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## Differences in Detection Rates of Adenomas and Serrated Polyps in Screening Versus Surveillance Colonoscopies, Based on the New Hampshire Colonoscopy Registry

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### Abstract

**BACKGROUND & AIMS**—The adenoma detection rate (ADR) is an important quality indicator originally developed for screening colonoscopies. However, it is unclear whether the ADR should be calculated using data from screening and surveillance examinations. The recommended benchmark ADR for screening examinations is 20% (15% for women and 25% for men > 50 y). There are few data available to compare ADRs from surveillance vs screening colonoscopies. We used a population-based registry to compare ADRs from screening vs surveillance colonoscopies. The serrated polyp detection rate (SDR), a potential new quality indicator, also was examined.

**METHODS**—By using data from the statewide New Hampshire Colonoscopy Registry, we excluded incomplete and diagnostic colonoscopies, and those performed in patients with inflammatory bowel disease, familial syndromes, or poor bowel preparation. We calculated the ADR and SDR (number of colonoscopies with at least 1 adenoma or serrated polyp detected, respectively, divided by the number of colonoscopies) from 9100 colonoscopies. The ADR and SDR were compared by colonoscopy indication (screening, surveillance), age at colonoscopy (50–64 y, > 65 y), and sex.

**RESULTS**—The ADR was significantly higher in surveillance colonoscopies (37%) than screening colonoscopies (25%;  $P < .001$ ). This difference was observed for both sexes and age groups. There was a smaller difference in the SDR of screening (8%) vs surveillance colonoscopies (10%;  $P < .001$ ).

**CONCLUSIONS**—In a population-based study, we found that addition of data from surveillance colonoscopies increased the ADR, but had a smaller effect on the SDR. These findings indicate that when calculating ADR as a quality measure, endoscopists should use screening, rather than surveillance colonoscopy, data.

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## Keywords

Colon Cancer; Early Detection; Endoscopy; Tumor

The adenoma detection rate (ADR) is a key quality indicator for endoscopist colonoscopy performance. It originally was developed as a benchmark to measure colonoscopy quality in first-time screening colonoscopies performed in asymptomatic individuals 50 years of age and older.<sup>1,2</sup> The ADR is defined as the proportion of screening colonoscopies in which one or more adenomas is detected.

Benchmark endoscopist ADRs of 25% and 15% have been recommended for men and women, respectively, who present for screening.<sup>3</sup> Studies performed over the past 20 years have shown ADRs in screening populations ranging from 25% to 40% in patients older than 50 years of age.<sup>4–13</sup> In a recent study, the ADR was found to be associated inversely with risk of an interval colorectal cancer (CRC).<sup>14</sup>

Although the ADR benchmark initially was intended to measure quality in screening colonoscopies, it is unclear if surveillance colonoscopies can be included when the ADR is calculated. If the addition of surveillance colonoscopies were to alter the ADR, then comparison with the quality benchmark established for screening ADR would be a less reliable measure. Adenomas might be expected to be more common within a surveillance, rather than a screening population, thus increasing the total ADR for the surveillance group. However, the impact of more frequent colonoscopy intervals within the surveillance group potentially may lower the relative ADR for that group. Some studies have reported ADRs calculated using both screening and surveillance colonoscopies.<sup>15–18</sup> Although some of the investigators have controlled for colonoscopy indication in their subsequent analyses, others have simply reported the combined rate.<sup>15</sup> Unfortunately, controlling for indication from a combined ADR measurement may not be practical when calculating ADR in a clinical setting.

In addition to the ADR, it has been suggested that calculating the serrated polyp detection rate (SDR) may be useful in measuring an endoscopist's quality in colonoscopy.<sup>19</sup> In a retrospective review of an academic endoscopy practice by Kahi et al,<sup>20</sup> a wide variation in proximal serrated polyp detection was observed. A recent article by these investigators showed that the SDR correlated with the ADR among providers in their endoscopy practice.

There are little data describing ADR in a surveillance population. Our goal was to measure and compare the ADR between screening and surveillance colonoscopies in the state-wide, population-based New Hampshire Colonoscopy Registry (NHCR). We also examined the SDR, which may represent a new quality indicator.

## Methods

The design and development of the NHCR is described in detail elsewhere.<sup>21–23</sup> Nearly all endoscopy sites in the state of New Hampshire contribute data to the NHCR, with a few sites still in the process of undergoing human subject review and implementation. Consenting patients complete a self-administered patient information form before colonoscopy, providing information on demographic characteristics, health history, and risk factors for CRC (including age, race, educational level achieved, height, weight, smoking history, and personal and/or family history [first-degree and other relatives] of CRC and polyps). On the NHCR procedure information form, completed during or immediately after colonoscopy, endoscopists or endoscopy nurses record the indication for the colonoscopy (screening, surveillance, or diagnostic), findings (location, size and specific treatment of

polyps, cancer, or other findings), type and quality of bowel preparation, sedation medication, region reached during the procedure, withdrawal time, follow-up recommendations, and immediate complications. The NHCR requests pathology reports for all colonoscopies with findings directly from the pathology laboratory used by each participating endoscopy facility. Trained NHCR staff abstract data from these pathology reports including location, size, and histology of all findings, and enter it into the NHCR database, linking it to information from the procedure information form at the polyp level.<sup>23</sup> All data collection and study procedures were approved by the Committee for the Protection of Human Subjects at Dartmouth College, as well as by other relevant human subjects reviewing bodies at participating sites.

## Cohort

Our analysis included data from screening colonoscopies and those conducted for surveillance for a personal history of colorectal cancer or adenomatous polyps. During the time period used for this analysis (April 6, 2009 to March 22, 2011), 12 endoscopy facilities, including hospitals, ambulatory surgery centers, and community practices across New Hampshire, were fully participating in the NHCR, and 16278 colonoscopies were performed by 54 endoscopists at these 12 facilities. The median pathology report reception rate for colonoscopies with polyps was 92% for these 12 facilities. Because average-risk CRC screening begins at age 50,<sup>24</sup> we removed colonoscopies performed on patients younger than 50 years of age at the time of colonoscopy (n = 2565) and we excluded colonoscopies for which patient sex was unknown (n = 653). Diagnostic colonoscopies (evaluation of gastrointestinal bleeding, ruling out inflammatory bowel disease, biopsy of suspected cancer; follow-up evaluation of a positive fecal occult blood test, abnormal virtual colonoscopy, or barium enema test; polypectomy of known polyp and/or iron-deficiency anemia) and colonoscopies in patients with familial syndromes (familial polyposis or hereditary non-polyposis colon cancer), as recorded by the endoscopist on the procedure information form, were deleted from the analysis cohort (n = 3122). Colonoscopies with a poor colonic preparation (n = 462) and incomplete colonoscopies (n = 376) also were removed. After excluding 7178 colonoscopies, 9100 colonoscopies for 9100 patients remained for this analysis, comprising 6161 (68%) screening colonoscopies and 2939 (32%) surveillance colonoscopies.

## Outcome Measures

We calculated the ADR (the number of colonoscopies with at least one adenoma detected, divided by the total number of colonoscopies), and 95% confidence interval (95% CI), overall and separately by indication for colonoscopy. In calculating the ADR, the numerator contained all colonoscopies in which at least one lesion with adenomatous tissue was detected, including tubular or villous adenomas, and polyps with highgrade dysplasia or adenocarcinoma. In addition, the ADR was evaluated for each of the patient-characteristic groups including age (50–64 and >65) and sex, by indication for colonoscopy (screening vs surveillance). To further understand the ADR differences among men and women, a comparison of ADR by screening and surveillance groups was stratified by age and sex. Analyses were conducted in SAS (9.3).

We defined clinically important serrated polyps to include hyperplastic polyps that were proximal to the sigmoid as well as all sessile serrated polyps or serrated adenomas. This definition was based on recent guideline recommendations for surveillance of serrated lesions.<sup>25,26</sup> Our calculation of the SDR was similar to that for the ADR; we divided the number of colonoscopies with at least one clinically important serrated polyp detected by the total number of colonoscopies. Both the ADR and SDR were calculated for all colonoscopies, and also for screening and surveillance colonoscopies separately.

## Exposure Measure

By using a hierarchical algorithm based on the comprehensive options for colonoscopy indication available on the procedure information form, we developed a definition for examination indication (screening vs surveillance) that served as the exposure measure in this analysis. A colonoscopy was defined as a screening examination if the endoscopist selected the following: “Screening : no symptoms or family history,” or “Screening: family history of polyps,” and/or “Screening: family history of colorectal cancer.” A colonoscopy was defined as a surveillance examination if the endoscopist selected the following: “Surveillance: personal history of colorectal cancer” and/or “Surveillance: personal history of polyps.”

## Results

Our cohort had a mean age of 60 years (standard error,  $\pm 8$  y), and was 52% female, 94% Caucasian, 77% with some college or a college degree, and 23% self-reporting a first-degree relative with CRC. Table 1 presents the ADR, calculated for all examinations and by indication, broken down by patient age and sex. The overall ADR was 29% (95% CI, 28%–30%). The ADR for surveillance colonoscopies (37%; 95% CI, 35%–39%) was significantly higher than screening colonoscopies (25%; 95% CI, 24%–26%), a pattern that held true for both patient age groups and for sex. ADRs were higher in men than in women for both screening (32% vs 19%) and surveillance (43% vs 29%) colonoscopies. The ADR was highest in the older male surveillance group (45%; 95% CI, 41%–49%) (Table 2). The SDR for surveillance colonoscopies (10%; 95% CI, 9%–11%) was higher than that for screening colonoscopies (8%; 95% CI, 7%–9%) (Table 1).

## Discussion

We observed that the ADR was significantly higher in surveillance colonoscopies compared with those procedures with a screening indication. Specifically, we observed an ADR of 37% for surveillance colonoscopies and 25% for screening colonoscopies. This difference was observed for male as well as female patients and in patients 50 to 64 years of age as well as those 65 years and older. In addition, we observed an SDR of 8% for screening and 10% for surveillance colonoscopies.

The ADR is one of the primary indicators of colonoscopy quality. To date, the ADR has been evaluated only in a large retrospective analysis of data from the Polish national screening program. In this study, Kaminski et al<sup>14</sup> observed a correlation between endoscopist ADR in screening examinations and sub-sequent interval cancer rates. This important study had some limitations, which included few interval cancers and wide CIs.

The detection of serrated polyps has been proposed as an additional quality measure for colonoscopy.<sup>20</sup> The serrated pathway has been implicated in interval cancers. One study showed that the risk for advanced adenomas, but not serrated polyps, was reduced in patients who had a previous colonoscopy.<sup>27</sup> These findings showed the need for better outcomes with regard to detection and removal of serrated lesions.

The ADRs for screening colonoscopies in our population (32% in males, 19% in females) are in line with suggested benchmarks noted in published screening guidelines (25% in males, 15% in females).<sup>28</sup> We found that the ADR calculated using both screening and surveillance examinations was higher than screening only (29% vs 25%); more so for males (36% vs 32%) than for females (22% vs 19%). Thus, the calculated ADR increased when surveillance examinations were included in the assessment.

Investigation of the surveillance colonoscopy group showed that, similar to the screening colonoscopy group, the ADR was higher in males (43%) than in females (29%); however, for the surveillance group, there was no established benchmark with which to compare. Although a few studies reported surveillance ADR in trials with protocol-driven surveillance intervals, there are little data regarding surveillance ADRs in the general population.<sup>29–31</sup> Millan et al,<sup>17</sup> in their analysis of ADR among 6 endoscopists at a single facility, reported a mean ADR of 31.5% (range, 22%–42.1%) for examinations conducted for polyp surveillance, and a mean of 21.8% (range, 11.2%–34.7%) for examinations conducted for cancer surveillance, both higher than the mean of 20.7% (range, 13.4%–25.8%) that they reported for screening examinations. The vast majority of NHCR surveillance examinations are for polyp surveillance, rather than colorectal cancer, and our overall surveillance ADR of 37% (95% CI, 35%–39%) is within the range of ADRs in polyp surveillance colonoscopies reported by Millan et al.<sup>17</sup>

An SDR benchmark of 4.5% has been suggested when the ADR in a population is 20%.<sup>20</sup> Thus, our SDR of 8% with an ADR of 25% in screening examinations may be comparable. However, unlike the difference for ADR, we observed no significant difference between the SDR for screening and surveillance colonoscopies. Therefore, there was little change from the screening SDR of 8% when surveillance examinations were included in the calculation.

A major strength of this study derives from the statewide, prospective, and comprehensive data collection of the NHCR, which allowed for the analysis of a large sample of colonoscopies, conducted by 54 endoscopists at 12 endoscopy facilities, including community health centers, academic settings, and ambulatory centers, across New Hampshire. This large number of facilities and endoscopists distinguishes it from the examination of Millan et al<sup>17</sup> of ADRs in a single facility, confirming and substantially broadening the minimal existing data on ADR for surveillance colonoscopies. Linkages between patient, colonoscopy, and pathology data within the NHCR database further strengthened this analysis. In addition, by design, the NHCR aims to capture and link pathology data for all colonoscopies with findings at all participating facilities, giving this study access to a level of complete pathology data not commonly found in colonoscopy registries<sup>32</sup>; 92% across all sites included in this analysis.

Limitations of this study include our relatively homogeneous sample of patients with regard to race, which reflects the demographic composition of New Hampshire. There may be differences with regard to ADR in diverse populations. Although one study observed a similar ADR for whites and Hispanic patients, another group observed a lower rate for white patients.<sup>33,34</sup> More studies are needed to confirm our findings among a broader population. However, although the absolute ADR may differ slightly between populations, the relative difference in ADR between surveillance and screening colonoscopies nonetheless may remain consistent. In addition, to establish a true threshold quality benchmark ADR for the surveillance population, further analysis is needed to determine when the interval colorectal cancer rate decreases based on the endoscopist's ADR.

This research provides strong implications regarding quality measurement in general practice. We found that ADRs for surveillance colonoscopies are significantly higher than those for screening colonoscopies, indicating that it may be inappropriate to combine the 2 different examination indications into a single quality metric, or to assess surveillance examinations, without adopting a new standard benchmark. The use of ADR as a key endoscopist-level quality measure requires that it be calculated accurately. Pooling screening and surveillance colonoscopies has the potential to inflate the ADR. Thus, comparison with a benchmark established for screening colonoscopies alone would not be appropriate. This problem would be compounded further by variation in the overall percentage of surveillance

colonoscopies that are performed by endoscopists. Solutions to these potential inaccuracies would be to calculate ADRs separately for screening and surveillance colonoscopies, or simply to calculate the ADR for screening colonoscopies alone.

Overall, the findings from our large sample indicate that although ADRs differ substantially between surveillance and screening colonoscopies, SDRs do not. For the purposes of measuring the quality of colonoscopy, this analysis suggests that the ADR for screening and surveillance should be calculated separately, and that comparison with established benchmarks should use only screening colonoscopies.

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## Abbreviations used in this paper

<b>ADR</b>	adenoma detection rate
<b>CI</b>	confidence interval
<b>CRC</b>	colorectal cancer
<b>NHCR</b>	New Hampshire Colonoscopy Registry
<b>SDR</b>	serrated polyp detection rate

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**Table 1**

ADR and SDR for all Colonoscopies and by Indication (Screening and Surveillance), by Patient Age and Sex

Patient characteristics		All Colonoscopies		Screening		Surveillance	
		N (%)	Rate, % (95% CI)	N (%)	Rate, % (95% CI)	N (%)	Rate, % (95% CI)
All patients	ADR	9100 (100)	29 (28–30)	6161 (68)	25 (24–26)	2939 (32)	37 (35–39)
	SDR		9 (8–10)		8 (7–9)		10 (9–11)
Age at colonoscopy, y							
50–64	ADR	6600 (73)	26 (25–27)	5083 (83)	23 (22–24)	1517 (52)	34 (32–36)
	SDR		9 (8–10)		8 (7–9)		10 (8–12)
65	ADR	2500 (27)	36 (34–38)	1078 (17)	31 (28–34)	1422 (48)	40 (37–43)
	SDR		9 (8–10)		8 (6–10)		10 (8–12)
Sex							
Male	ADR	4379 (48)	36 (35–37)	2681 (44)	32 (30–34)	1698 (58)	43 (41–45)
	SDR		10 (9–11)		10 (9–11)		10 (9–11)
Female	ADR	4721 (52)	22 (21–23)	3480 (56)	19 (18–20)	1241 (42)	29 (26–32)
	SDR		8 (7–9)		7 (6–8)		11 (9–13)

**Table 2**

ADR Among Males and Females for Screening and Surveillance Colonoscopies by Age Group

Age at colonoscopy, y	ADR, % (95% CI)			
	Male		Female	
	Screening	Surveillance	Screening	Surveillance
50–64	30 (28–32)	41 (38–44)	18 (17–19)	25 (22–28)
65	40 (36–44)	45 (41–49)	23 (20–26)	32 (28–36)