Risk of post colonoscopy colorectal cancer according to physician adenoma detection rates

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Main Text

Abstract
Colonoscopies, which enable detection and removal of pre-cancerous polyps, are an effective method to reduce the incidence of and mortality associated with colorectal cancer. Adenoma detection rate (ADR) is validated for measuring quality of colonoscopy. Here we summarize the @GIJournal discussion held on July 3, 2022, during which we discussed the article by Schottinger et al. titled Association of physician adenoma detection rates with postcolonoscopy colorectal cancer (JAMA 2022; 327:2114–2122)\(^1\). The session was moderated by Dr. Mariam Naveed (MN [@MN_GIMD]) and the key findings were critically reviewed by Dr. Aasma Shaukat (AS [@AasmaShaukatMD]) and Dr. Rajesh N. Keswani (RK [@RKeswaniMD]).

Introduction
Colorectal cancer is a leading cause of cancer death in the United States, and a key strategy to mitigating this problem is early detection. Adenoma detection rate (ADR) has been widely accepted as a highly validated quality indicator for endoscopists performing screening colonoscopies. Unfortunately, there is significant variability in endoscopists’ ADRs, which is concerning as several studies have now shown that higher ADRs are associated with decreased incidence of post-colonoscopy colorectal cancer (PCCRC).
Schottinger et al. performed a retrospective cohort study of colonoscopies performed at three large integrated health care systems in California and Washington. The study included 735,396 patients (50–75 years of age), amongst which 852,624 negative colonoscopies (no cancer detected) were performed. Colonoscopies were performed by 383 eligible physicians, who had performed at least 25 screening colonoscopies and a total of 100 total colonoscopies per year, at 43 endoscopy centers between January 2011 and June 2017. The ADR for each physician was calculated annually as the percentage of screening colonoscopies in which at least one adenoma was detected. The primary outcome was PCCRC (tumor registry verified) diagnosed within 6 months of a negative colonoscopy. Secondary outcomes included PCCRC-related deaths, PCCRCs by location, stage and stratified by patient demographics (sex or advanced age). The study cohort was roughly evenly split according to sex (51.6% of procedures performed in female patients) with a median patient age of 61.4 years (interquartile range [IQR], 55.5–67.2 years) and a median follow-up of 3.25 years (IQR, 1.56–5.01 years).

There were 619 diagnoses of PCCRC and 36 related deaths during the >2.4 million person-years of follow-up. The risk for PCCRC was significantly lower for patients whose physicians had higher ADRs (hazard ratio [HR] per 1% absolute ADR increase of 0.97 [95% confidence interval (CI), 0.96–0.98]). This was accompanied by lower risk for PCCRC-related death (HR, 0.95 [95% CI, 0.92–0.99]). Specifically, the risk of PCCRC was lower when the ADR of the physician was above the median rate of 28.3% (versus the risk when the physician’s rate was below the median value): 1.79 (versus 3.10) cases per 10,000 person-years; absolute difference in 7-year risk, −12.2 per 10,000 negative colonoscopies (95% CI, −10.3 to −13.4);
HR, 0.61 (95% CI, 0.52–0.73). Similarly, the risk for related deaths was lower: 0.05 (versus 0.22) cases per 10,000 person-years; absolute difference in 7-year risk, −1.2 per 10,000 negative colonoscopies (95%, CI, −0.80 to −1.69); HR, 0.26 (95% CI, 0.11–0.65).

Overall, these results support prior studies\textsuperscript{2-4} indicating that higher adenoma detection rate is inversely related to lower risk of post colonoscopy colorectal cancer. Furthermore, based on the results of this study, the authors propose ongoing discussion regarding changes in minimum quality benchmarks for ADRs for all physicians beyond what is currently recommended in the guidelines, including a discussion of setting aspiration ADR targets, beyond the minimum proposed numbers.

**Discussion**

MN administered a pre-discussion poll, specifically asking the following: “ADR, the single most important measure of colonoscopy quality, has been validated as a predictor of PCCRC. Recent data suggest that the average ADR has increased over time beyond current minimum standards. How far should we move our goal post when it comes to minimum ADR thresholds? In response to this question, 39% of the respondents answered “35–40%,” 27.5% answered “it’s complicated,” 18% answered “40–45%,” and 16% answered “45–50%.”

@\texttt{TheAKSdog}: It has to be adjusted for demographics to some degree. We also need to realize not all “screens” go down as “screens” and some diagnostics go down as screens. It should all balance out but not if there are major shifts.
@ravishnkr03: Interesting study with several important learning points. The JAMA article appears to be an extension of their prior publication in NEJM in 2014 involving a similar cohort of patients between 1998 and 2010.

In JAMA, the authors included 735,396 patients who underwent 852,624 colonoscopies with negative findings by 383 physicians between 2011 and 2017. They reported 619 PCCRCs and 36 PCCRC-related deaths during a 3.5-year follow-up. They concluded that higher ADR had lower risks for PCCRC/deaths.

In both studies, nearly half of the patients were FIT (fecal immunochemical test) cases. Current recommendations are ADR of 25% for asymptomatic average-risk individuals and a higher ADR for FIT-positive patients. It appears, in both studies, nearly 40% of endoscopists had an ADR of <25%!

Also, it appears low-ADR endoscopists from the first study continued to participate in the current JAMA study and might have added to the low-ADR group and PCCRC/death.

Low ADR and PCCRC are still issues at most places and need action. Had quality improvement measures been implemented after the first study, could some of these PCCRCs have been avoided? How could we enable gastroenterologists to rapidly acquire cognitive and technical skills to recognize polyps/flats?

**MN: Q1. This study adds to data that high ADRs are associated with decreasing PCCRC. Is this data convincing enough to change our benchmarks?**
RK: Getting straight to the big—but maybe easy(?)—question! I think it is very difficult to stay with the current benchmarks based on this study and the other available data. The question is “what's the ideal ADR?” It is definitely not 25%.

MN: Based on the poll, many felt like we needed to move to the 35–40% range. What was/is your vote?

RK: While we wait for @AasmaShaukatMD, my “vote” is in print in the @AmerGastroAssn CPU we wrote with Audrey Calderwood and @seth_crockett. We went with 30% minimum, 35% aspirational. Though the data in this study gets very confusing around that 30–35% mark.

@AllonKahn: Only had a chance to quickly review: what, in particular, gets confusing?

RK: The authors note that colonoscopies by endoscopists with high ADRs are more recent and there is shorter follow-up with less PCCRC. So, the confidence intervals become very wide with high ADRs and the rates visually go up.¹

AS: In my opinion, what is confusing is the lack of clarity above a threshold. Kaminski et al.³ showed a threshold of 19.5%. Corley et al.² showed 33.5%. We reported 26.5% and higher.⁶ Guidelines say 25%.⁷

@SultanMahmoodMD: Tying ADR with clinical outcomes is the best way to convince change! 35–40% seems like a reasonable target based on this study and others.
RK: Agree in concept, @SultanMahmoodMD, but there is the risk of diminishing returns as we aim for ADRs like 40+, which do not have amazing data to support them (versus 35%) if it results in longer withdrawal times. Better to screen two additional patients a day? Personally, [I think] aim for more is better, but…

@SultanMahmoodMD: Makes sense.

@ChrisAndersonM4: Where does SSL (sessile serrated lesion) detection rate (SSLDR) fit into the picture?

RK: Almost all data suggest that SSL detection rates parallel ADRs. So, ADR is a reasonable metric to focus on, as high adenoma detectors are generally high SSL detectors. In NM (Northwestern Medicine) data, they correlated really well—but this has been shown so much, we didn’t publish it!
MN: Q2. Higher ADRs in this study were not associated with decreasing PCCRC. Is there a cutoff beyond which increasing ADR leads to diminished returns?

RK: The question here—and I rely on the smarter people you tagged—is if that’s a physiologic reality or methodologic issue. I *think* that higher ADRs will be more beneficial. The authors talked about why the data after 35% is noisy in the discussion.

MN: The authors suggested that random chance, fewer person years follow-up, and follow-up time may have impacted this association.
RK: I posted this in a reply to @AllonKahn, but this figure [in reference to figure 2]—when you want to use it for talks—is confusing because the PCCRC rate goes *visually* up at some point. For the reasons @MN_GIMD and the authors said (I hope!).

AS: There seems to be some dose-response relationship, but in my opinion, most data point to a threshold above which incremental gains are extremely small or nonsignificant.

The idea of benchmarks is to find minimum thresholds to help everyone achieve and exceed. The good news is that PCCRCs are rare. In all the studies, including ours, the relative change in PCCRC above a threshold is so small that on an absolute number, it’s probably not meaningful for most endoscopists.

@AsadurRahman87: Another consideration could be the time interval where this data come from (2011–2017). With every passing year focusing on ADR and SSL-DR as endoscopy metrics, maybe the temporal benefit of the aspirational detectors has not been seen yet; thus, the wider confidence intervals.

@SultanMahmoodMD: That is a great question. I always assumed that at some point we will just be finding diminutive polyps which might not have a great effect in clinical outcomes. Makes me think about the artificial intelligence (AI) studies that show improvement beyond 40–50%.
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**RK:** It’s an existential question of AI (okay, probably not), if it is “worth it” for people with ADRs of 40% already. But, importantly, AI is effective in people with pretty low ADRs, which is really what we care about the most.

**@BilalMohammadMD:** Yes, that’s really where AI is helpful.

**@GI_Pearls:** @tberzin changed my mind on AI—mainly for combating fatigue, not really adding incremental gains in ADR. The main issue now is cost. It’s way too expensive at the moment.

**@NMansourMD:** Agree. AI needs to do more to justify current costs, but as with other newer technologies, I think costs (for CADe [computer-aided detection] at least) will come down relatively soon. There will be increasing competition in the space, and I know of at least one open-source CADe platform (in Europe).

**@BilalMohammadMD:** Great point @MN_GIMD. I think the issue is [whether] ADR beyond a certain point helps or not, we know that a “low” ADR is associated with increased CRC (colorectal cancer), the ADR 25% benchmark is low based on current studies, and [there is] no harm with an even higher ADR; plus, ADR is an easier metric to track.

AS: Totally Agree. Check point of finishing returns and adding burden of bringing people sooner.
RK: I agree to a point, @BilalMohammadMD, but remember that if we are converting more and more people to “surveillance” based on increasing an ADR from 35 to 50+%, most people still bring them back in 7 (or 5!) years: [it brings] more cost to the system and reduces the value of screening colonoscopy.

@BilalMohammadMD: Great point, @RKeswaniMD.

@BilalMohammadMD: In clinical practice, measuring “1 cm” or greater is variable because it’s operator dependent and the adenoma miss rate (AMR), etc., can’t be tracked in practice settings (outside of studies and trials).

@umair_min: @SultanMahmoodMD @RKeswaniMD do you guys think that eventually we will give people a 15 year follow up when it comes to a negative average risk screening index colonoscopy in a physician with high ADR?

RK: I think we could (and probably should) do something like this in the high detector. But the incentives to do colonoscopy and the fear of missed lesion have made it hard to de-intensify.

@SultanMahmood: Great question. We should be focusing on getting everybody on the same level. Although this would make sense.
@ernrobalino: Is there a role for measuring ADR in senior fellows, so that increased teaching can be provided for those with lower rates?

RK: At @NMGastro, we’ve studied trainee AMR (and “SMR” [serrated polyp miss rate]) using a modified tandem colonoscopy (right colon only) method—miss rate goes down with training. It’s easy to do in practice. Just have the trainee withdraw and you do it also. Teaches them a lot about subtle lesions.

### Miss Rate Decreases as Training Progresses

![Graph showing decrease in miss rate as training progresses](image)

*Siegel A, et al.; Keswani RN, DDW, 2021*

@BilalMohammmdMD: Yes, that’s exactly what I do, but the challenge is to make it a universal practice.

@SultanMahmoodMD: Should be a part of #gifellows training. We were doing this manually in our fellowship program every 6 months.
@Samir_Grover: I agree that fellows should collect their own data, such as ADR.

That said, underperformance is complex. The benefit of being in training is that underperformance can be identified/managed with individualized schema, as opposed to practice where the ADR may be the only assessment that takes place.

RK: And @Samir_Grover knows, greater detectors are not necessarily great resectors, or great clinicians, etc. We need to do a better job of assessing and coaching people in practice in a wider array of skills. We love video coaching as an opportunity to give feedback/improve.

@BilalMohammadMD: Yes, but how do you know if it’s the fellow’s ADR versus the attending pointing towards a polyp they didn’t see initially and then resected?

@SultanMahmoodMD: You don’t. That was the downside, and probably the only way to do that would be to do what @RKeswaniMD mentioned. Repeat the exam again.

MN: This seems like a tough ask given the struggle for time and push to be more productive while trying to safeguard trainee education and time on the scope.

RK: @MN_GIMD, I agree, I generally just do it for 1–2 procedures out of a block unless it’s for the research study. There are constantly competing demands on efficiency and teaching, as you know!
AS: Agree!! How to quantify/qualify adequate poly resection is a whole other bowl of wax.

- Incomplete resection rate has been proposed but is fraught with difficulty.
- A measurable metric might be referral to surgery for nonmalignant polyps.
- More to come in conjunction with CMS (Centers for Medicare & Medicaid Services).

@BilalMohammadMD: Yes, it’s very important to emphasize this in training. Although personally I am still trying to figure out how to do it for fellows in a practically possible way.

@ijlalakbar: We ask fellows to keep track of their ADRs themselves. Not perfect but a good habit-forming thing to do and it gives them something to focus on.

@AllonKahn: The trick is that adenoma detection is actually a function of the *team*. I definitely have techs/RN’s who are super detectors. We openly encourage them to speak up when they see a polyp. Now add a fellow/attending in the same room. The meaning of the ADR there is unknown.

AS: Agree!! It’s still a measure of the individual endoscopist. So, you get the fun job of being “captain of the ship” and having eventual responsibility for your team!!
MN: I have a saying! We follow the TSA (Transportation Security Administration) rules in my room, “if you see something, say something,” and I especially make it a point to tell everyone new/training in my room.

@AllonKahn: Can I…still leave my shoes on?

MN: Given my love of water-based insertion for colonoscope, I highly recommend you wear shoes. Just kidding, no waterfalls or rivers happening.

@AllonKahn: I’ve learned to wear shoe covers 100% of the time—first time I had a “spill” on my shoe as a fellow, my tech slapped me on the back and said, “now you’re a GI (gastrointestinal) doc!” I got new shoes.

AS: Water exchange is definitely evidence based!!
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@ernrobalino: That’s great; in fact, my next question was are there any promising tools/programs that can be used in conjunction with our EMR (endoscopic mucosal resection) systems to calculate ADRs in an efficient manner?

MN: Q3. Sub-analysis showed high proximal ADRs were not significantly associated with lower risk of proximal PCCRC. This was partly attributed to classifying SSAs (sessile serrated adenomas) as adenomas. Is this the correct approach or should there be a quality indicator for serrated polyps?

Is it too much to propose that lesions identified as HP (hyperplastic) in the right colon are reviewed by GI pathology until there is standard and consistent assessment/identification of these lesions?

RK: A big part of this will also be pathologist misclassification of these as HP polyps. So, are we getting a true assessment of “proximal ADR” in this study (beyond the issue that SSLs are classified as ADR in the study)? The second issue is the biology of proximal lesions.

@AllonKahn: That is a big issue—I have been told by more than one GI pathologist that proximal HPs should not necessarily be regarded as the same as distal ones for the reason you mentioned. I have learned to always heed their warnings.
MN. Q4. Efficient measurement of ADRs is challenging. Should all colonoscopies regardless of indication be used to calculate ADR? Can this artificially inflate the ADR and lead to missing low performers

RK: First, I challenge in this day of us flying rocket ships to space, measuring screening colonoscopy ADR should not be challenging. It’s “easy”—just not prioritized. @NMGastro, we’ve been doing it reliably for years using basic analytics & NLP (natural language processing). Beyond that, EHRs (electronic health records) have solutions!

But—to answer your question—I am still a bit wary about using all indications to calculate ADR even though my friends Tonya Kaltenbach & Andrew Gawron showed in the VA (Veteran’s Affairs) that it’s pretty good. While in general they correlate, I think it can be noisy for some people.

MN: What do you think is the barrier? Cost, time, or both? And if insurance companies or hospitals started incentives for high ADRs, will it all of a sudden become “easy”?

RK: I think that, in part, it’s that we have a very fragmented I system. But—for those using Epic—there will be an easy solution to calculate ADR if you go “all in” on Epic (pathology and endoscopic report writing). For those on Provation, there is a nice solution as well.
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@AllonKahn: So true, the process is so past due for wide-scale automation. It’s incredible to see the advances we’re making everywhere in endoscopy only to have a person manually tabulating ADR.

@ChrisAndersonM4: I think including all indications makes sense. I can see how the indication can be “manipulated” if ADR is being tracked, but including all colonoscopies would address this issue. Also, should ADR include SSLDR too or should they be tracked separately?

@BilalMohammadMD: While this is efficient, I worry that it may falsely reassure people that their/institutional ADR is good, especially for those with ADRs around 25%, when “all” indications are included. So, I am still a fan of the textbook ADR calculation.

@AllonKahn: I totally agree, Bilal. At the very least it would require a significant recalibration of our thresholds for adequacy, as we would be intentionally enriching the population for neoplasia.

AS: Great question! Yes, mixing indications will increase ADR but it is also simpler to do so. In my opinion, different information [is obtained] with how it is measured:

- Using all indications helps look at PCCRC risk and compares ADR of providers with similar mixes of indication. Use to compare within.

- But for apples-to-apples comparison, must restrict to screening indication only and compare against a benchmark.
Further separate by sex of patient, especially if provider has predominately female or male patients.

Robust data now on ADR for FIT+.

@SanjeevaniTomar: Which intervention (device or practice) in your opinion/experience leads to an increase in ADR in a low performer?

RK: This is such an important question and so many things that help improved ADR just a couple of percent—except AI and preps, which may be more impactful. Report cards, coaching, split dose, AI, among others... What does #GItwitter think?

@SultanMahmoodMD: I think just knowing your ADR would be the best way to improve it. Increasing withdrawal time, using assistive devices, and of course AI.

@AllonKahn: I agree, Sultan. It has been impressive to see studies show the impact of knowing that one is being observed/tracked. We are an inherently prideful bunch and this taps into that innate desire for high achievement.

@umair_min: I think a second look in the right colon is very important. Tracking withdrawals is also important. In our practice, we have set the withdrawal time to 8 minutes. What’s your take on cecal retroflexion?
AS: Forgot to discuss measuring WT (withdrawal time) @AAsmaShaukatMD would be horrified! Measure WT is great! If low, its actionable. But if high, can still have low-wish ADR. I largely abandoned routine cecal retroflexion for a good forward view second look. But its critical skill for right colon EMR.

@TheAKSdog: I retroflex sometimes especially, but it is kind of dependent on the anatomy of the cecum and if there is a clear unseen area, usually behind the valve. ADR is a better marker compared to anything else, and data back that. I think mainly it challenges us to do whatever we need to do.

@ChrisAndersonM4: Spending extra time in the right colon makes a big difference.

AS: Report cards and measure and feedback are most important.

- Each intervention increases ADR by 6–10%.
- Time and persistence are key.
- See our recent ASGE practice guideline⁹

To improve ADR, I think, technique technology or education intervention, or a combination.

- Try low-effort low-cost things first, such as enhanced withdrawal technique, water exchange, routine 2nd look.
- Distal attachment devices, especially Endo if next.
- AI and educational intervention.

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MN: Q5. Is ADR alone a sufficient marker of colonoscopy quality? Do we need to go beyond this to include other quality indicators such as APC, APP, and ADR+ to better differentiate low versus high performers?

My question reminds me of a certain rap song: APP, adenoma per positive patient; APC, adenomas per colonoscopy; ADR+, mean number of incremental adenomas after the first.

RK: @MN_GiMD: Q4 and Q5 are like polar opposites. ADR is hard, let’s make it harder! But kidding aside, I think that we can shift to these fancier metrics (which do help differentiate quality better—and perhaps at lower procedure volumes) once analytics catches up.

@SultanMahmoodMD: Oh yeah! Quality of resection (often overlooked) is probably the most important marker after detection.

RK: Note how many low-volume colonoscopists were excluded because ADR doesn’t work for them. Nearly 400,000 colonoscopies by low-volume colonoscopists! Ton of people getting colonoscopy from possibly low-quality colonoscopists we can’t assess. Will the metrics you propose help? Unclear.

AS: Would be lovely to have additional indicators that provide information beyond ADR, but the caveat is that it is hard to calculate.

- In the future, we will likely have tools to automate measurement, which will make it easier.
• Payers will expect it, especially if ADR tops out, so it is important to develop.

@SanjeevaniTomar: Data suggest certain endoscopist characteristics (such as younger age) can impact ADR. Beyond the number of colonoscopies, the study failed to provide any additional info about the endoscopists or if they used any devices (cap assisted). Could this lack of info have impacted ADRs?

RK: Those data are very important, but they speak more to why the ADR is low rather than the impact of a low ADR. Both important questions but “why” is not addressed here; if you know why, you can sometimes fix it!

MN: Q6. Incomplete polypectomies contribute to interval CRCs after colonoscopy. ADR is an inadequate surrogate marker of the quality of a polypectomy that has been performed. Is there a role for AI to assist in real life to provide real-time feedback on polypectomy completeness?

RK: It’s a great question, @MN_GIMD, but I think that’s a challenging role for AI. I think we need to rely on “old-fashioned” coaching and teaching to ensure those in practice can remove polyps effectively and safely. Didactics, video coaching, and hands-on. Do others disagree?

@ChrisAndersonM4: Marking the borders seems to be a promising technique!

@AllonKahn: I completely agree, @RKeswaniMD, at least for now. Need to provide teaching (and time!) so we move away from eyeballing polypectomy sites from afar and saying “eh, looks
good enough.” As I tell our fellows often, you do the patient no favors by removing 97% of a polyp.

**RK:** But it’s a kind thing to do for the polyp. Polyps have feelings too?

**@BilalMohammadMD:** Yes, @AllonKahn, I love the “97%” comment.

**@SultanMahmoodMD:** Interesting question, not sure AI is in a place now to provide real-time data on completeness of resection.

**RK:** To ensure complete resection of a complex polyp, we examine the edges meticulously, sometimes with near focus. I guess AI can tell you that you did a bad job of looking at polypectomy site, but it can’t assess what you don’t show it!

**@BabuPMohan2:** Interesting question. Thanks for the tag. As with everything in AI, it all depends on the training data. My guess: it will be a highly biased algorithm with very high prediction for incomplete resection or very low depending on how its trained. Practice uptake would be low.

**@jglissenbrown:** @BabuPMohan2 is right that with the right training data, this is a valid use case. Much like you can train a model to predict depth of invasion in CRC e.g., 10, it would be feasible to train a model to predict completeness/incompleteness of the resection bed.
@BilalMohammadMD: I always tell our fellows: the best resectors may not be the best detectors and vice versa :) 

AS: AI has potential and improves ADR. But…

- No data (yet) linking it to improved outcomes.
- Expensive.
- Assists endoscopist but doesn’t replace good technique.

@NMansourMD: Sorry a bit late to the party here. Current CADe systems probably cannot reliably do this as shown in this small study\(^1\).

Maybe AI can help with this in the future, but as others said, good old-fashioned careful inspection is key for now.

@jglissenbrown: Important to note here, though, that this is using an “out-of-the-box” commercial technology (CAD-Eye, the @FujifilmX_US product with no supplemental training on polypectomy sites.

MN: That’s all folks!

Thank you @GiJournal for inviting me!

Thank you @ernrobalino & @SanjeevaniTomar: you both rock!

Thank you @AasmaShaukatMD & @RKeswaniMD for their continued research in this area and their input on the study.

Thank you #GITwitter family for hanging with us on a holiday weekend!

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Discussion Summary

@AllonKahn: Great chat team. Really enjoyed all of the commentary and pointers!

@SanjeevaniTomar: Thank you for joining us! Happy 4th!

Conclusion

Schottinger et al.\(^1\) concluded that patients who underwent colonoscopies performed by physicians with a higher ADR were at a lower risk of PCCRC. Based on this study and other available data, the study authors propose ongoing discussion regarding changes in minimum quality benchmarks for ADRs for all physicians beyond what is currently recommended in the guidelines, including a discussion of setting aspiration ADR targets beyond the minimum proposed numbers. Several methods and interventions have been identified in the literature that help improve ADR including water assisted colonoscopy, increasing withdrawal time, retroflexion in cecum, routine second look, technology based aspects (distal attachment devices, AI, etc.), education (report cards, didactics, video coaching, hands-on, etc.), and other various strategies (split-dose bowel preparation, same-day bowel preparation, or video recording of colonoscopy).

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