Editorial

Adenoma detection rate: the perfect colonoscopy quality measure or is there more?

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Colonoscopy has been established as the gold standard for the screening of colorectal cancer (CRC). To help reduce the known variations in colonoscopy quality that exist from provider to provider, quality indicators have been established. Good quality indicators that have been established include the endoscopist's adenoma detection rate (ADR), a reportable rate of the endoscopist's ability to find adenomas, attempt of endoscopic removal of pedunculated polyps and large (<2 cm) sessile polyps prior to surgical referral, and cecal intubation. Documentation of informed consent, quality of bowel preparation, and withdrawal time, along with pre-procedure patient assessment and high compliance rates with guideline-recommended screening and surveillance intervals have also been proposed as process-based quality metrics. Despite all these quality indicators, it is the endoscopist's ADR that currently defines the quality of colonoscopy that an endoscopist performs. The benchmark for ADRs is 25% overall, 30% in men, and 20% in women (1).

The endoscopist's ADR currently stands as the "gold standard" for quality measures in screening colonoscopy. This is further reinforced with the study by Kaminski *et al.*, that showed an increased ADR resulted in an adjusted hazard ratio for interval CRC of 0.63 (95% CI, 0.45–0.88; P=0.006), and for cancer death of 0.50 (95% CI, 0.27–0.95; P=0.035). This is improved versus those that did not have an increase in ADR, with a decreased adjusted hazard ratio for interval CRC of 0.27 (95% CI, 0.12–0.63; P=0.003), and for cancer death of 0.18 (95% CI, 0.06–0.56; P=0.003) (2). Improving techniques to significantly increase your ADRs will improve the care given to your patients. It has been shown the frequency of "missed" CRC increases dramatically with ADR < 20% *vs*. ADR ≥20%, of which having an ADR ≥33.5% will minimize "missed" CRC (3). Statistically speaking, on average, for each 1% increase in ADR, there is a 3% decrease in the risk of CRC. Importantly, an endoscopist's ADR is inversely related to the patient's post-colonoscopy CRC risk (3). The importance of ADR has been well established in the medical literature and as a result has been the gold standard in colonoscopy quality.

However, is measuring ADR and improving ADR enough? Have we caught ourselves being satisfied with this one benchmark that we do not continue to strive to find other measurements or adjustments to improve the quality of our screening colonoscopies? Despite convincing data of the correlation of improving ADR and decreasing interval CRC, ADR is not without its flaws. Is ADR as a metric that we should be specifically focusing on or on the endoscopist's techniques and improving them that will ultimately result in improving our overall quality of care? At this time, there are new measures that being studied and need to be further studied to assess for efficacy.

There are many variables that factor into an endoscopist identifying an adenomatous polyp and hence an endoscopist's ADR. Personal factors include the one

and done phenomenon or being satisfied with finding one adenoma instead of continuing to seek more. Since an endoscopist's ADR is the proportion of screening colonoscopy patients who are found to have at least one adenoma, the measurement of ADR does not measure an endoscopist's ability to identify all adenomatous polyps in a patient. An endoscopist who is trying to manipulate the ADR quality measure, would do a high-quality examination until they found one adenoma and then could decrease the quality of their examination for the rest of the colon without negatively affecting their ADR. A relatively new benchmark being studied is adenoma under the curve (AUC). It is a plot that takes into consideration of not only your ADR, but also your likelihood of identifying multiple adenomas. In a study by Wang *et al.*, they identified an overall ADR in academic and community groups as 28.9% and 25.9%, respectively (P=0.056). However, among patients in whom >1 adenoma was removed, there were 1.94 *vs.* 1.65 mean adenomas detected in the academic and community groups, respectively (P<0.001). This difference scaled to AUCs of 56.4 *vs.* 42.7 units in academic and community groups, respectively. Whereas ADR varied by only 10.6% between groups, AUC varied by nearly 25%. This new metric incorporates and extends ADR by capturing data regarding incremental adenomas beyond the first detected (4). Though not studied, the identification of more adenomatous polyps in theory will lead to a decrease in CRC incidence.

Another personal factor that can is not accounted for in an endoscopist's ADR is the "bad day" phenomenon. ADR assesses the quality for an endoscopist over a large cohort of procedures. However it does not provide information as to whether every procedure done during that cohort was completed with the same quality. For example, an endoscopist may do 90 colonoscopies with high quality, but may have a "bad day" and do 10 colonoscopies with poor quality that may be due to a variety of factors (too many procedures scheduled, sub-optimal physician health/stamina, etc.). Because the ADR is an assessment of quality over the entire 100 procedures, there is no way to determine whether some of those procedures were done with poor quality. While colonoscopy withdrawal time has been replaced in favor for ADR, withdrawal time can provide value in assessing performance at an individual procedure level. Increasing withdrawal time is particularly important as the increased time to study the mucosa will inevitably lead to identifying more polyps that are normally missed. Like finding a needle in a haystack, the increased time spent in the colon will lead to more adenomas being identified. Sinn *et al.* discusses that formal documentation of significant increased withdrawal time (6 m 11s to 7 m 52s, P=0.001) demonstrated higher detection rate for adenoma smaller than 10 mm (0.34 to 0.83 per colonoscopy; P=0.012) (5). Though analyzed by Kaminski *et al.* and shown that improvement of ADRs results in decreased risk of interval CRC and death, it is the measures and techniques used by the endoscopist to improve their abilities to find adenomas that ultimately result in improved ADRs and interval CRC.

In addition, an endoscopist ADR is a quality measure that focuses on identification of adenomas. However, it has no assessment whatsoever on the quality of adenoma removal. While one purpose of colonoscopy is screening for CRC, the additional benefit of colonoscopy is in cancer prevention through removal of adenomas. If adenomas are not removed adequately, then interval cancers may still develop. As it stands today, there are no established quality metrics that assess the quality of adenoma removal.

An endoscopist's ADR is not only dependent on the endoscopist's ability to identify adenomas. Since the diagnosis of adenomas currently requires a pathologist to accurately diagnose adenomatous tissue on polyp biopsy/resection specimens, ADR is also dependent on the performance of the pathologist. While current data suggest that pathologist's ability to diagnose adenomas is fairly good, it is not without limitation. There also can be manipulation of these diagnoses in situations where pathologists receive "pressure" from endoscopists to diagnose more adenomas to increase the endoscopist's ADR, especially when financial incentives and/or penalties become linked to this performance.

Other factors not taken into account in an endoscopist's ADR is the epidemiology of their patient population. CRC remains the third most commonly diagnosed cancer in men, and second in women in the world (6). Incidence rates in Australia and New Zealand, Europe, and North America are among the highest, while the lowest rates are seen in Africa and South-Central Asia (7). Socioeconomic status (SES) further plays a role, with low SES being associated with 30 percent increase of CRC risk versus the highest SES quintile (8). Corley *et al.* identified in 2013 that the prevalence of detected adenomas is greater with age and in men. Importantly, this study also identifies an increase in proximal adenomas among blacks, especially black men, along with increased odds ratios for adenomas in Native Americans (9). Furthermore, a difference in can been seen in the prevalence of adenomas between patients seen at

the Veterans Affairs Medical Centers (VAMC) and civilian hospitals. In a study by Rastogi *et al.*, where cap-assisted colonoscopy was studied, 69% of those undergoing cap-assisted colonoscopy was found to have at least one adenoma versus 56% (10). Differences in environmental exposures may be the driving factor in the significantly higher rates seen within the VAMC versus the general population. These percentages are well above the prevalence of 25% among the general population. An endoscopist's patient population can greatly affect what their ADR and hence its ability to determine quality of colonoscopy.

There have also been evaluations of advanced ADRs and ADR plus sessile serrated polyp detection rate (SSP-DR). Though there are no studies understanding advanced ADR with improving interval cancer and death, there seems to be no correlation between advanced ADR and an endoscopist's ADR. Greenspan *et al.* discovered that patient age and male gender were variables associated with advanced adenomas; however, there was no correlation in an endoscopist's advanced and non-advanced ADR. Advanced ADR is not without importance, as the detection of such adenomas at index colonoscopy carries a greater risk for future advanced neoplasia during surveillance colonoscopy (11). Lee *et al.* further confirms that there is no correlation between advanced ADR and ADR among endoscopists as an individual, but interestingly identifies endoscopists as a group, on the basis of advanced ADR of 5%, having significantly higher ADRs (12). SSP-DR also appears to vary by endoscopist and without association to specific patient characteristics. Sanaka *et al.* found in general SSP-DR are low with equal frequency in men and women (13). More importantly, in analysis, SSP-DR is unrelated to the true prevalence (14). Kahi *et al.* identified variability in SSP-DR, ranging from 1% to 18%, versus the 2.8-fold range variability seen in ADRs (15). There also appears to be a variance among pathology laboratories, yielding another limiting factor to the utilization of SSPs. A study by Payne *et al.* has shown among 32 centers, the detection rate of serrated lesions can range from 0 to 9.8% (16). As a result, it appears advanced ADR and SSP-DR are inadequate indexes by themselves.

Overall, we may be investigating the wrong pathway by trying to seek other metrics to improve endoscopist's ADRs. Using newer and advanced technology may lead to the greatest increase in ADRs and thus reducing interval CRCs. With computer colonic mucosa visualization tracking, improved identification of polyps and mucosa will lead to decreased CRCs. Mielke *et al.* have used white light endoscopy with confocal laser endomicroscopy to study the colonic mucosa in mice. Confocal laser endomicroscopy uses fluorescent markers to enhance the visualization of lesions, whether it is polyps or inflammation from inflammatory bowel disease. This allows the observation of microscopic architecture and cellular features. The high-resolution visualization of the mucosa with monitoring of non-neoplastic tissue and early identification of aberrant crypt foci, the precursor to polyp formation, will help further identify ADRs (17). Though still being studied and refined, the importance of computer aided visualization can be seen in not only identifying adenomas, but potentially pre-adenomas. This will allow us to be more aggressive and further decrease interval CRC incidence and deaths.

ADR has been and still continues to be the gold standard quality indicator of colonoscopy. Understanding and improving our ADRs will not only allow us to identify more adenomas, but more importantly, decrease interval CRC and death. However, we must not stop here. Initial data shows the roles of other composite measures in the potential to further enhance ADR detection and thus decreasing CRC incidences and comorbidities. We must to continue to strive for what is needed to improve the ADRs and CRC detection of all endoscopists, regardless of individual or facility factors. Finding better metrics and improving technology is essential to decreasing the incidence of CRC and death.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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