Colorectal Cancer Screening in the Elderly

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KEY POINTS

- Colorectal cancer (CRC) is common, and incidence increases with age. However, routine screening guidelines recommend careful consideration of individual patient factors when determining appropriateness of CRC screening after age 75 years.
- With increasing age and comorbidities, the long-term benefits of CRC screening begin to diminish, and the risk of adverse events increases.
- Engaging elderly patients in an open dialogue about the pros and cons of ongoing CRC screening, overall functional status, and their health priorities is essential in order to ensure screening in this age group is done only on appropriate patients.

INTRODUCTION

It is widely accepted that cancer screening tests should be done in appropriate patient populations, as the benefits of screening and the resultant cancer prevention and early detection are great, and the risks of screening are generally low. Colorectal cancer (CRC) is very common, and the incidence increases with age. The downstream preventative benefit of CRC screening follows a decade or more after the chosen screening test is performed, whereas the risks of the screening test occur at the time of testing. Therefore, as individuals age and grow closer to end of life, eventually the risk-to-benefit ratio of ongoing CRC screening can no longer be justified. Understanding this as clinicians and conveying this to patients in a logical yet sensitive manner can be challenging. Clinical guidelines do provide some direction, with most suggesting discontinuation of screening once a certain age is reached or life expectancy becomes less than a specific threshold. However, chronologic age is merely one factor to consider, as comorbid conditions impart substantial physiologic heterogeneity between individuals of the same numeric age. Predicting life expectancy and

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conveying this to patients is also problematic, and clinicians should seek to frame the conversation about ongoing cancer screening versus cessation of screening in a thoughtful and empathetic manner. Here the authors review pertinent data to consider when making recommendations to elderly patients about CRC screening.

EPIDEMIOLOGY

CRC is common and carries a high mortality rate, especially when diagnosed at late stage. It is the third most frequently diagnosed cancer in both men and women in the United States, and it is expected to account for more than 50,000 US cancer-related deaths in the year 2020.[1] The likelihood of being diagnosed with CRC increases with age. For example, for men aged 50 to 54 years CRC incidence is 67.9 per 100,000. However, for men aged 75 to 79 years CRC incidence jumps substantially to 226.6 per 100,000.[2]

COLORECTAL CANCER SCREENING GUIDELINES

The United States Preventative Services Task Force (USPSTF) recommends CRC screening for average risk individuals aged 50 to 75 years, citing a high certainty that this intervention provides overall net benefit to patients with minimal potential harms.[3] In order to be considered "average risk" there must be no personal history of colon polyps or CRC or family history of CRC in first-degree relatives. The USPSTF does not advocate for any specific CRC screening test, naming the lack of head-to-head studies demonstrating that any one test is superior to the others.[3] The United States Multi-Society Task Force (USMSTF), which represents the American College of Gastroenterology, the American Gastroenterological Association, and the American Society for Gastrointestinal Endoscopy, also recommends CRC screening in individuals aged 50 to 75 years, but in contrast to the USPSTF, the USMSTF has ranked the various CRC screening tests into 3 tiers based on performance features, costs, and practical considerations.[4]

When it comes to recommendations regarding cessation of screening, the data are less robust. The USPSTF states that the age at which the potential harms of CRC screening may begin to outweigh the benefits depends on multiple factors, including prior screening status, comorbid conditions, health status, and life expectancy.[3,5] Although there are no randomized control data, modeling studies have shown that few additional life years are gained relative to the increase in colonoscopy burden when CRC screening is extended beyond age 75 years in average-risk individuals with negative prior screening.[6] The USMSTF states that discontinuation of screening should be considered when patients who are up to date with screening and have had no prior positive screening tests reach age 75 years or when the life expectancy is less than 10 years; however, this is a weak recommendation with low quality of evidence.[4] For elderly individuals with no prior screening, microsimulation modeling suggests that one-time CRC screening may be cost-effective up to age 86 years.[7]

What about the elderly patient in whom there is already a history of prior colorectal neoplasia? There is little guidance on when to discontinue CRC surveillance for these patients. Given that individuals with a history of adenomas, especially high-risk adenomas, are at higher risk for developing CRC, the potential benefit for surveillance in elderly patients with a history of neoplasia likely exceeds the benefits for elderly patients engaged in average-risk screening. The USMSTF states that for individuals aged 75 to 85 years, this group may be more likely to benefit from surveillance depending on life-expectancy, and the decision to proceed with ongoing surveillance should be personalized.[8]

COLORECTAL CANCER SCREENING MODALITIES

A variety of tests are available for CRC screening (see **Table 1**[3,4]). The tests exist on a continuum of invasiveness and frequency, with stool-based tests occurring as frequently as annually on the noninvasive end of the spectrum, radiologic tests occurring every 5 years in the middle, and endoscopic tests with screening intervals as long as every 10 years on the invasive end of the spectrum. In short, the more invasive the test, the less frequent the screening is needed; the less invasive the test, the more frequent the screening interval. If a noncolonoscopy screening test is found to be positive, the patient is advised to have a follow-up colonoscopy to further evaluate the

Table 1			
Colorectal cancer screening modalities			
Screening Test	Testing Interval	Pros	Cons
Stool-based tests			
gFOBT	Every 1 y	• RCT data with mortality endpoints. • Does not require bowel preparation, anesthesia. • Test performed at home.	• Frequent testing interval. • Requires dietary modification in advance of testing. • Requires follow-up colonoscopy if positive. • Requires 3 specimens.
FIT	Every 1 y	• Improved accuracy compared with gFOBT. • Can be done with a single specimen. • Does not require bowel preparation, anesthesia. • Test performed at home.	• Frequent testing interval. • Requires follow-up colonoscopy if positive.
FIT-DNA	Every 3 y	• Higher sensitivity than FIT. • Can be done with a single specimen. • Does not require bowel preparation, anesthesia. • Test performed at home.	• Requires follow-up colonoscopy if positive. • Specificity is lower than FIT (resulting in higher rate of false positives and subsequent colonoscopies). • Insufficient evidence about appropriate long-term follow-up of abnormal test after a negative diagnostic colonoscopy.
Nonendoscopic direct-visualization tests			
CT colonography	Every 5 y	• Does not require sedation.	• Requires bowel preparation. • Requires follow-up colonoscopy if positive, which may not occur same day, thus necessitating bowel preparation twice.

Abbreviations: gFBOT, Guaiac fecal occult blood test; RCT, randomized controlled trial.

positive test. As mentioned earlier, the USPSTF does not give preference to any single test[3]; however, the USMSTF ranks colonoscopy every 10 years and fecal immunochemical testing (FIT) annually as the preferred tier 1 tests.[4]

Colonoscopy has several advantages over the other screening modalities, which include the capability to both diagnose and remove premalignant lesions at the time of the examination, making it both diagnostic and therapeutic, as well as the long allowable interval between negative screening examinations, and the ability to detect both cancerous and a variety of premalignant lesions other than CRC.[4] However, colonoscopy does require the patient to undertake a bowel preparation, is substantially more invasive, and carries more procedure and sedation-related risks than nonendoscopic screening tests. It is important to point out that no randomized controlled trials for colonoscopy have been completed; however, multiple cohort studies, most notably the National Polyp Study, demonstrate reduction in CRC incidence and mortality due to colonoscopy and polypectomy.[9–11] For patients who value the highest-sensitivity screening modality and are willing to undergo an invasive test, colonoscopy is a reasonable choice.[4]

For individuals who prefer a noninvasive test that does not require bowel preparation or a procedure with sedation, FIT is a high-performing low-cost option. According to a meta-analysis, FIT has a one-time sensitivity for cancer of 79% and sensitivity for advanced adenomas of approximately 30%.[12] It is low cost (approximately $20).[4] Drawbacks include the need to repeat the test annually, the need to ensure that positive tests are followed-up with a diagnostic colonoscopy, and low sensitivity for serrated colonic lesions.[4] It is worth mentioning that serrated lesions typically exist in the proximal colon and are more difficult to detect endoscopically compared with adenomatous lesions. The prevalence of serrated lesions does increase with age: one study found a prevalence of serrated lesions to be 10% in patients aged 20 to 29 years (identified during examination not performed for CRC screening) and 16.4% in those older than 70 years.[13] In the elderly, cytologic dysplasia and molecular alterations are more frequently detected in serrated lesions compared with serrated lesions in younger patients.[14] So although FIT may be a good choice for elderly patients who prefer less invasive CRC screening tests, the limitations of the test in the elderly must be kept in mind.

A multitude of other screening tests exist and are delineated in more detail in **Table 1**.

COLORECTAL CANCER SCREENING IN THE ELDERLY
Defining the Elderly

In 2010, more than 40 million people in the United States were older than 65 years, and 5.5 million people were older than 85 years. The older-than-85-years group is a fast-growing segment of the population, and by the year 2030 20% of the US population is expected to be older than 65 years.[15] Historically, "elderly" has been defined as older than 65 years and "very elderly" is often defined as older than 75 years. However, there are significant limitations in defining elderly by chronologic age only. Among patients of the same chronologic age, but with different comorbidities and functional status, there exists considerable physiologic heterogeneity.[16]

Measuring Risk-to-Benefit of Screening in the Elderly

A key principle of cancer screening is that the benefits of screening ought to outweigh the risks. Therefore, it is important to be able to measure the risks and benefits in a given group to help determine if the test is warranted. Investigators have sought to

objectively measure the risk-to-benefit ratio of CRC screening in the elderly. To examine risk difference of screening individuals in their early 70s compared with those in their late 70s, one group looked prospectively at more than 1.3 million Medicare beneficiaries aged 70 to 79 years. All patients included in this study had not undergone any CRC screening in the 5 years before inclusion in the study. Individuals were followed-up for more than 8 years to determine the 8-year risk of CRC in those who did and did not undergo CRC screening. In individuals aged 70 to 74 years, the 8-year risk for CRC was 2.19% in the group that did undergo screening colonoscopy group and 2.62% in the group that did not undergo screening, giving an absolute risk difference of −0.42%. Among those aged 75 to 79 years, the 8-year risk for CRC was 2.84% in the screening colonoscopy group and 2.97% in the no-screening group, with an absolute risk difference of −0.14%[17]; this demonstrates that as individuals progress through their 70s, the relative benefit of screening colonoscopy decreases.

In a cross-sectional study of 1244 patients undergoing screening colonoscopy at a single academic center, investigators sought to estimate the number of life years saved by undergoing screening colonoscopy, stratified by age group. Despite higher prevalence of adenomatous colon polyps in elderly patients (28.6% in the patients older than 80 years vs 13.8% in the 50- to 54-year-old group and 26.5% in the 75- to 79-year-old group), mean extension in life expectancy was much lower in the group aged 80 years or older compared with the 50- to 54-year-old group (0.13 years vs 0.85 years). Stated differently, even though prevalence of precancerous colon polyps increases with age, screening colonoscopy in those aged 80 years or older results in only 15% of the expected gain in life expectancy of younger patients[18] because of the long lag time between the detection of an adenomatous polyp and the time at which this precancerous polyp would be expected to turn into CRC. In very elderly patients, death may occur due to other comorbidities before the development of an adenomatous polyp into a frank cancer.

Inherent to the discussion of whether or not to proceed with screening is the decision of which test to choose. Some elderly patients may not be willing to undergo colonoscopy as a screening test, but they would be amenable to noninvasive stool−based screening tests. However, it is important to recognize the potential drawbacks of stool-based testing. In addition to poor sensitivity for serrated lesions,[4] there is also a risk of false-positive results with stool-based tests, which would prompt a recommendation for colonoscopy. Physicians and patients should discuss this possibility before proceeding with fecal occult blood testing or FIT,[19] to ensure that the patient would be willing to continue with a colonoscopy, should a positive result be found.

Tools to Estimate Life Expectancy

Because the benefit of screening diminishes with decreasing life expectancy, being able to estimate life expectancy is valuable in guiding the decision of whether or not to continue screening. There are existing tools to help clinicians understand probable life expectancy so that they may apply this information to the shared decision-making process.

Gait speed has been shown to correlate well with life expectancy. A gait speed of 0.8 m/s is associated with median life expectancy; as gait speed increases or decreases, life expectancy is longer or shorter, respectively (**Fig. 1**).[20]

In addition, prognostic calculators have been created and validated to estimate 9- to 10-year life expectancy in older adults. Such models take into account age, gender, comorbid conditions, and functional measures.[21,22] These and other prognostic calculators are available online at www.eprognosis.org.[23]
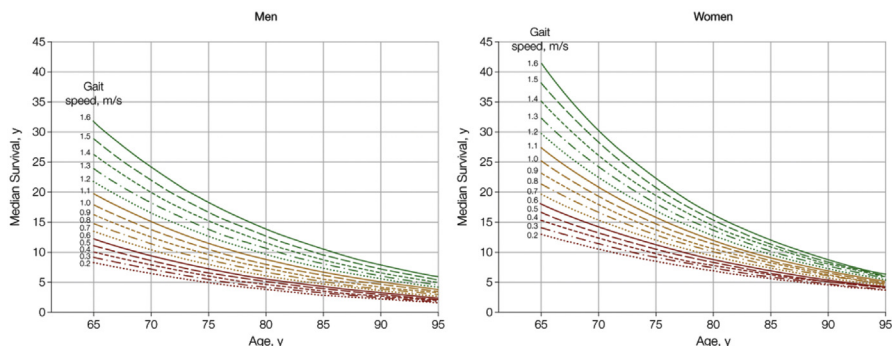
Fig. 1. Gait speed and median survival in older adults. (*From* Studenski S, Perera S, Patel K, et al. Gait speed and survival in older adults. JAMA. 2011;305(1):50–8; with permission.)

Overscreening

Despite recommendations to discontinue CRC screening in adults with less than 10 years life expectancy, many adults in this category report ongoing screening. A study from 2010 found that 51% of adults older than 75 years with life expectancies under 10 years still reported undergoing CRC screening.[24] Finding and removing premalignant lesions in this patient population is unlikely to improve quality of life or length of life. In some patients, depending on the number and severity of their comorbidities, even identifying a cancer may not alter the course of their medical treatments and clinical progression. If they are deemed too functionally debilitated to undergo treatment of the found cancer, identification of CRC does not alter their overall medical management. In fact, autopsy studies have shown that 2% to 3% of older adults have undiagnosed CRC at time of death, and 10% to 33% have colon polyps at time of death.[25] However, subjecting this population to CRC screening does put them at risk for the potential complications related to the screening procedure itself.

COLONOSCOPY IN THE ELDERLY
Sedation

Most endoscopic procedures are performed using either conscious sedation with a combination of narcotics and benzodiazepines or monitored anesthesia care with propofol. Elderly patients receiving sedation have an increased response to sedatives, and awareness of this is essential to prevent adverse sedation–related events.[15] However, chronologic age alone is not the main determinant of sedation-related complications. Age-related comorbidities and rapid or excessive dosing of sedatives are the major contributors to sedation-related complications in this group.[26] Elderly patients should be given fewer agents at a slower rate with lower initial and cumulative doses to avoid complications, such as respiratory depression, aspiration, and prolonged recovery periods.[15]

Bowel Preparation

Older patients, particularly those older than 80 years, are more likely to have inadequate bowel preparation and may have difficulty tolerating a large volume bowel preparation when undergoing colonoscopy.[15,27,28] When colonoscopy is pursued in this population, providers should strongly consider utilization of split-dose bowel preparations, which entails administering half of the preparation the evening before the

colonoscopy and administering half of the preparation several hours before the colonoscopy on the day of the procedure.[15] It is the opinion of these investigators that split-dose preparation improves both tolerability and effectiveness of bowel preparation in all age groups, including the elderly. As with all patients, careful assessment of comorbid conditions and chronic medications should be part of the preprocedure evaluation in elderly patients undergoing colonoscopy. Generally, balanced-electrolyte solutions are less likely to cause fluid and electrolyte shifts in this population, especially in those with comorbid renal or cardiac issues.[15,29] In addition, blood thinners, diabetic agents, and certain antihypertensives may need to be modified or temporarily suspended in advance of bowel preparation and colonoscopy. This requires good communication between primary care providers, endoscopists, and patients in order to avoid potentially dangerous medication errors in the periprocedure period.

Procedural Considerations

In addition to issues with sedation and bowel preparation, there are specific procedural considerations to be aware of in elderly patients. In a study of 180 patients, endoscopists reported that colonoscopy was more technically difficult and time to cecal intubation was longer in patients aged 61 to 75 years compared with younger patients.[30]

It is important to understand adverse events related to colonoscopy in the elderly. In a random sample of more than 50,000 Medicare beneficiaries aged 66 to 95 years who underwent colonoscopy, adverse events were measured. Adverse events after outpatient colonoscopy increased with older age, if a polypectomy was performed, and with certain comorbid conditions, such as stroke, chronic obstructive pulmonary disease, atrial fibrillation, or congestive heart failure, all of which are more prevalent in the elderly.[31] Looking prospectively at more than 1.3 million Medicare beneficiaries aged 70 to 79 years, the excess 30-day risk for any adverse event in patients undergoing colonoscopy was 5.6 events per 1000 individuals in the 70 to 74 years age group and approximately double this at 10.3 per 1000 individuals in the 75 to 79 years age group.[17]

SHARED DECISION-MAKING IN THE ELDERLY

Once armed with information about options for screening and evidence concerning relative risks and benefits of screening based on age, comorbidities, and life-expectancy as reviewed earlier, clinicians should seek to engage in a shared decision-making process and have a collaborative, honest, open conversation with their elderly patients. It is important to begin this dialogue with an assessment of patient perceptions of CRC screening. Many patients are more likely to overestimate the benefits of screening and underestimate the harms of screening.[32] An interview study of 116 adults aged 70 years or older living in retirement communities showed that although 81% of participants believed that they would die of some disease other than cancer, only 13% thought that they would not live long enough to benefit from cancer screening tests.[33] This highlights a thought-provoking paradox in elderly patients' perceptions of the risks and benefits of cancer screening. Before exploring a patient's specific situation and making a firm recommendation about screening to that patient, it is prudent for the clinician to provide them with general information about the logistics and risks of screening.

The conversation of cessation of screening can be a delicate conversation for clinicians to approach. On what should the clinician focus? Should a patient's predicted

life expectancy be directly discussed? Some clinicians may feel insensitive speaking about this in a pragmatic manner, which may lead them to avoid discussing the topic entirely, which could result in ongoing screening, even when not in the best interest of the patient. Avoiding the conversation is more likely to result in continuing CRC screening, as many older adults report that stopping screening is an active decision to be made but continuing screening is not.[34] However, elderly patients do want to discuss this topic, and there is consensus among both patients and clinicians that these are important conversations to have.[35] In one interview study, although most participants had not discussed the possibility of stopping cancer screening with their physicians, when prompted, 84% said they wanted to have these discussions.[33] In another study of 40 community dwelling adults older than 65 years who participated in semistructured interviews, participants were amenable to stopping cancer screening, especially in the context of a trusting relationship with their clinician.[36] However, in multiple studies, elderly individuals seem to be divided on whether life expectancy should be mentioned as part of the cessation of cancer screening conversation,[33,35] with 48% of patients older than 70 years preferring to not discuss life expectancy as an element in deciding about ongoing cancer screening.[33]

Some investigators recommend framing the discussion around age, health status, and helping people live longer, rather than making comments such as "you may not live long enough to benefit from this test."[36] Mentioning shifts in health priorities, and potentially avoiding an explicit discussion of life-expectancy, seems to be an acceptable communication strategy for both clinicians and older adults.[35] Overall, these interview-based studies are valuable and highlight the desire of patients to discuss screening, and cessation of screening, with their providers. They also underscore possible areas of misunderstanding that physicians can address with their elderly patients.

SUMMARY

The decision for elderly patients to continue with or forgo CRC screening is a complex and multifaceted clinical choice, which must involve an open and honest dialogue between clinicians and patients. After the age of 75 years, the risk to benefit ratio of CRC screening varies depending on prior screening status, comorbidities, predicted life expectancy, and functional capacity.[4,17,18] Once life expectancy is less than 10 years, the benefits of ongoing screening do not justify the associated risks.[4] However, predicting life expectancy in an individual patient is difficult. Gait speed and other prognostic calculators can be used to aid clinicians in assessing predicted life expectancy,[20–22] and these can be useful factors to consider when assessing if ongoing screening is justified. Once armed with accurate information about the risks and benefits of screening, the pros and cons of the multitude of screening tests, and an understanding of an individual patient's predicted life expectancy, clinicians need to engage their elderly patients in a sensitive and empathetic conversation. It is incumbent on the clinician to breach this conversation and explore patient understanding, priorities, and values as it relates to screening tests. Evidence shows that patients do want to discuss this with their doctors but may not open the conversation themselves,[33,35] further highlighting clinician responsibility for beginning this dialogue. Understanding elderly patients' hesitation to directly address life expectancy in this conversation is important. Elderly patients are split as to whether they prefer to explicitly talk about life expectancy[33,35]; therefore, focusing the conversation on patient values and health care priorities can avoid upsetting patients while still allowing them to explore the complexities of this topic with a trusted clinician.[35,36]

Engaging elderly patients in this discussion allows them the opportunity to obtain accurate information about the benefits of screening and can help dispel misconceptions about the relative risks and benefits, as many patients tend to overestimate the benefits and underestimate the risks of screening.[32,33] Furthermore, because many older adults view the decision to stop screening as an active choice and to continue screening as the default,[34] open discussion may empower patients to stop undergoing screening if that is their preference. Avoiding the conversation in this unique population could result in ongoing screening, even if not appropriate, which exposes the patients to unnecessary risk and potential harm. As the number of elderly patients continues to increase, the importance of appropriate utilization of screening tests in the elderly will become a commonly encountered clinical scenario that all clinicians will be engaging in regularly. Accurate information and empathetic shared decision-making are essential tools for clinicians and patients to successfully navigate these challenging topics.

CLINICS CARE POINTS

- Elderly patients tend to overestimate the benefits of cancer screening and underestimate the risks.
- Many elderly patients feel that the 'default' decision is to continue CRC screening, while cessation of screening requires an active decision.
- Patients want to discuss ongoing cancer screening and possible cessation of screening with their physician; however, many will not initiate this conversation. It is the responsibility of the clinician to breach this topic with patients.
- Patients have mixed preference regarding direct discussion of life expectancy as part of the CRC screening conversation. Focusing on functional status, overall health, health priorities, and quality of life is an acceptable method for framing this conversation.

DISCLOSURE

The authors have nothing to disclose.

REFERENCES

1. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2020. CA Cancer J Clin 2020; 70(1):7–30.
2. Data: SRD—AT. Surveillance, Epidemiology, and End Results (SEER) Program (www.seer.cancer.gov) Research Data (1975-2016), National Cancer Institute, DCCPS, Surveillance Research Program, released April 2019, based on the November 2018 submission. 2019. Accessed.
3. Bibbins-Domingo K, Grossman DC, Curry SJ, et al. Screening for colorectal cancer: US preventive Services Task Force recommendation statement. JAMA 2016; 315(23):2564–75.
4. Rex DK, Boland CR, Dominitz JA, et al. Colorectal cancer screening: recommendations for physicians and patients from the U.S. Multi-society Task Force on colorectal cancer. Am J Gastroenterol 2017;112(7):1016–30.
5. Lansdorp-Vogelaar I, Gulati R, Mariotto AB, et al. Personalizing age of cancer screening cessation based on comorbid conditions: model estimates of harms and benefits. Ann Intern Med 2014;161(2):104–12.

6. Knudsen AB, Zauber AG, Rutter CM, et al. Estimation of benefits, burden, and harms of colorectal cancer screening strategies: modeling study for the US preventive Services Task Force. JAMA 2016;315(23):2595–609.
7. van Hees F, Habbema JD, Meester RG, et al. Should colorectal cancer screening be considered in elderly persons without previous screening? A cost-effectiveness analysis. Ann Intern Med 2014;160(11):750–9.
8. Lieberman DA, Rex DK, Winawer SJ, et al. Guidelines for colonoscopy surveillance after screening and polypectomy: a consensus update by the US Multi-Society Task Force on Colorectal Cancer. Gastroenterology 2012;143(3):844–57.
9. O'Brien MJ, Winawer SJ, Zauber AG, et al. The National Polyp Study. Patient and polyp characteristics associated with high-grade dysplasia in colorectal adenomas. Gastroenterology 1990;98(2):371–9.
10. Winawer SJ, Zauber AG, Ho MN, et al. Prevention of colorectal cancer by colonoscopic polypectomy. The National Polyp Study Workgroup. N Engl J Med 1993; 329(27):1977–81.
11. Zauber AG, Winawer SJ, O'Brien MJ, et al. Colonoscopic polypectomy and long-term prevention of colorectal-cancer deaths. N Engl J Med 2012;366(8):687–96.
12. Lee JK, Liles EG, Bent S, et al. Accuracy of fecal immunochemical tests for colorectal cancer: systematic review and meta-analysis. Ann Intern Med 2014; 160(3):171.
13. Kim HY, Kim SM, Seo JH, et al. Age-specific prevalence of serrated lesions and their subtypes by screening colonoscopy: a retrospective study. BMC Gastroenterol 2014;14:82.
14. Nosho K, Igarashi H, Ito M, et al. Clinicopathological and molecular characteristics of serrated lesions in Japanese elderly patients. Digestion 2015;91(1):57–63.
15. Chandrasekhara V, Early DS, Acosta RD, et al. Modifications in endoscopic practice for the elderly. Gastrointest Endosc 2013;78(1):1–7.
16. Sabharwal S, Wilson H, Reilly P, et al. Heterogeneity of the definition of elderly age in current orthopaedic research. Springerplus 2015;4:516.
17. Garcia-Albeniz X, Hsu J, Bretthauer M, et al. Effectiveness of screening colonoscopy to prevent colorectal cancer among Medicare beneficiaries aged 70 to 79 years: a prospective observational study. Ann Intern Med 2017;166(1):18–26.
18. Lin OS, Kozarek RA, Schembre DB, et al. Screening colonoscopy in very elderly patients: prevalence of neoplasia and estimated impact on life expectancy. JAMA 2006;295(20):2357–65.
19. Kotwal AA, Schonberg MA. Cancer screening in the elderly: a review of breast, colorectal, lung, and prostate cancer screening. Cancer J 2017;23(4):246–53.
20. Studenski S, Perera S, Patel K, et al. Gait speed and survival in older adults. JAMA 2011;305(1):50–8.
21. Cruz M, Covinsky K, Widera EW, et al. Predicting 10-year mortality for older adults. JAMA 2013;309(9):874–6.
22. Schonberg MA, Davis RB, McCarthy EP, et al. External validation of an index to predict up to 9-year mortality of community-dwelling adults aged 65 and older. J Am Geriatr Soc 2011;59(8):1444–51.
23. Soung MC. Screening for cancer: when to stop?: a practical guide and review of the evidence. Med Clin North Am 2015;99(2):249–62.
24. Schonberg MA, Breslau ES, Hamel MB, et al. Colon cancer screening in U.S. adults aged 65 and older according to life expectancy and age. J Am Geriatr Soc 2015;63(4):750–6.
25. Colon cancer screening (USPSTF recommendation). U.S. Preventive Services Task Force. J Am Geriatr Soc 2000;48(3):333–5.

26. Muravchick S. The elderly outpatient: current anesthetic implications. Curr Opin Anaesthesiol 2002;15(6):621–5.
27. Houissa F, Kchir H, Bouzaidi S, et al. Colonoscopy in elderly: feasibility, tolerance and indications: about 901 cases. Tunis Med 2011;89(11):848–52.
28. Chatrenet P, Friocourt P, Ramain JP, et al. Colonoscopy in the elderly: a study of 200 cases. Eur J Med 1993;2(7):411–3.
29. Mamula P, Adler DG, Conway JD, et al. Colonoscopy preparation. Gastrointest Endosc 2009;69(7):1201–9.
30. Ristikankare M, Hartikainen J, Heikkinen M, et al. The effects of gender and age on the colonoscopic examination. J Clin Gastroenterol 2001;32(1):69–75.
31. Warren JL, Klabunde CN, Mariotto AB, et al. Adverse events after outpatient colonoscopy in the Medicare population. Ann Intern Med 2009;150(12):849–57, w152.
32. Sutkowi-Hemstreet A, Vu M, Harris R, et al. Adult patients' perspectives on the benefits and harms of overused screening tests: a qualitative study. J Gen Intern Med 2015;30(11):1618–26.
33. Lewis CL, Kistler CE, Amick HR, et al. Older adults' attitudes about continuing cancer screening later in life: a pilot study interviewing residents of two continuing care communities. BMC Geriatr 2006;6:10.
34. Torke AM, Schwartz PH, Holtz LR, et al. Older adults and forgoing cancer screening: "I think it would be strange. JAMA Intern Med 2013;173(7):526–31.
35. Schoenborn NL, Boyd CM, Lee SJ, et al. Communicating about stopping cancer screening: comparing clinicians' and older adults' perspectives. Gerontologist 2019;59(Suppl 1):S67–76.
36. Schoenborn NL, Lee K, Pollack CE, et al. Older adults' views and communication preferences about cancer screening cessation. JAMA Intern Med 2017;177(8):1121–8.