

The Distribution of the General Surgery Workforce in Rural and Urban America in 2019

KEY FINDINGS

- The per capita supply of general surgeons in the U.S. overall declined from 6.4 per 100,000 population to 5.2 per 100,000 from 2001 to 2019, a decrease of 18.0%.
- Rural areas of the U.S. experienced a decrease of 29.1% in general surgeon supply during the same period; small and isolated small rural areas experienced a decline of 32.6%. In 2019, 60.1% of non-metropolitan counties had no active general surgeon.
- The magnitude of the decreases in the supply of rural general surgeons from 2001 to 2019 varies considerably across Census Divisions.
- Rural general surgeons are older than their urban counterparts. About 48.8% of urban general surgeons are 50 years of age or older compared to 55.0% in large rural areas and 59.3% in small/isolated rural areas.
- While the proportion of women in the general surgery workforce rose from 10.6% in 2001 to 26.1% in 2019, this proportion is smaller in rural areas, only 19.7% in 2019.
- Long-term preservation of rural surgical services will require concerted efforts by medical school educators, residency directors, and rural advocates to promote and sustain interest in rural general surgery among medical students and surgical residents, especially women.

BACKGROUND

General surgeons have a crucial role in rural health care in the U.S. They provide backup to rural primary care providers in emergency care, obstetrics, and orthopedics. They also perform a wide range of low complexity surgical procedures at higher rates, and with lower rates of complications, than their urban counterparts.¹ The presence of a rural general surgeon decreases the need for patients to travel for routine surgical care and also contributes substantially to the financial health of rural hospitals.^{2,3} General surgery procedures accounted for 21.4% of inpatient procedures in small rural and isolated rural hospital settings compared to 17.9% in urban hospital settings.¹ However, despite the importance of general surgery in rural health care, the supply of general surgeons in the rural U.S. declined from 6.36 per 100,000 population in 1981 to 5.02 in 2005.⁴ In urban areas the ratio decreased from 8.04 to 5.85 during the same period.⁴

Rural communities may find recruiting and retaining surgeons increasingly problematic. In 2008, more than half of rural hospitals surveyed reported that it was more difficult to recruit a surgeon than a primary care physician, and one-third of rural hospital administrators reported that they expected a general surgeon to leave their hospital within two years.² Rural general surgeons tend to be older than their urban counterparts, which, coupled with a lower average retirement age than most physicians, suggests that general surgeons may be in even shorter supply in the future.⁵⁻⁷ There has also been a trend in graduate medical education towards greater subspecialization in general surgery,⁷⁻⁹ a trend which may leave young surgeons relatively unprepared for rural practice and encourage them to seek practice in urban settings where their subspecialty skills are in higher demand.⁷⁻⁹

At the same time, while the diminution of the overall supply of rural general surgeons is worrisome, previous research^{4,6-7,11} has shown considerable variation in the severity of the decrease both regionally and across types of rural areas. In this policy brief, we explore regional, rural-urban, and intra-rural differences in the supply of general surgeons using data from 2019. We also compare the 2019 findings to results of a similar analysis of surgeon supply data conducted by the WWAMI Rural Health Research Center (RHRC)¹⁰ using 2001 data. Our findings will give policymakers, workforce analysts, and medical educators an up-to-date and clear picture of both current and long-term trends in supply and distribution of the rural and urban general surgeon workforce in the U.S.

METHODS

Data sources used in this study included the American Medical Association (AMA) Physician Masterfile (2019),¹² the Rural-Urban Commuting Area (RUCA) codes ZIP code version 3.1,¹³ the U.S. Housing and Urban Development (HUD) ZIP code-county crosswalk¹⁴ and 2019 Claritas U.S. population data.¹⁵

We used the AMA Physician Masterfile to select general surgeons including the following specialty codes: Abdominal Surgery-‘AS,’ General Surgery-‘GS,’ Traumatic Surgery-‘TRS,’ and Critical Care Surgery-‘CCS,’ the four fields identified by Jonnason et al. as constituting the “major scope of general surgery.”⁵ In addition, only general surgeons aged 62 years (the mean and median retirement age for surgeons) or younger were included.⁵ These age and specialty inclusion criteria are identified by Jonnason et al. as a “minimal scenario” for defining general surgeons.⁵ It is identified as “minimal” because it excludes surgical sub-specialists who may, or may not, practice some general surgery. In addition to being a conservative definition of surgeon supply relevant to rural areas, use of this definition allowed direct comparison of 2019 supply data to 2001 data published in earlier work.¹⁰ Surgical residents were not included in the analysis.

We assigned each physician to a location using the ZIP code of their practice address (89.6% of surgeons), or, when practice address was missing, the ZIP code of the physician’s home address (10.4% of surgeons). Each ZIP code was assigned to a county based on the HUD ZIP code-county crosswalk table. For ZIP codes not in the table, we searched online using the U.S. Postal Service website to determine the city and county of each ZIP code.

We categorized ZIP codes of all U.S. general surgeons into one of three geographic categories using the primary digit of the RUCA codes grouped as follows: urban (codes 1-3), large rural (codes 4-6), and small/isolated small rural (codes 7-10).

We calculated general surgeon counts and the ratio per 100,000 population for each U.S. county and for each U.S. Census Division overall and for each level of rurality (urban, large rural and small/isolated small rural). We compared 2019 values with 2001 values from a previous WWAMI RHRC study¹⁰ that used the same methods. We used Version 9.4 of the SAS System for Windows for the data analyses. The University of Washington Human Subjects Division approved this research.

RESULTS

We identified 17,268 practicing general surgeons in the U.S. in 2019. Table 1 shows that 15,066 (87.2%) general surgeons were in urban areas. There were 2,202 (12.8%) located in rural areas where 15.8% of the population resided in 2019.¹⁵ Just 8.5% (1,469) of general surgeons were practicing in large rural areas where 8.9% of the population lived, and 4.2% (733) were practicing in small and isolated areas where 7.0% of the population lived. Compared to urban general surgeons, rural general surgeons were more often male (72.9% in urban areas vs 80.3% in rural areas), older, and more likely to have graduated from a U.S. or Canadian medical school than their urban counterparts. Differences in age were slightly more pronounced among the general surgeons working in small and isolated small rural areas compared to large rural areas: 48.8% of urban general surgeons were 50 years of age or older, compared to 55.0% in large rural areas and 59.3% in small/isolated areas. No information on physician ethnicity/race is available in the AMA Physician Masterfile.

Table 1. Characteristics of General Surgeons* in Urban, Large Rural, and Small/Isolated Rural Areas of the U.S. in 2019

	Urban		Rural (all)		Large Rural		Small/Isolated Rural		Overall	
	Count n=15,066 (87.2% of all)	Col. %	Count n=2,202 (12.8% of all)	Col. %	Count n=1,469 (8.5% of all)	Col. %	Count n=733 (4.3% of all)	Col. %	Count n=17,268 (100.0% of all)	Col. %
Gender**										
Male	10,975	72.9%	1,766	80.3%	1,177	80.2%	589	80.6%	12,741	73.9%
Female	4,078	27.1%	432	19.7%	290	19.8%	142	19.4%	4,510	26.1%
Age										
<40	2,405	16.0%	297	13.5%	211	14.4%	86	11.7%	2,702	15.7%
40-49	5,304	35.2%	662	30.1%	450	30.6%	212	28.9%	5,966	34.6%
≥50	7,357	48.8%	1,243	56.4%	808	55.0%	435	59.3%	8,600	49.8%
Medical School										
U.S. or Canadian medical graduate	13,013	86.4%	1,951	88.6%	1,305	88.8%	646	88.1%	14,964	86.7%
International medical graduate	2,053	13.6%	251	11.4%	164	11.2%	87	11.9%	2,304	13.3%

*Surgeons who listed their surgical specialty as general surgery, abdominal surgery, trauma surgery or critical care.

**Data on gender missing for 17 surgeons.

Table 2 shows the number and general surgeon/population ratio in each U.S. Census Division by level of rurality. Overall, there were 5.24 general surgeons per 100,000 population, but that ratio varied widely by Census Division and level of rurality. Nationally, small and isolated small rural communities had just 3.15 general surgeons per 100,000 population while urban communities had 5.44. The New England Census Division had 7.31 general surgeons per 100,000 population in small and isolated rural communities, while the West South Central Census Division had only 1.75. Figure 1 shows the wide variation in the availability of surgeons at the county level, particularly in the central part of the U.S. where there is a high concentration of counties without general surgeons. In 2019, 1,196 of 1,976 non-metropolitan counties (60.1%) had no active general surgeon. The WWAMI RHRC found, in a comparable analysis of family physicians, that 5% of non-metropolitan counties had no active family physician in 2019.¹⁶

Table 2. Number and Ratio of General Surgeons per 100,000 Population in Urban, Rural, Large Rural and Small/Isolated Rural Areas of the U.S. in 2019, by Census Division†

	Urban		Rural		Large Rural		Small/Isolated Rural		Overall	
	Number of General Surgeons	Ratio								
New England	807	6.19	141	7.65	66	8.08	75	7.31	948	6.37
Middle Atlantic	2,083	5.45	134	3.81	90	4.37	44	3.02	2,217	5.31
East North Central	2,056	5.45	426	4.59	285	5.63	141	3.35	2,482	5.28
West North Central	900	6.28	311	4.37	202	6.59	109	2.69	1,211	5.65
East South Central	803	6.35	258	3.96	174	4.64	84	3.04	1,061	5.54
South Atlantic	3,113	5.34	303	4.04	212	4.68	91	3.07	3,416	5.19
West South Central	1,674	4.96	210	3.04	157	4.04	53	1.75	1,884	4.64
Mountain	1,134	5.66	223	4.85	141	5.68	82	3.88	1,357	5.51
Pacific	2,496	5.10	196	3.96	142	4.31	54	3.25	2,692	4.99
Total U.S.	15,066	5.44	2,202	4.22	1,469	5.07	733	3.15	17,268	5.24

†New England=CT, ME, MA, NH, RI, VT; Middle Atlantic=NJ, NY, PA; East North Central=IL, IN, MI, OH, WI; West North Central=IA, KS, MN, MO, NE, ND, SD; South Atlantic=DE, DC, FL, GA, MD, NC, SC, VA, WV; East South Central=AL, KY, MS, TN; West South Central=AR, LA, OK, TX; Mountain=AZ, CO, ID, MT, NV, NM, UT, WY; Pacific=AK, CA, HI, OR, WA.

Figure 1. Active General Surgeons per 100,000 Population in the Rural U.S. by County, 2019

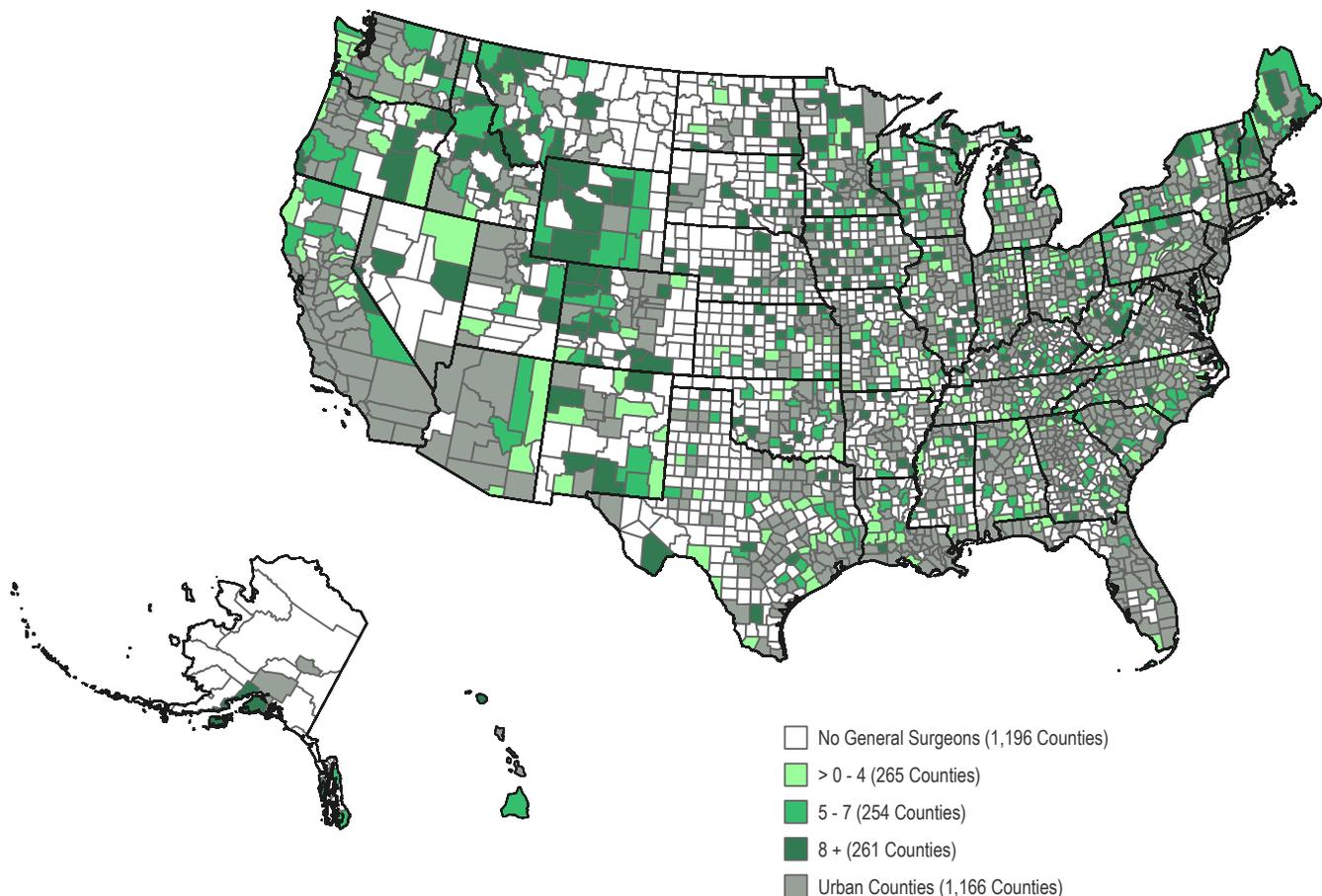


Table 3 highlights the change in general surgeon characteristics from 2001 to 2019. Most notably, at the national level, the proportion of female general surgeons increased substantially from 2001 to 2019. In 2001, women made up only 11.7% of all urban general surgeons; in 2019, 27.1% were women. Similar increases were observed in large rural areas (6.1% to 19.8%) and in small/isolated rural areas (7.3% to 19.4%). In addition, the proportion of surgeons 50 years old or older increased from 2001 to 2019, from 42.1% to 48.8% in urban areas and from 47.6% to 56.4% in rural areas.

Table 3. Characteristics of General Surgeons in Rural vs. Urban Areas of the U.S. in 2001* and 2019

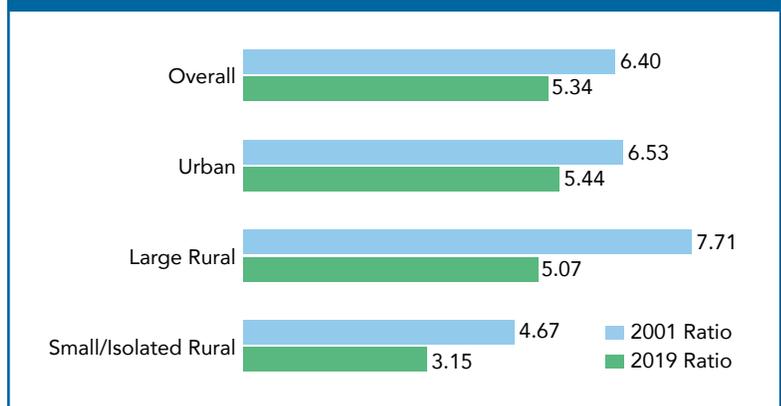
	Urban		Rural (all)		Large Rural		Small/Isolated Rural		Overall	
	2001 n=13,647	2019 n=15,066	2001 n=3,592	2019 n=2,202	2001 n=1,956	2019 n=1,469	2001 n=1,636	2019 n=733	2001 n=17,239	2019 n=17,268
Gender**										
Male	88.3%	72.9%	93.3%	80.3%	93.9%	80.2%	92.7%	80.6%	89.4%	73.9%
Female	11.7%	27.1%	6.7%	19.7%	6.1%	19.8%	7.3%	19.4%	10.6%	26.1%
Age										
<40	20.1%	16.0%	17.8%	13.5%	19.9%	14.4%	15.2%	11.7%	19.7%	15.6%
40-49	32.8%	35.2%	34.6%	30.1%	35.9%	30.6%	33.1%	28.9%	37.1%	34.5%
≥50	42.1%	48.8%	47.6%	56.4%	44.2%	55.0%	51.7%	59.4%	43.2%	49.8%
Medical School										
U.S. or Canadian medical graduate	79.9%	86.4%	80.9%	88.6%	86.0%	88.8%	74.8%	88.1%	80.1%	86.7%
International medical graduate	20.1%	13.6%	19.1%	11.4%	14.0%	11.2%	25.2%	11.9%	19.9%	13.3%

*2001 values were sourced directly from Thompson et al.¹⁰

**Gender of 17 general surgeons was missing from the 2019 data.

The overall decline in the supply of rural surgeons from 2001 to 2019 is shown in Figure 2. Overall, the supply of general surgeons in the U.S. decreased by 18.0% from 6.40 per 100,000 population to 5.24. In urban areas, the supply of general surgeons decreased from 6.53 per 100,000 population to 5.44, a decrease of 16.6%. Supply dropped from 7.71 to 5.07 in large rural areas and from 4.67 to 3.15 in small and isolated rural areas (decreases of 34.2% and 32.5%, respectively). Regional variation in the overall decline in the general surgeon-to-population ratio across Census Divisions and rural/urban geography is seen in Table 4. Except for a slight increase in the supply of general surgeons in urban areas of the West North Central Census Division, the supply of general surgeons decreased between 2001 and 2019 in large rural, small/isolated rural, and urban areas of all Divisions. The overall magnitude of the declines varied substantially across Census Divisions, from a decline of 8.3% in the Pacific Division to a decline of 29.1% in the Middle Atlantic Division. The supply of general surgeons in New England remained relatively high compared to other Census Divisions. The lowest per capita supply of general surgeons was found in the West South Central Division in both time periods and decreased by 18.3% between 2001 and 2019. Small/isolated small rural areas experienced the lowest supply of surgeons in every Division and in both time periods.

Figure 2. Ratio of General Surgeons per 100,000 Population in Urban, Large Rural, and Small/Isolated Rural Areas of the U.S. in 2001* and 2019



*2001 values were sourced from Thompson et al.¹⁰

Table 4. General Surgeons per 100,000 Population in Urban and Rural Areas of the U.S. in 2001* and 2019, by Census Division†

	Urban Ratio			Rural Ratio			Large Rural Ratio			Small/Isolated Rural Ratio			Overall		
	2001	2019	% Change	2001	2019	% Change	2001	2019	% Change	2001	2019	% Change	2001	2019	% Change
New England	7.32	6.19	-15.4%	8.10	7.65	-5.6%	8.22	8.08	-1.7%	8.04	7.31	-9.1%	7.32	6.37	-13.0%
Middle Atlantic	7.49	5.45	-27.3%	6.63	3.81	-42.5%	8.25	4.37	-47.0%	5.62	3.02	-46.3%	7.49	5.31	-29.1%
East North Central	6.18	5.45	-11.8%	6.05	4.59	-24.1%	7.67	5.63	-26.6%	4.7	3.35	-28.7%	6.18	5.28	-14.6%
West North Central	6.26	6.28	0.3%	5.56	4.37	-21.5%	8.97	6.59	-26.5%	3.66	2.69	-26.5%	6.26	5.65	-9.7%
East South Central	7.01	6.35	-9.4%	5.99	3.96	-33.8%	8.17	4.64	-43.2%	4.58	3.04	-33.6%	7.01	5.54	-21.0%
South Atlantic	6.74	5.34	-20.8%	6.51	4.04	-37.9%	8.22	4.68	-43.1%	5.47	3.07	-43.9%	6.74	5.19	-23.0%
West South Central	5.68	4.96	-12.6%	4.47	3.04	-32.1%	6.20	4.04	-34.8%	3.04	1.75	-42.4%	5.68	4.64	-18.3%
Mountain	6.11	5.66	-7.4%	5.96	4.85	-18.6%	7.50	5.68	-24.3%	4.59	3.88	-15.5%	6.11	5.51	-9.8%
Pacific	5.44	5.10	-6.3%	5.70	3.96	-30.6%	6.82	4.31	-36.8%	4.22	3.25	-23.0%	5.44	4.99	-8.3%
Total U.S.	6.53	5.44	-16.7%	5.95	4.22	-29.1%	7.71	5.07	-34.2%	4.67	3.15	-32.6%	6.40	5.24	-18.0%

*2001 values were sourced from Thompson et al.¹⁰

†New England=CT, ME, MA, NH, RI, VT; Middle Atlantic=NJ, NY, PA; East North Central=IL, IN, MI, OH, WI; West North Central=IA, KS, MN, MO, NE, ND, SD; South Atlantic=DE, DC, FL, GA, MD, NC, SC, VA, WV; East South Central=AL, KY, MS, TN; West South Central=AR, LA, OK, TX; Mountain=AZ, CO, ID, MT, NV, NM, UT, WY; Pacific=AK, CA, HI, OR, WA.

DISCUSSION

Summary. The per capita supply of general surgeons in the U.S. continues to decline, particularly in rural areas. Earlier work indicates that the decline began in the 1980s and continued into the mid-2000s.^{4,7,11} The analyses presented above show that the number of general surgeons in the U.S. remained largely unchanged at about 17,200, from 2001 to 2019. However, the U.S. population grew by 43 million¹⁷ during the same period, creating a 16.7% decrease in the number of general surgeons per 100,000 population in urban areas and a 29.1% decrease in rural areas. The decrease in per capita supply occurred in every Census Division and at all levels of rurality. The analyses show a consistent trend of rural/urban differences and a decrease in supply over time, although there is variation in the magnitude of those differences and decreases across Census Divisions.

Limitations. This analysis has some limitations. Most important, this study measures only the geographic availability of general surgeons; it does not address the utilization of those surgeons by patients who, for any number of reasons (e.g., lack of insurance coverage, a desire to be treated by a surgical specialist, or personal preference) may not obtain surgical services locally. In addition, we chose to use the “minimal scenario” to facilitate direct comparison with earlier studies^{5,10} and guard against overestimating rural

general surgeon supply, but it is possible that this method may have resulted in underestimates by using overly restrictive specialty and age criteria. The age criterion we used excluded 4,265 rural surgeons ages 63 to 70 who would otherwise have been included in the study population. In addition, the absence of physician race/ethnicity information in the AMA data makes it impossible to examine the relationship between race/ethnicity and the supply and geographic distribution of the general surgeon workforce.

Conclusions and Policy Implications. In addition to the declining per capita supply and geographic maldistribution of the general surgical workforce, the age and gender distribution of this workforce may have long-term implications for the availability of surgical services in rural areas. The rural general surgery workforce continues to be older and more male than the urban workforce. Small and isolated areas in particular have an older general surgeon workforce than large rural and urban areas. The gender imbalance in the general surgical workforce reported by Thompson et al.¹⁰ has lessened, but it has not disappeared. In 2019, women made up 26.1% of the general surgery workforce compared to 10.6% in 2001. The proportion of women in the overall physician workforce increased from 23% in 2000¹⁸ to 36% in 2019.¹⁹ Our analysis also showed that female general surgeons were more likely to practice in urban settings than rural ones (27.1% vs 19.7%) in 2019. As the proportion of women entering medical careers continues to increase, the supply of physicians in specialties with significant gender and/or age imbalances, such as general surgery, may be affected disproportionately. This appears to be the situation facing rural general surgery. In 2018, women made up 47% of graduates of allopathic medical schools²⁰; if the gender imbalance in specialty and location choice is not further reduced, the supply of general surgeons, and rural surgeons in particular, will be under even greater pressure.

To preserve the vital patient services provided by rural general surgeons, and the contribution of surgical services to the financial viability of many rural hospitals, medical school and residency educators and policymakers will need to focus sustained efforts on increasing the supply of rural general surgeons. Those efforts will necessarily include exposing medical students to rural practice, increasing the availability of general surgery residencies focused on rural training,^{7,21-22} and reimbursement policies that support general surgery in rural hospitals.^{3,7,23} In addition, an option for states with identified shortages is for officials who operate Conrad 30 J-1 visa waiver programs to explore using their discretion to prioritize general surgeons for those waivers.²⁴ Future research on increasing the supply of rural general surgeons should seek to understand what makes existing rural surgical residencies successful.^{7,21-22} Medical students and surgical residents are often attracted to general surgery and rural practice by the potential for a broad scope of practice and a rural lifestyle, but it can be challenging to sustain that interest over the ten years it typically takes to train a general surgeon.^{7, 25-29} Identifying training models that sustain that interest and attract young surgeons, especially women,³⁰ to rural careers is essential to preserving rural surgical services.

REFERENCES

1. Doescher M, Jackson J, Fordyce M, Lynge D. *Variability in General Surgical Procedures in Rural and Urban U.S. Hospital Inpatient Settings*. Final Report #142. WWAMI Rural Health Research Center, University of Washington; February 2015.
2. Doty B, Zuckerman R, Finlayson S, Jenkins P, Rieb N, Heneghan S. General surgery at rural hospitals: a national survey of rural hospital administrators. *Surgery*. 2008;143(5):599-606. doi:10.1016/j.surg.2007.11.022
3. Karim SA, Holmes GM, Pink GH. The effect of surgery on the profitability of rural hospitals. *J Health Care Finance* 2015;41(4). Accessed October 6, 2020. <https://healthfinancejournal.com/index.php/johcf/article/view/30>
4. Doescher M, Lynge D, Skillman SM. *The Crisis in Rural General Surgery*. Policy Brief. WWAMI Rural Health Research Center, University of Washington; April 2009.
5. Jonasson O, Kwakwa F, Sheldon GH. Calculating the workforce in general surgery. *JAMA*. 1995;274(9):731-34.
6. Avery DM, Wallace JC. Why is there a deficit of rural surgeons on the United States? *J Rural Health*. 2016;32:231-234.
7. Cogbill TH, Cofer JB, Jarman BT. Contemporary issues in rural surgery. *Curr Probl Surg*. 2012;49(5):263-318. doi:10.1067/j.cpsurg.2012.01.002
8. Long S. Rural surgery: High pressure but rewarding. *Bull Am Coll Surg*. 2017;102(1):55-57.
9. Stitzenberg KB, Sheldon GF. Progressive specialization within general surgery: adding to the complexity of workforce planning. *Bull Am Coll Surg*. 2005;201(6):925-932.
10. Thompson MJ, Lynge DC, Larson EH, Tachawachira P, Hart LG. Characterizing the general surgery workforce in rural America. *Arch Surg*. 2005;140(1):74-79. doi:10.1001/archsurg.140.1.74
11. Lynge DC, Larson EH, Thompson MJ, Rosenblatt RA. A longitudinal analysis of the general surgery workforce in the United States, 1985-2005. *Arch Surg*. 2008;143(4):345-350.
12. American Medical Association. *AMA Physician Masterfile-2019*. Chicago, IL: American Medical Association; 2020.
13. US Department of Agriculture Economic Research Service. 2010 Rural-Urban Commuting Area Codes ZIP code file. Accessed September 21, 2020. <https://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes/>
14. US Department of Housing and Urban Development Office of Policy Development. HUD USPS ZIP Code Crosswalk Files. Accessed July 13, 2020. https://www.huduser.gov/portal/datasets/usps_crosswalk.html
15. Claritas. 2019 Selected Population Facts Data for All ZIP Codes and Boroughs Nationwide. San Diego, CA: Claritas, 2020.
16. Larson EH, Andrilla CHA, Garberson LA. *Supply and Distribution of the Primary Care Workforce in Rural America: 2019*. Policy Brief #167. WWAMI Rural Health Research Center, University of Washington; June 2020.
17. Statista. Resident Population of the United States from 1980 to 2020. Accessed February 4, 2021. <https://www.statista.com/statistics/183457/united-states--resident-population/>
18. Salsberg ES, Forte GJ. Trends in the physician workforce, 1980-2000. *Health Aff*. 2002;21(5):165-173.
19. Kaiser Family Foundation. Professionally Active Physicians by Gender. Accessed September 21, 2020. <https://www.kff.org/other/state-indicator/physicians-by-gender/?dataView=1¤tTimeframe=0&sortModel=%7B%22colId%22:%22Female%22,%22sort%22:%22desc%22%7D>
20. Kaiser Family Foundation. Professionally Active Physicians by Gender. Accessed September 21, 2020. <https://www.kff.org/other/state-indicator/physicians-by-gender/?dataView=1¤tTimeframe=0&sortModel=%7B%22colId%22:%22Female%22,%22sort%22:%22desc%22%7D>
21. Patterson DG, Andrilla CHA, Garberson LA. Preparing physicians for rural practice: availability of rural training in rural-centric residency programs. *J Grad Med Educ*. 2019;11(5):550-557.
22. Rossi IR, Wiegmann AL, Schou P, Borgstrom DC, Rossi MB. Reap what you sow: which rural surgery training programs currently exist and do medical students know of their existence? *J Surgical Educ*. 2017;75(3):697-701.
23. Doty B, Zuckerman R, Finlayson S, Jenkins P, Rieb N, Heneghan S. How does degree of rurality impact the provision of surgical services at rural hospitals? *J Rural Health*. 2008;24(3):306-10.

24. Patterson DG, Keppel G, Skillman SM, Berry C, Daniel C, Doescher MP. *Recruitment of Non-U.S. Citizen Physicians to Rural and Underserved Areas through Conrad State 30 J-1 Visa Waiver Programs*. Final Report #148. WWAMI Rural Health Research Center, University of Washington; April 2015.
25. Hughes D, Williams JAR, Brooks JV. Movers and stayers: what birthplaces can teach us about rural practice choice among midwestern general surgeons. *J Rural Health*. 2020; Online ahead of print.
26. Doty B, Zuckerman R, Borgstrom D. Are general surgery residency programs likely to prepare future rural surgeons? *J Surg Educ*. 2009;66(2);74-79.
27. Jarman BT, Cogbill TH, Mathiason MA, O'Heron CT, Foley EF, Martine RF, Weigelt JA, Brasel KJ, Webb TP. Factors correlated with surgery resident choice to practice general surgery in a rural area. *J Surg Educ*. 2009;66(6);319-324.
28. Mercier PJ, Skube SJ, Leoiard SL, McElroy AN, Goettl TG, Najarian MM, Termuhlen PM, Chipman JG. Creating a rural surgery track and a review of rural surgery training programs. *J Surg Educ*. 2018;76(2);459-468.
29. Polk HC, Bland KI, Ellison C, Grosfeld J, Trunkey DD, Stain SC, Townsend CM. A proposal for enhancing the general surgical workforce and access to surgical care. *Ann Surg*. 2012;258(4);611-17.
30. Park J, Minor S, Taylor RA, Vikis E, Poenaru D. Why are women deterred from general surgery training? *Am J Surg*. 2005;190;141-46.

AUTHORS

Eric H. Larson, PhD, WWAMI Rural Health Research Center, University of Washington.
C. Holly A. Andrilla, MS, WWAMI Rural Health Research Center, University of Washington.
John Kearney, BA, WWAMI Rural Health Research Center, University of Washington.
Lisa A. Garberson, PhD, WWAMI Rural Health Research Center, University of Washington.
Davis G. Patterson, PhD, WWAMI Rural Health Research Center, University of Washington.

FUNDING

This study was supported by the Federal Office of Rural Health Policy (FORHP), Health Resources and Services Administration (HRSA), U.S. Department of Health and Human Services (HHS) under cooperative agreement #U1CRH03712. The information, conclusions and opinions expressed in the policy brief are those of the authors and no endorsement by FORHP, HRSA, or HHS is intended or should be inferred.

ACKNOWLEDGMENTS

The authors gratefully acknowledge Beverly Marshall for her assistance with manuscript production.

SUGGESTED CITATION

Larson EH, Andrilla CHA, Kearny J, Garberson LA, Patterson DG. *The Distribution of the General Surgery Workforce in Rural and Urban America in 2019*. Policy Brief. WWAMI Rural Health Research Center, University of Washington; March 2021.

University of Washington • School of Medicine
Box 354982 • Seattle WA 98195-4982
phone: (206) 685-0402 • fax: (206) 616-4768
<http://depts.washington.edu/uwrhrc>