

Rural Workforce Years: Quantifying the Rural Workforce Contribution of Family Medicine Residency Graduates

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ABSTRACT

Background Rural regions of the United States continue to experience a disproportionate shortage of physicians compared to urban regions despite decades of state and federal investments in workforce initiatives. The graduate medical education system effectively controls the size of the physician workforce but lacks effective mechanisms to equitably distribute those physicians.

Objective We created a measurement tool called a “rural workforce year” to better understand the rural primary care workforce. It quantifies the rural workforce contributions of rurally trained family medicine residency program graduates and compares them to contributions of a geographically matched cohort of non-rurally trained graduates.

Methods We identified graduates in both cohorts and tracked their practice locations from 2008–2018. We compared the average number of rural workforce years in 3 cross sections: 5, 8, and 10 years in practice after residency graduation.

Results Rurally trained graduates practicing for contributed a higher number of rural workforce years in total and on average per graduate compared to a matched cohort of non-rural/rural training track (RTT) graduates in the same practice intervals ($P < .001$ in all 3 comparison groups). In order to replace the rural workforce years produced by 1 graduate from the rural/RTT cohort, it would take 2.89 graduates from non-rural/RTT programs.

Conclusions These findings suggest that rural/RTT-trained physicians devote substantially more service to rural communities than a matched cohort of non-rural/RTT graduates and highlight the importance of rural/RTT programs as a major contributor to the rural primary care workforce in the United States.

Introduction

The graduate medical education (GME) system in the United States effectively controls the overall size and makeup of the physician workforce.¹ Yet despite a more than \$15 billion public investment in GME, we lack accountability measures and mechanisms to align GME training outcomes with community health needs.² This problem is particularly evident in rural areas, where 19% of the US population is served by less than 5% of all physicians.^{3–6} Deficiencies in rural workforce and access to care were well-known prior to the COVID-19 pandemic, which has only heightened awareness of each as already-challenged rural hospitals and primary care practices now struggle for their survival just as they are most needed.^{7,8}

Several interventions have been proposed to address the geographic maldistribution of the US physician workforce.^{9–16} Policymakers and workforce planners increasingly view community-based

education and training in medical school and residency, including rural training tracks or integrated rural training track residencies (RTTs or IRTTs, which are synonymous), as a solution, citing clear but limited evidence that graduates tend to practice in close proximity to their training locations.^{17–23} These programs located in rural areas have been successfully sending graduates to practice in rural communities at higher rates than graduates from other residency programs without meaningful rural training exposure.²⁴ For these reasons, some have argued that training programs like RTTs represent a better investment of public dollars than non-rural residency programs for developing a physician workforce that addresses the geographic inequities of access to medical care throughout the United States.^{25,26} However, to our knowledge, the workforce contributions of RTT programs have never been compared to a matched cohort of non-rural programs in nearby geographic areas. This analysis adds to our understanding of the comparative workforce contributions while controlling for differences in residents' training experiences within the rural-urban continuum.

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Editor's Note: The online version of this article contains 2 tables of (1) sample characteristics and (2) locations of sample residency programs by 2013 Rural-Urban Continuum Code.

Federal investment in rural residency programs from the Health Resources and Services Administration (HRSA) through the Rural Residency Planning and Development Program in 2019–2020 necessitates further evidence of their overall success in developing a primary care physician workforce that serves rural needs. In this article, we describe GME impact on rural access to primary care physicians and present a new measure, the “rural workforce year,” as a means of quantifying the contributions of graduates of various GME program types to the rural workforce. We then apply these methods to compare outcomes of rural programs (including RTTs) to a geographically matched cohort of non-rural and non-RTT programs.

Our “rural workforce year” is an extension of Bowman’s proposed “primary care year,” but focuses its application in a rural workforce context.²⁷

Bowman proposed the “primary care year” as a standardized measurement tool to compare the primary care workforce contributions between family physicians and all other health professionals (eg, nurse practitioners, physician assistants, general internists, and pediatricians). Bowman does not apply this measure to assess the workforce contributions of GME training programs. In contrast, our rural workforce year is specific to the contributions of family medicine physicians (while avoiding a comparison between other specialties and/or health professions) and provides further rationale for targeting educational investment in rural/RTT programs to support and sustain the rural physician workforce.

Methods

In this retrospective cohort study, we used a 2013 directory from the Accreditation Council for Graduate Medical Education to obtain residency program locations and characteristics. We cross-referenced this list with a directory of rural programs created by The RTT Collaborative and identified each of the rural programs, including RTTs, active in 2013.²⁸ We adopted The RTT Collaborative definition of a rural program in family medicine, which is a residency program where residents spend more than 50% of their time training in a rural place by at least 2 federal definitions. This includes separately accredited programs that are both rurally focused and rurally located and are integrated and affiliated with another program (typically larger, urban) as a deliberate rural track.²⁹ We then selected a corresponding geographically matched cohort of non-rural programs from the same state (TABLE 1). If no non-rural/RTT residency programs were located within the same state as the rural/RTT program(s), we found a program from a neighboring state that was geographically closest to a rural/RTT program.

What was known and gap

Graduates from rural and RTT residency programs are more likely to practice in rural communities when compared to non-rural programs, but comparative retention rates and workforce contributions in rural practice were unknown for rural and non-rural programs in geographic proximity.

What is new

In order to replace the rural workforce years produced by 1 graduate from a rural or RTT residency program, it would take nearly 3 graduates from a non-rural program.

Limitations

The AMA Masterfile is limited by incomplete osteopathic residency program data and a time lag that may impact the practice address of physicians included in the study.

Bottom line

We challenge existing state and federal programs designed to address the maldistribution of physicians in the United States to consider using the rural workforce year to quantify their contribution to the rural workforce.

We used 2013 American Board of Family Medicine (ABFM) residency program identifiers to include family medicine graduates from each of the rural/RTT and matched control family medicine residency programs from 2007 to 2013. We then matched the ABFM sample to the American Medical Association (AMA) Physician Masterfile for each year from 2008 to 2018 to track those graduates through their primary practice location from 2008 to 2018. We geocoded the practice locations from 2008 to 2018. Rural was defined as a county with a 2013 Rural-Urban Continuum Code (RUCC) of 4 or greater.³⁰ The RUCC is a classification system that distinguishes metropolitan counties by the population size of their metro area and nonmetropolitan counties by degree of urbanization and adjacency to a metro area. We selected the RUCC classification system because it is suited for binary rural/non-rural distinction at the county level. We restricted the sample to residency graduates from 2007 to 2013 with a self-reported specialty in family medicine (to remove those who had further specialized). We considered a physician to be practicing if their status was classified as direct patient care in the AMA Masterfile for a given year.

We measured the total years that graduates participated in the rural workforce (rural workforce years) and the percentage of their total practice years spent in rural areas. We calculated average rural workforce years per graduate for the rural/RTT and the matched cohort by multiplying average practice years by the average share of total workforce years in a rural location. Then, we divided average rural workforce years per graduate by the rural/RTT cohort average rural workforce years per graduate to calculate how many matched graduates were needed to match the rural workforce year

TABLE 1
List of Sample Programs

Rural/RTT Programs		Matched Programs	
Program Name	State	Program Name	State
North Colorado Medical Center Wray Rural Program	CO	North Colorado Medical Center Program	CO
Mayo Clinic Health System in Waycross Program Satilla, Georgia Regents University/Medical College of Georgia, Department of Family Medicine	GA	Georgia Health Sciences University Program	GA
Mercy Medical Center Mason City Program	IA	Siouxland Medical Education Foundation Program	IA
Family Medicine Residency of Idaho Magic Valley Rural Program	ID	Family Medicine Residency of Idaho Program	ID
Dixon Rural Training Track in Family Medicine Dixon	IL	Rush University Medical Center/Copley Memorial Hospital Program	IL
Southern Illinois University Quincy Program	IL	Southern Illinois University Program	IL
University of Kansas Wichita/Salina Program	KS	University of Kansas Wichita/Wesley Program	KS
Baptist Health Madisonville Program	KY	St Elizabeth Medical Center Program	KY
University of Kentucky College of Medicine Morehead Rural Program	KY	University of Kentucky College of Medicine (Hazard) Program	KY
University of Louisville Glasgow/Barren County Family Medicine Residency Program	KY	University of Kentucky College of Medicine Program	KY
Louisiana State University Bogalusa Program	LA	Louisiana State University Kenner Program	LA
Louisiana State University Shreveport Rural Program	LA	Louisiana State University Shreveport Program	LA
Maine-Dartmouth Family Medicine Program	ME	Eastern Maine Medical Center Program	ME
Munson Medical Center Program	MI	McLaren Regional Medical Center Program	MI
UP Health System—Marquette Program	MI	MidMichigan Medical Center—Midland Program	MI
North Mississippi Medical Center Tupelo Program	MS	University of Mississippi Medical Center Program	MS
University of North Dakota Minot Program	ND	Altru Health System—Grand Forks	ND
University of Nebraska Medical Center College of Medicine Rural Program Kearney	NE	Lincoln Medical Education Partnership Program	NE
University of New Mexico Rural Program—Roswell	NM	Memorial Medical Center Las Cruces Program	NM
SUNY at Buffalo Rural Program Olean	NY	University at Buffalo Program	NY
University of Oklahoma School of Community Medicine Tulsa Rural Program	OK	University of Oklahoma Health Sciences Center Lawton Program	OK
Oregon Health & Science University Cascades East Program	OR	Mercy Medical Center Redding Program	CA
Robert Packer Hospital/Guthrie Program	PA	Wyoming Valley Program	PA
AnMed Health Anderson/Seneca Rural Program	SC	AnMed Health Anderson Program	SC
Self Regional Healthcare/Greenwood Program	SC	McLeod Regional Medical Center Program	SC
Valley Health System/Medical College of Virginia/ Virginia Commonwealth University Program	VA	Centra Health Program	VA
Spokane Teaching Health Center Rural Program	WA	Community Health of Central Washington Program	WA
University of Wisconsin Baraboo Rural Program	WI	University of Wisconsin Wausau Program	WI
United Hospital Center Program	WV	Wheeling Hospital Program	WV

contribution of the rural/RTT graduates. To further explore their contributions to the rural workforce, we grouped each of the rural/RTT and matched cohorts by graduation year (2007–2013) and tracked them longitudinally from 2008 to 2018, beginning 1 year after the year of residency graduation. We assessed contribution of rural workforce years at 3 cross-sections: 5, 8, and 10 years in practice. We conducted *t* tests to compare the rural workforce years between

rural/RTT graduates and the matched cohort. Next, we conducted a multivariate linear regression testing the association between the dependent variable, percent of total practice years that were rural workforce years, and the independent variable of interest, rural/RTT residency program graduation status, accounting for clustering at the program level. Covariates included total years in practice, gender, US medical graduate (USMG) or international medical

TABLE 2
Total and Standardized Rural Workforce Years

Comparative Workforce Contributions	Rural/RTT	Matched
Number of graduates	682	1109
Total rural workforce years	2599	1460
Total practice years	5019	8111
Average practice years	7.36	7.31
Share of practice years in rural environment	52%	18%
Average rural workforce years per graduate	3.81	1.32
Graduates needed to meet rural workforce contribution of 1 rural/RTT graduate	1	2.89

graduate (IMG), degree type (MD/DO), region, and age at residency start.

Statistical analysis was conducted using STATA 14.2 (StataCorp LLC, College Station, TX). The study was approved by the Institutional Review Board of the American Academy of Family Physicians.

Results

The final sample consisted of 1791 physicians, 682 in the rural/RTT cohort and 1109 in the control cohort, from 29 rural/RTT programs and 29 matched programs (TABLE 1, online supplemental TABLE 1). We found that the rural/RTT cohort contributed a greater

number of rural workforce years both in aggregate and per physician compared to the non-rural/RTT cohort (TABLE 2). In order to replace the rural workforce years produced by 1 graduate from the rural/RTT cohort, it would take 2.89 graduates from non-rural/RTT programs (TABLE 2). In our sample, this is an additional 865 non-rural/RTT physicians. Collectively, graduates from the rural/RTT cohort spent over 50% of their professional time in rural locations during our study period, while graduates from non-rural programs only spent 18% of their time in rural locations (FIGURE 1).

For graduates in practice for 10 years, the cohort of rurally trained physicians contributed an average of 5.24 rural workforce years, while the average rural workforce year contribution for non-rural/RTT physicians was 2.03 years ($P < .001$; TABLE 2). For graduates in practice for 8 years, rural/RTT graduates had an average of 4.46 rural workforce years compared to the matched cohort's 1.43 ($P < .001$). Of those in practice for 5 years, rural/RTT graduates contributed 2.77 years in practice and non-rural/RTT graduates contributed 0.89 ($P < .001$). Of all rural/RTT program graduates, 44% contributed at least 5 rural workforce years, while 31% contributed none (TABLE 3).

The effect of program type (rural/RTT versus geographic match) was statistically significant in the adjusted model with all covariates included (FIGURE 1). Significant predictors of higher rural workforce years

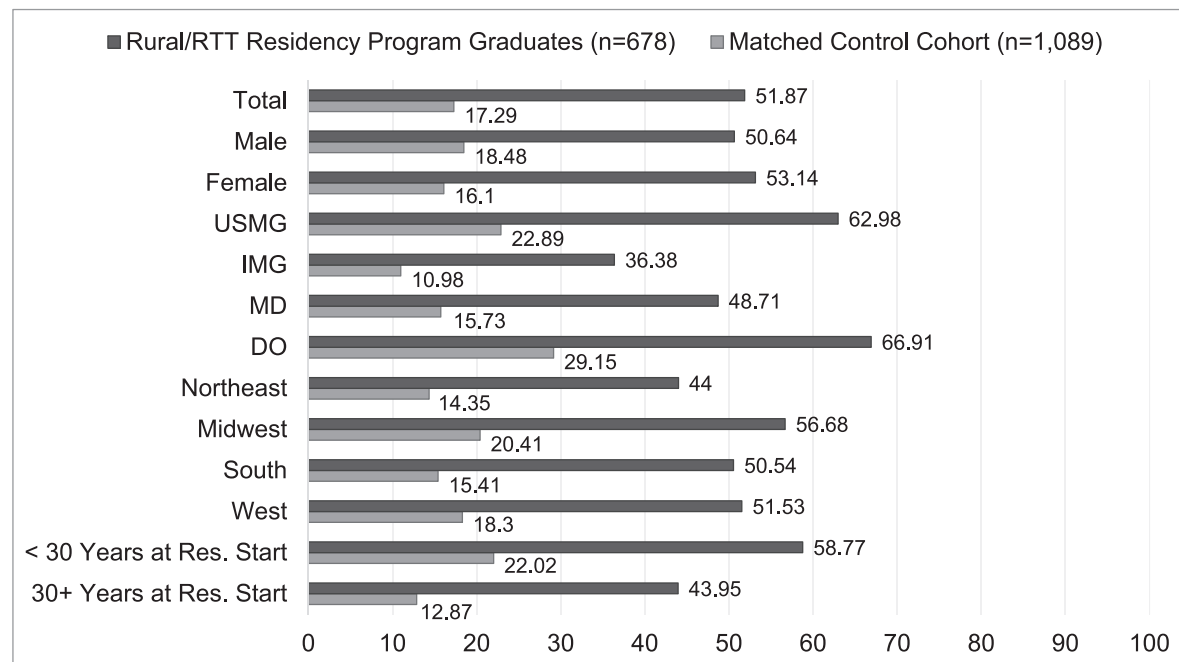


FIGURE 1
Average Percent of Total Practice Years That are Rural Workforce Years

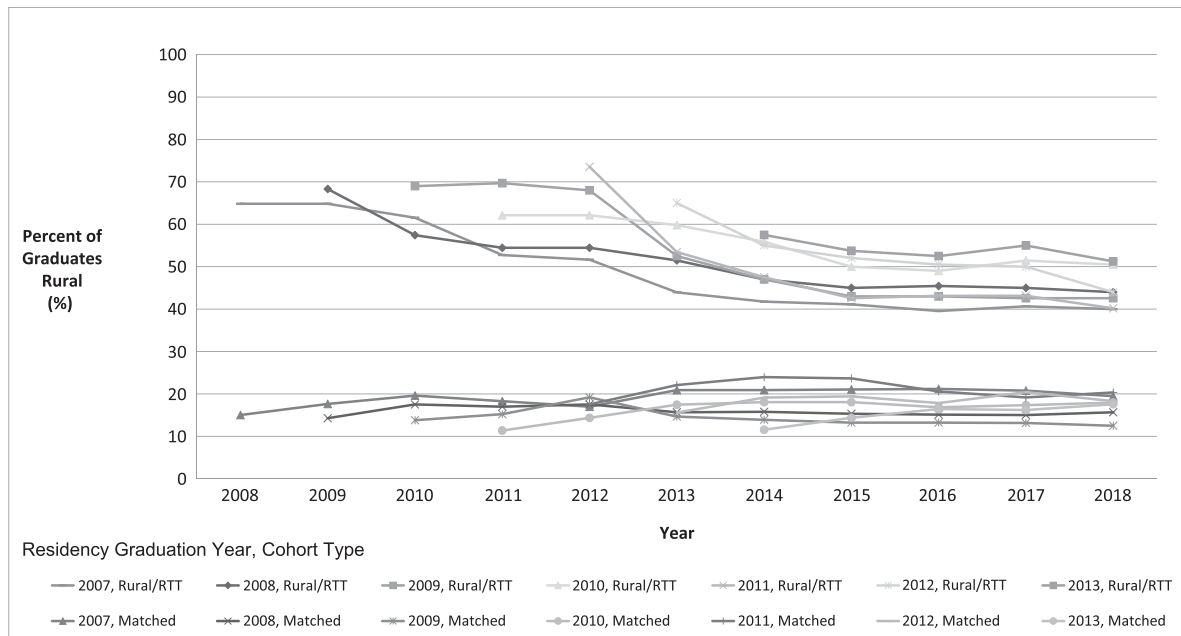


FIGURE 2
Percent of Graduates Practicing in Rural Areas per Year by Residency Graduation Year

also include DO degree compared to MD degree, USMG status compared to IMG status, and age less than 30 at residency start compared to 30 and above (FIGURE 1). We found no statistically significant differences in rural workforce contribution between regions of training or between men and women in either cohort (FIGURE 1).

Of the 29 rural/RTT programs, 19 were rural programs located in geographies with a RUCC score of 4 or greater (online supplemental TABLE 2); 10 had primary sites located in geographies with RUCC scores less than 4, but each of those programs were RTTs where residents generally spend the first year in a metro location and the final 2 years of residency in non-metro or metro-adjacent locations (and the metro site was listed as the primary site in the program database used to collect this information). Four non-rural/RTT programs were in large metropolitan areas with a population of 1 million or more (RUCC score of 1), 12 in areas with 250 000 to 1 million people (RUCC score of 2), and 12 in areas with a population of fewer than 250 000 people (RUCC score of 3). There was also 1 non-rural/RTT program located in a small urban area of 2500 to 19 999 people with a RUCC score of 5.

For each class of rural/RTT graduates from 2007 through 2013, the proportion entering the rural workforce peaked in the first 3 to 5 years of their career while the trend lines for non-rural/RTT graduates remained relatively flat (FIGURE 2).

Discussion

Taken together, these findings suggest that compared with a matched cohort of non-rural/RTT graduates, rural/RTT graduates devote more service to rural communities, both in the proportion entering rural communities and number of rural workforce years contributed per graduate. These findings were consistent across each of the cross-sections of time in practice and across the 10-year study time frame. This also corroborates earlier research using a similar time period suggesting that rural and RTT residency programs are a major contributor for training physicians to work in rural communities.^{25,26}

While the total number of residents included in our sample is approximately 14% of all US family medicine residents and the number of included residency programs is 9% of all US family medicine residency programs, we feel that our sample is representative of training sites across the United States.³¹ We therefore believe that these findings show that rural/RTT programs make the best investment to strengthen and support the rural physician workforce.

We also found that 31% of rural/RTT graduates do not contribute to the rural workforce at all. This is consistent with previous literature that found rural/RTT programs place approximately 70% of graduates in rural regions.^{22,32}

We noted several other important findings that would benefit from further exploration, including

TABLE 3
Average Rural Workforce Years by Cohort Type and Years in Practice

Characteristics	5 Years in Practice				8 Years in Practice				10 Years in Practice					
	Rural/RTT		Matched		Rural/RTT		Matched		Rural/RTT		Matched		t test	
	n	Rural Workforce Years	n	Rural Workforce Years	n	Rural Workforce Years	n	Rural Workforce Years	n	Rural Workforce Years	n	Rural Workforce Years	P Value	t test
Overall	647	2.77	1041	0.89	317	4.46	507	1.43	138	5.24	219	2.03	< .001	< .001
Gender														
Male	329	2.65	521	0.93	171	4.53	263	1.48	67	5.07	116	2.27	< .001	< .001
Female	318	2.88	520	0.85	146	4.37	244	1.39	71	5.39	103	1.76	< .001	< .001
Medical School Type														
USMG	371	3.23	548	1.17	201	5.29	283	1.83	91	6.82	135	2.40	< .001	< .001
IMG	276	2.14	493	0.58	116	3.01	224	0.92	47	2.17	84	1.43	< .001	.17
Degree Type														
MD	537	2.63	914	0.81	253	4.11	448	1.31	111	4.77	193	2.01	< .001	< .001
DO	110	3.42	127	1.50	64	5.83	59	2.37	27	7.15	26	2.19	< .001	< .001
Region														
Northeast	84	2.50	130	0.68	35	3.00	56	1.29	11	2.36	23	1.30	.004	.34
Midwest	219	2.94	322	1.07	110	5.29	154	1.58	56	6.59	62	2.37	< .001	< .001
South	268	2.65	412	0.80	134	4.13	197	1.25	54	4.72	90	1.76	< .001	< .001
West	76	2.95	177	0.93	38	4.55	100	1.65	17	4.29	44	2.48	< .001	.09
Age at Residency Start														
< 30 years	343	3.09	507	1.12	180	5.02	238	1.91	86	6.42	109	2.79	< .001	< .001
30+ years	304	2.40	534	0.68	137	3.72	269	1.01	52	3.29	110	1.27	< .001	< .001

Abbreviations: RTT, rural training track; USMG, United State medical school graduate; IMG, international medical school graduate; MD, allopathic medical degree; DO, osteopathic medical degree.
Source: 2013 ABFM Residency Identifiers, 2018 AMA Historical Residency File, 2008-2018 AMA Masterfile.

differences in the contributions of rural workforce years between osteopathic and allopathic physicians, USMG and IMG physicians, and age at the start of residency. Across all covariates, the percentage of residents from rural/RTT programs working in rural areas appears to decrease over time. This is a well-known phenomenon but would benefit from further study as well.

While there is likely some selection bias within our sample, we do not believe this is the central reason for the success of rural/RTT programs. Many studies have assumed this, but it is an area of research that needs further exploration. While rural upbringing has been associated with a 2.35-fold increase in the relative likelihood of practicing in a rural area as compared to those who grow up in non-rural areas, it is also true that only 5% of medical students and approximately 25% of practicing rural physicians claim a rural upbringing.^{32–37} This suggests that a majority of physicians with rural upbringing actually choose to work in non-rural environments. Similarly, if 75% of rural physicians have a non-rural upbringing, other factors must contribute to their career choice (eg, exposure to rural practice environments in clinical training).

Several limitations of this study should be considered. The American Medical Association (AMA) Masterfile may not capture all osteopathic physicians who graduated from solely American Osteopathic Association (AOA)-accredited residency programs. Therefore, the structure of the AMA Masterfile and the ABFM survey databases necessitated the exclusion of the solely AOA-accredited residency programs from our analysis. The AMA Masterfile has a time lag in updating the practice location of new graduates and may occasionally misidentify practice address. The AMA Masterfile only includes one office location per physician, so we cannot account for physicians who practice in rural areas on a secondary basis. We were also unable to account for other variables that have been shown to influence rural practice including marital status or rural birthplace of physicians.^{23,24,38–47}

Additionally, our matched cohort was generated by reviewing the ABFM list of residency programs active in 2013 and finding the closest geographic match to programs in our rural/RTT sample. We may have overlooked residency programs that could be considered more precise matches for one of the rural/RTT programs. There also may be distinct cultural, socioeconomic, or demographic differences between the matched programs in each of the cohorts, which could limit their utility as a matched pairing.

This publication also may be useful to support current policy efforts to expand rural training

opportunities. As noted above, the HRSA recently committed \$28 million toward the development of new rural training opportunities through the Rural Residency Planning and Development Program. This program will help address the geographic disparity in access to medical care in rural communities and represents an opportunity to further study the efficacy of rural training programs.

We challenge existing state and federal programs designed to address the maldistribution of physicians in the United States to consider using the rural workforce year to quantify their contribution to the rural workforce. These include loan forgiveness programs through the National Health Service Corps, J-1 Visa waivers for IMGs, or debt-free medical education programs (eg, New York University Medical School or the Primary Care Scholars Program at Geisinger Commonwealth School of Medicine). Using the rural workforce year as a tool in this context would help improve our understanding of the relative efficacy of these programs to address the maldistribution of our primary care physicians and inform critical workforce funding decisions at the state and federal levels.

Conclusions

Our findings support and build upon previous research on the utility of decentralizing GME outside of non-rural health centers to address the geographic maldistribution of physicians. To meet the rural workforce contributions of one graduate from a rural/RTT program (measured in rural workforce years), nearby non-rural/RTT programs would need to nearly triple their current production of graduates.

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