The Honorable Adam Turk, Chairperson
House Committee on Higher Education Budget
300 SW 10th Avenue, Room 281-N Topeka, Kansas 66612

Dear Representative Howe:

SUBJECT: HB 2374 Specialty Practice Student Loan Program (SPSLP)

I would like to give testimony in support of HB 2374 which would allow the chancellor for the University of Kansas to direct the funds for the Medical Loan Repayment Fund to specialties that would best serve underserved populations in Kansas. My opinions and comments are mine and mine alone as a constituent in Kansas and do not represent the University of Kansas in any way.

It has been well documented that rural and frontier areas in Kansas are medically underserved. In 2019 the American College of Surgeons lobbied to have the Health Resources and Services Administration (HRSA) study general surgeon coverage in the United States. They concluded that we only meet 69% of the demand for care in rural areas. We also have many critical access hospitals in Kansas and without adequate general surgical coverage these hospitals continue to be at high risk of closing. General surgical care IS primary care.

The general surgery department at KU-Wichita has published studies on the surgical care in rural and frontier areas in Kansas (see attached). Across the nation, only 20% of general surgical graduates go directly into practice with without specializing. At the University of Kansas – Wichita 60% of our graduates go directly into private practice with many serving in rural and even frontier areas. However, we see many medical students who have a desire and aptitude for a career in general surgery, but have accepted the medical loan repayment fund. Having their loans converting to a very high interest rate and coming due while in residency is prohibitive for a farm kid from Kansas that wants to return to their community to practice and dissuades them from a career in general surgery.

I am a firm believer that primary care is a must for every person and we must support getting more primary care coverage into our rural areas. However, I also believe that we need some flexibility to adequately support specialties such as general surgery that provide a majority of screening colonoscopies, emergency acute care and trauma surgery to our rural communities.

Sincerely,

Kyle B. Vincent, MD
Clinical Associate Professor
Associate Program Director for General Surgery Residency
Department of Surgery Kansas University School of Medicine - Wichita

Brief Reports

Brief Reports should be submitted online to www.editorialmanager.com/amsurg. (See details online under "**Instructions for Authors**".) They should be no more than 4 double-spaced pages with no Abstract or sub-headings, with a maximum of four (4) references. If figures are included, they should be limited to two (2). The cost of printing color figures is the responsibility of the author.

In general, authors of case reports should use the Brief Report format.

Trouble on the Horizon: An Evaluation of the General Surgeon Shortage in Rural and Frontier Counties

The number of general surgeons presently practicing in rural communities is critically low. Lynge et al.[1] found that from 1981 to 2005, the rural surgeon to population ratio declined by 21 per cent. There are multiple factors that contribute to the apparent shortage of rural surgeons including declining numbers of medical students entering general surgery (GS) residencies and fewer residents choosing rural surgical practices. This could be due to lack of exposure to rural environments while in training or lack of adequate broad scope of training during residency.[2] In addition, there is an increasing trend in surgical residency graduates to pursue fellowship training, which therefore reduces the number of graduates who will be seeking rural GS positions. The shortage is also only going to get worse based on demographics of rural *versus* urban surgeons. The rural general surgeon on average is older than their urban counterparts,[2] so as surgeons reach retirement, rural hospitals will feel the impact the soonest.

A list of all hospitals in the state of Kansas was generated using a simple internet search of public records. The county for each hospital was categorized based on the population density county peer groups as defined by the Kansas Department of Health and Environment. Only hospitals from nonurban population density county peer group counties (frontier, rural, or densely settled rural) were included. Hospital administrators were contacted by phone. Hospitals were excluded after three failed attempts.

Hospital representatives were asked about the size of the population served, the number of permanent general surgeons on staff, the number of locum tenum surgeons, the number of rotating surgeons, the number of surgeons retiring in the next five years, whether they plan to replace retiring surgeons, whether they are actively seeking general surgeons, the percentage of patients who are transferred each year because of lack of surgical coverage, and to indicate the current impediments to surgical care at their facility.

A list of 99 hospitals met the inclusion criteria. We were able to successfully contact 66 hospitals (27 frontier, 21 rural, and 18 densely settled rural), for a response rate of 67 per cent.

Frontier Hospitals: Only one facility reported that they had a permanent surgeon on staff. Locum tenum surgeons were not used by any facility, and the median number of rotating surgeons was 0 (Table 1). One facility reported actively seeking a general surgeon to replace one that was retiring soon. The median percentage of surgical patients who were transferred because of lack of surgical coverage was 100 per cent. The median coverage ratio for permanent surgeons was 0 surgeons per 100,000 residents. If we include rotating and locum tenum surgeons, the median was still 0 surgeons per 100,000 residents. The most commonly reported impediments to surgical care were lack of an operating room or lack of anesthesia coverage.

Rural Hospitals: The median number of permanent surgeons on staff was 0, and the median number or rotating surgeons was 1 rotating surgeon (Table 1). Six facilities reported presently seeking a general surgeon, although nine facilities reported that they planned to replace surgeons who are planning to retire. Respondents reported that a median of five per cent of surgical patients are transferred because of lack of surgical coverage. The median coverage ratio for permanent surgeons was 0 surgeons per 100,000 people. When including rotating surgeons, the median ratio increased to 8.7 surgeons per 100,000 people. The most commonly reported impediments to surgical care were a lack of a general surgeon, lack of anesthesia coverage, and call coverage.

Densely Settled Rural Hospitals: The median number of permanent surgeons was 1 (Table 1). The

Presented at the 71st Annual Meeting of the Southwestern Surgical Congress, April 14–17, 2019, Huntington Beach, CA.

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median number of locum tenum surgeons was 0, and the median number of rotating surgeons was 0. The median number of surgeons expected to retire within the next five years was 1, and it ranged from 0 to 2, with six facilities (46%) expecting to replace those surgeons—five of which are presently seeking a general surgeon. The median percentage of surgical patients who are transferred because of lack of surgical coverage was five per cent. The median coverage ratio for permanent surgeons was 0 surgeons per 100,000 people. When including rotating surgeons, the median ratio increased to 5.0 surgeons per 100,000 people. The most commonly reported impediments to surgical care were limited anesthesia coverage and the limited scope of procedures that surgeons perform.

Comparisons across population density peer groups show that frontier hospitals have the greatest shortages with a median of 0 permanent, rotating, and locum tenum surgeons (Table 1). Rural hospitals were slightly better with a median of 1 rotating surgeon, but still a median of 0 permanent surgeons. Densely settled rural hospitals had a median of 1 permanent surgeon to provide full-time surgical services, but median surgeon to population ratios were still only 5 surgeons per 100,000 people, with both permanent and rotating general surgeons included.

The Rural Surgeon Shortage: There is no standardized benchmark for surgeon density; however, based on prior studies, a benchmark of 7.0 general surgeons per 100,000 residents was used in this study.[3] The findings in Kansas are well below this benchmark, with the median number of the largest population group studied (densely settled rural) having 0 surgeons per 100,000 residents, and Kansas has shortages in all three population density peer groups. The rural surgeon shortage may even be worse than in other areas of the country. National data show that large rural areas are spared from surgeon shortages compared with small rural and urban areas[1]; however, based on results of this study, densely settled rural areas in Kansas have similar shortages as smaller areas (frontier and rural).

Surgical Coverage: Presently, many hospitals in Kansas use either permanent surgeons or rotating surgeons rather than locum tenum surgeons to provide surgical services. Based on survey respondents, small hospitals commonly have a rotating surgeon providing very limited scope of practice GS and endoscopy only one to two times a month; so, most of the time, small hospitals are without any surgical coverage for acute surgical issues that come in through the emergency department, or surgical coverage is provided by surgeons rotating on only a limited number or days.

Patient Transfers: Rural hospitals reported very high transfer rates (80–100%) in this study. Previous studies have shown that delays in performing surgery negatively impact the outcomes for many patients who are transferred to larger hospitals for care.[4]

Barriers to Surgical Coverage: Many hospitals, regardless of the size of community, listed cost and lack of resources including operating room space and anesthesia personnel as a barrier to providing surgical care. This leads to most hospitals only providing endoscopy and the ability to perform very select elective surgical cases.

Limitations of this study include recall bias by participants. We attempted to minimize this limitation by asking for a hospital administrator or physician recruiter who would be more likely to know information asked.

After completion of this study, it does seem that Kansas has a shortage of surgeons based on benchmark data from other studies; however, we do not have data to indicate whether or not these surgeon population figures actually contribute to differences in patient outcomes. Median coverage ratios of 0 surgeons per 100,000 residents for frontier, rural, and densely settled rural counties show that there is indeed a shortage of general surgeons providing coverage to rural Kansas counties.

TABLE 1. *Population Served and General Surgeon Staffing for Frontier and Rural Hospitals in Kansas*

Survey Question†	Hospital Classification*			*P* Value
	Frontier	Rural	Densely Settled Rural	
Number of hospitals	217 (40.9%)	21 (31.8%)	18 (27.3%)	–
Population size (×1000)	3.8 (2.5–5.0)[a]	10.0 (5.0–17.0)[b]	25.0 (10.0–50.0)[b]	<0.001
Permanent surgeons	0 (0–0)[a]	0 (0–1)[a,b]	1 (0–2)[b]	0.001
Locum tenum surgeons	0 (0–0)	0 (0–0)	0 (0–0)	0.287
Rotating surgeons	0 (0–1)	1 (0–2)	0 (0–1)	0.520
Presently seeking a GS	1/26 (3.8%)[a]	6/21 (28.6%)[a]	5/18 (27.8%)[a]	0.046
Surgeons retiring in next five years	0 (0–0)[a]	1 (0–1)[b]	1 (0–1)[b]	0.008
Plan to replace retirees	1/12 (8.3%)[a]	9/13 (69.2%)[b]	6/13 (46.2%)[a,b]	0.008
Percentage of patients who transfer per year because of lack of surgical coverage	100 (25–100)[a]	5 (5–20)[b]	5 (1.5–20)[b]	<0.001

* Values are expresses as number (%) or median (IQR).
† Values within a row with different superscript letters are significant at $P < 0.05$.

Rotating surgeons helped to increase coverage in some areas; however, in frontier and densely settled rural counties, these still fall below benchmark standards.

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The American Journal of Surgery 250 (2025) 116511

Contents lists available at ScienceDirect

The American Journal of Surgery

journal homepage: www.americanjournalofsurgery.com

Original Research Article

Who is performing routine screening endoscopy in Kansas rural communities

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ARTICLE INFO

Keywords:
Rural endoscopy
Residency
General surgery
Family medicine

ABSTRACT

Background: General surgeons perform a majority of endoscopic procedures in rural areas. This study examined which providers are performing endoscopies in Kansas communities and how prepared those providers felt to perform those procedures after their residency.
Methods: Family medicine physicians (FMP) and general surgeons in rural Kansas were surveyed if they provide endoscopic procedures in their communities and how prepared they felt to provide those services after residency.
Results: 76.2 % of FMP performed less than 50 endoscopic procedures a year, while 68 % of general surgeons performed more than 200 endoscopic procedures a year. 88 % and 76 % of general surgeons felt comfortable performing screening colonoscopies and EGD respectively compared to 25 % of FMP.
Conclusions: General surgeons appear to perform the majority of endoscopic procedures in rural areas. General surgeons reported they felt prepared and comfortable performing screening endoscopies. However, general surgeons felt less prepared and comfortable in performing advanced endoscopic procedures.

1. Introduction

The American Cancer Society reports there were approximately 153,000 new cases of colorectal cancer diagnosed in the US and approximately 52,000 deaths from colon cancer in the US in 2023.[1] It has also been found that the incidence of colorectal cancer and death rates are increasing in people under the age of 50.[1] Colorectal adenocarcinoma remains a significant cause of morbidity and mortality in the United States and these cancers are increasingly being seen in younger populations. Screening rates have steadily been increasing in the United States.[2] Despite the variety of imaging and stool-based screening tests for colorectal cancer, Colonoscopy remains the gold standard for screening for colorectal cancer. According to a meta-analysis performed by the USPSTF, Colonoscopy has 90–98 % sensitivity for detecting adenocarcinoma.[3] Despite the importance, the prevalence of screening for colorectal cancer is only 61 % in the state of Kansas.[1] Furthermore, patients in rural communities have been found to have lower screening rates for colorectal cancer when compared to patients in urban areas.[4]

The majority of colonoscopies in the United States appear to be performed by gastroenterologists. However, in rural areas, the majority of colonoscopies are being performed by general surgeons.[5–7] One survey of 1700 rural surgeons found that seventy-four percent of these surgeons performed more than fifty screening colonoscopies and forty-two percent performed more than two hundred screening colonoscopies in one year.[5] It appears that general surgeons perform the majority of colorectal cancer screening in the rural United States. Studies also suggest that general surgeons do not feel adequately trained to perform various endoscopic procedures required by their rural communities. Sixty-three percent of rural general surgeons surveyed in a study reported that they wished they had further endoscopy training before starting practice.[5]

There are many upper gastrointestinal disorders that require screening or surveillance upper endoscopy. The American Society for Gastrointestinal Endoscopy recommends that patients with low-grade dysplasia of Barrett's esophagus undergo upper endoscopy every 3–5 years.[8] Screening endoscopy is also indicated regularly for patients with a wide variety of genetic disorders that affect the GI tract, such as Lynch Syndrome and Familial Adenomatous Polyposis Syndrome.[9] There are also a large number of upper gastrointestinal disorders that require diagnostic or therapeutic upper endoscopy. Upper endoscopy is indicated in patients with GERD symptoms who are not responding to empiric therapy or if patients present with alarm symptoms such as

This article is part of a special issue entitled: SWSC 2025 published in The American Journal of Surgery.

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https://doi.org/10.1016/j.amjsurg.2025.116511
Received 20 March 2025; Received in revised form 25 June 2025; Accepted 5 July 2025

weight loss or dysphagia. Upper endoscopy can diagnose and treat upper GI bleeding from peptic ulcer disease or esophageal varices. It can be used to identify and monitor caustic ingestion injuries as well as for the retrieval of ingested foreign bodies.[9] Upper endoscopy can be an effective screening, diagnostic, and therapeutic tool for the rural general surgeon. A study found that there has been a 63 % increase of available gastrointestinal physicians in urban areas, while a majority of the endoscopic procedures in rural settings were performed by general surgeons.[10] Likely due to this disparity, it has been found that patients in rural settings who present with upper GI bleeds are less likely to undergo endoscopy and endoscopic hemostasis.[11]

While it appears that a significant portion of a rural general surgeon's practice involves upper and lower endoscopy, there currently are no studies examining who is performing endoscopy in rural communities in Kansas. Furthermore, there has been no study evaluating the endoscopic training of Kansas' rural general surgeons. The primary purpose of this study is to determine who is performing screening, diagnostic, and advanced endoscopy in rural Kansas. In addition, we sought to assess how prepared these physicians felt to perform these procedures directly out of residency.

2. Methods

2.1. Participant selection and survey distribution

A survey and cover letter were sent by email to all general surgeons and family medicine physicians in "rural counties." A county was considered rural using the Office of Management and Budget criteria for non-metropolitan counties. This included the Kansas Department of Health and Environment–designated frontier, rural, densely settled rural, and some semi-urban counties, but excluded urban counties. A county was considered "urban" if it had a population cluster of 50,000 people or more and, therefore, was excluded. Physicians were identified using a list of general surgeons, internal medicine physicians, and family medicine physicians provided by the Kansas Board of Healing Arts. Physicians received the cover letter and survey by e-mail. For physicians that could not be reached by email, or had a general email listed for a group of physicians, investigators attempted to obtain an alternate email or fax number to invite physician participation. Two reminder emails or fax attempts were sent to non-responders after the initial contact attempt.

2.2. Survey content

The survey (Appendix A) consisted of three primary sections: a demographics section to collect data regarding age, gender, years of practice, and percent of practice dedicated to specific specialties (general surgery, gastroenterology, etc.), where they did their training and fellowship training if performed. The second section investigated the types and number of endoscopy procedures performed. They were also asked to rate how comfortable they were with performing endoscopic procedures on a Likert scale from 1 to 4, designating themselves as (1) not comfortable at all, (2) slightly comfortable, (3) somewhat comfortable, and (4) extremely comfortable. The third section investigated the perceived preparedness to perform various endoscopic procedures prior to starting their practice. Providers were asked to rank their preparedness to perform endoscopic procedures on a Likert scale from 1 to 4, designating themselves as (1) not prepared at all, (2) slightly prepared, (3) somewhat prepared, and (4) extremely prepared.

2.3. Statistical analyses

Continuous data are reported as the mean ± the SD of the mean or median (IQR) when continuous data were not normally distributed. Frequencies are reported for categorical data. Continuous variables were compared using t-tests or the Mann-Whitney *U* test when appropriate. Comparisons were made between physician specialties. An additional comparison on comfort level was made between categories of time in practice. All tests were two-tailed with an alpha level of 0.05 considered statistically significant. All statistical analyses were conducted using SPSS software, version 29.0 (IBM Corp., Somers, NY). This study was approved by the University of Kansas School of Medicine—Wichita Institutional Review Board.

3. Results

Surveys were sent to 542 practicing physicians. This included 459 family medicine physicians, 66 general surgeons, and 17 internal medicine physicians. Responses were received from 3 physicians who identified as practicing a specialty other than general surgery or primary care, 25 general surgeons, and 48 family medicine physicians for a response rate of 14.0 %. The median age of family medicine physicians was 44.1 ± 11.5 years. The median age of general surgeons was 49.0 ± 12.0 years. For family medicine physicians; 31.3 % were in practice between 0 and 5 years, 22.9 % were in practice between 6 and 10 years, 12.5 % were in practice between 11 and 15 years, 29.2 % were in practice between 16 and 20 years, and 4.2 % were in practice for greater than 20 years. For general surgeons; 28.0 % were in practice between 0 and 5 years, 8.0 % were in practice between 6 and 10 years, 20.0 % were in practice between 11 and 15 years, 32.0 % were in practice between 16 and 20 years, and 12 % were in practice for greater than 20 years (Table 1). Fellowships were completed by 6.8 % of family medicine physicians and 16.0 % of general surgeons.

We examined the amount and types of endoscopic procedures that were performed by family medicine physicians and general surgeons. For family medicine physicians; 76.2 % reported performing less than 50 endoscopic procedures per year, 19 % reported performing 50–100 endoscopic procedures per year and 4.8 % reported performing greater than 200 endoscopic procedures per year. For general surgeons; 8.0 % reported performing less than 50 endoscopic procedures per year, 8.0 % reported performing between 50 and 100 endoscopic procedures per year, 8.0 % reported performing between 101 and 150 endoscopic procedures per year, 8.0 % reported performing 150–200 endoscopic procedures per year, and 68 % reported performing greater than 200

Table 1
Demographics by specialty.

	Family Medicine (n = 48)	General Surgery (n = 25)	Other (n = 3)	P value
Age	44.1 ± 11.5	49.0 ± 12.0	42.3 ± 7.8	0.208
Years in Practice				0.315
0–5yrs	31.3 % (15)	28.0 % (7)	33.3 % (1)	
6–10yrs	22.9 % (11)	8.0 % (2)	33.3 % (1)	
11–15yrs	12.5 % (6)	20.0 % (5)	0.0 % (0)	
16–20yrs	29.2 % (14)	32.0 % (8)	0.0 % (0)	
>20 yrs	4.2 % (2)	12.0 % (3)	33.3 % (1)	
Gender				0.170
Male	58.3 % (28)	76.0 % (19)	100.0 % (3)	
Female	41.7 % (20)	24.0 % (6)	0.0 % (0)	

Table 2
Current practice with endoscopic procedures.

	Family Medicine (n = 48)	General Surgery (n = 25)	Other (n = 3)	P value
Endoscopic Procedures in a Year				
Less than 50 (includes 0)	76.2 % (32)$_a$	8.0 % (2)$_b$	100.0 % (3)$_a$	<0.001
50-100	19.0 % (8)	8.0 % (2)	0.0 % (0)	
101-150	0.0 % (0)	8.0 % (2)	0.0 % (0)	
151-200	0.0 % (0)	8.0 % (2)	0.0 % (0)	
>200	4.8 % (2)$_a$	68.0 % (17)$_b$	0.0 % (0)$_{a,b}$	
Performs Screening/Diagnostic Colonoscopy	27.1 % (13)$_a$	100.0 % (25)$_b$	0.0 % (0)$_a$	<0.001
Performs Screening/Diagnostic EGD	20.8 % (10)$_a$	100.0 % (25)$_b$	0.0 % (0)$_a$	<0.001
Performs Mucosal Lift	4.2 % (2)$_a$	44.0 % (11)$_b$	0.0 % (0)$_{a,b}$	<0.001
Performs Enteroscopy	0.0 % (0)	4.0 % (1)	0.0 % (0)	0.368
Performs Esophageal Stenting	0.0 % (0)	8.0 % (2)	0.0 % (0)	0.183
Performs Esophageal Banding for Esophageal Varices	0.0 % (0)	8.0 % (2)	0.0 % (0)	0.183
Performs Esophageal Sclerotherapy for Esophageal Varices	0.0 % (0)	0.0 % (0)	0.0 % (0)	–
Performs "Endo-Clipping" for GI Bleeding	4.2 % (2)$_a$	56.0 % (14)$_b$	0.0 % (0)$_{a,b}$	<0.001
Performs Electrocautery for GI Bleeding	4.2 % (2)$_a$	68.0 % (17)$_b$	0.0 % (0)$_{a,b}$	<0.001
Performs Injection of Epinephrine for GI Bleeding	4.2 % (2)$_a$	64.0 % (16)$_b$	0.0 % (0)$_{a,b}$	<0.001

Each subscript letter denotes a subset of year categories whose proportions do not differ significantly at the .05 level

Table 3
Current comfort with selected procedures.

	Family Medicine (n = 48)	General Surgery (n = 25)	Other (n = 3)	P value
Screening/Diagnostic Colonoscopy				
Not at all comfortable	56.3 % (27)$_a$	0.0 % (0)$_b$	100.0 % (3)$_a$	<0.001
Slightly comfortable	0.0 % (0)$_a$	0.0 % (0)$_a$	33.3 % (1)$_b$	0.039
Somewhat comfortable	2.1 % (1)	4.0 % (1)	0.0 % (0)	>0.999
Extremely comfortable	25.0 % (12)$_a$	88.0 % (22)$_b$	0.0 % (0)$_a$	<0.001
Screening/Diagnostic EGD				
Not at all comfortable	50.0 % (24)$_a$	0.0 % (0)$_b$	66.7 % (2)$_a$	<0.001
Slightly comfortable	0.0 % (0)$_a$	0.0 % (0)$_a$	33.3 % (1)$_b$	0.039
Somewhat comfortable	0.0 % (0)	4.0 % (1)	0.0 % (0)	0.368
Extremely comfortable	25.0 % (12)$_a$	76.0 % (19)$_b$	0.0 % (0)$_a$	<0.001
Mucosal Lift				
Not at all comfortable	58.3 % (28)$_a$	20.0 % (5)$_b$	66.7 % (2)$_{a,b}$	0.003
Slightly comfortable	6.3 % (3)	20.0 % (5)	0.0 % (0)	0.166
Somewhat comfortable	0.0 % (0)$_a$	20.0 % (5)$_b$	0.0 % (0)$_{a,b}$	0.011
Extremely comfortable	4.2 % (2)	20.0 % (5)	0.0 % (0)	0.093
Enteroscopy				
Not at all comfortable	64.6 % (31)$_a$	24.0 % (6)$_b$	66.7 % (2)$_{a,b}$	0.002
Slightly comfortable	2.1 % (1)$_a$	28.0 % (7)$_b$	0.0 % (0)$_{a,b}$	0.003
Somewhat comfortable	0.0 % (0)	8.0 % (2)	0.0 % (0)	0.183
Extremely comfortable	0.0 % (0)	4.0 % (1)	0.0 % (0)	0.368
Esophageal Stenting				
Not at all comfortable	68.8 % (33)	44.0 % (11)	66.7 % (2)	0.108
Slightly comfortable	0.0 % (0)a	12.0 % (3)b	0.0 % (0)a,b	0.049
Somewhat comfortable	0.0 % (0)	8.0 % (2)	0.0 % (0)	0.183
Extremely comfortable	0.0 % (0)	4.0 % (1)	0.0 % (0)	0.368
Esophageal Banding for Esophageal Varices				
Not at all comfortable	68.8 % (33)	48.0 % (12)	66.7 % (2)	0.212
Slightly comfortable	0.0 % (0)$_a$	12.0 % (3)$_b$	0.0 % (0)a,b	0.049
Somewhat comfortable	0.0 % (0)	4.0 % (1)	0.0 % (0)	0.368
Extremely comfortable	0.0 % (0)	4.0 % (1)	0.0 % (0)	0.368
Esophageal Sclerotherapy for Esophageal Varices				
Not at all comfortable	68.8 % (33)	52.0 % (13)	66.7 % (2)	0.329
Slightly comfortable	0.0 % (0)	8.0 % (2)	0.0 % (0)	0.183
Somewhat comfortable	0.0 % (0)	4.0 % (1)	0.0 % (0)	0.368
Extremely comfortable	0.0 % (0)	0.0 % (0)	0.0 % (0)	–
"Endo-Clipping" for GI Bleeding				
Not at all comfortable	56.3 % (27)$_a$	20.0 % (5)$_b$	66.7 % (2)$_{a,b}$	0.005
Slightly comfortable	4.2 % (2)	16.0 % (4)	0.0 % (0)	0.217
Somewhat comfortable	4.2 % (2)	12.0 % (3)	0.0 % (0)	0.456
Extremely comfortable	2.1 % (1)$_a$	36.0 % (9)$_b$	0.0 % (0)$_{a,b}$	<0.001
Electrocautery for GI Bleeding				
Not at all comfortable	60.4 % (29)$_a$	0.0 % (0)$_b$	66.7 % (2)$_a$	<0.001
Slightly comfortable	4.2 % (2)	20.0 % (5)	0.0 % (0)	0.093
Somewhat comfortable	4.2 % (2)$_a$	28.0 % (7)$_b$	0.0 % (0)$_{a,b}$	0.009
Extremely comfortable	2.1 % (1)$_a$	44.0 % (11)$_b$	0.0 % (0)$_{a,b}$	<0.001
Injection of Epinephrine for GI Bleeding				
Not at all comfortable	60.4 % (29)$_a$	16.0 % (4)$_b$	66.7 % (2)$_{a,b}$	<0.001
Slightly comfortable	6.3 % (3)	8.0 % (2)	0.0 % (0)	>0.999
Somewhat comfortable	2.1 % (1)	12.0 % (3)	0.0 % (0)	0.248
Extremely comfortable	2.1 % (1)$_a$	48.0 % (12)$_b$	0.0 % (0)$_{a,b}$	<0.001

Each subscript letter denotes a subset of year categories whose proportions do not differ significantly at the .05 level

endoscopic procedures per year. 100 % of general surgeons reported performing screening and diagnostic colonoscopy compared to 27.1 % who reported performing screening/diagnostic colonoscopy ($p < 0.001$). 100 % of general surgeons reported performing screening/diagnostic EGD compared to 20.8 % of family medicine physicians ($p < 0.001$). There was also a statistically significant difference between general surgeons who performed mucosal lifts and family medicine physicians who performed mucosal lifts (44.0 % vs 4.2 %, $p < 0.001$). There was not statistically significant difference between the number of general surgeons and family medicine physicians who performed enteroscopy (4.0 % vs 0.0 %, $p = 0.368$), esophageal stenting (8.0 % vs 0 % $p = 0.183$), banding for esophageal varices (8.0 % vs 0 % $p = 0.183$), and sclerotherapy (0 % vs 0 %) for esophageal varices (Table 2).

At least half of family medicine physicians that responded to the survey are not comfortable performing colonoscopies (56.3 %), esophagogastroduodenoscopies (50.0 %), mucosal lifts (58.3 %), enteroscopies (64.6 %), esophageal stenting (64.6 %), esophageal banding (68.8 %), esophageal sclerotherapy (68.8 %), endo-clipping for gastrointestinal bleeds (56.3 %), electrocautery for gastrointestinal bleeds (60.4 %), and injections of epinephrine for gastrointestinal bleeds (60.4 %). General surgeons are statistically more comfortable with each of these procedures except esophageal stenting (44.0 % not at all comfortable), esophageal banding (48.0 % not at all comfortable), and esophageal sclerotherapy (52.0 % not at all comfortable; Table 3). When comparing level of comfort with the various procedures across years of practice, no significant differences were found except with respect to those that answered slightly comfortable with endo-clipping for gastrointestinal bleeds ($p = 0.049$) and those answering they were slightly comfortable with injection of epinephrine for gastrointestinal bleeds ($p = 0.016$). For endo-clipping for gastrointestinal bleeds, 4.3 % of responding physicians in practice for <6 years felt slightly comfortable, 14.3 % of physicians in practice 6–10 years, and 27.3 % of physicians in practice 11–15 years answered the same. None of the responding physicians in practice >15 years said they were slightly comfortable with endo-clipping for gastrointestinal bleeds. For injection of epinephrine for gastrointestinal bleeds, 4.3 % of responding physicians in practice for <6 years felt slightly comfortable, and 28.6 % of physicians in practice 6–10 years answered the same. None of the responding physicians in practice >10 years said they were slightly comfortable with injection of epinephrine for gastrointestinal bleeds. Fig. 1 shows the breakdown of the comfort level that responding physicians had with screening, diagnostic, and advanced endoscopic procedures by their years in practice.

The majority of responding family medicine physicians felt they were not at all prepared after residency to perform mucosal lifts (70.8 %), enteroscopies (75.0 %), esophageal stenting (75.0 %), esophageal banding (75.0 %), esophageal sclerotherapy (75.0 %), endo-clipping for gastrointestinal bleeds (72.9 %), electrocautery for gastrointestinal bleeds (70.8 %), and injections of epinephrin for gastrointestinal bleeds (70.8 %). General surgeons did not statistically differ with feeling not at all prepared when it comes to mucosal lifts (48.0 %), enteroscopy (52.0 %), esophageal stenting (52.0 %), esophageal banding (56.0 %), and esophageal sclerotherapy (64.0 %; Table 4).

For post-residency education in endoscopic procedures, general surgeons participated in more website learning (44.0 % vs. 14.6 %, $p = 0.018$), simulation (28.0 % vs. 6.3 %, $p = 0.044$), lectures (52.0 % vs. 10.4 %, $p < 0.001$), and conferences or meetings (60.0 % vs. 18.8 %, $p < 0.001$; Table 5).

4. Discussion

Gastroenterologists still perform the vast majority of colonoscopies in the United States.[5,6] However, these colonoscopies are mostly performed in large cities. In rural areas of the United States, a large portion of colonoscopies are done by general surgeons.[5–7] A systematic review in 2014 looked to examine colonoscopies in rural communities. This study

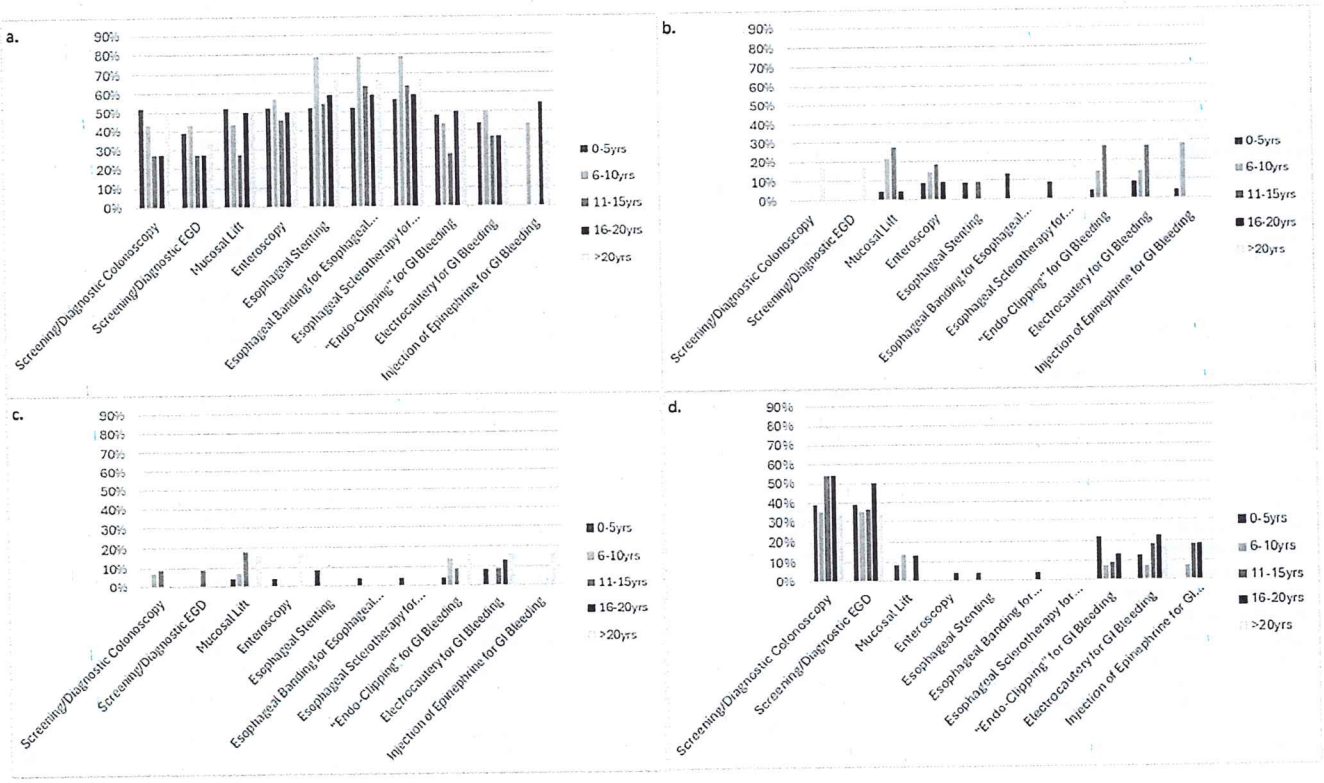

Fig. 1. The proportion of physicians that selected a.) "Not at all comfortable", b.) "Slightly comfortable", c.) "Somewhat comfortable", or d.) "Extremely comfortable" as their level of comfort with the selected procedures stratified by the number of years in practice.

Table 4
Post-residency preparation with selected procedures.

	Family Medicine (n = 48)	General Surgery (n = 25)	Other (n = 3)	P value
Screening/Diagnostic Colonoscopy				
Not at all prepared	31.3 % (15)$_a$	0.0 % (0)$_b$	33.3 % (1)$_a$	0.002
Slightly prepared	14.6 % (7)	4.0 % (1)	0.0 % (0)	0.465
Somewhat prepared	10.4 % (5)	20.0 % (5)	33.3 % (1)	0.202
Extremely prepared	25.0 % (12)$_a$	76.0 % (19)$_b$	33.3 % (1)$_{a,b}$	<0.001
Screening/Diagnostic EGD				
Not at all prepared	35.4 % (17)$_a$	4.0 % (1)$_b$	33.3 % (1)$_{a,b}$	0.004
Slightly prepared	14.6 % (7)	4.0 % (1)	0.0 % (0)	0.465
Somewhat prepared	10.4 % (5)	20.0 % (5)	33.3 % (1)	0.202
Extremely prepared	20.8 % (10)$_a$	72.0 % (18)$_b$	33.3 % (1)$_{a,b}$	<0.001
Mucosal Lift				
Not at all prepared	70.8 % (34)	48.0 % (12)	66.7 % (2)	0.145
Slightly prepared	2.1 % (1)	8.0 % (2)	0.0 % (0)	0.353
Somewhat prepared	2.1 % (1)$_a$	24.0 % (6)$_b$	0.0 % (0)$_{a,b}$	0.015
Extremely prepared	0.0 % (0)$_a$	16.0 % (4)$_b$	0.0 % (0)$_{a,b}$	0.021
Enteroscopy				
Not at all prepared	75.0 % (36)	52.0 % (13)	66.7 % (2)	0.123
Slightly prepared	0.0 % (0)$_a$	12.0 % (3)$_b$	0.0 % (0)$_{a,b}$	0.049
Somewhat prepared	0.0 % (0)	8.0 % (2)	0.0 % (0)	0.183
Extremely prepared	0.0 % (0)	8.0 % (2)	0.0 % (0)	0.183
Esophageal Stenting				
Not at all prepared	75.0 % (36)	52.0 % (13)	66.7 % (2)	0.123
Slightly prepared	0.0 % (0)	8.0 % (2)	0.0 % (0)	0.183
Somewhat prepared	0.0 % (0)	4.0 % (1)	0.0 % (0)	0.368
Extremely prepared	0.0 % (0)$_a$	16.0 % (4)$_b$	0.0 % (0)$_{a,b}$	0.021
Esophageal Banding for Esophageal Varices				
Not at all prepared	75.0 % (36)	56.0 % (14)	66.7 % (2)	0.199
Slightly prepared	0.0 % (0)$_a$	12.0 % (3)$_b$	0.0 % (0)$_{a,b}$	0.049
Somewhat prepared	0.0 % (0)	4.0 % (1)	0.0 % (0)	0.368
Extremely prepared	0.0 % (0)	8.0 % (2)	0.0 % (0)	0.183
Esophageal Sclerotherapy for Esophageal Varices				
Not at all prepared	75.0 % (36)	64.0 % (16)	66.7 % (2)	0.594
Slightly prepared	0.0 % (0)	4.0 % (1)	0.0 % (0)	0.368
Somewhat prepared	0.0 % (0)	4.0 % (1)	0.0 % (0)	0.368
Extremely prepared	0.0 % (0)	4.0 % (1)	0.0 % (0)	0.368
"Endo-Clipping" for GI Bleeding				
Not at all prepared	72.9 % (35)$_a$	44.0 % (11)$_b$	66.7 %(2)$_{a,b}$	0.039
Slightly prepared	0.0 % (0)	4.0 % (1)	0.0 % (0)	0.368
Somewhat prepared	2.1 % (1)$_a$	24.0 % (6)$_b$	0.0 % (0)$_{a,b}$	0.015
Extremely prepared	0.0 % (0)$_a$	20.0 % (5)$_b$	0.0 % (0)$_{a,b}$	0.011
Electrocautery for GI Bleeding				
Not at all prepared	70.8 % (34)$_a$	20.0 % (5)$_b$	66.7 % (2)$_a$	<0.001
Slightly prepared	0.0 % (0)	8.0 % (2)	0.0 % (0)	0.183
Somewhat prepared	4.2 % (2)$_a$	40.0 % (10)$_b$	0.0 % (0)$_{a,b}$	<0.001
Extremely prepared	0.0 % (0)$_a$	32.0 % (8)$_b$	0.0 % (0)$_{a,b}$	<0.001
Injection of Epinephrine for GI Bleeding				
Not at all prepared	70.8 % (34)$_a$	28.0 % (7)$_b$	66.7 % (2)$_{a,b}$	<0.001
Slightly prepared	2.1 % (1)	8.0 % (2)	0.0 % (0)	0.353
Somewhat prepared	2.1 % (1)$_a$	24.0 % (6)$_b$	0.0 % (0)$_{a,b}$	0.015
Extremely prepared	0.0 % (0)$_a$	44.0 % (11)$_b$	0.0 % (0)$_{a,b}$	<0.001

Each subscript letter denotes a subset of year categories whose proportions do not differ significantly at the .05 level

Table 5
Participation in education.

	Family Medicine (n = 48)	General Surgery (n = 25)	Other (n = 3)	P value
Website	14.6 % (7)$_a$	44.0 % (11)$_b$	0.0 % (0)$_{a,b}$	0.018
Simulation	6.3 % (3)$_a$	28.0 % (7)$_b$	0.0 % (0)$_{a,b}$	0.044
Lectures	10.4 % (5)$_a$	52.0 % (13)$_b$	0.0 % (0)$_{a,b}$	<0.001
Conferences/ Meetings	18.8 % (9)$_a$	60.0 % (15)$_b$	33.3 % (1)$_{a,b}$	<0.001
Other	8.3 % (4)	8.0 % (2)	0.0 % (0)	>0.999

Each subscript letter denotes a subset of year categories whose proportions do not differ significantly at the .05 level

found that in rural communities in Canada; 54 % of colonoscopies were performed by general surgeons, 39 % were performed by gastroenterologists and 7 % were performed by general practitioners.[7] Another study used the National Ambulatory Medical Care Survey to examine who was performing rural colonoscopies. This study found that in a 10 year period, 41 % of rural colonoscopies were performed by a general surgeon compared to 22 % performed by family medicine physicians, and 37 % performed by other specialties.[12] A study estimated that 61 % of procedures that rural general surgeons performed were endoscopy and 32 % of those endoscopy cases were upper endoscopy.[13] This is consistent with our study which showed that every rural general surgeon that responded performed endoscopy, and a majority of these surgeons performed more than 200 endoscopic procedures a year. This would suggest that general surgeons perform the majority of endoscopic procedures in rural Kansas.

Another important part of a rural general surgeon's endoscopy practice is the management of upper GI bleed. Upper GI bleeding is usually broken down into variceal and nonvariceal bleeding. The mortality rate for upper GI bleeding has been reported as high as 5 %.[14] Both variceal and nonvariceal upper GI bleeding can be treated endoscopically and early treatment of these upper GI bleeds can lead to improved

30-day mortality, lower rates of repeat endoscopy, and lower ICU admission rates.[15] A previous survey of rural surgeons found that 85 % of surgeons surveyed managed upper GI bleeding endoscopically, with 30 % of those surgeons performing more than 15 cases per year.[16] Nearly 30 % of the surgeons surveyed reported that they were not comfortable or neutral at performing these endoscopic procedures for upper GI bleeding.[16] This is consistent with the findings in our study. A larger portion of general surgeons in our study answered that they performed procedures to manage upper GI bleeding compared to the family medicine physicians who responded to our survey. However, a portion of general surgeons answered they were "not comfortable at all" or "slightly comfortable" at performing various procedures that treated upper GI bleeding endoscopically. This could serve as an opportunity for further education of rural general surgeons for future studies.

During the literature review there were not specific studies that evaluated how the number of endoscopic procedures performed by a physician affected how comfortable that physician felt in performing those endoscopic procedures. A study of over 4000 physcians compared quality metrics in screening colonoscopies between family medicine physicians, general surgeons and gastroenterologists. The study found that gastroenterologists performed a larger number of colonoscopies and had the highest levels of adenoma detection rates and cecal intubations. General surgeons and family medicine physicians performed the second and third most colonoscopies, respectively. These two groups of physicians met national standards for cecal intubation and adenoma detection rates, but their rates were lower than the rates of gastroenterologists.[17] A limitation of our survey was that we did not assess the quality of the endoscopic procedures being performed in rural Kansas. Therefore, we were not able to make any conclusions between the number of procedures performed and the quality of endoscopy in rural Kansas. It appeared that respondents to this survey who responded that they felt comfortable performing the various endoscopic procedures that we assessed overall performed more than 50 endoscopic procedures a year. Our survey doesn't specifically break down how many of each procedure a respondent performs in a year and it is difficult to know how many upper-endoscopies versus colonoscopies are needed for a physician to feel comfortable. It is important that physicians performing endoscopic procedures in a rural setting are comfortable performing these procedures, but what is even more important is that they are performing quality procedures to best help rural patients. Further research is required to determine the minimum number of endoscopic procedures required per year for a physician to comfortably perform a quality procedure.

Another survey of rural general surgeons who performed endoscopic procedures looked to examine how prepared these surgeons felt after residency. 63 % of those surgeons reported that they felt they would have benefited from additional endoscopy training in their residency.[5] A separate cross-sectional survey demonstrated that 85 % of surgeons performed endoscopy in their practice, but 47 % of those surgeons reported that residency training is currently inadequate to produce competent endoscopists.[18] It would appear that some surgeons feel that endoscopic training in residency is inadequate. This could explain why surgeons in our study were more likely to respond that they were not comfortable at all or slightly comfortable with more advanced endoscopic procedures, such as mucosal lifts, enteroscopy, esophageal stenting and management of upper GI bleeding (banding, sclerotherapy, endo-clipping, electrocautery and injection of epinephrine). As discussed previously, endoscopic procedures are a large part of a rural general surgeon's practice and training in more advanced endoscopic procedures could help general surgeons provide more services to their communities, at least with greater confidence.

Research would suggest that a portion of rural general surgeons did not feel that residency prepared them to perform the various endoscopic procedures that are required by their communities. It also appears that where surgeons train also impacts if they will implement endoscopy into their practice. A survey found that general surgeons who trained in an academic program were less likely to perform both upper and lower endoscopy compared to general surgeons who trained in a community program.[19] Another report also found that using gastroenterologists to train general surgery residents in academic programs did not improve adequate exposure to endoscopy.[20] This research could signify a need for increased endoscopic post-residency training for general surgeons in rural communities. Our survey found that a significant portion of general surgeons participated in some post-residency endoscopic education including over half of the general surgeons reporting that they participated in lectures and conferences about endoscopy. This could signify a need for future endoscopic educational opportunities for rural general surgeons, which could include simulations, lectures, conferences or even an endoscopic fellowship.

There are several limitations to this study. A small number of general surgeons responded to the survey compared to the number of family medicine physicians who responded to the survey. This could lead to bias in the study, given that general surgeons were mostly performing endoscopy. This small sample size could make it difficult to extrapolate results both within and outside of rural Kansas. Although multiple attempts were made to contact physicians practicing in rural Kansas, not all the contact information provided by the Board of Healing Arts was current or accurate. Rural physicians may practice at multiple locations or share general contact information amongst a practice group, which can add a barrier to making contact with this population. Also, no gastroenterologists responded to the survey. A limited numbers of physicians are listed as gastroenterologists in rural Kansas. Without their input, it is difficult to get a clear picture of all the physicians performing endoscopy in the area. We also did not assess what resources physicians had access to in their rural communities. Rural hospitals may not have access to enough trained ICU staff, a blood bank or specialized endoscopy equipment that is required to care for conditions that can be managed endoscopically. This could confound our results as physicians may not be comfortable performing some endoscopic procedures because of the resources available and not due to endoscopic skills. Finally, we did not get any information about communities with large hospitals near these rural communities. This could also confound our results as physicians may refer patients to these hospitals rather than perform the procedures themselves.

5. Conclusion

General surgeons appear to be performing the majority of endoscopic procedures in rural areas. General surgeons also appear to be comfortable performing a variety of basic screening and diagnostic endoscopic procedures compared to primary care physicians. However, general surgeons in rural areas felt less comfortable when performing advanced endoscopic procedures. Endoscopy appears to play a significant role in rural general surgeons' practices, and this research could serve as a starting point for future studies on the best ways to support rural general surgeons' endoscopy practices.

CRediT authorship contribution statement

Todd T. Savolt: Writing – review & editing, Writing – original draft, Methodology, Investigation, Conceptualization. **Jared Reyes:** Writing – review & editing, Supervision, Project administration, Investigation, Formal analysis, Data curation. **Siman Antar:** Writing – review & editing, Project administration. **Kyle Vincent:** Writing – review & editing, Supervision, Project administration, Methodology, Conceptualization.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amjsurg.2025.116511.

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