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Quality of Colonoscopy Performed in Rural Practice: Experience From the Clinical Outcomes Research Initiative and the Oregon Rural Practice-based Research Network

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Abstract

Purpose—Colon cancer screening is effective. To complete screening in 80% of individuals over age 50 years by 2018 will require adequate colonoscopy capacity throughout the country, including rural areas, where colonoscopy providers may have less specialized training. Our aim was to study the quality of colonoscopy in rural settings.

Methods—The Clinical Outcomes Research Initiative (CORI) and the Oregon Rural Practice-based Research Network (ORPRN) collaborated to recruit Oregon rural practices to submit colonoscopy reports to CORI's National Endoscopic Database (NED). Ten ORPRN sites were compared to non-ORPRN rural (n=11) and non-rural (n=43) sites between January 2009 and October 2011. Established colonoscopy quality measures were calculated for all sites.

Results—No ORPRN physicians were gastroenterologists compared with 82% of non-rural physicians. ORPRN practices reached the cecum in 87.4% of exams compared with 89.3% of rural sites ($P = .0002$) and 90.9% of non-rural sites ($P < .0001$). Resected polyps were less likely to be retrieved (84.7% vs 91.6%; $P < .0001$) and sent to pathology (77.1% vs 91.3%; $P < .0001$) at ORPRN practices compared to non-rural sites. The overall polyp detection (39.0% vs 40.3%) was similar ($P = .217$) between ORPRN and non-rural practices. Of exams with polyps, the rate for largest polyp on exam 6–9 mm was 20.8% at ORPRN sites, compared to 26.8% at non-rural sites ($P < .0001$), and for polyps >9mm 16.6% vs 18.7% ($P = .106$).

Conclusion—ORPRN sites performed well on most colonoscopy quality measures, suggesting that high-quality colonoscopy can be performed in rural settings.

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Keywords

colonoscopy; primary care; quality; rural

The recommendation by the United States Preventive Services Task Force for routine screening of individuals at average risk for colorectal cancer (CRC) screening beginning at age 50¹ generated concern about the US capacity to meet this need. Although the task force included a broad range of screening methods (high-sensitivity fecal occult blood testing, sigmoidoscopy, CT colonography, multi-target stool DNA, or colonoscopy), all screening programs ultimately can lead to colonoscopy.²

Rural residents are less likely than urban dwellers to be screened for colorectal cancer, based on evidence from the Behavioral Risk Factor Surveillance Study (BRFSS) in 1998 and 2005 and an examination of the 2005 Medicare Current Beneficiary Study.^{3,4} An Iowa study of patients with Medicare coverage found that although there was no correlation between time to travel to colonoscopy service and late-stage diagnosis of CRC, two-thirds of the population had late-stage disease, suggesting the need for interventions to improve access to screening across the entire population.⁵ A study conducted in rural Oregon in 2009 found that 38% of men and 35% of women were up-to-date for colorectal cancer screening using any test at appropriate screening intervals.⁶ Within the Oregon Coordinated Care Organization model, screening rate for colorectal cancer is one of the 17 quality incentive measures tied to payment beginning in 2015. Whatever screening program is used, reaching the benchmark of 47% of eligible adults up-to-date⁷ will require an increase in current rates of colonoscopy.

One barrier to performing colonoscopy in rural settings is the availability of trained endoscopists. While specialists are more likely to settle in urban areas, family physicians are the largest single source of physicians in rural areas.⁸ General surgeons and primary care practitioners, specifically internists and family medicine specialists, perform colonoscopy in rural settings while in urban environments the procedure is primarily performed by gastroenterologists.

Recent studies have shown that colonoscopy may be less effective when performed by non-gastroenterologists than when performed by gastroenterologists based on mortality from interval colorectal cancer (CRC),^{9,10} sensitivity of colonoscopy in detection of CRC,¹¹ or occurrence of CRC following negative colonoscopy.^{12–15} Performance on quality measures by non-gastroenterologists was found in a meta-analysis to be equivalent to the expectations of gastroenterologists¹⁶ but others have found different results.¹⁷ The differences that have been found have not consistently been related to differences in volumes of procedures performed.^{12,13,18,19} Few studies have evaluated quality of colonoscopy in rural versus urban settings. Our underlying hypothesis was that while there would be variation on a few quality indicators, overall quality of colonoscopy in rural Oregon would be comparable regardless of rurality (eg, urban vs rural) and regardless of specialty (eg, gastroenterologist vs family physician/generalist surgeon).

Quality metrics have been identified for colonoscopy by the American Society for Gastrointestinal Endoscopy/American College of Gastroenterology (ASGE/ACG) Taskforce on Quality in Endoscopy, initially released in 2006²⁰ and updated in 2014.²¹ Their 14 original quality initiatives for colonoscopy addressed a wide range of issues, including appropriate documentation (eg, documentation of the quality of bowel preparation for the procedure), performance of appropriate processes (eg, recommendations on mean withdrawal times), and proxies for patient outcomes (eg, adenoma detection rates). Using key intraprocedure quality metrics derived from these suggestions, the primary goal of this study was to assess the quality of screening and diagnostic colonoscopies performed in rural practices in Oregon and compare this to the quality of similar procedures performed nationally, as evidenced in the National Endoscopic Database of the Clinical Outcomes Research Initiative.

Methods

Clinical Outcomes Research Initiative (CORI)

CORI and the National Endoscopic Database were developed to better understand and improve the clinical practice of endoscopy in the US. This project began in 1995 with the goal of creating a consortium of clinical practice settings to determine utilization and outcomes of endoscopic procedures. The CORI Endoscopic Reporting Software is a specialty electronic health record which presents a standardized reporting format and collects highly structured data on all types of GI endoscopic procedures. It has been available since before 2000 to any endoscopic practice in the US for installation in their endoscopy suite; this allows prospective data acquisition of endoscopic procedures in a diversity of practice sites across the US. The endoscopy procedure data is entered in real time by endoscopists and becomes the legal medical record of the procedure at the practice. Pre-procedure data collected in the report include patient demographics and indications for the procedure. Details of the procedure collected include sedation medication use during the procedure, length of the procedure, quality and type of bowel preparation, procedure findings, and additional therapeutic procedures performed such as biopsy or polypectomy. Findings are collected with a mapping function that notes the exact location and description of any lesion. Immediate complications are specifically collected which include unplanned interventions such as reversal of conscious sedation, transfer to an emergency room or hospital, bleeding, and cardiopulmonary or respiratory complications.

Endoscopy reports are generated and stored locally at the participating practice site and can be integrated with a longitudinal care electronic health record at that site. The data that is transmitted from the local site to the National Endoscopic Database (NED) does not contain most patient or provider identifiers and qualifies as a Limited Data Set under 45 C.F.R. Section 164.514(e)(2). After completion of quality control checks, data from all sites are merged in the NED for analysis. Procedure counts are monitored on a weekly basis for atypical activity. The study was approved by the Institutional Review Board of the Oregon Health & Science University (eIRB 4333).

During the study period, the CORI consortium included 67 adult endoscopic practice sites with more than 500 clinicians from 25 states. Seventy-one percent of the practices were

community-based, 12% were academic, and 17% were at Veterans Affairs or military facilities.

Oregon Rural Practice-based Research Network (ORPRN)

ORPRN, founded in 2002, is 1 of 160 practice-based research networks (PBRNs) registered with the Agency for Healthcare Research and Quality's PBRN Resource Center. ORPRN is a well-established academic-affiliated statewide PBRN whose mission is to improve the health of rural Oregonians by promoting knowledge transfer between communities and clinicians. The network includes 161 primary care clinicians in 49 practices who care for over 250,000 patients. One in 5 rural Oregonians receives care in an ORPRN affiliated clinic.

Collection of Data in Rural Practices—Rural communities are defined in this project as having a Rural-Urban Commuting Area (RUCA) of >4. RUCA is a classification scheme that uses the US Census Bureau and includes commuting area.²² In addition to RUCA criteria, all the participating sites met the Oregon Office of Rural Health definition of rural, which includes geographic areas in Oregon 10 or more miles from the centroid of a population center of 40,000 people or more. ORPRN had identified that over a quarter of family physicians in the network performed colonoscopy.²³ With the assistance of network clinicians, 25 rural ambulatory care centers or hospitals performing GI endoscopic procedures were identified in rural Oregon in 2008; this includes 21 of the 25 critical access hospitals in Oregon. No community site of these facilities is closer than a 30-minute commute from a major metropolitan area (Portland, Salem, Bend, Eugene, Corvallis, and Medford).

One of the ORPRN practices already participated in the CORI consortium. At each of the remaining 24 hospitals and ambulatory surgery centers in ORPRN where colonoscopies were being performed, clinicians, hospital or care center administrators, and information technology managers were contacted in order to gain permission to install the CORI Endoscopic Reporting Software at their practice. Representatives of ORPRN and CORI visited each potential practice to demonstrate the CORI application and discuss installation. Once a practice signed appropriate data use and licensing agreements, CORI personnel visited the practice to install and initiate the application, and to train endoscopists onsite. This is similar to other site initiation within the CORI consortium except that in this case practice sites were actively recruited; the normal process for new CORI sites begins with a request for participation from the practice.

Of these 24 sites, 14 were recruited to participate in the consortium and this study, resulting in a total of 15 Oregon rural practices representing 14 Oregon rural communities. Participation required installation of the CORI v4 Endoscopic Reporting Software, training of all endoscopists at the site, and use of the software for all endoscopic procedures for the duration of the study. Not all endoscopists at these practices agreed to use the software. The refusals were primarily due to workflow issues related to data entry and the electronic health record. The software was installed between March 2008 and October 2009. After installation, endoscopic procedures that accrued at all ORPRN sites between January 2009

and October 2011 were analyzed. Five of the ORPRN practices contributed 30 or fewer procedures to the repository during this time period. Because this small number of procedures does not allow an accurate calculation of procedure quality, we have excluded these practices from the analysis. Only colonoscopies were included.

As a comparison for the 15 recruited ORPRN practices, we identified 11 sites in the national endoscopic database outside of Oregon having a RUCA score of >4 that met the criteria for rural. These sites were compared to the sites in the entire CORI consortium with a RUCA score of ≤ 4 ($n = 43$ sites).

Quality Measures in Colonoscopy—The use of the CORI Endoscopic Reporting Software for colonoscopy quality measurement had previously been studied in work funded by the Agency for Healthcare Research and Quality (#R18 HS17017) and reported elsewhere.²⁴ That work implemented all of the quality measures proposed by the ASGE/ACG Taskforce for which data elements were available in the highly structured CORI Endoscopic Reporting Software and studied the effect on ambulatory endoscopic practice of the availability of quality measure reports (the Excellence Reports). Quality measure data were transferred from the NED to a specialized database that calculated the quality measures monthly on a per endoscopist basis.

Drawing from the previous work, 5 quality measures were chosen for this study, felt to be the most important as well as the most reliable given the restriction that the CORI Endoscopic Reporting Software is not a longitudinal health record, but a procedure record. These quality measures are described in Table 1.

Statistical Analysis

We compared 3 groups of endoscopists from the following sites: ORPRN sites, non-ORPRN rural sites, and non-rural sites. The quality measure data were collected per provider by site. Average withdrawal time was first calculated for each provider. The group (ORPRN, non-ORPRN rural, non-rural) weighted mean was calculated by averaging the providers' average withdrawal times within each group. The remaining quality measures were calculated as a proportion from numerator and denominator totals for the groups of interest. For descriptive analyses, we used Pearson's chi-square test for categorical variables and one-way analysis of variance for continuous measures to examine variation in demographic and quality measure data. All analyses were performed using SAS version 9.4 software (SAS Institute Inc., Cary, North Carolina).

Results

Comparison of the ORPRN practice sites, non-ORPRN rural practice sites already participating in the CORI consortium and all other non-rural CORI practices (ie, non-rural with RUCA ≤ 4) are found in Table 2. None of the endoscopists at the ORPRN practices were board certified gastroenterologists compared to 58% of endoscopists in the non-ORPRN rural practices and 82% in the non-rural practices.

Table 3 describes the demographics of the patients whose procedures were included from these cohorts. Procedures at rural practices (both ORPRN and non-ORPRN) were performed on individuals who were on average 2 years older than those at non-rural practices. Both rural ORPRN and non-ORPRN rural practices were more evenly balanced between males and females, and they were less racially diverse as compared to non-rural practices.

Key results are shown in Table 4. Cecal intubation reflects the completeness of the exam. The cecum was reached less frequently in the ORPRN practices compared with non-ORPRN rural practices (87.4% vs 89.3%; $P = .0002$) and non-rural practices (87.4% vs 90.9%; $P < .0001$). Withdrawal time of less than 6 minutes was more common in the ORPRN group (10.7%) compared to the non-ORPRN rural group (5.1%) and non-rural group (6.3%). Although the quality of bowel preparation was significantly different between rural and non-rural practices, the very small difference is of no real clinical importance. Perhaps more importantly, there was no statistically significant difference in the proportion of screening colonoscopies in which polyps were discovered or in the discovery of large polyps (>9 mm) between ORPRN practices and non-rural practices.

There was a significant difference in the measures related to polyp descriptors. Polyps were more likely to be completely described by ORPRN endoscopists; however, significantly fewer polyps were removed in non-ORPRN rural procedures (74.3%) while the ORPRN removal rate (84.6%) was similar to non-rural sites (83.9%). ORPRN practices were significantly more likely to biopsy and not remove a polyp compared to non-rural practices (55.4% vs 44.4%; $P < .0001$). The biopsy rates for ORPRN and non-ORPRN rural were similar (55.4% vs 52.8%; $P = .254$). Of those polyps removed, a smaller proportion were retrieved in ORPRN practices and sent for a pathologic examination.

Discussion

Overall, there were small differences in several quality measures between the rural practices in ORPRN and the non-rural practices. One important colonoscopy quality measure is the adenoma detection rate (ADR), which has been associated with risk of interval cancer occurring after colonoscopy.^{25,26} We measured polyp detection rate (PDR) because we did not have final pathology in most cases. We have previously shown PDR to be a robust surrogate for ADR.²⁷ We measured the rate of polyp(s) of >9 mm diameter as a surrogate for an advanced adenoma (defined as polyp ≥ 10 mm diameter, or with villous histology or high-grade dysplasia). Our previous analysis of 13,992 screening examinations with histopathology demonstrated that this surrogate is robust.²⁸

We found no significant difference in the rate of detection of polyps at ORPRN practices as compared to non-rural practices. Along with that, there was no significant difference in the large polyp (>9 mm) detection rate between those 2 groups. Results from non-ORPRN rural practices did detect significantly more polyps, primarily those which are 6–9 mm diameter and overall showed detection of large polyps in 2.0% more cases than at ORPRN sites. This is statistically significant as well as clinically significant.

A second key quality metric is adequacy of bowel preparation defined as “allow[ing]... detection of polyps 5 mm or larger”²⁰ or “adequate to allow the use of recommended surveillance or screening intervals.”²¹ Common ways to measure bowel prep adequacy are subjective scales (“excellent,” “good,” or “fair” but not “poor”) or by use of the Boston Bowel Preparation Scale with a score of ≥ 6 .²⁹ We observed only minor differences among the 3 study groups, all of which were above the 85% threshold.²¹

The remaining 3 measures address intra-procedural processes and techniques. The first of these is average withdrawal time. Several studies have suggested that withdrawal times (from reaching the cecum until completion of the examination) correlate directly with detection of polyps.²¹ The current quality measure recommendation is that the *average* withdrawal time for procedures in which no polypectomy has been performed should be ≤ 6 minutes. The average withdrawal time was similar among the groups, but the proportion of exams in which the withdrawal time was < 6 minutes differed (ORPRN 10.7%; non-ORPRN rural 5.1%; non-rural 6.3%).

Cecal intubation rate measures the percent of procedures in which the cecum is reached on examination. Ideally, the cecum should be reached 100% of the time when the bowel prep is adequate and no factors, such as severe colitis, are present that may limit the examination. Expected rates are $\geq 90\%$ for all cases.^{20,21} In this study, the measure was calculated excluding cases with poor bowel prep or where severe colitis was noted. ORPRN sites had significantly lower rates of cecal intubation compared to rural sites (ORPRN 87.4%; non-ORPRN rural 89.3%; non-rural 90.9%). This finding highlights the importance of measuring quality in practice, which can identify metrics for quality improvement.

Finally, the polyp retrieval rate measures the percent of removed polyps which are retrieved and therefore which can be sent for pathologic examination. Retrieval and examination of polyps is one of the steps in polyp documentation that is important for determining appropriate surveillance intervals. When polyps were removed, ORPRN practices had lower retrieval rates (ORPRN 84.7%; non-ORPRN rural 90.6%; non-rural 91.6%) and lower rates of sending retrieved polyps to pathology. Polyps were more likely to be biopsied than removed in both rural settings compared to non-rural (ORPRN 8.5%; non-ORPRN rural 13.6%; non-rural 7.2%).

Taken separately, the differences in quality between rural and non-rural practices in CORI were small and appear to be of relatively small clinical consequence except perhaps for the retrieval of polyps. When combined, however, it is possible that several of these differences may be associated with important future outcomes such as interval cancer.

The small differences between rural and non-rural practices may be due to several factors including endoscopy training and procedure volume.

The quality measures used in this study were based on recommendations from national groups.²¹ One important limitation of our study is the use of PDR as a surrogate for ADR, due to lack of pathology data from most sites. An additional limitation is that practice sites which participate in CORI are comfortable using computers for endoscopic reporting and sharing data from their practice. Such practices may differ in important ways from those

which will not share data or do not use computerized databases to monitor quality in their practice.

This is the largest analysis that we have identified of the quality of colonoscopy performed in rural practice in the US. A particular strength of this study is the range and scope of practices in the CORI consortium, representing rural locations in 9 states and all regions of the US. While it is possible that the ORPRN practices that were actively recruited to participate differ from the other rural CORI practices in CORI, the overall size of the cohort adds strength. All the rural practices in this study may in fact be more interested in procedural quality than the practices that chose to not participate. In fact, the 10 practices that did not opt to participate in CORI cited barriers to installing the CORI software application, incorporation of the software into their electronic health record, other priority projects, or were uninterested in comparing procedural quality more broadly.

Conclusion

In order to achieve national goals for colorectal cancer screening, there must be adequate capacity to perform high-quality colonoscopy. Primary care providers deliver most medical care in rural settings, including endoscopy. Offering colonoscopy in rural settings may improve rural screening rates.³⁰ These data suggest that colonoscopy can be performed with high quality in rural settings.

We conclude that the polyp detection rate was similar in rural and non-rural practices. This endpoint has been associated with subsequent risk of cancer after colonoscopy, and it is arguably the most important quality measure. With regard to other quality measures such as bowel prep, cecal intubation, polyp retrieval, and withdrawal time, statistical differences between rural and urban settings were noted, but they were small. These differences highlight areas for quality improvement in rural settings, and they highlight the importance of monitoring quality of colonoscopy.

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Table 1

Quality Measures for Colonoscopy

Measure	Inclusions/exclusions	Value(s) measured
Average Withdrawal Time	Screening colonoscopies in adults; excluded if biopsies or polypectomies were performed, if the cecum was not reached on exam or if the colon was not intact.	Average time for scope withdrawal, from identification of cecum until scope removal by key time intervals. ^f
Adequate Bowel Prep	All colonoscopies in adults	The percent of procedures performed having adequate bowel preparation. ^a
Cecal Intubation Rate	All colonoscopies in adults; excludes cases where reaching the cecum would not be expected, such as incomplete procedures or with a history of bowel resection.	The percent of procedures in which the cecum is reached. ^b
Polyp Retrieval Rate and related sub-measures: <ul style="list-style-type: none"> Polyp description documentation Polypectomy rate Polyp biopsy rate Sent to Pathology 	All colonoscopies in adults	Of all polyps removed during procedures, the percent which were retrieved. ^c <ul style="list-style-type: none"> the percent of polyps with description of size, location and morphology percent of detected polyps which were removed of polyps not removed by polypectomy, the percent which were biopsied of polyps retrieved after polypectomy, the percent which were sent to pathology
Polyp Detection Rate	All screening colonoscopies in adults	The percent of screening procedures where a polyp was found; of these, the percent with largest polyp found in 3 size categories. ^d

^fAppropriate average withdrawal times were initially proposed to be 6 minutes for normal examinations with intact colons, although there is some evidence that it should be even longer.

^aAdequate bowel preparation is defined as “fair,” “good” or “excellent” subjectively or a Boston Bowel Prep Scale score ≥ 6. It is the documentation of prep results and not the prep results themselves that was recommended by the ASGE/ACG Taskforce in 2006. However, in the CORI Electronic Reporting Software, bowel prep quality is a required field. The percent of procedures with adequate preparation might be used as a proxy for the number of procedures which need to be repeated because of inadequate visualization due to poor bowel prep.

^bThe ASGE/ACG Taskforce 2006 recommendation was that visualization of the cecum be documented by photo or notation of landmarks, which could not be documented in structured fields in the CORI Endoscopic Reporting Software at that time. Appropriate intubation rates were expected to be ≥ 90% for all colonoscopies not meeting exclusion criteria and in over 95% of screening colonoscopies.

^cThis measure was applied only to polyps which were documented as single polyps rather than as polyp clusters.

^dBecause only a proportion of the procedures documented in CORI have pathology results, and therefore pathologic diagnoses are not known, polyp detection rate, especially of polyps > 9 mm is a proxy for adenoma detection rate. Size is estimated by the endoscopist.

Table 2

Description of Rural and Non-rural Endoscopy Sites and the Physicians Contributing Quality Measure Data

	Practice type:		
	ORPRN	Non-ORPRN rural	Non-rural
Number of practices	10	11	43
Total number of endoscopists	33	38	292
Primary specialty: Gastroenterology	0 (0%)	25 (66%)	248 (85%)
<u>Board Certification</u>			
Gastroenterology	0	22 (58%)	240 (82%)
Non-Gastroenterology ^a	33 (100%)	16 (42)%	52 (18%)
<i>Non-Gastroenterology certifications:</i>			
Family medicine	16 (48%)	0 (0%)	0 (0%)
Internal medicine	7 (21%)	3 (19%)	7 (13%)
Surgery	6 (18%)	13 (34%)	26 (50%)
Colorectal surgery	0	2 ^b (5%)	16 ^b (31%)
GI Pediatrics and Pediatrics	0	0	11 (21%)
unknown	4 (12%)	0 (0%)	8 (15%)

^aPhysicians without gastroenterology board certification may have more than 1 other type of certification.

^bAll providers with colorectal surgery board certification were also board certified in surgery.

Table 3

Demographics of Patients Undergoing Colonoscopy

Practice Type:	ORPRN	Non-ORPRN	Rural	Non-rural	<i>p</i> ^c
Total colonoscopies performed	5,564	13,426		120,186	
Mean age in years (SD)	60.1 (13.7)	59.7 (14.2)		58.1 (14.3)	< .0001
Age Category, n (%)					
<50	919 (16.5)	2,496 (18.6)	< .0001	27,386 (22.8)	< .0001
50 – 59	1,693 (30.4)	4,105 (30.6)		36,162 (30.1)	
60 – 69	1,646 (29.6)	3,565 (26.6)		31,328 (26.1)	
70 – 79	973 (17.5)	2,270 (16.9)		18,519 (15.4)	
80	333 (6.0)	990 (7.4)		6,791 (5.7)	
Gender, n (%)					
Female	2,895 (52.0)	6,876 (51.2)	.3053 ^b	65,864 (54.8)	< .0001 ^d
Male	2,669 (48.0)	6,550 (48.8)		54,322 (45.2)	
Race/Ethnicity,^a n (%)					
White	4,765 (85.6)	11,748 (87.5)	.0005	89,565 (74.5)	< .0001
Black	5 (0.1)	551 (4.1)		7,303 (6.1)	
Asian/Pacific Islander	13 (0.2)	42 (0.3)		3,937 (3.3)	
American Indian	59 (1.1)	171 (1.3)		1,047 (0.9)	
Multi-racial	9 (0.2)	21 (0.2)		245 (0.2)	
Hispanic	91 (1.6)	872 (6.5)		17,192 (14.3)	
Other	622 (11.2)	21 (0.2)		897 (0.8)	

^aRace categories are non-Hispanic; Hispanic includes all races that also selected “is Hispanic.”

^bAny screening includes: Average risk screening, family history of polyps, family history of colorectal cancer.

^c*P*-values are compared to the ORPRN group.

^dThe *P*-value reported for race/ethnicity is for the comparison white non-Hispanic versus all other races/ethnicities combined.

Table 4

Key Measures of the Quality of Colonoscopy

Practice Type:	ORPRN	Non-ORPRN Rural	<i>p</i> ^a	Non-rural	<i>p</i> ^a
Average Endoscope Withdrawal Time Is 6 Minutes for Normal Screening Examinations Where no Biopsies or Polypectomies Are Performed					
N eligible for measure with documentation of withdraw time	1,332	1,820		23,890	
Proportion of procedures with withdrawal times:	N (%)	N (%)		N (%)	
< 6 minutes	142 (10.7)	93 (5.1)	< .0001	1,497 (6.3)	< .0001
6 – 8 minutes	503 (37.8)	718 (39.5)		13,136 (55.0)	
> 8 minutes	687 (51.6)	1,009 (55.4)		9,257 (38.7)	
Average withdrawal time (minutes)	9.36	10.24	.249	10.45	.147
Bowel Preparation Is Documented to Be Adequate					
N eligible for measure	5,614	12,847		121,373	
Adequate bowel preparation	5,333 (95.0)	12,386 (96.4)	< .0001	116,234 (95.8)	.005
Cecal Intubation Rate^b					
N eligible with documentation of depth of insertion	5,649	12,855		121,381	
Cecum reached	4,939 (87.4)	11,480 (89.3)	.0002	110,383 (90.9)	< .0001
Polyp Retrieval Rate (and sub-measures)					
Total polyp N	3,931	9,025		67,486	
Polyp N with descriptors documented	2,838 (72.2)	6,038 (66.9)	< .0001	47,583 (70.5)	.024
Removed polyp N	3,324 (84.6)	6,707 (74.3)	< .0001	56,593 (83.9)	.246
Of those not removed, percent of polyps biopsied	336 (55.4)	1,223 (52.8)	.254	4,838 (44.4)	< .0001
Of those removed, retrieved N	2,817 (84.7)	6,078 (90.6)	< .0001	51,853 (91.6)	< .0001
Of those removed, N retrieved after February 2010 ^c	1,971	5,266		45,400	
Of those retrieved, N sent to pathology ^c	1,520 (77.1)	4,966 (94.3)	< .0001	41,400 (91.3)	< .0001
Polyp Detection Rate in Screening Examinations					
Screening colonoscopy N	2,474	4,699		48,143	
Of these, exam N where polyp(s) detected	965 (39.0)	2,288 (48.7)	< .0001	19,379 (40.3)	.217
Of these, N where size was documented	929	2,231		18,195	

Practice Type:	ORPRN	Non-ORPRN Rural	<i>p^a</i>	Non-rural	<i>p^d</i>
Percent of exams with polyps largest documented size:					
< 5 mm	582 (62.6)	1,272 (57.0)	.003	9,913 (54.5)	< .0001
6 – 9 mm	193 (20.8)	572 (25.6)	.004	4,881 (26.8)	< .0001
> 9 mm	154 (16.6)	387 (17.3)	.601	3,401 (18.7)	.106
Large polyp (>9mm) polyp detection rate	6.2	8.2	.002	7.1	.111

^a*p* value compares to ORPRN.

^bExcludes any procedures with poor bowel preparation or severe colitis.

^cThe sent to pathology checkbox was added in January 2010. These results contain data entered after February 2010.