urbanization, and proximity to metropolitan areas—were used to code the ZIP codes of medical schools and dermatology practice locations as metropolitan (RUCC 1-3) or non-metropolitan (RUCC 4-9), [19]. Data on the rural and total population of each state was obtained from the U.S. Department of Agriculture Economic Research Service [20]. The medical schools at the 25 institutions with the highest amount of total funding awarded from the National Institutes of Health (NIH) were identified by searching the NIH RePORT Database [21].

The number of dermatologists in metropolitan and non-metropolitan counties was tabulated and stratified by gender and medical school variables. Univariate odds ratios were calculated to measure the association between gender and medical school variables and non-metropolitan dermatologist practice.

For each medical school, the number of total dermatologist alumni and the number of dermatologist alumni who practice in non-metropolitan areas was also computed. Subsequently, the percentage of non-metropolitan dermatologist graduates from medical schools in each state was calculated and graphed into crowdsourced maps produced by OpenStreetMap using Tableau Desktop version 2019.3 (Tableau Software, Seattle, WA), [22]. To assess whether medical schools in states with larger rural populations produced a higher percentage of dermatologists practicing in non-metropolitan counties, we calculated the Spearman correlation coefficient between the percentage of rural population in each state and the percentage of non-metropolitan dermatologist graduates from medical schools in each state. All data analysis was performed using R version 3.6.2 (R Foundation for Statistical Computing, Vienna, Austria), [23]. Review by the Institutional Review Board was waived.

Results

The study sample included 10,076 dermatologists, of which 543 (5.4%) practiced in non-metropolitan counties. The non-metropolitan dermatologist workforce was predominantly male (N=323, 59.5%), had graduated from public medical schools (N=370, 68.1%), and had obtained allopathic medical degrees (N=495, 91.2%). Male gender (odds ratio (OR) 1.48, 95% CI 1.23-1.77), public medical school attendance (OR 1.94, 95% CI 1.61-2.34), Doctor of Osteopathy (DO) degree (OR 1.84, 95% CI 1.32-2.51), and medical school location in a non-metropolitan county (OR 5.41, 95% CI 3.66-7.84) were all associated with higher odds of non-metropolitan dermatology practice (**Table 1**). Dermatologists who attended medical schools that were among the top 25 NIH-funded institutions were less likely to practice in non-metropolitan settings (OR 0.68, 95% CI 0.54-0.84). Dermatologists who practiced in non-metropolitan counties were more likely to practice in the same state that they attended medical school rather than in a different state (OR 1.50, 95% CI 1.28-1.77). In

Table 1. *Demographic and medical school characteristics and choice of metropolitan versus non-metropolitan dermatology practice.*

	Individuals, No. (%)			
Variable	**Metropolitan (N=9533)**	**Non-Metropolitan (N=543)**	**Non-Metropolitan Practice, OR (95% CI)**	**P-value**
Sex				
Male	4752 (49.8)	323 (59.5)	1.48 (1.23-1.77)	< 0.001
Female	4781 (50.2)	220 (40.5)	Reference	
Medical School Type				
Public	4999 (52.4)	370 (68.1)	1.94 (1.61-2.34)	< 0.001
Private	4534 (47.6)	173 (31.9)	Reference	
Degree				
DO	478 (5.0)	48 (8.8)	1.84 (1.32-2.51)	< 0.001
MD	9055 (95.0)	495 (91.2)	Reference	
Medical School Graduation Year				
2006-2015	2818 (29.6)	147 (27.1)	0.87 (0.68-1.12)	0.26
1996-2005	2613 (27.4)	145 (26.7)	0.93 (0.72-1.19)	0.54
1986-1995	1967 (20.6)	123 (22.7)	1.04 (0.80-1.36)	0.75
1985 or earlier	2135 (22.4)	128 (23.6)	Reference	
Medical School at Top 25 NIH-Funded Institution				
Yes	2472 (25.9)	104 (19.2)	0.68 (0.54-0.84)	< 0.001
No	7061 (74.1)	439 (80.8)	Reference	
Medical School Location				
Non-metropolitan	138 (1.5)	40 (7.4)	5.41 (3.66-7.84)	< 0.001
Metropolitan	9395 (98.6)	503 (92.6)	Reference	
Medical School and Practice Location				
Same state	3529 (37.0)	297 (54.7)	1.50 (1.28-1.77)	< 0.001
Different states	6004 (63.0)	336 (61.9)	Reference	
Rural Track Program in Medical School [a]				
Present	651 (23.1)	47 (32.0)	1.57 (1.07-2.26)	0.01
Absent	2167 (76.9)	100 (68.0)	Reference	

Abbreviations: OR, odds ratio; CI, confidence interval, NIH, National Institutes of Health, DO, Doctor of Osteopathy, MD, Doctor of Medicine
[a]Analysis restricted to dermatologists who graduated between 2006 and 2015 (n=2965) to account for the implementation of most rural track programs after the year 2000.

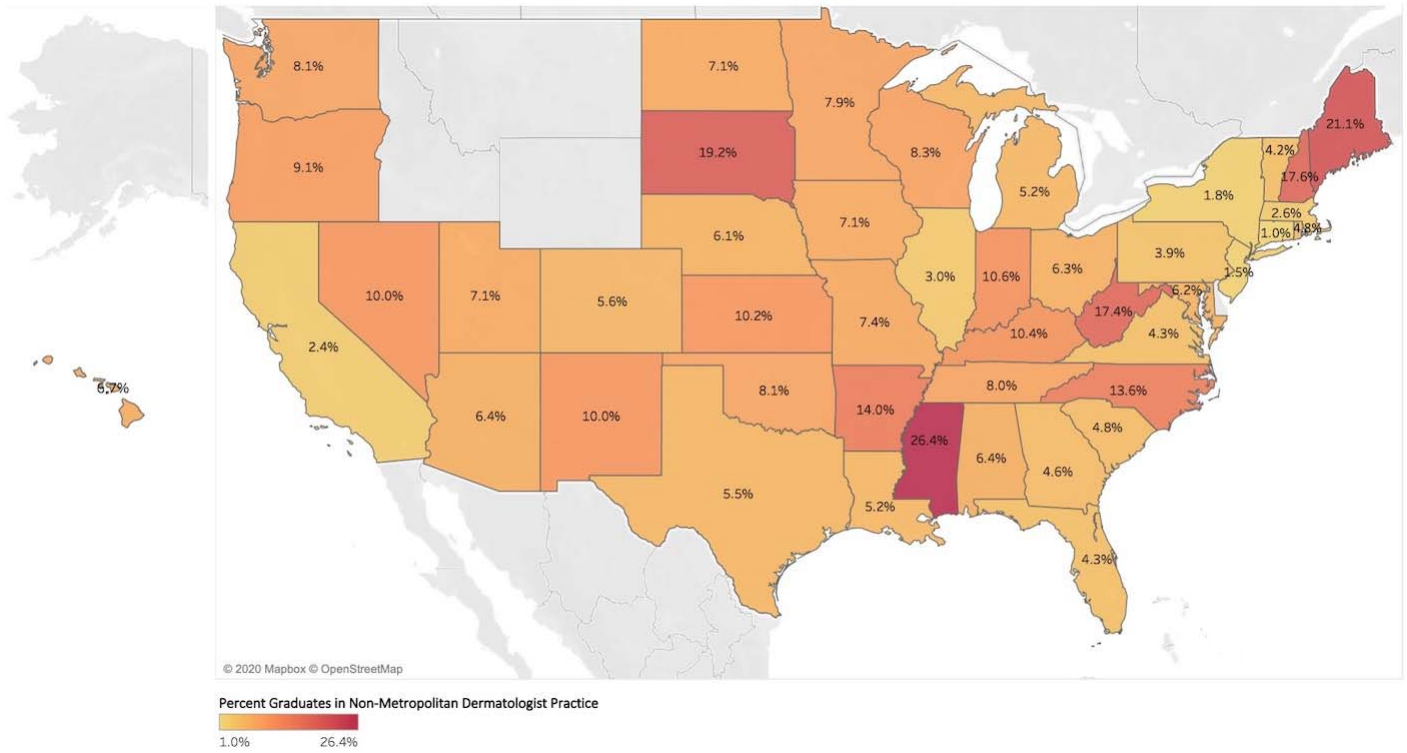

Figure 1. *The percentage of dermatologist graduates from allopathic and osteopathic medical schools in each state who practice dermatology in non-metropolitan counties. Grey-colored states signify no medical schools are present in the state. Generated with OpenStreetMap [22].*

addition, dermatologists who attended medical schools with rural track programs had higher odds of practicing in non-metropolitan counties compared to graduates of medical schools without rural track programs (OR 1.57, 95% CI 1.07-2.26). The year of medical school graduation was not associated with non-metropolitan dermatologist practice.

The percentage of non-metropolitan dermatologist graduates from medical schools in each state is illustrated in **Figure 1**. Approximately 26.4%, 21.1%, and 19.2% of dermatologists who graduated from medical schools in Mississippi, Maine, and South Dakota, respectively, practiced in non-metropolitan counties. Meanwhile, medical schools in Connecticut, New Jersey, and New York produced the lowest percentages of dermatologists who practiced in non-metropolitan counties (1.0%, 1.5%, and 1.8%, respectively). Medical schools in states with larger rural populations had a significantly higher percentage of their dermatologist graduates who practiced in non-metropolitan counties (r=+0.67, P<0.001).

Of 144 medical schools from which dermatologists graduated, 120 medical schools had graduates who practiced dermatology in non-metropolitan settings. The top 25 MD- or DO-granting medical schools with the highest percentages of dermatologist alumni who practice in non-metropolitan counties are listed in **Table 2**. Between 10.2% and 39.1% of dermatologist alumni from these medical schools practiced dermatology in non-metropolitan counties. Altogether, these 25 medical schools produced 34.3% (186/543) of non-metropolitan dermatologists while only representing 17.4% (25/144) of medical schools with dermatologist alumni. Notable characteristics of these 25 medical schools were that 17 (68%) were public medical schools, 9 (36%) had rural track programs, and 7 (28%) were osteopathic medical schools.

Discussion

To our knowledge, this study represents the largest national study examining the specific associations between different medical school characteristics and

Table 2. *The top 25 MD- or DO-granting medical schools with the highest percentages of dermatologists practicing in non-metropolitan counties.*

Medical School	Total No. of Dermatologist Graduates	Percentage of Dermatologist Graduates in Non-Metropolitan Practice (%)
East Carolina University Brody School of Medicine	23	39.1
West Virginia School of Osteopathic Medicine	24	29.2
University of Mississippi School of Medicine	52	26.9
Kirksville College of Osteopathic Medicine	57	26.3
Pikeville College School of Osteopathic Medicine	4	25.0
West Virginia University School of Medicine	63	23.8
University of New England College of Osteopathic Medicine	19	21.1
Mercer University School of Medicine	10	20.0
University of Toledo College of Medicine and Life Sciences	10	20.0
University of South Dakota Sanford School of Medicine	26	19.2
Dartmouth College Geisel School of Medicine	34	17.6
University of Osteopathic Medicine and Health Sciences	23	17.4
University of Kentucky College of Medicine	46	15.2
University of Arkansas for Medical Sciences	57	14.0
Texas Tech University Health Sciences Center School of Medicine	61	13.1
Chicago College of Osteopathic Medicine	23	13.0
Louisiana State University Health Shreveport School of Medicine	39	12.8
University Of North Carolina School of Medicine	95	11.6
Southern Illinois University School of Medicine	26	11.5
University Of Minnesota Medical School	117	11.1
Oklahoma College of Osteopathic Medicine and Surgery	9	11.1
Duke University School of Medicine	118	11.0
Indiana University School of Medicine	161	10.6
University of Wisconsin School of Medicine and Public Health	66	10.6
University of Kansas Medical Center	59	10.2

non-metropolitan dermatologist practice. Our findings highlight that male gender, graduation from a non-metropolitan or public medical school, DO degree, and rural track program availability in medical school are associated with higher odds of practicing dermatology in a non-metropolitan setting. In addition, medical schools in states with larger rural populations produce more non-metropolitan dermatologists. Furthermore, a small number of medical schools produce a disproportionately high proportion of non-metropolitan dermatologists.

These results may relate to certain medical schools attracting students who want to practice in non-metropolitan areas. For example, 21% of incoming osteopathic medical students in 2016 grew up in rural towns compared to only 4.3% of incoming allopathic medical students [24,25]. In turn, this difference in the proportion of medical students from rural areas may have contributed to our finding that physicians with DO degrees are more likely to practice in non-metropolitan counties than physicians with MD degrees. Alternatively, our findings may reflect certain medical schools dedicating more resources, special curricula, and learning experiences than other medical schools in order to foster interest in rural health among their students. For example, medical schools with smaller amounts of NIH grant funding may prioritize educating clinicians who will serve rural and underserved areas whereas institutions receiving

large amounts of NIH grant funding may prioritize training future academic researchers [26,27]. Most likely, both of these elements are contributory.

Consistent with our results, prior studies have found that male gender is associated with increased likelihood of practicing medicine in rural settings [10,26,28]. Furthermore, two prior studies examining which medical schools produced the highest percentage of rural physicians across all specialties found similar associations to our findings: physicians with DO degrees, public medical school graduates, and graduates of institutions with smaller amounts of NIH grant funding were more likely to enter rural practice [26,28]. Recent studies have also found that rural track programs are positively associated with entry into rural primary care practice and that many dermatologists practice in the same geographic regions where they attended medical school [10,29–31].

The strengths of this study include its large sample size, inclusion of both osteopathic and allopathic medical school graduates, and national scope. However, this study had several limitations. First, the study's cross-sectional study design cannot identify causal relationships. Second, we only used the primary practice location of dermatologists in the analysis so we did not assess dermatologists who may occasionally practice dermatology in non-metropolitan counties. In addition, only dermatologists registered as health care providers in CMS were assessed, but we believe we captured the vast majority of the dermatologist workforce since our sample size was near the 10,845 dermatologists noted in the 2016 American Academy of Dermatology members directory [32].

Conclusion

With the widening urban-rural gap in dermatologist distribution [1], disparities in dermatologist access and rural patient outcomes will likely increase over time. This study found that public, osteopathic, and non-metropolitan medical schools produce more non-metropolitan dermatologists than private, allopathic, and metropolitan medical schools, respectively. Additionally, implementation of rural track programs during medical school may increase the recruitment of dermatologists who serve in non-metropolitan areas. Further studies are needed to examine the extent to which the associations between medical school variables and non-metropolitan dermatologist practice are related to medical school curricular differences versus the differing backgrounds of their medical student populations. Our findings can inform the recruitment efforts of training program directors, policy makers, and employers who aim to promote dermatologist access among rural patients.

Potential conflicts of interest

The authors declare no conflicts of interests.

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