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Colonoscopy Access and Utilization – Rural Disparities in the Carolinas, 2001-2010

Key findings

- Geospatial analysis looking at availability of colonoscopy providers suggests that rural residents in the Carolinas have limited access to colonoscopy services in their own counties (particularly gastroenterologists), and tend to utilize colonoscopy less frequently than their urban counterparts (49% vs. 59%).
- Approximately 32.5% and 33.7% of NC and SC residents, respectively, live in rural counties. About 33% of hospitals and ambulatory surgery centers in NC and SC that provided colonoscopy were located in rural counties.
- There was a 27% and 32% rise in the number of facilities providing colonoscopies from 2001-2010 in SC and NC, respectively. Most of this change occurred in urban counties.
- Among those seeking colonoscopy, 54% of SC rural residents received the procedure in their own county. In contrast, 75% of SC urban residents utilized colonoscopy in their own county of residence. Similar findings were observed for NC.

BACKGROUND

Colorectal cancer is the third most common cancer in the U.S. for men and women combined.[1] The American Cancer Society has predicted 95,270 new cases of colon cancer and 39,220 new cases of rectal cancer for the year of 2016 among men and women. Additionally, an estimated 49,190 deaths are predicted to occur. Despite medical efforts to reduce colon cancer mortality, these figures place colorectal cancer as the second leading cause of cancer-related death in the U.S.[1]

In South Carolina (SC), approximately 2,220 people will be diagnosed and 830 will die from colorectal cancer in 2016. In contrast, North Carolina (NC) will experience about 4,280 new cases of colorectal cancer per year and 1,480 deaths.[1] Comparatively, SC and NC have slightly lower incidence rates (40.7 and 39.6 per 100,000) than the national average (41.9 per 100,000). For mortality, findings are mixed; NC has a lower mortality rate (14.7 per 100,000), while SC has a higher mortality rate (16.2 per 100,000) than the national average (15.5 per 100,000)[2]

The American Cancer Society has stated that colorectal cancer screening is said to have the ability to prevent 65% of all colorectal cancer cases, however only 59% of eligible individuals are up to date with their screening.[3] Colorectal cancer screening is recommended by the American Cancer Society and US Preventive Services Task Force (USPSTF) starting at 50 years of age for average-risk persons, and up to age 75 by the USPSTF.[4, 5] *Healthy People 2020* has a stated objective to increase the percent of all individuals aged 50-75 screened for colorectal cancer to 70.5%.[6]

Several modalities for screening are available (e.g., flexible sigmoidoscopy, fecal DNA, fecal occult blood testing (FOBT/FTT), and colonoscopy); however, colonoscopy is the most frequently utilized and sensitive test available to date. In both traditional colonoscopy and flexible sigmoidoscopy, which are both endoscopic procedures, polyps can be immediately identified, excised, and sent to pathology for testing; however, due to its inability to detect lesions in the right side of the colon, use of sigmoidoscopy has substantially declined in recent years and colonoscopy use has increased.[7-10] Other reasons for this trend include the establishment of colonoscopy reimbursement among average-risk persons (e.g., Medicare reimbursement began in 2001), professional recommendations that favor colonoscopy, media coverage, and physician preferences and referral patterns.[11, 12] For these reasons, this brief focuses on use of colonoscopy among persons ages 50-74.

Rural residence has been shown to effect access to cancer specialists and treatment for colon cancer.[13, 14] Similarly, access to colonoscopy - which can prevent colon cancer, has been shown to vary geographically and correlate with odds of late-stage diagnosis (i.e., lower access associated with later stage at diagnosis).[15, 16] Other known barriers to colorectal cancer screening include type or lack of insurance,[9, 17-20] no physician recommendation,[19] low socioeconomic status,[18-21] no regular source of care,[9, 19] and racial/ethnic minority status.[17-20] The objective of this study was to identify disparities in colonoscopy utilization and access to care across urban-rural populations in Carolinas. NC and SC are in the top 10% of states for the proportion of residents living in rural areas, making these states an ideal location to examine the effects of access to care.

This report illustrates key findings from a study using ambulatory surgery discharge data from NC and SC from 2001-2010. Details concerning the methods used in the report are provided in the Appendix. In the sections that follow, we describe the geographic distribution of colonoscopy providers in the Carolinas, estimate colonoscopy utilization in urban and rural populations, and explore where patients seek their care based on the availability of providers in their county.

Technical Notes

We used ambulatory surgery discharge data for colonoscopies provided between 2001-2010 in North and South Carolina. The following Current Procedural Terminology (CPT), Healthcare Common Procedure Coding System (HCPCS) and International Classification of Diseases, Ninth Revision procedural codes (ICD-9) were used to identify colonoscopy procedures:

CPT Codes	44388-44397, 45355, 45378-80, 45382-45387, 45391, 45392
ICD-9 Codes	45.21-45.23, 45.25, 45.42, 45.43
HCPCS Codes	G0105, G0121

Further explanation of the methods can be found in the Appendix at the end of this report.

Geographic definitions

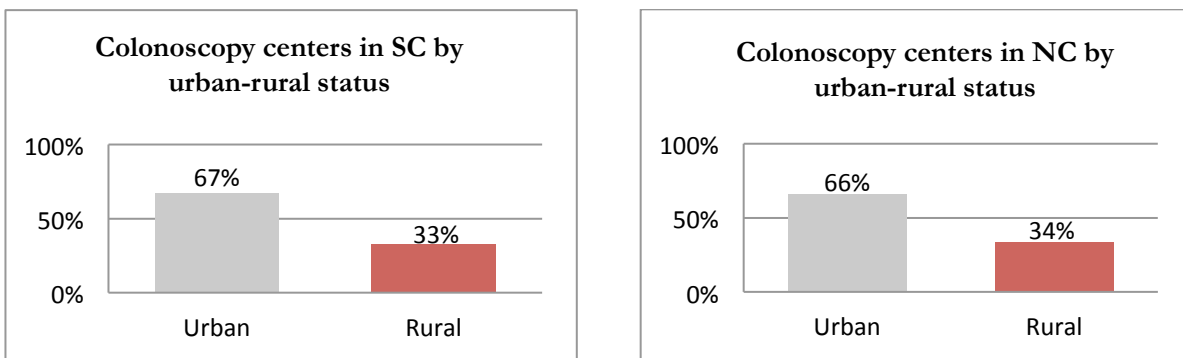
Our geographic analysis is based on the county of residence or location of physician medical practice. As defined by the U.S. Department of Agriculture Economic Research Service, patients were categorized by their rural or urban status at the county level based on Rural-Urban Continuum Codes (RUCC). Patients with a county RUCC code of 1-3 were categorized as residing in a metro area, while patients with a code of 4-9 were categorized as residing in a non-metro area.

Geographic distribution of colonoscopy providers in the Carolinas

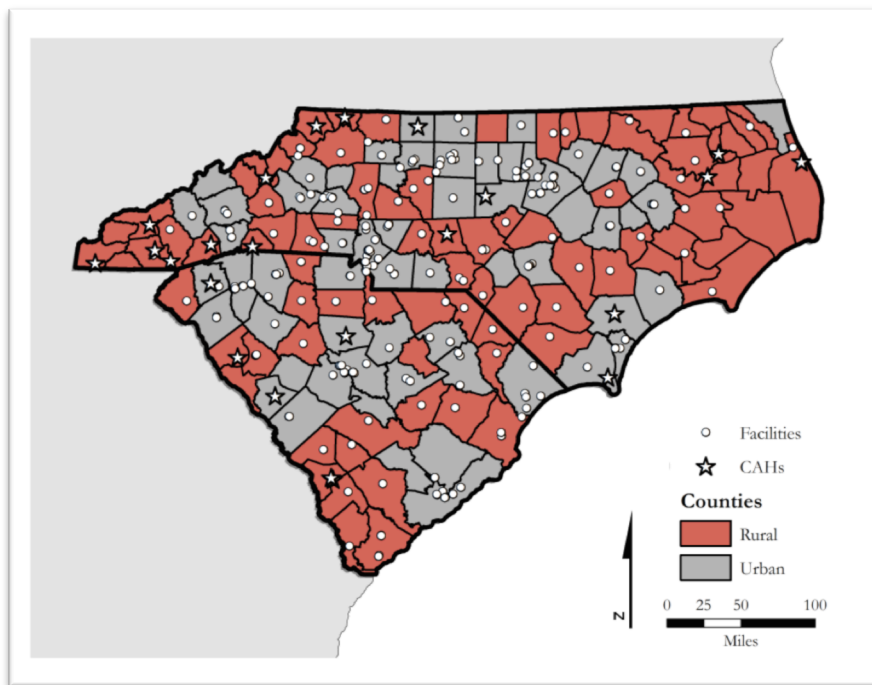
Trends in colonoscopy facilities over time

In 2010, there were 93 and 158 hospitals and ambulatory surgery centers (hereafter colonoscopy centers) that provided colonoscopy services in SC and NC, respectively. About one-third of colonoscopy centers were located in rural counties in both states (Figure 1). Over the years 2001-2010, there were a 27% and 32% increase in the number of colonoscopy centers in SC and NC respectively, however the increase was mostly observed in urban counties. In SC, rural counties saw a 19% rise in the number of colonoscopy-providing centers (vs. 32% in urban counties). In NC, rural counties only saw a 4% increase in the number of centers, compared to the 44% increase in urban counties (Table 1). The locations of colonoscopy-providing centers overall and by presence of a gastroenterologist are shown in Maps 1-3.

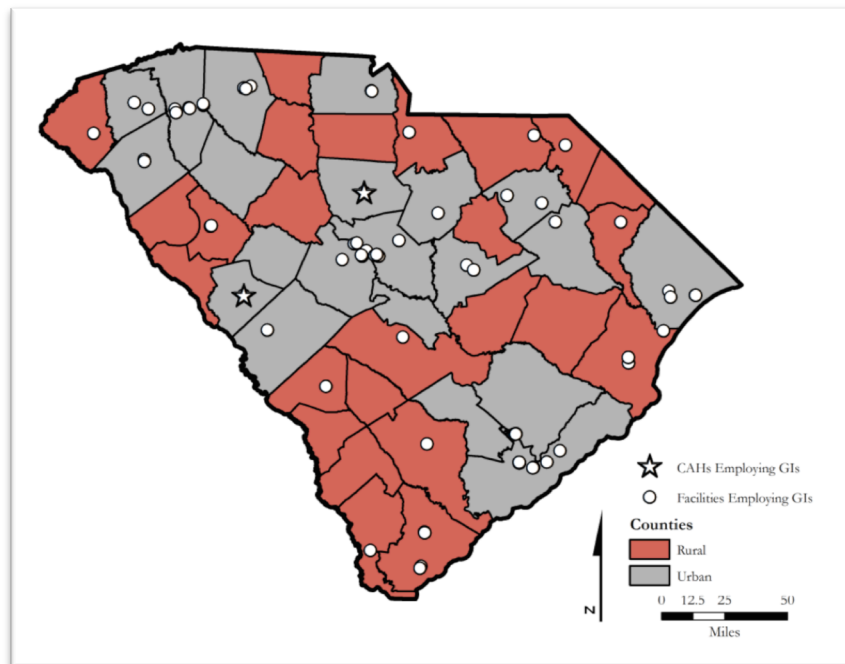
Figure 1: Colonoscopy centers in the Carolinas by county urban/rural status



Map 1: Locations of colonoscopy centers in NC and SC, 2010



Map 2: Locations of colonoscopy centers in SC used by self-reported gastroenterologists for colonoscopy services, 2010



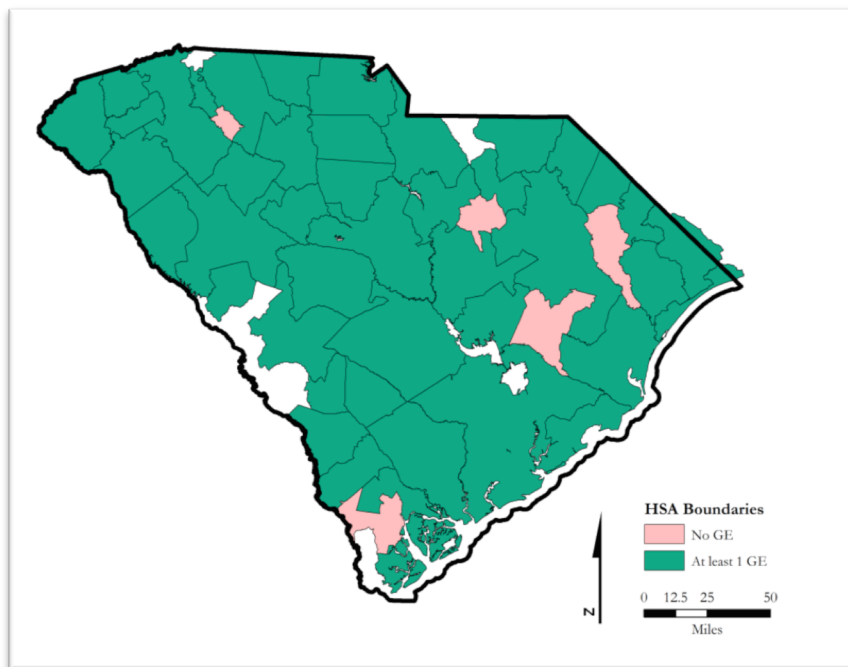
Note: Gastroenterologists do not include colon and rectal surgeons. We were unable to explore locations of gastroenterologists in NC in Maps 2 & 3 due to data quality of physician specialty information.

The number of physicians providing colonoscopy services in SC increased by 31% from 2001-2010 (448 to 585, respectively), with an average of 10.5 providers per colonoscopy center in 2010 (see Table 1). Over the same time period, the number of physicians increased by 24% in NC, with an average of 13.4 providers per colonoscopy center in 2010.

In urban SC counties, the median number of colonoscopies performed per year per provider over this period was 46, while the median in rural counties was 3. The median number of colonoscopies performed per year per provider in NC was 3 in urban counties and 26 in rural. This seemingly contradictory trend in NC is in part due to the large number of urban providers doing only 1 colonoscopy/year. Moreover, while volume (i.e., demand) is high in urban NC, there is also greater supply.

In rural SC counties, 69% of colonoscopy providers were non-gastroenterologists (i.e., general surgeons, internal medicine, family practice or colon and rectal surgeons), as compared to 44% in urban counties in 2010. Gastroenterologists performed a median of 473 colonoscopies in 2010, compared to 55 for non-gastroenterologists (see Table 1). Among rural counties, 48% of SC rural counties had at least 1 gastroenterologist in practice. Ninety percent of the hospital service areas in the state have at least one practicing gastroenterologist (Map 3).

Map 3. Availability of self-reported gastroenterologists at the hospital service area level in SC, 2010



By 2010, 46% of the providers performed colonoscopies in more than one facility in SC, and 58% in NC. Of those that worked in multiple facilities, 11% in SC and 19% in NC performed colonoscopies in both rural and urban facilities.

Table 1. SC colonoscopy center characteristics by care setting (hospital vs. ambulatory surgery center) over time

	Hospitals		Ambulatory Surgery Centers		All Centers Combined	
	2001	2010	2001	2010	2001	2010
<i>Provider Level</i>						
All colonoscopy providers (N)	442	553	60	158	448	585
<i>Urban</i>	328	380	50	139	336	411
<i>Rural</i>	132	192	10	20	135	195
Gastroenterologists (N)	136	132	47	102	137	146
<i>Urban</i>	114	120	39	89	116	133
<i>Rural</i>	31	21	8	14	33	23
Median no. of colonoscopies/provider	32.5	10	139	309.5	48	16
<i>Urban</i>	40.5	17	154	299	58.5	46
<i>Rural</i>	18.5	3	78.5	341.5	24	3
Median no. of colonoscopies/GI	167	74.5	224	452.5	274	473
<i>Urban</i>	159.5	68.5	259	451	265	444
<i>Rural</i>	100	122	153.5	565.5	174	346
<i>Center Level</i>						
Colonoscopy centers (N)	58	59	15	34	73	93
<i>Urban</i>	35	36	12	27	47	63
<i>Rural</i>	23	23	3	7	26	30
Total colonoscopy volume/center	41,250	41,088	12,988	51,637	54,238	91,525
<i>Urban</i>	33,076	31,856	10,982	45,108	44,058	76,964
<i>Rural</i>	8,174	9,232	2,006	6,529	10,180	15,761

Median colonoscopy volume/center	470.5	352	200	1,078	425	692
<i>Urban</i>	690	715	161	1,520	584	966
<i>Rural</i>	171	252	475	839	174	290
Average no. of providers/center	10.7	13.2	4.5	6.0	9.4	10.5
<i>Urban</i>	13.6	15.6	4.8	6.8	11.4	11.8
<i>Rural</i>	6.1	9.4	3.7	2.9	5.8	7.9

Note: Data was not available to distinguish hospitals from ambulatory surgery centers in the NC discharge database. Volume calculations based on data from all patients served, including out-of-state patients and various indications (i.e., surveillance, screening, and diagnostic). Provider counts by urban/rural status may not add to the total; some providers work in both rural and urban centers, as well as both hospital and ambulatory surgery centers.

Table 2. County-level colonoscopy availability, 2001 and 2010

Variable	2001			2010		
	Total Counties N	Urban Counties N	Rural Counties N	Total Counties N	Urban Counties N	Rural Counties N
South Carolina	46	22	24	46	22	24
Any colonoscopy center ^a	38 (83%)	16 (73%)	22 (92%)	38 (83%)	16 (73%)	22 (92%)
Any GI in practice	26 (57%)	13 (59%)	13 (54%)	24 (52%)	15 (68%)	10 (42%)
North Carolina	100	40	60	100	40	60
Any colonoscopy center ^a	78 (78%)	35 (88%)	43 (72%)	77 (77%)	33 (83%)	44 (73%)
Any GI in practice	N/A	N/A	N/A	N/A	N/A	N/A

Note: We were unable to explore locations of gastroenterologists in NC due to data quality.

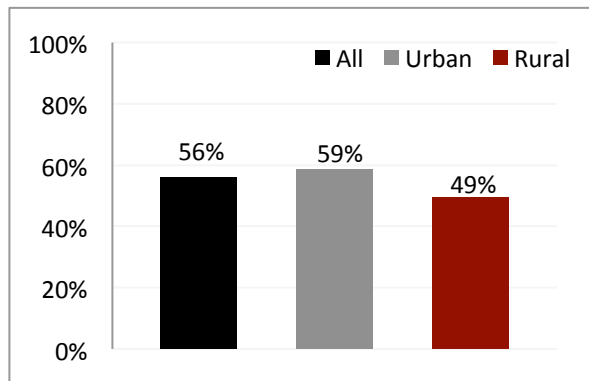
^a *Number of counties with a colonoscopy center, and the proportion of counties with a colonoscopy center.*

Disparities in utilization of colonoscopy in SC

Utilization lags behind in rural counties

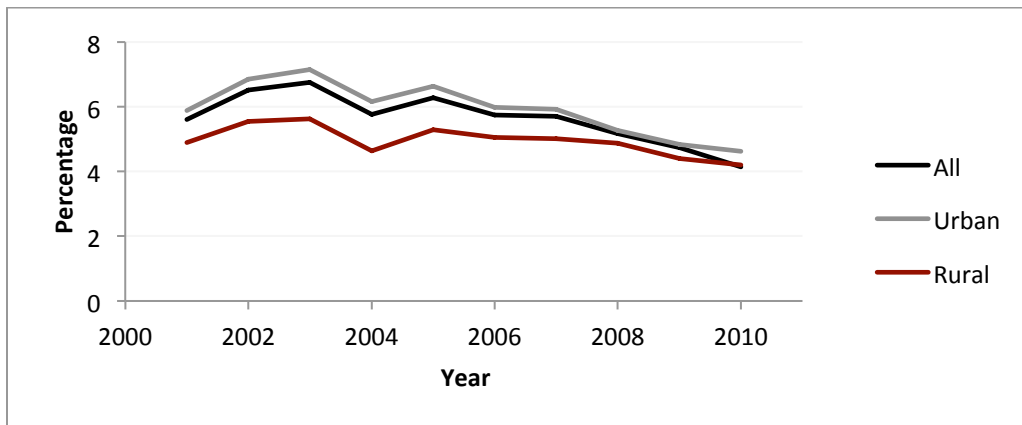
Over the years 2001-2010, 56% of SC population between the ages of 50 to 75 years underwent at least one colonoscopy procedure (Figure 2); this proportion is cumulative over the ten year study period. Persons with more than one colonoscopy during the study period were only counted once. Disparities were noted by the area of residence, where only 49% of rural residents received a colonoscopy, as compared to 59% of their urban counterparts. Similar percentages could not be calculated for North Carolina due to lack of patient identifiers in the ambulatory surgery discharge data by which to calculate population prevalence.

Figure 2: Percentage of SC residents who had a colonoscopy between 2001 and 2010



Over the past decade, the percentage of the population in SC that underwent a colonoscopy procedure in *any one year* decreased from 5.6% in 2001 to 4.1% in 2010. From 2001 to 2003, there was a gradual increase in colonoscopy procedures (5.6 % to 6.8%); however, percentages have declined thereafter. The rise in colonoscopies after 2001 was expected, due to the establishment of colonoscopy reimbursement by Medicare for average-risk persons in 2001. Disparities were noted in favor of urban residents; however, differences have attenuated over the past decade (Figure 3). Annual utilization rates were based on the population receiving colonoscopy each year; persons with more than one colonoscopy during that year were only counted once.

Figure 3. Percentage of SC population that had colonoscopies by area of residence and year (Unique IDs for each year)



Geographic distribution of colonoscopy-seeking in the Carolinas

Where patients seek their care

SC residents living in urban counties utilized a facility in their county 75% of the time, a facility in another urban county 21% of the time or a rural facility 3% of the time (Figure 4). In contrast rural residents may have limited access to colonoscopy services in their county of residents and often traveled to other counties for screening.

Only 56% rural residents utilized a facility in their county, a facility in another rural county 10.5% of the time or an urban facility 33% of the time. Patterns of care-seeking in North Carolina were similar, although slightly fewer rural residents obtain a colonoscopy in their own county (51% in NC vs. 56% in SC).

Figure 4: Location of colonoscopy procedure by patient county of residence, SC, 2010

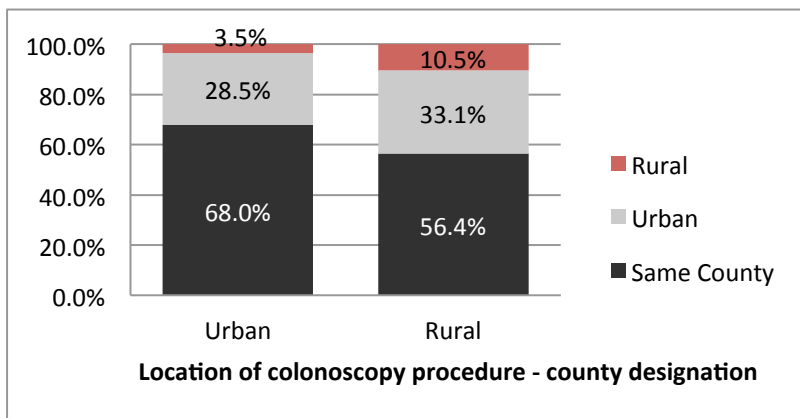
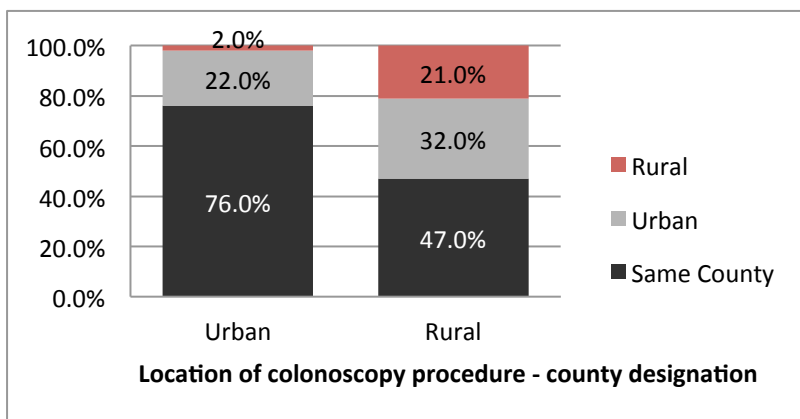


Figure 5: Location of colonoscopy procedure by patient county of residence, NC, 2010



Looking across SC regions, most of the residents in the Upstate and Midlands of SC had a colonoscopy procedure in their own region (99.5% and 98%, respectively). Six percent of residents in the Pee Dee region and 5% of residents in the Low country region traveled to other parts of the state for colonoscopy. Similarly, in NC regions, most residents in the Central region of the state (99%) had a colonoscopy in their own region, while some in the western and eastern regions (11% and 14% respectively) traveled to the central region.

In 2010, approximately 84% of patients that had a colonoscopy in SC had a colonoscopy center within their county for which to seek care (see Table 3); there were differences when considering rural and urban residents separately, 81% of urban residents and 94% of rural patients had an in-county colonoscopy center. Of those with colonoscopy centers located within their own county, 16% of urban residents and 40% of rural residents bypassed a local (i.e., in their county) colonoscopy center for one in another county. About 26% of patients bypassed their closest colonoscopy center that did not have a gastroenterologist for another county where a

gastroenterologist practiced. However, when stratifying by location, urban patients only bypassed their in-county center (with no gastroenterologist) for a colonoscopy center with a practicing gastroenterologist 0.5% of the time compared to 26% of rural patients.

When comparing urban to rural accessibility, urban patients had more colonoscopy centers in their geographic area from which to seek care; of those who went outside their county of residence for a colonoscopy, 52% of urban residents bypassed to another county with a gastroenterologist, even though there was an in-county gastroenterologist available, compared to 17% of rural residents. Among rural-dwelling SC patients in 2010, only 55% of them lived in a county with a practicing gastroenterologist (vs. 81% of urban-dwelling SC patients).

Table 3. Patient bypass patterns for colonoscopy in SC, 2010

Variable	Total	Urban	Rural
Opportunity to bypass ^a	84%	81%	94%
Actually bypassed ^b	22%	16%	40%
Bypassed for a center with a gastroenterologist			
<i>No gastroenterologist in county</i>	26%	0.5%	26%
<i>Gastroenterologist in county</i>	69%	52%	17%
Distance traveled			
<i>Average distance traveled to utilized colonoscopy center for all patients^c</i>	12.55 miles	12.78 miles	11.45 miles
<i>Average distance traveled to utilized colonoscopy center for subset of patients who bypassed their nearest center</i>	17.42 miles	16.79 miles	23.60 miles

Note: Each percentage represents a proportion of SC patients in our discharge dataset.

^a *Patient had a colonoscopy center in his or her county.*

^b *Patient had a colonoscopy center in his or her county, but received care in another county.*

^c *The distance that a patient travel to have a colonoscopy based on the zip code centroid of the patient and colonoscopy center address.*

Border residents did occasionally seek care from their bordering states, particularly when a metropolitan area with many healthcare resources was located just over the border. Over 1,000 residents of NC and GA visited SC counties for their care in 2010 (residents mostly from Franklin County, GA, Hart County, GA, Columbus County, NC, Brunswick County, NC, Polk County, NC and Rutherford County, NC). These out-of-state travelers most often visited facilities located in Greenville County, Spartanburg County, Anderson County, or Horry County. During the same year, facilities in NC provided care for over 4,000 residents of neighboring states, South Carolina, Tennessee, and Virginia. South Carolina residents most often visited facilities in Mecklenburg, Gaston or Union County (i.e., a cluster of colonoscopy providers is present in these counties, drawing in SC residents from border counties; see Map 1). Tennessee residents most often visited facilities in Watauga, Buncombe, or Pickens County. Virginia residents most often visited Durham, Rockingham, or Surry County.

CONCLUSION

The growth of colonoscopy centers from 2001 to 2010 was largely in urban areas (NC and SC data) and ambulatory surgery centers (SC data only). While the number of SC hospitals providing care largely remained unchanged (as did the overall procedure volume at SC hospitals), there was nearly a two-fold increase in median volume per ambulatory surgery center in rural areas and a 10-fold increase in urban areas.

Although the vast majority of SC's rural counties had a colonoscopy center available within the county, only 42% had a practicing gastroenterologist on staff. From 2001 to 2010, rural SC counties lost 10 gastroenterologists, while urban SC counties gained 17. Twice as many rural residents compared to urban residents bypassed an in-county provider for one out-of-county; however, when a gastroenterologist was available within the county, fewer rural patients bypassed than their urban counterparts (17 vs. 52%, respectively).

Rural-dwelling residents often bypassed local care that did not have a gastroenterologist for an out-of-county provider that had a practicing gastroenterologist. Some regions of NC also saw significant travel between regions, with 14% of eastern-dwelling North Carolinians (a very rural part of the state) traveling to the central region of the state for their colonoscopy. In South Carolina, rural residents aged 50-74 had a lower rate of colonoscopy utilization (49% vs. 59%) than their urban counterparts.

The downward trend of the number of colonoscopies from the beginning of the study period until the end is likely due to the new reimbursement policy for average-risk population by Medicare in 2001. Prior to 2001, only high-risk individuals were reimbursed for a colonoscopy, which is a small portion of the population. It is expected to see a peak in the first few years, and then see the number of colonoscopies decrease since the average-risk population is not due for another procedure for 10 years.

Provisions of the Affordable Care Act state that persons aged 50-75 can receive a screening colonoscopy without cost-sharing, regardless of whether a polyp is found and removed. Preventive care provisions such as these allow more individuals to access affordable care, which may have downstream effects on colorectal cancer mortality. Finally, the results of this findings brief point to the need for possible structural and policy changes aimed at ensuring rural residents have access to colonoscopy, particularly from gastroenterologists. Rural residents in our study showed significant bypass behaviors, even when colonoscopy was available in their county, presumably because more specialized care is available elsewhere. Further research should explore how rural facilities can hire and retain gastroenterologists (or other dedicated endoscopists), sustain high enough volumes to maintain quality outcomes, and gain financial stability.

Appendix A. Technical Notes

Data Sources

This analysis used 2001-2010 ambulatory surgery discharge data from North and South Carolina, obtained from each state separately through a data request and review process. Data on individuals who obtained a colonoscopy between 2001 and 2010 in NC or SC were extracted from the surgery discharge files using the Current Procedural Terminology (CPT), Healthcare Common Procedure Coding System (HCPCS) and International Classification of Diseases, Ninth Revision procedural codes (ICD-9) codes in the Technical Notes section. No limitations were placed on the medical specialties of physicians providing the colonoscopies. Some SC-specific analyses, however, are limited only to self-reported gastroenterologists as specified. No VA or active military sites providing colonoscopy were included in our analysis.

Geographic definitions and covariates

To examine travel patterns associated with care, we utilized information about both patients' and providers' county of residence and medical practice location, respectively. The medical practice location was classified as the county where the colonoscopy took place, not necessarily the physician's primary medical practice location. County urban/rural designation was based on the US Department of Agriculture Economic Research Service 2003 Rural Urban Continuum Codes (i.e., metro vs. nonmetro areas).

As defined by the USDA ERS, patients were categorized by their rural or urban status at the county level based on RUCC codes. Patients with a county RUCC code of 1-3 were categorized as residing in a metro area, while patients with a code of 4-9 were categorized as residing in a non-metro area. All mapping and spatial analyses were conducted using ArcGIS Version 10.2, and statistical analyses in SAS Version 9.3 or R Version 3.1.3.

The ambulatory surgery data was supplemented by data from the US Census Bureau (2000 and 2010 Census provided annual estimates for the county population aged 50-74), Geolytics Inc. (2001-2009 Estimates Professional provided annual estimates for the county population aged 50-74), SC Medical Licensing Board (provided medical specialty information), and the National Provider Index (NPI Registry; provided medical specialty information). These additional data sources supplemented our ambulatory surgery discharge data with information on physician specialty and county population estimates (used to estimate the percent of the population utilizing colonoscopy in any one year and over 2001-2010). All analyses were performed at the state or county level, and subdivided by the category of interest.

Doctor specialty classifications were not presented for NC in this report due to the lack of information over time. The SC doctor specialty classifications were compiled using the SC licensing codes (included in the ambulatory surgery discharge database), and supplemented with data from the NPI Registry and/or SC Medical Licensing Board (CMS began issuing NPIs to providers in late 2006).

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