

Original Research

Physician Workforce in Kansas: Where are the Orthopedic Surgeons?

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Received July 17, 2023; Accepted for publication Feb. 13, 2024; Published online March 15, 2024
<https://doi.org/10.17161/kjmvol17.21124>

ABSTRACT

Introduction. Rural patients have greater need but less access to orthopedic surgical care than their urban counterparts. Previous studies have investigated rural surgical care, but this is the first to assess the Kansas orthopedic surgery workforce to identify changes over time and rurality and inform thinking about future workforce composition.

Methods. The authors analyzed 2009 and 2019 AMA MasterFile and Area Health Resource File (AHRF) data. Using frequencies, percentages, and calculations of orthopedic surgeons per capita, we assessed workforce changes by rurality (Rural Urban Continuum Codes).

Results. The dataset included 307 orthopedic surgeons; 197 were in both 2009 and 2019. Of these, 165 were in active practice in 2009 and 244 in 2019, an increase of 79 (47.9%). Kansas had smaller proportions of surgeons in rural (non-metro) versus urban (metro) counties in both years. Orthopedic surgeons per capita grew throughout the state, but the increase was smaller in rural counties. There were 11 women orthopedic surgeons in both years, 3.6% of the total 307. Among the 197 surgeons in both years, four (2.0%) were women. No women orthopedic surgeons were in non-metro counties either year.

Conclusions. Although the Kansas orthopedic surgery workforce grew from 2009 to 2019, rural Kansas remains a *surgery desert* based on orthopedic surgeons per capita. Further studies could determine whether this trend is similar to that in other rural states and how to attract orthopedic surgeons to rural practice. *Kans J Med* 2024;17:1-5

INTRODUCTION

Rural America has long been referred to as older and sicker,¹ but the more nuanced reality is that those in rural communities have higher rates of chronic diseases, activity limitations, and chronic pain, and lower levels of physical activity than those in urban locations, while having less access to healthcare² and, for some, lower levels of health literacy.³ Patients in rural areas tend to prefer receiving orthopedic care locally, especially for chronic, potentially disabling conditions such as osteoarthritis.⁴ However, rural Americans have less access to orthopedic surgeons than do their urban counterparts,⁵ especially a lack of access to local care.⁶ While states with larger rural populations, except in the South, have a higher density of orthopedic surgeons overall,⁷ there is a widening gap between urban and rural communities in the per capita

number of orthopedic surgeons.⁵ In addition, while more women are entering the practice of orthopedic surgery (women represented 6.0% of orthopedic surgeons in 2010 and 7.4% by 2022), available data regarding physician distribution have not looked at the gender composition of the orthopedic surgeon workforce by rurality in Kansas.⁸⁻¹⁰

Patient-physician gender concordance has been well-studied, but results have been divided on the benefits of concordance.¹¹ Outcomes studied have been related to patient-physician communication,¹¹⁻¹³ patient satisfaction or care rating scores,¹⁴⁻¹⁸ impressions of care outcomes,¹⁹ and care and intervention effectiveness.^{20,21} While the vast majority of patients who seek orthopedic care do not express a preference for the gender of their surgeon, those who do may prefer having a woman surgeon.²² Some studies have found that patients who receive care from women surgeons have better outcomes in terms of mortality, and that women patients, in particular, may have better outcomes when treated by a woman surgeon; however, this line of inquiry is relatively nascent.^{23,24} Even if outcomes are not different based on surgeon gender, increasing the number of rural orthopedic surgeons requires making positions in these areas attractive to all potential candidates, including the increasing number of women orthopedic surgeons.

A variety of approaches to addressing the orthopedic needs of those in rural communities have been developed over the years. These include outreach clinics, telemedicine, and recruiting additional orthopedic surgeons to these communities.⁴ In a survey of 145 hospital administrators, Weichel et al.²⁵ found that 71.0% noted a need for increased orthopedic services in their communities, and one-third of rural hospitals were actively recruiting orthopedic surgeons. However, there is limited information regarding changes in the rural orthopedic workforce, including the composition of that workforce over time.

This study used physician- and county-level data to describe the Kansas orthopedic surgery workforce, aiming to add to our knowledge of diversity issues in rural care and inform thinking about the future composition of the orthopedic surgery workforce.

METHODS

The authors used 2009 year-end and 2019 year-end American Medical Association (AMA) MasterFile data for surgical specialists in Kansas to describe the orthopedic surgery workforce by rurality, type of practice, and gender using summary statistics. This allowed the authors to describe what percentage of orthopedic surgeons were engaged in direct patient care in rural counties.

We limited our analysis to the following surgical specialties (as named in the MasterFile): orthopedic adult reconstructive surgery, orthopedics (foot and ankle), orthopedic surgery, orthopedic surgery of the spine, orthopedic surgery-trauma, orthopedic pediatric surgery, orthopedic sports medicine, orthopedic musculoskeletal oncology, and hand surgery/orthopedic surgery. In the MasterFile, surgeons identified their primary specialty; therefore, these categories do not necessarily neatly align with existing residency programs, fellowships, or board certifications. The MasterFile codebook suggests that the category “orthopedic surgery” is general orthopedic surgical practice. For our purposes, we used the term “orthopedic surgeons” as an umbrella term inclusive of all aforementioned categories.

The MasterFile contained data on sex in 2009 (using categories “M”

and “F”) and gender in 2019 (also using categories “M” and “F”). We recognized gender and sex were different, and therefore the collection and treatment (use of M and F categories) of these data were problematic. However, we treated both years’ data as gender to approximate how gender representation may have changed from 2009 to 2019. We have referred to the “F” category as women and the “M” category as men.

We analyzed the total number of orthopedic surgeons in 2009 and 2019, excluding trainees. We differentiated between those present in both years versus those only present in the 2019 data. We analyzed the primary type of practice (direct patient care, semi-retired, retired, not active for other reasons, or not classified) and the genders of these surgeons. We defined those in “direct patient care” as in “active practice” to avoid any confusion with the term DPC, which often stands for “direct primary care.” We also included “semi-retired” in our definition of active practice, as those surgeons may still have been providing patient care, though likely on a part-time basis. We compared the presence of orthopedic surgeons in Kansas counties by using the Rural-Urban Continuum Code (RUCC) classification system.²⁶ We categorized RUCC’s 1-3 as urban, consistent with the RUCC’s description of 1, 2, and 3 as “metro” counties. We categorized 4-9 as rural, although we recognized that counties in category 4 differ greatly from counties in category 9. Counties that are a 4 may have populations of 20,000 or greater and are adjacent to metro areas. A 7 would have a population between 5,000 and 20,000 and not be adjacent to metro areas. The most rural RUCC classification, a 9, includes counties with populations under 5,000 and not adjacent to metro areas. We considered urban and rural to be interchangeable with metropolitan and non-metropolitan, respectively, although there are a variety of approaches to rural classification and terminology.

We utilized the 2020-21 release of the Health Resources and Services Administration (HRSA) Area Health Resource File (AHRF) to analyze basic population demographics for urban and rural U.S. counties, including population and percentage of population over age 65. We did not have access to the AHRF for 2009; only population variables for 2010 were available. So, comparisons between 2009 MasterFile data and 2010 AHRF data were approximate. When describing these data together, we used “2009/10.”

RESULTS

In our Kansas dataset, there were 307 orthopedic surgeons. Of these, 197 were present in both 2009 and 2019, while an additional 110 were added to the MasterFile between January 1, 2010 and December 31, 2019 (Table 1). These data included fully retired surgeons. No surgeons were marked “presumed dead” in the dataset, but it should be noted that the 75th percentile of age in 2019 was 65, and there were three surgeons over age 90.

Table 1. Kansas orthopedic surgery workforce by practice type, 2009 and 2019.

Practice Type, n (%)	2009	2019	Change
Direct patient care	161 (81.7%)	234 (76.2%)	73 (66.4%)
Semi-retired	4 (2.0%)	10 (3.3%)	6 (5.5%)
<i>Subtotal, active practice*</i>	<i>165 (83.8%)</i>	<i>244 (79.5%)</i>	<i>79 (71.8%)</i>
Retired	28 (14.2%)	54 (17.6%)	26 (23.6%)
Not active for other reasons	1 (0.5%)	1 (0.3%)	0 (0.0%)
No classification	3 (1.5%)	8 (2.6%)	5 (4.5%)
Total	197 (100.0%)	307 (100.0%)	110 (100.0%)

*The definition of active practice includes those classified by the MasterFile as in “direct patient care” as well as those classified as “semi-retired,” as those in semi-retirement could still be providing some patient care.

Of the 197 orthopedic surgeons in the 2009 data, 165 were in active practice; 32 surgeons changed practice type from 2009 to 2019. Most practice type changes were due to retirement. In 2019, 24 moved from active practice to full retirement. Also in 2019, there were 244 orthopedic surgeons actively practicing in Kansas, representing a net gain of 79 (47.9%) surgeons over the 10-year period. Of the 79 actively practicing orthopedic surgeons acquired from 2009 to 2019, 62 (78.5%) were incorporated into urban counties, while 17 (21.5%) were added in rural counties. The increase of 17 surgeons in rural counties represented a 58.6% growth in the rural orthopedic surgery workforce. Nevertheless, this surge in rural counties did not encompass any female practitioners, nor did it substantially impact the proportion of locally available orthopedic surgeons for rural populations. Kansas experienced a slight increase in proportion of orthopedic surgeons practicing in rural counties from 2009 to 2019. Of the 165 orthopedic surgeons actively practicing in 2009, 136 (82.4%) were in urban counties, and 29 (17.6%) were in rural counties. Among the 244 orthopedic surgeons in active practice in Kansas in 2019, 198 (81.1%) practiced in urban counties, and 46 (18.9%) practiced in rural communities.

For those in practice in rural counties in 2009, orthopedic surgeons were most commonly found in RUCC 5 (n = 10). Counties in this classification have populations of 20,000 or more and are not adjacent to urban areas. There were no orthopedic surgeons in counties classified as RUCC 8 or 9. Among orthopedic surgeons practicing in rural areas in 2019, 17 (35.4%) were in RUCC 5 counties. There was one orthopedic surgeon located in a county classified as RUCC 9, but none in any RUCC 8 counties, showing little change over the preceding decade.

Four women were in active orthopedic surgery practice in 2009, comprising 2.4% of the 165 actively practicing orthopedic surgeons that year. All these women practiced in urban counties. One woman surgeon retired between 2009 and 2019. Among the 110 orthopedic surgeons who entered the workforce after 2009, there were six women who entered active practice, resulting in a total of nine women orthopedic surgeons in active practice in 2019, 3.7% of the total 244 in active practice. All nine (100.0%) women orthopedic surgeons practiced in

urban counties (Table 2).

According to the AHRF, in 2010, Kansas had a total population exceeding 2.8 million, with approximately 1.9 million people (66.5%) residing in urban counties and 956,485 (33.5%) in rural counties. By 2019, the state's population had grown to over 2.9 million, reflecting a net increase of 60,196 people. Urban counties housed 2.0 million people (68.7%), while 911,973 (31.3%) resided in rural areas. This demographic shift resulted in an increase from approximately 7.2 orthopedic surgeons per 100,000 population in urban areas in 2009/10 to 9.9 in 2019. In contrast, rural areas experienced a rise from 3.0 orthopedic surgeons per 100,000 population in 2009 to 5.0 in 2019 (Table 3).

Table 2. Kansas orthopedic surgeons in active practice by rurality, 2009 and 2019.

Active Practice by Rurality, n (%)	2009	2019	Change
Men, urban (Metro)	132 (80.0%)	189 (77.5%)	57 (72.2%)
Women, urban (Metro)	4 (2.4%)	9 (3.7%)	5 (6.3%)
<i>Subtotal, urban (Metro)</i>	<i>136 (82.4%)</i>	<i>198 (81.1%)</i>	<i>62 (78.5%)</i>
Men, rural (Non-metro)	29 (17.6%)	46 (18.9%)	17 (21.5%)
Women, rural (Non-metro)	0 (0.0%)	0 (0.0%)	0 (0.0%)
<i>Subtotal, rural (Non-metro)</i>	<i>29 (17.6%)</i>	<i>46 (18.9%)</i>	<i>17 (21.5%)</i>
Total	165 (100.0%)	244 (100.0%)	79 (100.0%)

Table 3. Kansas orthopedic surgeons in active practice per capita, 2009 and 2019.

	2009/10	2019	Change
Kansas, urban (Metro)	7.2	9.9	2.7
Kansas, rural (Non-metro)	3.0	5.0	2.0
<i>Difference</i>	<i>4.1</i>	<i>4.8</i>	<i>0.7</i>
Kansas	5.8	8.4	2.6

DISCUSSION

People living in rural areas undergo more orthopedic procedures, such as total hip or knee replacements, than those in urban communities, indicating the need for access to orthopedic care in rural areas.²⁷ However, rurality was based on where the patients resided, not where care was provided. To assess access to local care, we needed to look at databases such as those used in this study. Although our study identified a rise in the count of orthopedic surgeons practicing in Kansas, including in rural communities, there was a widening gap in the number of surgeons per 100,000 population during the specified time. This is noteworthy due to a substantial portion of the state's population residing in counties that are not adjacent to urban areas. The absence of adjacency has implications for patients, affecting their ability to travel for care, as well as for providers, impacting their ability to commute to these areas or provide periodic, elective care. This underscores the necessity to augment the number of orthopedic surgeons in rural communities.

Similar issues with concentration of surgeons, including orthopedic surgeons, in urban communities have been identified in other states.

Uribe-Leitz et al.²⁸ found that 47% of counties in California were “surgical deserts”, meaning fewer than 6 orthopedic surgeons per 100,000 population. Even with the increase in orthopedic surgeons in rural areas, the current data demonstrated that rural Kansas also could be described as a “surgical desert.” This not only impacts the ability of patients in rural communities to obtain care for their chronic musculoskeletal conditions locally, but also leads to longer travel distances to access emergency orthopedic care. Weichel et al.²⁵ estimated that for communities without orthopedic surgeons, residents traveled an average of 50 miles for emergent orthopedic care and 45 miles for elective care. However, distances ranged up to 250 and 135 miles, respectively. This can place hardships on patients and their families and is of particular concern regarding emergent care. Although orthopedic surgeons may indeed travel to operate and provide outreach clinics, our data did not address this aspect. This represents a notable limitation in workforce research overall, as the MasterFile, a commonly used source, does not accommodate multiple practice locations.

In addition to the immediate impact on access to orthopedic care, the relative lack of orthopedic surgeons can impact the longer-term viability of rural hospitals and access to healthcare. The American Hospital Association reported that 136 rural hospitals closed in 2010 to 2021, similar to the time period of the current study, and more than half of rural hospitals in Kansas are at risk of closing.^{29,30} Orthopedic surgeons can be economic drivers for local hospitals.^{31,32} Hoskins et al.³¹ demonstrated the significant positive impact that surgical services have on the bottom line of critical access hospitals, and Weichel²⁵ noted that having a full-time orthopedic surgeon significantly impact the bottom line of rural hospitals. Recruiting more orthopedic surgeons to rural Kansas would seem to be critical in maintaining overall access to care for people living in those areas.

However, it can be challenging to recruit orthopedic surgeons to rural areas due to financial constraints, as physicians are incurring greater levels of debt in completing their education and training and may seek opportunities with greater compensation, or at minimum, greater volumes of cases.³³ In addition, there may be concerns with the ability to provide subspecialty care in more rural settings. More than 90% of graduating orthopedic residents complete a subspecialty fellowship, and attracting these physicians to areas in which they may not have the resources to practice to the limits of their training have been shown to limit their interests in rural care.³⁴

Given the increasing diversity in orthopedic surgery, including the number of women entering the field,⁸ we need to better understand the demographic details of the orthopedic workforce and what leads to, or prevents, orthopedic surgeons from practicing in rural communities. Our analysis of MasterFile and AHRF data found that while the number of women orthopedic surgeons in active practice in Kansas more than doubled from 2009 to 2019, this translated to women comprising only 3.7% of the active orthopedic surgery workforce in the state by 2019. This was somewhat lower than the national percentage of 7.4%.¹⁰ None of the women surgeons in Kansas practiced in rural counties; this was in contradistinction to findings by Rodgers et al.,³⁵ who found that there were no differences in percentages of women compared to men in urban versus rural practice. There is emerging evidence of increased risks of adverse post-operative outcomes,

including for some common orthopedic procedures, when comparing the results of women patients who were treated by men surgeons to those of women patients treated by women surgeons, although similar impacts of gender discordance were not seen when assessing outcomes of male patients treated by women or men surgeons.²³ However, even if outcomes are not dependent on surgeon gender, efforts to recruit orthopedic surgeons to rural areas need to be made to all orthopedic surgeons and to take account of needs they have related to practice and life outside of work. Women physicians face unique challenges in practice, especially having the resources needed to integrate work and home responsibilities. Women orthopedic surgeons are more impacted by issues with work-family balance and bearing the burden of home responsibilities than are men,³⁶ similar to women physicians in other specialties.³⁷ Addressing this requires that hospitals understand the needs of women physicians and provide the resources to make jobs in rural areas attractive. As noted by Ponzio et al.,³⁶ “the discrepancy in work-family integration must be addressed to attract, support, and retain women as successful orthopedic surgeons.”

Limitations. This study was primarily limited by access to data and the observational nature of the data used. This also was a descriptive study using two cross-sectional datasets, meaning we cannot draw causal conclusions among concepts like patient population characteristics, surgeon sub-specialty, and surgeon practice location. Kansas shared demographic trends with other similarly rural states during the study period, such as rural population loss. For these reasons, it served as a reasonable example that other primarily rural and frontier states facing surgical workforce shortages might consider. Future, similar studies in other states could help inform regional and national conversations on addressing orthopedic care for rural communities. In addition, the data we used were common in the literature, and it was important to highlight what can and cannot be done using these datasets.

Future Directions. To better inform efforts to improve access to rural orthopedic surgery care, it is important for centralized institutions, such as the AMA and HRSA, to collect more granular demographic data about providers and for surgical specialty societies to identify those providing rural care in their databases. On a more local or regional level, it is important to assess data regarding the orthopedic surgery workforce in states with similar rural compositions. This would allow identification of programs that are working for those with a greater per capita rural orthopedic surgery workforce. If findings show all rural states are in similar positions, that could indicate the need for discussion and intervention at a regional or national level.

In addition, work is needed to identify and address challenges that keep orthopedic surgeons from establishing practices in rural communities, especially issues with education debt, compensation packages, and the ability to practice subspecialty care. However, efforts can start earlier in the physician pipeline. Physicians from rural communities are more inclined to eventually practice in such areas; however, the percentage of medical students from rural backgrounds has continued to decline.³⁸ If the rural healthcare workforce is to keep up with demand, there needs to be continued efforts to reach rural students and interest them in careers in medicine and surgery. In addition, once physicians enter orthopedic surgery training programs, efforts could be made to

increase their exposure to rural practice with the goal of interesting them in this as a future career option. However, recruiting, supporting, and retaining women in rural orthopedic practice requires additional career-long efforts above and beyond those intended to initially interest them in careers in orthopedic surgery.³⁹ Women orthopedic surgeons are more likely to practice in larger groups than are men,³⁵ but these large groups are unlikely to exist outside of urban locations. We need to better understand the support that women find in these larger groups to determine whether those issues can also be addressed by smaller, non-urban hospitals and practices.

CONCLUSIONS

While the orthopedic surgery workforce in Kansas increased over a 10-year period, rural counties in Kansas still exist in a *surgical desert* for orthopedic care. This is of concern in terms of the impact this may have on meeting both acute and chronic care needs, as well as the potential impact on the bottom line of rural and critical access hospitals. Growing the rural surgical workforce requires attracting and interesting medical students and trainees in rural care, as well as identifying and addressing barriers they might face in practice. In lieu of growing the permanent workforce, rural healthcare organizations may want to explore establishing surgical outreach programs by partnering with urban surgeons. Further study is needed to determine whether other states have faced similar workforce trends and to determine how to attract orthopedic surgeons, including women, to rural practice.

REFERENCES

- Glasgow N, Berry EH, editors. Rural Aging in 21st Century America. New York: Springer Science+Business Media; 2013.
- Jensen L, Monnat SM, Green JJ, Hunter LM, Sliwinski MJ. Rural population health and aging: Toward a multilevel and multidimensional research agenda for the 2020s. *Am J Public Health* 2020; 110(9):1328-1331. PMID: 32673118.
- Wood FG. Health literacy in a rural clinic. *Online J Rural Nurs Health Care* 2005; 5(1):9-18.
- Lese A, Sraj S. Rural orthopedics: Providing orthopedic care in rural communities. *Orthopedics* 2019; 42(4):e350-e355. PMID: 31323106.
- Fu MC, Buerba RA, Gruskay J, Grauer JN. Longitudinal urban-rural discrepancies in the US orthopaedic surgeon workforce. *Clin Orthop Relat Res* 2013; 471(10):3074-3081. PMID: 23801063.
- Ali SA, Walsh KE, Kloseck M. Patient perspectives on improving osteoarthritis management in urban and rural communities. *J Pain Res* 2018; 11:417-425. PMID: 29503578.
- Scanlon CM, Perez BA, Yu A, et al. Local trends in total joint arthroplasty and orthopaedic surgeon distribution in the United States. *J Am Acad Orthop Surg Glob Res Rev* 2022; 6(7):e22.00114. PMID: 35794094.
- Pinpun C, White PB, Nellans KW, Bitterman AD, Mulcahey MK, Cohn RM. Exponential growth in female residency applicants in orthopaedic surgery over the past 15 years. *JB JS Open Access* 2023; 8(2):e23.00004. PMID: 37255671.
- Acuña AJ, Sato EH, Jella TK, et al. How long will it take to reach gender parity in orthopaedic surgery in the United States? An analysis of the National Provider Identifier Registry. *Clin Orthop Relat Res* 2021; 479(6):1179-1189. PMID: 33871403.
- Peterman NJ, Macinnis B, Stauffer K, Mann R, Yeo EG, Carpenter K. Gender representation in orthopaedic surgery: A geospatial analysis from 2015 to 2022. *Cureus* 2022; 14(7):e27305. PMID: 35903485.
- Shen MJ, Peterson EB, Costas-Muñiz R, et al. The effects of race and racial concordance on patient-physician communication: A systematic review of the literature. *J Racial Ethn Health Disparities* 2018; 5(1):117-140. PMID: 28275996.

- ¹² Cooper LA, Roter DL, Johnson RL, Ford DE, Steinwachs DM, Powe NR. Patient-centered communication, ratings of care, and concordance of patient and physician race. *Ann Intern Med* 2003; 139(11):907-915. PMID: 14644893.
- ¹³ Sandhu H, Adams A, Singleton L, Clark-Carter D, Kidd J. The impact of gender dyads on doctor-patient communication: A systematic review. *Patient Educ Couns* 2009; 76(3):348-355. PMID: 19647969.
- ¹⁴ Bertakis KD, Franks P, Azari R. Effects of physician gender on patient satisfaction. *J Am Med Womens Assoc* (1972) 2003; 58(2):69-75. PMID: 12744418.
- ¹⁵ Laveist TA, Nuru-Jeter A. Is doctor-patient race concordance associated with greater satisfaction with care? *J Health Soc Behav* 2002; 43(3):296-306. PMID: 12467254.
- ¹⁶ Lu LY, Sharabianlou Korth MJ, Cheng RZ, et al. Provider personal and demographic characteristics and patient satisfaction in orthopaedic surgery. *J Am Acad Orthop Surg Glob Res Rev* 2021; 5(4). PMID: 33835991.
- ¹⁷ Rogo-Gupta LJ, Haunschild C, Altamirano J, Maldonado YA, Fassiotto M. Physician gender is associated with Press Ganey patient satisfaction scores in outpatient gynecology. *Womens Health Issues* 2018; 28(3):281-285. PMID: 29429946.
- ¹⁸ Takeshita J, Wang S, Loren AW, et al. Association of racial/ethnic and gender concordance between patients and physicians with patient experience ratings. *JAMA Netw Open* 2020; 3(11):e2024583. PMID: 33165609.
- ¹⁹ Kumar D, Schlundt DG, Wallston KA. Patient-physician race concordance and its relationship to perceived health outcomes. *Ethn Dis* 2009; 19(3):345-351. PMID: 19769019.
- ²⁰ Field C, Caetano R. The role of ethnic matching between patient and provider on the effectiveness of brief alcohol interventions with Hispanics. *Alcohol Clin Exp Res* 2010; 34(2):262-271. PMID: 19951297.
- ²¹ Meghani SH, Brooks JM, Gipson-Jones T, Waite R, Whitfield-Harris L, Deatrick JA. Patient-provider race-concordance: Does it matter in improving minority patients' health outcomes? *Ethn Health* 2009; 14(1):107-130. PMID: 19012091.
- ²² Dineen HA, Patterson JMM, et al. Gender preferences of patients when selecting orthopaedic providers. *Iowa Orthop J* 2019; 39(1):203-210. PMID: 31413695.
- ²³ Wallis CJ, Ravi B, Coburn N, Nam RK, Detsky AS, Satkunasivam R. Comparison of postoperative outcomes among patients treated by male and female surgeons: A population based matched cohort study. *BMJ* 2017; 359:j4366. PMID: 29018008.
- ²⁴ Wallis CJD, Jerath A, Coburn N, et al. Association of surgeon-patient sex concordance with postoperative outcomes. *JAMA Surg* 2022; 157(2):146-156. PMID: 34878511.
- ²⁵ Weichel D. Orthopedic surgery in rural American hospitals: A survey of rural hospital administrators. *J Rural Health* 2012; 28(2):137-141. PMID: 22458314.
- ²⁶ Cromartie J. Documentation: Rural-Urban Continuum Codes. In: Service ER, editor. Washington, DC: US Department of Agriculture; 2020.
- ²⁷ Francis ML, Scaife SL, Zahnd WE. Rural-urban differences in surgical procedures for Medicare beneficiaries. *Arch Surg* 2011; 146(5):579-583. PMID: 21242423.
- ²⁸ Uribe-Leitz T, Esquivel MM, Garland NY, Staudenmayer KL, Spain DA, Weiser TG. Surgical deserts in California: An analysis of access to surgical care. *J Surg Res* 2018; 223:102-108. PMID: 29433860.
- ²⁹ Rural Hospital Closures Threaten Access: Solutions to Preserve Care in Local Communities. [White Paper]. In press 2022.
- ³⁰ Mipro R. As rural Kansas emergency department announces closure, Gov. Kelly and Statehouse Republicans clash over Medicaid expansion. *Kansas Reflector* [Internet]. 2023 13 December 2023.
- ³¹ Hoskins NN, Cunicelli MA, Hopper W, Zeller R, Cheng N, Lindsey T. The value surgical services bring to critical access hospitals. *Cureus* 2021; 13(4):e14367. PMID: 33987043.
- ³² Borgstrom DC, Deveney K, Hughes D, et al. Rural surgery. *Curr Probl Surg* 2022; 59(8):101173. PMID: 36055747.
- ³³ Hanson M. Average Medical School Debt [Webpage]. Education Data Initiative; 2023 [updated 17 September 2023; cited 2023 13 December 2023].
- ³⁴ Wu VS, Schmidt JE, Jella TK, et al. Rural communities in the United States face persistent disparities in access to orthopaedic surgical care. *Iowa Orthop J* 2023; 43(1):15-21. PMID: 37383875.
- ³⁵ Rodgers BM, Moore ML, Mead-Harvey C, et al. How does orthopaedic surgeon gender representation vary by career stage, regional distribution, and practice size? A large-database medicare study. *Clin Orthop Relat Res* 2023; 481(2):359-366. PMID: 35302532.
- ³⁶ Ponzio DY, Bell C, Stavrakis A, et al. Discrepancies in work-family integration between female and male orthopaedic surgeons. *J Bone Joint Surg Am* 2022; 104(5):465-472. PMID: 34851322.
- ³⁷ Phillips J, Hustedde C, Bjorkman S, et al. Rural women family physicians: Strategies for successful work-life balance. *Ann Fam Med* 2016; 14(3):244-251. PMID: 27184995.
- ³⁸ Shipman SA, Wendling A, Jones KC, Kovar-Gough I, Orlowski J, Phillips J. The decline in rural medical students: A growing gap in geographic diversity threatens the rural physician workforce. *Health Affairs* 2019; 12:2011-2018. PMID: 31794312.
- ³⁹ Gerull KM, Salles A, Porter SE, Braman JP. Strategies for recruiting and retaining women and minorities in orthopaedics: AOA Critical Issues Symposium. *J Bone Joint Surg Am* 2021; 103(24):e98. PMID: 34153011.

Keywords: rural health, orthopedics, orthopedic procedures, healthcare disparities, health workforce