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Colorectal cancer screening

Using evidence-based guidelines

Abstract: Colorectal cancer is the third most common cancer diagnosed in men and women. There are multiple options for prevention and early detection. Evidence-based guidelines are available to select the best option based on personal and family history. NPs should utilize these guidelines in clinical practice to select the appropriate screening for their patients.

By Suzanne M. Mahon, DNSc, RN, AOCN, AGN-BC

Colorectal cancer (CRC) is the third most common cancer diagnosed in both men and women in the United States.[1] NPs face challenges in explaining the role of cancer detection strategies for CRC and implementing screening strategies appropriately. Understanding the epidemiology of CRC, known risk factors, the benefits and limitations of CRC screening modalities, and evidence-based recommendations is important to select appropriate screening for patients based on age and risk assessment.

Epidemiology of CRC

The American Cancer Society (ACS) estimates there will be 95,520 new cases of colon cancer and 39,910 new cases of rectal cancer in the United States 2017.[1] The incidence of colon cancer is fairly equal in men (47,700 new cases) and women (47,820 new cases), but a larger number of men (23,720) than women (16,190) will be diagnosed with rectal cancer.[2] One in 22 men and 1 in 24 women will be diagnosed with CRC during their lifetime.[1]

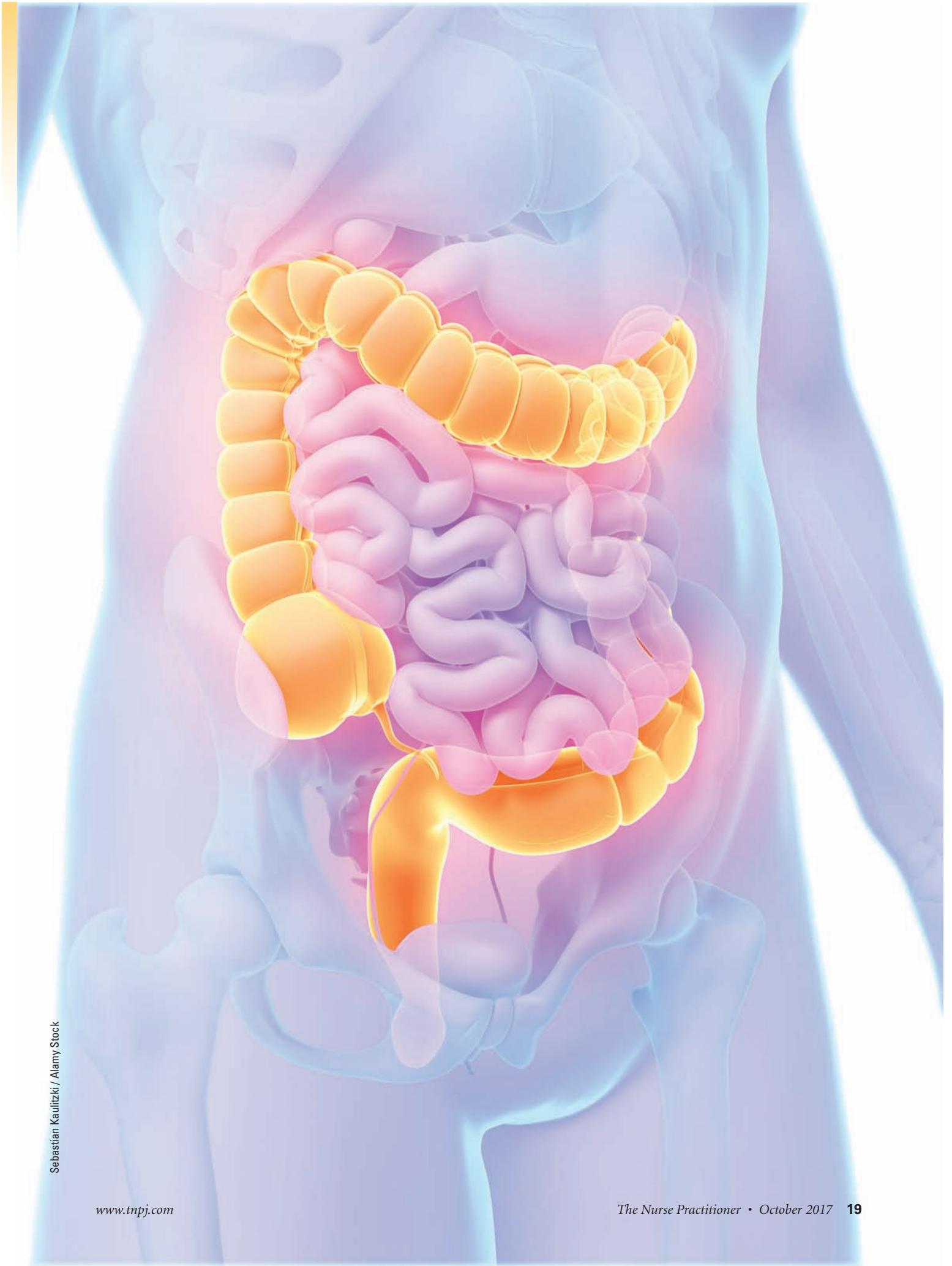
Incidence rates are higher for Black Americans, which can be attributed to lifestyle factors and poorer access to and utilization of recommended screening tests, especially those that detect and remove polyps.[3] The incidence of CRC has decreased since the mid-1990s. In the most recent 10-year data available, incidence rates have decreased about 3% for individuals age 50 and older but increased about 2% per year in individuals under age 50, primarily due to an increase in rectal cancer.[1] This decrease in incidence is attributed to increased screening and the removal of polyps, which results in the prevention of CRC.[2]

CRC is more common as individuals age.[2] Mortality is also higher in older adults.[2] These epidemiologic considerations guide screening recommendations. Mortality is directly related to the stage of CRC when it is detected. As of January 2016, there were an estimated 724,690 men and 727,350 women alive with a history of CRC.[2] The 5-year relative survival rate has steadily increased since 1975.

Pathophysiology of CRC

CRC usually begins as a polyp that develops on the inner lining of the colon or rectum and grows over a period of 10 to 20 years.[2] Most polyps are adenomas, which arise from glandular cells that produce mucus to lubricate the lumen of the colon/rectum. As many as half of all individuals will

Keywords: cancer prevention, cancer screening, colorectal cancer, evidence-based guidelines, hereditary cancer



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eventually develop one or more adenomas; however, less than 10% of polyps progress to invasive CRC. Approximately 96% of CRCs are adenocarcinomas and arise from the inner lining of the colon/rectum.[4] Once invasive CRC invades the inner lining, it can extend into the wall of the colon/rectum and then, by direct extension, into the lymph nodes. Common sites of metastasis include the liver, lungs, and abdominal peritoneum.[2]

Early CRC is usually asymptomatic, which is why screening is critical to decrease morbidity and mortality.[1] Tumor growth can lead to obstruction, and blood loss from the tumor can lead to anemia, resulting in unexplained weakness, excessive fatigue, and sometimes shortness of breath. Additional symptoms include rectal bleeding or blood in the stool; dark or black stools; a change in bowel habits; a narrowing of the stool; cramping or abdominal pain; and decreased appetite or unintentional weight loss.[5]

Risk factors for CRC

Risk factor assessment guides screening decisions.[6] Increasing age is a known risk factor for developing CRC, which is why all individuals should begin screening by age 50.[6] Certain risk factors are modifiable and others are not (see *Risk factors for CRC*). Family history is a significant risk factor for developing CRC and plays a large role in determining appropriate screening recommendations. Approximately 10% of individuals

Risk factors for CRC[2,6,9,11,23]

Risk factor	Pathophysiologic basis and implications for care	Relative risk*
Known genetic risk	Mutations include *MLH1, MSH2, MSH6, EPCAM, PMS2, APC, BMPRIA, CHEK2, TP53, MUYTH, STK11, PTEN, ATM, SMAD4, AXIN2, POLD1, POLE, and SCG5 and GREM1*. Individuals who have a germline mutation resulting in a gene that does not function properly often develop cancers at an earlier age than expected and more often than expected. Recommendations for screening are usually initiated at a much earlier age and a much more frequent interval than in the general population based on the specific gene as well as the individual family history.	3.0–4.0
CRC in one or more relatives	May have a lower penetrance susceptibility gene associated with increased risk; may benefit from modified screening recommendations	2.2–3.0
Personal history of adenomatous polyps	Adenomatous polyps are precursors to developing CRC; individuals with 20 or more polyps in a lifetime, especially at a younger age, are at higher risk; individuals may benefit from modified screening recommendations	1.5–2.5
Personal history of CRC	Risk is higher in individuals with a younger age of onset, possibly due to underlying genetic risk; screening is done at more frequent intervals	1.5–2.5
IBD	Chronic inflammation in the colon can lead to the development of dysplasia, thereby increasing the risk of developing CRC; more frequent screening may be recommended	1.7
Alcohol >4 drinks daily Alcohol 1–2 drinks daily	Byproducts of alcohol metabolism may be associated with increased risk; education and efforts to decrease consumption, especially regular daily consumption, should be offered	1.4 1.2
Diabetes mellitus	The pathologic basis is not clear, and individuals with diabetes mellitus may have a less favorable outcome after diagnosis; individuals may benefit from more frequent screening	1.3
Obesity (body mass index ≥30 kg/m^2)	Risk is especially higher in those with increasing abdominal girth; excess body weight can have a negative impact on metabolic health, altering biochemical processes in the body; education and weight loss efforts should be encouraged	1.3
Red meat consumption consistently over 50–100 g/daily	May be related to the constituents of meat and/or carcinogens that form during high-temperature cooking, curing, and/or smoking; diets high in vegetables, fruits, and whole grains have been linked with a lower risk of colorectal cancer, but supplements have not been shown to decrease risk; education and efforts to improve diet should be encouraged	1.2–1.4
Smoking	Carcinogens in tobacco increase risk; education and smoking cessation strategies should be offered	1.2

*The term *relative risk* refers to a comparison of the incidence or deaths among those with a particular risk factor compared with those without the risk factor. With the use of relative risk factors, individuals can determine their risk factors and thus better understand their personal chances of developing a specific cancer compared with an individual without such risk factors. If the risk of a person with no known risk factors is 1.0, one can evaluate the risk of those with risk factors in relation to this figure. A person with a relative risk of 3.5 is 3.5 times more likely to develop the cancer than a person without the risk factor.

with a diagnosis of CRC have a genetic predisposition due to a mutation; another 10% to 20% are attributed to family history, and the rest are sporadic.[2,7]

Individuals with a known or suspected genetic risk for developing CRC should be evaluated by a credentialed genetics provider (see *CRC development: Key indicators of genetic risk*). Credentialed providers include physicians with a board subspecialty in genetics, master's-prepared genetics counselors, and advanced practice nurses credentialed by the American Nurses Credentialing Center with the credential Advanced Genetics Nursing-Board Certified (AGN-BC).[8] A list of credentialed providers is available through the National Society of Genetic Counselors at www.nsgc.org. Credentialed genetics professionals will assist with providing specific screening guidelines for these families with known or suspected genetic risk, which are initiated at a much earlier age and more frequent intervals.[7,9]

Research suggests that maintaining a healthy weight, being physically active, limiting alcohol consumption, and eating a healthy diet could reduce the risk of developing CRC by about 33%.[10] Excess body weight, amount of physical activity, smoking, alcohol consumption, and certain dietary factors are individually related to CRC risk. The interaction of these risk factors is not fully understood, but preliminary research suggests that improvements in all areas might lead to an even larger reduction in CRC risk.[10] NPs should incorporate education in regards to these modifiable risk factors when discussing CRC risk, prevention, and screening.

CRC development: Key indicators of genetic risk[2,6,7,9,11]

Nonpolyposis CRC syndromes
- Personal history of CRC diagnosed before age 50
- Personal history of endometrial cancer diagnosed before age 50
- First-degree relative with CRC diagnosed before age 50
- Two or more relatives with CRC or an associated cancer, including endometrial, ovarian, gastric, hepatobiliary, small bowel, renal pelvis, or ureter cancer; the first relative must be a first-degree relative of the others
- CRC occurring in two or more generations on the same side of the family
- A personal history of CRC and a first-degree relative with adenomas diagnosed before age 40
- An affected relative with a known nonpolyposis mutation (*MLH1, MSH2, MSH6, EPCAM, PMS2, CHEK2, TP53, STK11, PTEN, ATM, AXIN2, POLD1, POLE, and SCG5 and GREM1*)

Polyposis syndromes
- Clinical diagnosis of polyposis (100 or more polyps)
- Suspected polyposis or attenuated polyposis (15 to 99 polyps over a lifetime)
- First-degree relative of polyposis patient
- Affected relative with a known polyposis mutation (APC, BMPR1A, MUTYH, and SMAD4)
- Any number of adenomas in a family with a polyposis syndrome

Note: Any of these indicators is suggestive of hereditary risk, and the patient/family should be referred to a credentialed genetics provider for more intensive risk assessment, possible genetic testing, and specific recommendations for CRC prevention and early detection.

CRC screening impact and guidelines

There are several recommended methods for CRC screening, including both visual/structural exams, which detect both polyps and CRC, and stool-based tests (specimens may be collected at home and returned to the lab specified in the kit) that primarily detect blood in the stool (see *Screening tests for average-risk individuals*).[6] These tests can help reduce CRC death when performed in individuals of average risk at the appropriate time intervals and with the recommended follow-up.

Positive results from any test other than colonoscopy should be followed with a colonoscopy for complete diagnostic evaluation. Patients should be given information about the benefits, limitations, and risks of each screening test, and the test selection should be based on the patient's risk assessment and preferences. Research findings suggest that offering patients different test options substantially increases adherence to screening recommendations.[11]

The National Comprehensive Cancer Network (NCCN), United States Preventive Services Task Force (USPSTF), and ACS emphasize that the appropriate screening guideline cannot be applied without comprehensive risk factor assessment.[5,6,11] Patients age 50 or older without a history of adenoma, sessile serrated polyp, CRC, inflammatory bowel disease (IBD), or family history of CRC should consider the guidelines for those of average risk.[6] Patients with a family history and/or genetic risk and a personal history of polyps or CRC will need modified screening guidelines (see *Screening recommendations for individuals at increased risk*). The NCCN provides evidence-based algorithms for managing individuals of average, increased, and genetic risk for developing CRC (see *Screening recommendations for individuals with a history of polyps*).[6,9]

For adults age 50 and older of average risk, CRC screening increased from 34% in 2000 to 63% in 2015.[2] The National Colorectal Cancer Roundtable (NCCRT), established by the ACS and the CDC, is a coalition of more than 100 member organizations focused on CRC screening.[2] In 2014, the NCCRT launched the "80% by 2018" initiative, with a goal of an 80% CRC screening rate of adults age 50 and older by 2018. If this goal is reached, an estimated 277,000 CRC cases and 203,000 CRC deaths will be prevented by 2030.[12]

In average–risk individuals, a colonoscopy every 10 years could potentially reduce CRC mortality by 68%.[13] Despite the known effectiveness of CRC screening and the

Screening tests for average-risk individuals[2,6,9,11]

Test and interval	Procedure	Accuracy	Strengths	Limitations
Fecal immunochemical test (FIT): Annual	• Uses antibodies against hemoglobin to detect occult blood in the stool	• Sensitivity 79%; specificity 94%	• No bowel cleansing or sedation • Specimens may be collected at home and returned to the lab specified in the kit • Low cost • Noninvasive • No dietary restrictions (only detects human blood)	• Requires multiple stool samples • A test that is positive for blood in the stool does not confirm the presence of polyps or colon cancer • Colonoscopy necessary if positive • May produce false-positive test results • Slightly more effective when combined with a flexible sigmoidoscopy every 5 years
High-sensitivity guaiac-based fecal occult blood test (gFOBT): Annual	• Uses a chemical reaction to detect blood in the stool • Patient collects three serial specimens at home	• Sensitivity 37% to 79%; specificity >90% • Regular use of high-sensitivity guaiac-based fecal occult blood testing reduced risk of death by 32% after 30 years of follow-up • Decreases incidence of CRC by 20% by detecting large precancerous polyps	• No bowel cleansing • Specimens may be collected at home and returned to the lab specified in the kit • Low cost • Noninvasive	• Requires multiple stool samples • A test that is positive for blood in the stool does not confirm the presence of polyps or colon cancer • Colonoscopy necessary if positive • May produce false-positive test results • Pretest dietary limitations include avoiding red meat for 3 days prior to and during the test because they can lead to false-positive results (gFOBT detects blood from any source, including meat in the diet) • Fruit juices, which contain vitamin C (ascorbic acid) and vitamin C supplements should be avoided because they may inhibit the guaiac oxidation reaction, producing a false-negative result • Patients must avoid nonsteroidal anti-inflammatory drugs for 3 days prior to and during collection
FIT-DNA test: Every 3 years	• Detects blood in the stool and certain genetic mutations in the DNA of cells that are shed into the stool by large adenomas and CRC	• Sensitivity 82%; specificity 84%	• No bowel cleansing • Specimens may be collected at home and returned to the lab specified in the kit • Requires a single stool sample • Noninvasive • Covered by Medicare	• A test that is positive for blood in the stool does not confirm the presence of polyps or colon cancer • Colonoscopy necessary if positive • Will miss most polyps unless they are bleeding • More false-positive results than other tests • Higher cost than gFOBT and FIT

(continued on next page)

Screening tests for average-risk individuals[2,6,9,11] *(continued)*

Test and interval	Procedure	Accuracy	Strengths	Limitations
Colonoscopy: Every 10 years	• Most common screening test for CRC in the United States • Allows for direct visual exam of the entire colon and rectum • Performed for screening purposes as well as after abnormal results from any other screening test • During the exam, the colon is inflated with either air or carbon dioxide while the patient is sedated • Carbon dioxide is used less often, but is safer (because it eliminates the small risk of explosion during polypectomy) and causes less discomfort after the procedure • The colonoscope has a light and small video camera on the end, which allows for the detection and removal of most polyps with a wire loop or electric current • The quality of the colonoscopy in the United States is variable and influences sensitivity/specificity	• Sensitivity 96%; specificity 97% • Decreases CRC incidence by about 40% and mortality by about 50%	• Examines entire colon • Can biopsy and remove polyps • Can diagnose other diseases • Required for abnormal results from all other tests	• Full bowel cleansing • Expensive • Sedation required, patients cannot drive home after the test and will need a chaperone to return home • May miss 1 day of work. • Highest risk of bowel tears (1 to 2 of every 1,000 colonoscopies) • Can miss some adenomas, especially flat ones (sessile adenomas), from which 20% to 30% of CRCs are thought to originate
Computed tomography (CT) colonography: Every 5 years	• Results in detailed, cross-sectional two- or three-dimensional views of the entire colon and rectum • A small, flexible tube is inserted into the rectum to allow carbon dioxide, or sometimes air, to open the colon; then the patient passes through the CT scanner • Patients with polyps or other abnormal results are referred for colonoscopy, optimally on the same day in order to alleviate the necessity of a second bowel preparation	• For polyps 1 cm and larger, sensitivity 93%; specificity 97% • For smaller polyps, sensitivity 86%; specificity 93%	• Examines entire colon • No sedation • Noninvasive • No recovery time • Typically takes 10 to 15 minutes to complete	• Full bowel cleansing • Cannot remove polyps or perform biopsies • Exposure to low-dose radiation • Colonoscopy necessary if positive • Not covered by Medicare and some insurance plans
Flexible sigmoidoscopy every 5 years: Consideration can be given to every 5 years combined with either gFOBT or FIT annually	• A sigmoidoscope is passed to view the lower third of the colon • Current availability of flexible sigmoidoscopy is limited, and prevalence among adults 50 years or older is only about 2.5%	• Sensitivity 33%; specificity 97% • 20% reduction in CRC incidence • 30% reduction in CRC mortality	• Fairly quick • Minimal bowel preparation • Does not require sedation or a specialist	• Partial bowel cleansing • Views only 33% of colon • Cannot remove large polyps • Small risk of infection or bowel tear • Slightly more effective when combined with annual gFOBT • Colonoscopy necessary if positive • Limited availability

availability of multiple CRC screening modalities, utilization of screening for CRC remains lower than for breast and cervical cancers. In 2015, the CDC committed an additional $23 million to their Colorectal Cancer Control Program, which aims to increase population-level CRC screening, especially among low-income, underinsured, or uninsured individuals and certain racial and ethnic groups by using evidence-based strategies.[14]

Recommendations for when to stop screening in older adults are more complicated, especially for those over age 75.[15] CRC screening in older adults may be appropriate and beneficial for individuals in good health but can lead to unnecessary burdens and complications in those with limited life expectancy. An individualized approach considers differences in disease risk rather than the age of the patient.[16] The use of an instrument such as the comprehensive geriatric assessment, which is a measure of physical function, frailty, cognitive impairments, nutrition, and physical disabilities, may be useful in individualized cancer screening decisions for older adults.[17]

Guidelines for CRC screening in older adults endorse individualized decision-making.[11,18] Estimates are that nearly 25% of adults ages 76 to 84 have never been screened for CRC, and rates of provider recommendation in this group are very low. Greater attention to informed CRC screening discussions with screening-eligible older adults is needed.[19,20] The USPSTF recommends that no adult over age 85 be screened.[11]

Implications for NPs

Patients may or may not understand how common CRC is or the potential benefits of CRC screening/prevention maneuvers.[21] Because 33% of eligible adults in the United States have never been screened, the USPSTF updated their recommendations in 2016. They clearly emphasize that providers should stress the convincing evidence that CRC screening can help save lives instead of emphasizing specific screening tests. Taking a few minutes to communicate these data to patients might influence the decision of whether or not to engage in CRC screening. This may be especially important in patients in ethnic minority groups who tend to have later-stage diagnosis and higher mortality.[22]

Ideally, healthy lifestyle factors are initiated early in life, but patients need education on the benefits of a healthy lifestyle not only for themselves but other relatives.[23] It is not enough to tell patients they should adopt a healthier lifestyle. Physical activity and a healthy lifestyle should be given as a prescription with the same amount of education on its importance as one for a pharmaceutical agent.[24]

Family history should be reviewed at every visit.[25] Patients with suspected genetic risk should be referred to a credentialed genetics professional for further evaluation and possible genetic testing. Patients with a known mutation should have recommendations for prevention and detection reviewed on an annual basis to determine if they are current, especially for the newer susceptibility genes. NPs can check with credentialed genetics professionals to assure the recommendations are current and appropriate.[26]

NPs need to consider the risk assessment and available data prior to making a recommendation and should also consider the capability of the patient to complete a screening exam. Recommending CRC screening is an important initial step that should not be overlooked; a provider recommendation is one of the strongest, most consistent predictors of CRC screening.[27,28]

NPs also need to consider the costs and reimbursement for CRC screening. When medical care is equally available to all ethnicities, such as through Medicare coverage or Veterans Affairs programs, the overall CRC survival rates are similar.[29] This suggests that problems with access in individuals under age 65 may be directly related to differences in CRC survival.[30]

Screening recommendations for individuals at increased risk[2,6,9,11]

Risk factor	Screening recommendation
• History of CRC in a first-degree relative diagnosed at age >60 • Adenomas that are ≥1cm, villous, or with high-grade dysplasia in a first-degree relative diagnosed at age ≥60	Begin screening at age 40 with any test recommended for average risk; repeat at usual intervals based on type of test and findings
• Two second-degree relatives with CRC	Begin screening at age 40 with any test recommended for average risk; repeat at usual intervals based on type of test and findings
• CRC in a first-degree relative diagnosed before age 60 • Adenomas that are ≥1 cm, villous, or with high-grade dysplasia in a first-degree relative diagnosed before age 60 years	Colonoscopy every 5 years starting at age 40, or 10 years before the youngest case in the family was diagnosed (whichever comes first)
• Two or more first-degree relatives diagnosed at any age (with family history not suggestive of genetic syndrome)	Colonoscopy every 5 years starting at age 40 or 10 years before the youngest case in the family was diagnosed (whichever comes first)

Despite the implementation of the Patient Protection and Affordable Care Act with the elimination of copays for colonoscopy, colonoscopy rates in adults ages 50 to 65 have remained stable.[31] Identifying ways to enable individuals ages 50 to 65 to have CRC screening access is a challenge, and NPs need to be familiar with options for screening in uninsured and underinsured patients in their region.

According to the National Health Interview Survey responses from civilian, noninstitutionalized U.S. residents ages 50 to 75 between 2010 and 2012, those with and without disability generally engage in CRC screening at similar rates.[32] NPs should offer CRC screening to patients with disabilities with reasonable life expectancy, and current research suggests this should not be a limitation to screening.[32]

CRC screening is a complex process that achieves the maximum benefit for the patient when all steps are implemented appropriately. Problems with screening implementation have been well documented for all screening options.[2] The USPSTF emphasizes that the overall goal is to increase the number of individuals who are screened with an appropriate tool given their risk.[11] NPs need to consider patient preferences, ability to complete an adequate bowel preparation, screening history, and risk factors. Stool-based screening, when conducted correctly, can be a satisfactory and effective means to detect CRC early when it is most amenable to treatment, and patients need to understand that this can be an acceptable screening modality.[11]

Colonoscopy is not without limitations. The endoscopist may fail to visualize the polyp or complete the exam by reaching the cecum. Patients need to know about these limitations as well as the risk of perforation. As many as 33% of all patients can have suboptimal preparation for structural exams, which impacts the sensitivity of the exam and adds to increased healthcare costs because of the need to repeat exams.[33]

Suboptimal bowel preparation may be associated with low health literacy, inability to understand directions, and diabetes mellitus. Patient motivation or engagement in healthcare is an important factor in colonoscopy preparation. Those with low motivation stand to benefit more from education and counseling on the importance of screening and why proper bowel preparation is needed for an optimal exam.

There is more to stool blood testing than handing out kits. To be effective, there must be a comprehensive system to ensure appropriate testing, which includes using a test with sensitivity over 50%, ensuring follow-up of abnormal test results with colonoscopy, and annual test completion. There is no evidence that any type of stool blood testing is sufficiently sensitive when used on a stool sample collected during a rectal exam.[2,6,11]

Screening recommendations for individuals with a history of polyps[2,4,6,11]

Polyps	Colonoscopy interval
• 1–2 tubular adenomas <10 mm	5–10 years
• 3–10 adenomas <10 mm • ≥1 adenoma ≥10 mm • ≥1 adenoma with villous features • ≥1 adenoma with high-grade dysplasia	3 years
• >10 adenomas	<3 years (consider syndrome)
• Any adenoma with piecemeal or possibly incomplete excision	2–6 months
• Hyperplastic polyps <10 mm in rectum or sigmoid • Hyperplastic polyp(s) ≤5 mm and proximal to sigmoid	10 years
• Hyperplastic polyp(s) >5 mm and proximal to sigmoid • Serrated polyp(s) <10 mm and no dysplasia	5 years
• Serrated polyp(s) ≥10 mm or with dysplasia	3 years
• Serrated polyposis/hyperplastic polyposis	1 year

Conclusion

Complete, ongoing risk assessment and appropriate application of CRC screening based on risk assessment have the potential to decrease the morbidity and mortality associated with CRC. NPs should utilize CRC risk assessment as not only a means to select appropriate screening modalities but as an opportunity to educate patients on the importance of screening to improve utilization of screening, ultimately improving the quality of life through the prevention and early detection of CRC.

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INSTRUCTIONS

Colorectal cancer screening: Using evidence-based guidelines

TEST INSTRUCTIONS

- To take the test online, go to our secure website at **www.nursingcenter.com/ce/NP**.
- On the print form, record your answers in the test answer section of the CE enrollment form on page 27. Each question has only one correct answer. You may make copies of these forms.
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Lippincott Professional Development is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation.

This activity is also provider approved by the California Board of Registered Nursing, Provider Number CEP 11749 for 1.5 contact hours. Lippincott Professional Development is also an approved provider of continuing nursing education by the District of Columbia, Georgia, and Florida CE Broker #50-1223.