

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
<p>1. Siegel RL, Miller KD, Jemal A. Cancer Statistics, 2017. CA Cancer J Clin. 2017;67(1):7-30.</p>	<p>Review/Other-Dx</p>	<p>N/A</p>	<p>To estimate the numbers of new cancer cases and deaths that will occur in the United States in the current year and compile the most recent data on cancer incidence, mortality, and survival.</p>	<p>Mortality data were collected by the National Center for Health Statistics. In 2017, 1,688,780 new cancer cases and 600,920 cancer deaths are projected to occur in the United States. For all sites combined, the cancer incidence rate is 20% higher in men than in women, while the cancer death rate is 40% higher. However, sex disparities vary by cancer type. For example, thyroid cancer incidence rates are 3-fold higher in women than in men (21 vs 7 per 100,000 population), despite equivalent death rates (0.5 per 100,000 population), largely reflecting sex differences in the "epidemic of diagnosis." Over the past decade of available data, the overall cancer incidence rate (2004-2013) was stable in women and declined by approximately 2% annually in men, while the cancer death rate (2005-2014) declined by about 1.5% annually in both men and women. From 1991 to 2014, the overall cancer death rate dropped 25%, translating to approximately 2,143,200 fewer cancer deaths than would have been expected if death rates had remained at their peak. Although the cancer death rate was 15% higher in blacks than in whites in 2014, increasing access to care as a result of the Patient Protection and Affordable Care Act may expedite the narrowing racial gap; from 2010 to 2015, the proportion of blacks who were uninsured halved, from 21% to 11%, as it did for Hispanics (31% to 16%). Gains in coverage for traditionally underserved Americans will facilitate the broader application of existing cancer control knowledge across every segment of the population.</p>	<p>4</p>

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2. National Cancer Institute. Surveillance, Epidemiology, and End Results Program. Cancer Stat Facts: Colon and Rectum Cancer. Available at: <a href="https://seer.cancer.gov/statfacts/html/colorect.html">https://seer.cancer.gov/statfacts/html/colorect.html</a> .	Review/Other-Dx	N/A	To present colon and rectum cancer population statistics that are based on the US population.	No results stated in abstract.	4
3. Atkin WS, Edwards R, Kralj-Hans I, et al. Once-only flexible sigmoidoscopy screening in prevention of colorectal cancer: a multicentre randomised controlled trial. <i>Lancet</i> . 2010;375(9726):1624-1633.	Experimental-Dx	170,038 participants	To test the hypothesis that only one flexible sigmoidoscopy screening between 55 and 64 years of age can substantially reduce colorectal cancer incidence and mortality.	113 195 people were assigned to the control group and 57 237 to the intervention group, of whom 112 939 and 57 099, respectively, were included in the final analyses. 40 674 (71%) people underwent flexible sigmoidoscopy. During screening and median follow-up of 11.2 years (IQR 10.7-11.9), 2524 participants were diagnosed with colorectal cancer (1818 in control group vs 706 in intervention group) and 20 543 died (13 768 vs 6775; 727 certified from colorectal cancer [538 vs 189]). In intention-to-treat analyses, colorectal cancer incidence in the intervention group was reduced by 23% (hazard ratio 0.77, 95% CI 0.70-0.84) and mortality by 31% (0.69, 0.59-0.82). In per-protocol analyses, adjusting for self-selection bias in the intervention group, incidence of colorectal cancer in people attending screening was reduced by 33% (0.67, 0.60-0.76) and mortality by 43% (0.57, 0.45-0.72). Incidence of distal colorectal cancer (rectum and sigmoid colon) was reduced by 50% (0.50, 0.42-0.59; secondary outcome). The numbers needed to be screened to prevent one colorectal cancer diagnosis or death, by the end of the study period, were 191 (95% CI 145-277) and 489 (343-852), respectively.	1

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4. Holme O, Loberg M, Kalager M, et al. Effect of flexible sigmoidoscopy screening on colorectal cancer incidence and mortality: a randomized clinical trial. <i>Jama</i> . 2014;312(6):606-615.	Experimental-Dx	98,792 participants	To estimate the effectiveness of flexible sigmoidoscopy screening on colorectal cancer incidence and mortality in a population-based trial.	A total of 98,792 participants were included in the intention-to-screen analyses, of whom 78,220 comprised the control group and 20,572 comprised the screening group (10,283 randomized to receive a flexible sigmoidoscopy and 10,289 to receive flexible sigmoidoscopy and FOBT). Adherence with screening was 63%. After a median of 10.9 years, 71 participants died of colorectal cancer in the screening group vs 330 in the control group (31.4 vs 43.1 deaths per 100,000 person-years; absolute rate difference, 11.7 [95% CI, 3.0-20.4]; hazard ratio [HR], 0.73 [95% CI, 0.56-0.94]). Colorectal cancer was diagnosed in 253 participants in the screening group vs 1086 in the control group (112.6 vs 141.0 cases per 100,000 person-years; absolute rate difference, 28.4 [95% CI, 12.1-44.7]; HR, 0.80 [95% CI, 0.70-0.92]). Colorectal cancer incidence was reduced in both the 50- to 54-year age group (HR, 0.68; 95% CI, 0.49-0.94) and the 55- to 64-year age group (HR, 0.83; 95% CI, 0.71-0.96). There was no difference between the flexible sigmoidoscopy only vs the flexible sigmoidoscopy and FOBT screening groups.	1

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5. Kronborg O, Jorgensen OD, Fenger C, Rasmussen M. Randomized study of biennial screening with a faecal occult blood test: results after nine screening rounds. Scand J Gastroenterol. 2004;39(9):846-851.	Observational-Dx	53, 344 patients	To determine whether FOBT screening could detect early stages of colorectal cancer and thereby decrease mortality from this disease.	First screening was accepted by 67% (20,672). Positivity rates varied between 0.8% and 3.8%, and the cumulative proportion of the test group having colonoscopy was 5.3%. Screen-detected CRC was early (Dukes' A) in 36% compared to 11% among controls. Incidence of CRC was unchanged, but mortality was reduced by 11%. This figure increased to 43% in persons participating in all 9 rounds. No more than 8,558 were screened at the 9th round. Patients with CRC detected between screenings had better survival than controls. Death rates from causes other than CRC among participants never became higher than among controls.	1

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6. Lin JS, Piper MA, Perdue LA, et al. Screening for Colorectal Cancer: Updated Evidence Report and Systematic Review for the US Preventive Services Task Force. <i>Jama</i> . 2016;315(23):2576-2594.	Meta-analysis	47, 44, and 113 articles were reviewed to answer questions 1, 2 and 3, respectively.	To systematically review the effectiveness, diagnostic accuracy, and harms of screening for CRC.	Four pragmatic randomized clinical trials (RCTs) evaluating 1-time or 2-time flexible sigmoidoscopy (n = 458,002) were associated with decreased CRC-specific mortality compared with no screening (incidence rate ratio, 0.73; 95% CI, 0.66-0.82). Five RCTs with multiple rounds of biennial screening with guaiac-based fecal occult blood testing (n = 419,966) showed reduced CRC-specific mortality (relative risk [RR], 0.91; 95% CI, 0.84-0.98, at 19.5 years to RR, 0.78; 95% CI, 0.65-0.93, at 30 years). Seven studies of computed tomographic colonography (CTC) with bowel preparation demonstrated per-person sensitivity and specificity to detect adenomas 6 mm and larger comparable with colonoscopy (sensitivity from 73% [95% CI, 58%-84%] to 98% [95% CI, 91%-100%]; specificity from 89% [95% CI, 84%-93%] to 91% [95% CI, 88%-93%]); variability and imprecision may be due to differences in study designs or CTC protocols. Sensitivity of colonoscopy to detect adenomas 6 mm or larger ranged from 75% (95% CI, 63%-84%) to 93% (95% CI, 88%-96%). On the basis of a single stool specimen, the most commonly evaluated families of fecal immunochemical tests (FITs) demonstrated good sensitivity (range, 73%-88%) and specificity (range, 90%-96%). One study (n = 9989) found that FIT plus stool DNA test had better sensitivity in detecting CRC than FIT alone (92%) but lower specificity (84%). Serious adverse events from colonoscopy in asymptomatic persons included perforations (4/10,000 procedures, 95% CI, 2-5 in 10,000) and major bleeds (8/10,000 procedures, 95% CI, 5-14 in 10,000). Computed	Good

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				tomographic colonography may have harms resulting from low-dose ionizing radiation exposure or identification of extracolonic findings.	
7. Lindholm E, Brevinge H, Haglind E. Survival benefit in a randomized clinical trial of faecal occult blood screening for colorectal cancer. <i>Br J Surg.</i> 2008;95(8):1029-1036.	Experiment al-Dx	23,916 individuals	To evaluate the effect of faecal occult blood test (FOBT) screening on colorectal cancer mortality in a Swedish population.	After a mean of 9 years from the last screening, there was a significant reduction in colorectal cancer mortality in the screening group compared with the control group. The overall risk ratio of death from colorectal cancer was 0.84 (95 per cent confidence interval 0.71 to 0.99). The groups did not differ in incidence of colorectal cancer or in overall mortality.	1
8. Mandel JS, Church TR, Bond JH, et al. The effect of fecal occult-blood screening on the incidence of colorectal cancer. <i>N Engl J Med.</i> 2000;343(22):1603-1607.	Experiment al-Dx	46,445 people	To evaluate the effectiveness of fecal occult-blood testing in reducing the rate of death from colorectal cancer.	During the 18-year follow-up period, we identified 1359 new cases of colorectal cancer: 417 in the annual-screening group, 435 in the biennial-screening group, and 507 in the control group. The cumulative incidence ratios for colorectal cancer in the screening groups as compared with the control group were 0.80 (95 percent confidence interval, 0.70 to 0.90) and 0.83 (95 percent confidence interval, 0.73 to 0.94) for the annual-screening and biennial-screening groups, respectively. For both screening groups, the number of positive slides was associated with the positive predictive value both for colorectal cancer and for adenomatous polyps at least 1 cm in diameter.	1

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9. Schoen RE, Pinsky PF, Weissfeld JL, et al. Colorectal-cancer incidence and mortality with screening flexible sigmoidoscopy. <i>N Engl J Med.</i> 2012;366(25):2345-2357.	Review/Ot her-Dx	77,445 participants	To evaluate the effect of screening with flexible sigmoidoscopy on colorectal-cancer incidence and mortality.	Of the 77,445 participants randomly assigned to screening (intervention group), 83.5% underwent baseline flexible sigmoidoscopy and 54.0% were screened at 3 or 5 years. The incidence of colorectal cancer after a median follow-up of 11.9 years was 11.9 cases per 10,000 person-years in the intervention group (1012 cases), as compared with 15.2 cases per 10,000 person-years in the usual-care group (1287 cases), which represents a 21% reduction (relative risk, 0.79; 95% confidence interval [CI], 0.72 to 0.85; $P<0.001$ ). Significant reductions were observed in the incidence of both distal colorectal cancer (479 cases in the intervention group vs. 669 cases in the usual-care group; relative risk, 0.71; 95% CI, 0.64 to 0.80; $P<0.001$ ) and proximal colorectal cancer (512 cases vs. 595 cases; relative risk, 0.86; 95% CI, 0.76 to 0.97; $P=0.01$ ). There were 2.9 deaths from colorectal cancer per 10,000 person-years in the intervention group (252 deaths), as compared with 3.9 per 10,000 person-years in the usual-care group (341 deaths), which represents a 26% reduction (relative risk, 0.74; 95% CI, 0.63 to 0.87; $P<0.001$ ). Mortality from distal colorectal cancer was reduced by 50% (87 deaths in the intervention group vs. 175 in the usual-care group; relative risk, 0.50; 95% CI, 0.38 to 0.64; $P<0.001$ ); mortality from proximal colorectal cancer was unaffected (143 and 147 deaths, respectively; relative risk, 0.97; 95% CI, 0.77 to 1.22; $P=0.81$ ).	4

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<p>10. Scholefield JH, Moss SM, Mangham CM, Whynes DK, Hardcastle JD. Nottingham trial of faecal occult blood testing for colorectal cancer: a 20-year follow-up. <i>Gut</i>. 2012;61(7):1036-1040.</p>	<p>Review/Other-Dx</p>	<p>152,850 randomised individuals</p>	<p>To compare the CRC mortality and incidence in the intervention arm with the control arm after long-term follow-up.</p>	<p>At a median follow-up of 19.5 years there was a 13% reduction in CRC mortality (95% CI 3% to 22%) in the intervention arm despite an uptake at first invitation of approximately 57%. The CRC mortality reduction in those accepting the first screening test, adjusted for the rate of non-compliers, was 18%. There was no significant difference in mortality from causes other than CRC between the intervention and control arms. Despite removing 615 adenomas &gt;10 mm in size from the intervention arm, there was no significant difference in CRC incidence between the two arms.</p>	<p>4</p>



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11. Segnan N, Armaroli P, Bonelli L, et al. Once-only sigmoidoscopy in colorectal cancer screening: follow-up findings of the Italian Randomized Controlled Trial--SCORE. J Natl Cancer Inst. 2011;103(17):1310-1322.	Experimental-Dx	34,272 subjects (17,136 in each group)	To evaluate the effect of flexible sigmoidoscopy screening on CRC incidence and mortality.	A total of 34,272 subjects (17,136 in each group) were included in the follow-up analysis. The median follow-up period was 10.5 years for incidence and 11.4 years for mortality; 251 subjects were diagnosed with CRC in the intervention group and 306 in the control group. Overall incidence rates in the intervention and control groups were 144.11 and 176.43, respectively, per 100,000 person-years. CRC-related death was noted in 65 subjects in the intervention group and 83 subjects in the control group. Mortality rates in the intervention and control groups were 34.66 and 44.45, respectively, per 100,000 person-years. In the intention-to-treat analysis, the rate of CRC incidence was statistically significantly reduced in the intervention group by 18% (rate ratio [RR] = 0.82, 95% confidence interval [CI] = 0.69 to 0.96), and the mortality rate was non-statistically significantly reduced by 22% (RR = 0.78; 95% CI = 0.56 to 1.08) compared with the control group. In the per-protocol analysis, both CRC incidence and mortality rates were statistically significantly reduced among the screened subjects; CRC incidence was reduced by 31% (RR = 0.69; 95% CI = 0.56 to 0.86) and mortality was reduced by 38% (RR = 0.62; 95% CI = 0.40 to 0.96) compared with the control group.	1

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12. Shaukat A, Mongin SJ, Geisser MS, et al. Long-term mortality after screening for colorectal cancer. <i>N Engl J Med.</i> 2013;369(12):1106-1114.	Experimental-Dx	46,551 healthy volunteers	To update the Minnesota Colon Cancer Control Study through 30 years of follow-up to assess the long-term effect of screening on colorectal-cancer mortality and all-cause mortality and to evaluate effects specific to age and sex.	Through 30 years of follow-up, 33,020 participants (70.9%) died. A total of 732 deaths were attributed to colorectal cancer: 200 of the 11,072 deaths (1.8%) in the annual-screening group, 237 of the 11,004 deaths (2.2%) in the biennial-screening group, and 295 of the 10,944 deaths (2.7%) in the control group. Screening reduced colorectal-cancer mortality (relative risk with annual screening, 0.68; 95% confidence interval [CI], 0.56 to 0.82; relative risk with biennial screening, 0.78; 95% CI, 0.65 to 0.93) through 30 years of follow-up. No reduction was observed in all-cause mortality (relative risk with annual screening, 1.00; 95% CI, 0.99 to 1.01; relative risk with biennial screening, 0.99; 95% CI, 0.98 to 1.01). The reduction in colorectal-cancer mortality was larger for men than for women in the biennial-screening group (P=0.04 for interaction).	1
13. Muller AD, Sonnenberg A. Protection by endoscopy against death from colorectal cancer. A case-control study among veterans. <i>Arch Intern Med.</i> 1995; 155(16):1741-1748.	Observational-Dx	4,411 patients	Case-control study to examine whether diagnostic procedures of the large bowel were performed in the period preceding the diagnosis of CRC less frequently in patients dying of CRC than in control patients.	Diagnostic procedures of the large bowel reduced mortality from CRC, the odds ratio being 0.41 (range 0.33-0.50) for the comparison with living control patients.	4
14. Selby JV, Friedman GD, Quesenberry CP, Jr., Weiss NS. A case-control study of screening sigmoidoscopy and mortality from colorectal cancer. <i>N Engl J Med.</i> 1992; 326(10):653-657.	Observational-Dx	261 died of cancer of the rectum or distal colon; 868 control subjects	Compare the use of screening sigmoidoscopy in patients who had died of CRC (case subjects) with matched control subjects to determine the efficacy of sigmoidoscopic screening.	8.8% of the case subjects had undergone screening by sigmoidoscopy, as compared with 24.2% of the control subjects. Screening by sigmoidoscopy can reduce mortality.	3

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15. Hofstad B, Vatn M. Growth rate of colon polyps and cancer. <i>Gastrointest Endosc Clin N Am.</i> 1997; 7(3):345-363.	Review/Other-Dx	N/A	To review methodologic problems associated with the measurement of polyps and cancer.	The malignancy potential of colorectal polyps increases with size. Recent studies show that polyps <10 mm left in situ may partly regress or partly increase in size, whereas one quarter of polyps are unchanged after 3 years. Polyps <5 mm show a mean increase in size, whereas polyps measuring 5 to 9 mm show a mean decrease in size. More studies of polyp growth related to risk factors are needed.	4
16. Winawer SJ, Zauber AG, Ho MN, et al. Prevention of colorectal cancer by colonoscopic polypectomy. The National Polyp Study Workgroup. <i>N Engl J Med.</i> 1993;329(27):1977-1981	Review/Other-Dx	1,418 patients	To evaluate the hypothesis that colonoscopic polypectomy reduces the incidence of CRC by analyzing results from the National Polyp Study.	Compared with 3 reference groups, a group of individuals who underwent colonoscopic polypectomy had reduction in CRC incidence of 76%-90% (P<0.001).	4
17. Jass JR. Classification of colorectal cancer based on correlation of clinical, morphological and molecular features. <i>Histopathology.</i> 2007; 50(1):113-130.	Review/Other-Dx	N/A	To review the morphological correlates of five molecular subtypes are outlined: Type 1 (CIMP-high/MSI-H/BRAF mutation), Type 2 (CIMP-high/MSI-L or MSS/BRAF mutation), Type 3 (CIMP-low/MSS or MSI-L/KRAS mutation), Type 4 (CIMP-neg/MSS) and Type 5 or Lynch syndrome (CIMP-neg/MSI-H).	The molecular pathways are determined at an early evolutionary stage and are fully established within precancerous lesions. Serrated polyps are the precursors of Types 1 and 2 CRC, whereas Types 4 and 5 evolve through the adenoma-carcinoma sequence. Type 3 CRC may arise within either type of polyp. Types 1 and 4 are conceived as having few, if any, molecular overlaps with each other, whereas Types 2, 3 and 5 combine the molecular features of Types 1 and 4 in different ways. This approach to the classification of CRC should accelerate understanding of causation and will impact on clinical management in the areas of both prevention and treatment.	4
18. O'Brien MJ. Hyperplastic and serrated polyps of the colorectum. <i>Gastroenterol Clin North Am.</i> 2007; 36(4):947-968, viii.	Review/Other-Dx	N/A	To review serrated polyp pathway in molecular and clinicopathological terms.	No results stated in abstract.	4

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19. Robbins DH, Itzkowitz SH. The molecular and genetic basis of colon cancer. <i>Med Clin North Am.</i> 2002; 86(6):1467-1495.	Review/Ot her-Dx	N/A	To discuss the molecular pathogenesis of carcinogenesis in sporadic CRC and then the hereditary colon cancer syndromes.	Progress has been accomplished in understanding the molecular basis of genetic colon cancer syndromes including FAP and HNPCC, and their variants of sporadic colon cancer and of the rare hamartomatous polyp syndromes. This molecular progress now has to be translated into clinical progress in molecular diagnosis, and in pharmacologic therapy for colonic polyps and cancers.	4
20. Pickhardt PJ, Taylor AJ, Kim DH, Reichelderfer M, Gopal DV, Pfau PR. Screening for colorectal neoplasia with CT colonography: initial experience from the 1st year of coverage by third-party payers. <i>Radiology.</i> 2006;241(2):417-425.	Review/Ot her-Dx	1,110 patients	Retrospective study to evaluate 1st year of CTC screening since the initiation of local third-party payer coverage.	Large colorectal polyps were identified at CTC in 3.9% and medium-sized lesions in 6.9% of patients. Concordant lesions were identified in 65/71 patients who had subsequent optical colonoscopy (PPV 91.5%).	4
21. Lieberman D, Moravec M, Holub J, Michaels L, Eisen G. Polyp size and advanced histology in patients undergoing colonoscopy screening: implications for CT colonography. <i>Gastroenterology.</i> 2008; 135(4):1100-1105.	Observatio nal-Dx	13,992 patients	To determine rates of advanced histology in patients undergoing CRC screening whose largest polyp is $\geq$ 9 mm.	Among 13,992 asymptomatic patients who had screening colonoscopy, 6,360 patients (45%) had polyps, with complete histology available in 5,977 (94%) patients. The proportion with advanced histology was 1.7% in the 1 to 5 mm group, 6.6% in the 6 to 9 mm group, 30.6% in the >10 mm group, and 72.1% in the tumor group. Distal location was associated with advanced histology in the 6 to 9 mm group (P=.04) and in the >10 mm group (P=.002).	3

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<p>22. Hofstad B, Vatn MH, Andersen SN, et al. Growth of colorectal polyps: redetection and evaluation of unresected polyps for a period of three years. ..</p>	<p>Observational-Dx</p>	<p>116 patients</p>	<p>To evaluate growth and new polyp formation in the adenomatous polyps in the patients using placebo to avoid a possible effect of the intervention medication. In addition to assess the safety aspect and the feasibility of such a study after completion.</p>	<p>Redetection rate varied from 75%-90% for each year, and was highest in the rectum and sigmoid colon. There was no net change in size of all polyps in the placebo group, however, polyps &lt;5 mm showed a tendency to net growth, and polyps 5-9 mm a tendency to net regression in size, both for adenomas and hyperplastic polyps. This pattern was verified by computerized image analysis. Patients between 50 and 60 years showed evidence of adenoma size increase compared with the older patients, and the same was true for those with multiple adenomas (four to five) compared with those with a single adenoma. The new adenomas were significantly smaller and 71% were located in the right side of the colon. Patients with multiple adenomas had more new polyps at all the follow up examinations than patients with a single adenoma. One patient developed an invasive CRC, which may be evolved from a previously overlooked polyp. Two polyps, showing intramucosal carcinoma after follow-up for 3 years, were completely removed, as judged by endoscopy and histological examination.</p>	<p>3</p>

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23. Pickhardt PJ, Kim DH, Pooler BD, et al. Assessment of volumetric growth rates of small colorectal polyps with CT colonography: a longitudinal study of natural history. <i>Lancet Oncol.</i> 2013;14(8):711-720.	Observational-Dx	243 patients included in the final study cohort.	To assess the behaviour of such polyps with CT colonography assessments.	Between April, 2004, and June, 2012, we screened 22,006 asymptomatic adults and included 243 adults (mean age 57.4 years [SD 7.1] and median age 56 years [IQR 52-61]; 106 [37%] women), with 306 small colorectal polyps. The mean surveillance interval was 2.3 years (SD 1.4; range 1-7 years; median 2.0 years [IQR 1.1-2.3]). 68 (22%) of 306 polyps progressed, 153 (50%) were stable, and 85 (28%) regressed, including an apparent resolution in 32 (10%) polyps. We established immediate histology in 131 lesions on colonoscopy after final CT colonography. 21 (91%) of 23 proven advanced adenomas progressed, compared with 31 (37%) of 84 proven non-advanced adenomas, and 15 (8%) of 198 other lesions (p<0.0001). The odds ratio for a growing polyp at CT colonography surveillance to become an advanced adenoma was 15.6 (95% CI 7.6-31.7) compared with 6-9 mm polyps detected and removed at initial CT colonography screening (without surveillance). Mean polyp volume change was a 77% increase per year for 23 proven advanced adenomas and a 16% increase per year for 84 proven non-advanced adenomas, but a 13% decrease per year for all proven non-neoplastic or unresected polyps (p<0.0001). An absolute polyp volume of more than 180 mm <sup>3</sup> at surveillance CT colonography identified proven advanced neoplasia (including one delayed cancer) with a sensitivity of 92% (22 of 24 polyps), specificity of 94% (266 of 282 polyps), positive-predictive value of 58% (22 of 38 polyps), and negative-predictive value of 99% (266 of 268 polyps). Only 16 (6%) of the 6-9 mm polyps exceeded 10 mm at follow-up.	2

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24. Stryker SJ, Wolff BG, Culp CE, Libbe SD, Ilstrup DM, MacCarty RL. Natural history of untreated colonic polyps. <i>Gastroenterology</i> . 1987; 93(5):1009-1013.	Review/Other-Dx	226 patients	Retrospective review to determine the incidence of colon carcinoma in a group of persons with colonic polyps =10 mm followed radiographically for many years.	Cumulative risk of diagnosis of cancer at the polyp site at 5, 10, and 20 year was 2.5%, 8%, and 24%, respectively. Data support the recommendation for excision of all colonic polyps =10 mm in diameter.	4
25. Bibbins-Domingo K, Grossman DC, Curry SJ, et al. Screening for Colorectal Cancer: US Preventive Services Task Force Recommendation Statement. <i>Jama</i> . 2016;315(23):2564-2575.	Review/Other-Dx	N/A	To update the 2008 US Preventive Services Task Force (USPSTF) recommendation on screening for colorectal cancer.	The USPSTF concludes with high certainty that screening for colorectal cancer in average-risk, asymptomatic adults aged 50 to 75 years is of substantial net benefit. Multiple screening strategies are available to choose from, with different levels of evidence to support their effectiveness, as well as unique advantages and limitations, although there are no empirical data to demonstrate that any of the reviewed strategies provide a greater net benefit. Screening for colorectal cancer is a substantially underused preventive health strategy in the United States.	4
26. American Cancer Society. American Cancer Society Recommendations for Colorectal Cancer Early Detection. Available at: <a href="https://www.cancer.org/cancer/colorectal-cancer/early-detection/acs-recommendations.html">https://www.cancer.org/cancer/colorectal-cancer/early-detection/acs-recommendations.html</a> .	Review/Other-Dx	N/A	To encourage patients to have tests that have the best chance of finding both polyps and cancer.	No results stated in abstract.	4
27. Levin B, Lieberman DA, McFarland B, et al. Screening and surveillance for the early detection of colorectal cancer and adenomatous polyps, 2008: a joint guideline from the American Cancer Society, the US Multi-Society Task Force on Colorectal Cancer, and the American College of Radiology. <i>CA Cancer J Clin</i> . 2008; 58(3):130-160.	Review/Other-Dx	N/A	Guidelines for the detection of adenomatous polyps and CRC in asymptomatic average-risk adults developed by American Cancer Society, the US Multi-Society Task Force on Colorectal Cancer, and the ACR.	All 3 organizations agree colon cancer prevention should be the primary goal of screening.	4

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28. American College of Radiology. ACR–SAR–SCBT-MR Practice Parameter for the Performance of Computed Tomography (CT) Colonography in Adults. Available at: <a href="https://www.acr.org/~media/ACR/Documents/PGTS/guidelines/CT_Colonography.pdf">https://www.acr.org/~media/ACR/Documents/PGTS/guidelines/CT_Colonography.pdf</a> . Accessed September 5, 2014.	Review/Other-Dx	N/A	Guidance document to promote the safe and effective performance of computed tomography (CT) colonography in adults.	No results stated in abstract.	4
29. Hassan C, Pickhardt PJ. Management of subcentimetric polyps detected by CT colonography. <i>Nat Rev Gastroenterol Hepatol</i> . 2013;10(2):119-124.	Review/Other-Dx	N/A	To summarize the evidence on the natural history and management of small colorectal polyps, and suggests a patient-tailored approach when these lesions are detected by CTC (or another noninvasive imaging test) in a screening setting.	No results stated in abstract.	4
30. Pickhardt PJ, Hanson ME, Vanness DJ, et al. Unsuspected extracolonic findings at screening CT colonography: clinical and economic impact. <i>Radiology</i> . 2008;249(1):151-159.	Observational-Dx	2,195 consecutive asymptomatic adults	Retrospective study to evaluate the frequency and estimated costs of additional diagnostic workup for extracolonic findings detected at CTC in a large screening cohort.	Benign findings were confirmed in most cases, but relevant new diagnoses were made in 55 (2.5%) patients, including extracolonic malignancies in 9 patients. The mean cost per patient for nonsurgical procedures was \$31.02 (95% CI: \$23.72, \$38.94); that for surgical procedures was \$67.54 (95% CI: \$38.62, \$101.55).	4



**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
31. Stoop EM, de Haan MC, de Wijkerslooth TR, et al. Participation and yield of colonoscopy versus non-cathartic CT colonography in population-based screening for colorectal cancer: a randomised controlled trial. <i>Lancet Oncol.</i> 2012; 13(1):55-64.	Experiment al-Dx	8,844 patients	To compare participation and diagnostic yield between screening with colonoscopy and with non-cathartic CTC.	1,276 (22%) of 5,924 colonoscopy invitees participated, compared with 982 (34%) of 2,920 CTC invitees (relative risk 1.56, 95% CI, 1.46-1.68; P<0.0001). Of the participants in the colonoscopy group, 111 (9%) had advanced neoplasia of whom 7 (<1%) had a carcinoma. Of CTC participants, 84 (9%) were offered colonoscopy, of whom 60 (6%) had advanced neoplasia of whom 5 (<1%) had a carcinoma; 82 (8%) were offered surveillance. The diagnostic yield for all advanced neoplasia was 8.7 per 100 participants for colonoscopy vs 6.1 per 100 for CTC (relative risk 1.46, 95% CI, 1.06-2.03; P=0.02) and 1.9 per 100 invitees for colonoscopy and 2.1 per 100 invitees for CTC (relative risk 0.91, 0.66-2.03; P=0.56). The diagnostic yield for advanced neoplasia of 10 mm or more was 1.5 per 100 invitees for colonoscopy and 2.0 per 100 invitees for CTC, respectively (relative risk 0.74, 95% CI, 0.53-1.03; P=0.07). Serious adverse events related to the screening procedure were post-polypectomy bleedings: two in the colonoscopy group and three in the CTC group.	3

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
32. Zalis ME, Blake MA, Cai W, et al. Diagnostic accuracy of laxative-free computed tomographic colonography for detection of adenomatous polyps in asymptomatic adults: a prospective evaluation. <i>Ann Intern Med.</i> 2012; 156(10):692-702.	Observational-Dx	605 patients	To assess the performance of detecting adenomas 6 mm or larger and patient experience of laxative-free CTC.	For adenomas =10 mm, per-patient sensitivity of CTC was 0.91 (95% CI, 0.71 to 0.99) and specificity was 0.85 (CI, 0.82 to 0.88); sensitivity of optical colonoscopy was 0.95 (CI, 0.77 to 1.00) and specificity was 0.89 (CI, 0.86 to 0.91). Sensitivity of CTC was 0.70 (CI, 0.53 to 0.83) for adenomas =8 mm and 0.59 (CI, 0.47 to 0.70) for those =6 mm; sensitivity of optical colonoscopy for adenomas =8 mm was 0.88 (CI, 0.73 to 0.96) and 0.76 (CI, 0.64 to 0.85) for those =6 mm. The specificity of optical colonoscopy at the threshold of =8 mm was 0.91 and at =6 mm was 0.94. Specificity for optical colonoscopy was greater than that for CTC, which was 0.86 at the threshold of =8 mm and 0.88 at =6 mm (P=0.02). Reported participant experience for comfort and difficulty of examination preparation was better with CTC than optical colonoscopy.	2

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
33. Pooler BD, Kim DH, Pickhardt PJ. Potentially Important Extracolonic Findings at Screening CT Colonography: Incidence and Outcomes Data From a Clinical Screening Program. <i>AJR Am J Roentgenol.</i> 2016;206(2):313-318.	Observational-Dx	7952 consecutive asymptomatic adults	To analyze the incidence and outcomes of unsuspected potentially significant (CT Colonography Reporting and Data System [C-RADS] extracolonic category E4) findings in a population undergoing clinical CTC screening.	Overall, 2.5% (202/7952) of patients had a potentially significant (C-RADS category E4) extracolonic finding for which further imaging (56%; 113/202) or clinical follow-up (44%; 89/202) was recommended. No patients had multiple category E4 findings. Twenty-two patients were lost to follow-up. Of the remaining 180 patients, 68% (123/180) proved to have clinically significant disease, including 23% (42/180) with malignant or potentially malignant neoplasms and 32% (57/180) with abdominal aortic or other visceral artery aneurysms requiring treatment or surveillance. The most commonly involved organs and systems included the vascular system (26%; 53/202), the genitourinary system (18%; 36/202), the liver (15%; 30/202), the gastrointestinal system (9.9%; 20/202), the lungs (9.4%; 19/202), and the gynecologic system (6.9%; 14/202).	2
34. Sutherland T, Coyle E, Lui B, Lee WK. Extracolonic findings at CT colonography: a review of 258 consecutive cases. <i>J Med Imaging Radiat Oncol.</i> 2011; 55(2):149-152.	Observational-Dx	258 patients	A retrospective review of CTC cases performed within our Australian tertiary hospital to identify the frequency and types of extracolonic findings.	258 CTC examinations were performed and an extracolonic findings was present in 70.1% and were more common with increasing age (P=0.01), but were not related to gender, or source of referral or the presence of colonic findings. Major extracolonic findings were diagnosed in 8.9% of patients.	4

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
35. Veerappan GR, Ally MR, Choi JH, Pak JS, Maydonovitch C, Wong RK. Extracolonic findings on CT colonography increases yield of colorectal cancer screening. <i>AJR Am J Roentgenol.</i> 2010; 195(3):677-686.	Review/Other-Dx	2,277 patients	To evaluate the impact of extracolonic findings when screening is undertaken by CTC.	Of 2,277 patients (mean +/- SD age, 59 +/- 11 years; 60% white; 56% male) undergoing CTC, extracolonic findings were identified in 1,037 (46%) patients, with 787 (34.5%) insignificant and 240 (11.0%) significant findings. Evaluation of significant findings generated 280 radiology procedures and 19 surgeries over a mean follow-up time of 19 +/- 10 months. The total cost of the radiology studies was \$113,179; the studies added approximately \$50 extra per patient. Seven high-risk lesions were identified (six extracolonic malignancies and one large aortic aneurysm) in patients with significant findings. CTC also identified six intracolonic malignancies and three adenomas with high-grade dysplasia. When considering extracolonic findings, CTC increased the odds of identifying high-risk lesions by 78% (nine intracolonic lesions vs 16 intracolonic plus extracolonic lesions; P=0.0156). Of the 16 intracolonic and extracolonic high-risk lesions, 11 (69%) underwent curative resection, and 5/11 (44.4%) were extracolonic.	4
36. Yee J, Kumar NN, Godara S, et al. Extracolonic abnormalities discovered incidentally at CT colonography in a male population. <i>Radiology.</i> 2005; 236(2):519-526.	Review/Other-Dx	500 men	To prospectively evaluate the prevalence of incidental extracolonic findings at CTC and to estimate the cost of their imaging work-up in male patients with high and those with average risk of CRC.	315 (63.0%) of 500 had extracolonic findings; 45 (9.0%) had clinically important extracolonic findings. Of 596 extracolonic findings identified, 50 (8.4%) were thought to be clinically important. The mean additional cost to work up important findings was \$28.12 per CTC examination.	4
37. DiSantis DJ. Gastrointestinal fluoroscopy: what are we still doing? <i>AJR Am J Roentgenol.</i> 2008;191(5):1480-1482.	Review/Other-Dx	N/A	To quantify trends in gastrointestinal fluoroscopy volume.	Nationwide Medicare data from 2001 to 2006 reveal that the volumes of barium enema and upper gastrointestinal studies suffered a steep drop, but the numbers of esophagograms and swallowing studies actually increased.	4

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
38. Pickhardt PJ. Incidence of colonic perforation at CT colonography: review of existing data and implications for screening of asymptomatic adults. <i>Radiology</i> . 2006; 239(2):313-316.	Review/Other-Dx	N/A	To report the incidence of colonic perforation rate at CTC.	No results stated in abstract.	4
39. Winawer SJ, Fletcher RH, Miller L, et al. Colorectal cancer screening: clinical guidelines and rationale. <i>Gastroenterology</i> . 1997; 112(2):594-642.	Review/Other-Dx	N/A	Guideline to present panel's recommendations with respect to screening and surveillance in people at average risk for CRC and those at increased risk because of a family history of CRC or genetic syndromes or a personal history of adenomatous polyps, inflammatory bowel disease, or curative-intent resection of CRC.	No results stated in abstract.	4
40. Johnson CD, Chen MH, Toledano AY, et al. Accuracy of CT colonography for detection of large adenomas and cancers. <i>N Engl J Med</i> . 2008; 359(12):1207-1217.	Observational-Dx	2,531 patients	To assess accuracy of CTC for detection of large adenomas and cancers.	Complete data available for 2,531 participants. For large adenomas and cancers, the mean (+/-SE) per-patient estimates of the sensitivity, specificity, PPV, NPV, and AUC for CTC were 0.90+/-0.03, 0.86+/-0.02, 0.23+/-0.02, 0.99+/-<0.01, and 0.89+/-0.02, respectively. CTC identified 90% of subjects with adenomas or cancers =10 mm.	2
41. Pickhardt PJ, Choi JR, Hwang I, et al. Computed tomographic virtual colonoscopy to screen for colorectal neoplasia in asymptomatic adults. <i>N Engl J Med</i> . 2003; 349(23):2191-2200.	Observational-Dx	1,233 patients	Prospective, multicenter study to evaluate sensitivity and specificity of CTC in detecting colorectal neoplasia in an average-risk screening population. Virtual and optical colonoscopy was compared.	Sensitivity and specificity of CTC for adenomas =10 mm were 94% and 96%, respectively. CT virtual colonoscopy with the use of a 3-D approach is an accurate screening method for the detection of colorectal neoplasia and compares favorably with optical colonoscopy.	3

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
42. Graser A, Stieber P, Nagel D, et al. Comparison of CT colonography, colonoscopy, sigmoidoscopy and faecal occult blood tests for the detection of advanced adenoma in an average risk population. Gut. 2009; 58(2):241-248.	Observational-Dx	307 patients	To compare the performance characteristics of five different screening tests in parallel for the detection of advanced colonic neoplasia: CTC, colonoscopy, flexible sigmoidoscopy, faecal immunochemical stool testing and FOBT.	221 adenomas were detected in 307 subjects who completed CTC (mean radiation dose, 4.5 mSv) and colonoscopy; 269 patients provided stool samples for both FOBT and faecal immunochemical stool testing. Sensitivities of colonoscopy, CTC, flexible sigmoidoscopy, faecal immunochemical stool testing and FOBT for advanced colonic neoplasia were 100% (95% CI, 88.4% to 100%), 96.7% (82.8% to 99.9%), 83.3% (95% CI, 65.3% to 94.4%), 32% (95% CI, 14.9% to 53.5) and 20% (95% CI, 6.8% to 40.7%), respectively. Combination of flexible sigmoidoscopy with FOBT or faecal immunochemical stool testing led to no relevant increase in sensitivity. 12/45 advanced adenomas were <10 mm. 46% of patients preferred CTC and 37% preferred colonoscopy (P<0.001).	3
43. Halligan S, Altman DG, Taylor SA, et al. CT colonography in the detection of colorectal polyps and cancer: systematic review, meta-analysis, and proposed minimum data set for study level reporting. Radiology. 2005; 237(3):893-904.	Meta-analysis	24 studies; 4,181 patients; 2 reviewers	Systematic review and meta-analysis to assess the methodologic quality of available data in published reports of CTC.	Meta-analysis of 2,610 patients, showed high per-patient average sensitivity (93%; 95% CI: 73%, 98%) and specificity (97%; 95% CI: 95%, 99%) for colonography; sensitivity and specificity decreased to 86% (95% CI: 75%, 93%) and 86% (95% CI: 76%, 93%), respectively, when the threshold was lowered to include medium polyps. When polyps of all sizes were included, studies were too heterogeneous in sensitivity (range 45%-97%) and specificity (range 26%-97%) to allow meaningful meta-analysis. Of 150 cancers, 144 were detected (sensitivity 95.9%; 95% CI: 91.4%, 98.5%).	Good

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
44. Mulhall BP, Veerappan GR, Jackson JL. Meta-analysis: computed tomographic colonography. <i>Ann Intern Med.</i> 2005; 142(8):635-650.	Meta-analysis	33 studies 6,393 patients	Systematically review the test performance of CTC compared to colonoscopy or surgery and to assess variables that may affect test performance. Prospective studies with colonoscopy or surgery as gold standard were selected.	Sensitivity of CTC was heterogeneous but improved as polyp size increased (48% [95% CI: 25%-70%] for detection of polyps <6 mm, 70% [CI: 55%-84%] for polyps 6 to 9 mm, and 85% [CI: 79%-91%] for polyps >9 mm). In contrast, specificity was homogenous (92% [CI: 89%-96%] for detection of polyps <6 mm, 93% [CI: 91%-95%] for polyps 6-9 mm, and 97% [CI: 96%-97%] for polyps >9 mm).	Good
45. Cotton PB, Durkalski VL, Pineau BC, et al. Computed tomographic colonography (virtual colonoscopy): a multicenter comparison with standard colonoscopy for detection of colorectal neoplasia. <i>JAMA.</i> 2004; 291(14):1713-1719.	Observational-Dx	600 patients	Multicenter study to evaluate the sensitivity and specificity of CTC in detecting colorectal neoplasia in patients referred for clinically indicated colonoscopy.	Sensitivity of CTC for detecting subjects with one or more lesions =10 mm was 55%; Specificity for detecting subjects without lesions =10 mm was 96%.	3
46. Rockey DC, Paulson E, Niedzwiecki D, et al. Analysis of air contrast barium enema, computed tomographic colonography, and colonoscopy: prospective comparison. <i>Lancet.</i> 2005; 365(9456):305-311.	Observational-Dx	614 patients	Multicenter study to prospectively compare sensitivity and specificity of air contrast barium enema, CTC and colonoscopy in detecting colorectal polyps and cancers in patients at increased risk for colorectal neoplasia.	For lesions =10 mm, per patient sensitivities of air contrast barium enema, CTC and colonoscopy were 48%, 59% and 98%, respectively, per lesion sensitivities were 45% 53% and 98.7%, respectively, and specificities were 90%, 96% and 99.6%, respectively. Colonoscopy was more sensitive compared to other tests.	3
47. Kim DH, Pickhardt PJ, Taylor AJ, et al. CT colonography versus colonoscopy for the detection of advanced neoplasia. <i>N Engl J Med.</i> 2007;357(14):1403-1412.	Observational-Dx	3,120 patients on CTC; 3,163 patients on optical colonoscopy	To compare CTC with colonoscopy for detection of advanced neoplasia.	During CTC and optical colonoscopy, 123 and 121 advanced neoplasms were found, including 14 and 4 invasive cancers, respectively. Advanced neoplasia was confirmed in 100/3,120 (CTC group) and in 107/3,163 (optical colonoscopy group). CTC-detected polyps of 6-9 mm. Findings support the use of CTC as a primary screening test before therapeutic colonoscopy.	3

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
48. Atkin W, Dadswell E, Wooldrage K, et al. Computed tomographic colonography versus colonoscopy for investigation of patients with symptoms suggestive of colorectal cancer (SIGGAR): a multicentre randomised trial. <i>Lancet</i> . 2013;381(9873):1194-1202.	Experimental-Dx	1610 patients	To compare rates of additional colonic investigation after CTC or colonoscopy for detection of colorectal cancer or large (>=10 mm) polyps in symptomatic patients in clinical practice.	1610 patients were randomly assigned to receive either colonoscopy (n=1072) or CTC (n=538). 30 patients withdrew consent, leaving for analysis 1047 assigned to colonoscopy and 533 assigned to CTC. 160 (30.0%) patients in the CTC group had additional colonic investigation compared with 86 (8.2%) in the colonoscopy group (relative risk 3.65, 95% CI 2.87-4.65; p<0.0001). Almost half the referrals after CTC were for small (<10 mm) polyps or clinical uncertainty, with low predictive value for large polyps or cancer. Detection rates of colorectal cancer or large polyps in the trial cohort were 11% for both procedures. CTC missed 1 of 29 colorectal cancers and colonoscopy missed none (of 55). Serious adverse events were rare.	1
49. Kim DH, Pooler BD, Weiss JM, Pickhardt PJ. Five year colorectal cancer outcomes in a large negative CT colonography screening cohort. <i>Eur Radiol</i> . 2012; 22(7):1488-1494.	Review/Other-Dx	1,011 patients	To assess the 5-year incidence of clinically presenting CRCs following a negative CTC screening examination, as few patient outcome data regarding a negative CTC screening result exist.	Of the 1,050 cohort (mean [+/-SD] age 56.9 +/- 7.4 years), 39 (3.7%) patients were excluded owing to lack of follow-up within our system beyond the initial screening CTC. The remaining 1,011 patients were followed for an average of 4.73 +/- 1.15 years. One incident colorectal adenocarcinoma represented a crude cancer incidence of 0.2 cancers per 1,000 patient years. Electronic medical record revealed 14 additional patients with clinically important gastrointestinal tumors including: advanced adenomas (n = 11), appendiceal goblet cell carcinoid (n = 1), appendiceal mucinous adenoma (n = 1) and metastatic ileocolonic carcinoid (n = 1). All positive patients including the incident carcinoma are alive at the time of review.	4



**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
50. Kim DH, Pickhardt PJ, Hanson ME, Hinshaw JL. CT colonography: performance and program outcome measures in an older screening population. <i>Radiology</i> . 2010; 254(2):493-500.	Observational-Dx	577 patients	To evaluate CTC performance and program outcome measures in an older cohort (65-79 years) of an established large-scale CRC screening program.	With a 6 mm threshold for positivity, the overall referral rate to optical colonoscopy was 15.3% (88/577), leading to 277 polypectomies and the removal of 103 nondiminutive adenomas. For adenomas, the per-patient positivity rates were 10.9% (63/577) and 6.8% (39/577) at the 6- and 10-mm thresholds, respectively. The prevalence of advanced neoplasia was 7.6% (44/577). 54 adenomas met advanced status, and 5 unsuspected cancers were detected. The advanced neoplasias identified were typically large, with a mean size of 21 mm. Potentially important extracolonic findings were seen in 15.4% (89/577) of patients, with a workup rate of 7.8% (45/577). The majority of important extracolonic diagnoses were vascular aneurysms (n = 18). No major complications were encountered.	4
51. Macari M, Nevsky G, Bonavita J, Kim DC, Megibow AJ, Babb JS. CT colonography in senior versus nonsenior patients: extracolonic findings, recommendations for additional imaging, and polyp prevalence. <i>Radiology</i> . 2011; 259(3):767-774.	Observational-Dx	454 patients	To retrospectively evaluate the frequency of recommendations for additional imaging for important extracolonic findings and polyp prevalence among a cohort of seniors (age ≥65 years) and nonseniors (age <65 years) undergoing low-dose CTC.	The percentage of patients with at least one reported polyp was 14.2% (29/204) for the nonsenior group and 13.2% (33/250) for seniors, which was not significantly different (P=.772). The percentage of patients with at least one extracolonic finding was 55.4% (113/204) for nonseniors and 74.0% (185/250) for seniors (P<.0001). The percentage of patients in which an recommendations for additional imaging was suggested was 4.4% (9/204) for nonseniors and 6.0% (15/250) for seniors, which was not significantly different (P=.450).	4

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
52. Johnson CD, Herman BA, Chen MH, et al. The National CT Colonography Trial: assessment of accuracy in participants 65 years of age and older. <i>Radiology</i> . 2012; 263(2):401-408.	Observational-Dx	477 patients	To conduct post-hoc analysis of National CT Colonography Trial data and compare the sensitivity and specificity of CTC in participants <65 years with those in participants aged 65 years and older.	Complete data were available for 477 participants 65 years of age or older (among 2,531 evaluable participants). Prevalence of adenomas =1 cm for the older participants vs the younger participants was 6.9% (33/477) vs 3.7% (76/2,054) (P<.004). For large neoplasms, mean estimates for CTC sensitivity and specificity among the older cohort were 0.82 (95% CI: 0.644, 0.944) and 0.83 (95% CI: 0.779, 0.883), respectively. For large neoplasms in the younger group, CTC sensitivity and specificity were 0.92 (95% CI: 0.837, 0.967) and 0.86 (95% CI: 0.816, 0.899), respectively. Per-polyp sensitivity for large neoplasms for the older and younger populations was 0.75 (95% CI: 0.578, 0.869) and 0.84 (95% CI: 0.717, 0.924), respectively. For the older and younger groups, per-participant sensitivity was 0.72 (95% CI: 0.565, 0.854) and 0.81 (95% CI: 0.745, 0.882) for detecting adenomas =6 mm in diameter.	3
53. Cash BD, Riddle MS, Bhattacharya I, et al. CT colonography of a Medicare-aged population: outcomes observed in an analysis of more than 1400 patients. <i>AJR Am J Roentgenol</i> . 2012; 199(1):W27-34.	Observational-Dx	1,410 patients	To evaluate outcomes of patients 65 years old and older who underwent CTC between 2004 and 2009.	The frequency of referral to colonoscopy based on a polyp size threshold of 6 mm was 14.5%. Colorectal neoplasia was found in 9.3% of patients, with advanced neoplasia in 3.3%. Potentially important extracolonic findings were observed in 2.9% of patients. The low rates of referral to colonoscopy, prevalence of advanced neoplasia, and prevalence of extracolonic findings make CTC a viable option for Medicare-aged patients.	3

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
<p>54. Kim DH, Matkowskyj KA, Lubner MG, et al. Serrated Polyps at CT Colonography: Prevalence and Characteristics of the Serrated Polyp Spectrum. <i>Radiology</i>. 2016;280(2):455-463.</p>	<p>Observational-Dx</p>	<p>A final study cohort of 221 patients.</p>	<p>To report the prevalence and characteristics of serrated polyps identified in a large, average-risk population undergoing screening computed tomographic (CT) colonography.</p>	<p>Nondiminutive serrated lesions (<math>\geq 6</math> mm) were seen at CT colonography-based screening with a prevalence of 3.1% (254 of 8289 patients). Sessile serrated adenomas (SSAs) and traditional serrated adenomas (TSAs) constituted 36.8% (137 of 372) and 4.3% (16 of 372) of serrated lesions, respectively; hyperplastic polyps (HPs) accounted for 58.9% (219 of 372 lesions). SSA and TSA tended to be large (mean size, 10.6 mm and 14.1 mm, respectively), with size categories and polyp subgroups significantly associated (<math>P &lt; .0001</math>). SSA tended to be proximal in location (91.2%, 125 of 137 lesions) and flat in morphologic appearance (39.4%, 54 of 137 lesions) compared with TSA and HP. The presence of high-grade dysplasia in serrated lesions was uncommon when compared with advanced adenomas (one of 372 lesions vs 22 of 395 lesions, respectively; <math>P &lt; .0001</math>). Multivariate analysis showed that contrast material tagging markedly improved serrated polyp detection with an odds ratio of 40.4 (95% confidence interval: 10.1, 161.4).</p>	<p align="center">4</p>

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
55. Fletcher JG, Silva AC, Fidler JL, et al. Noncathartic CT colonography: Image quality assessment and performance and in a screening cohort. <i>AJR Am J Roentgenol.</i> 2013;201(4):787-794.	Observational-Dx	564 asymptomatic subjects	To examine noncathartic CT colonography (CTC) quality and performance using four similar bowel-tagging regimens in an asymptomatic screening cohort.	Of the 556 subjects, 7% (37/556) and 3% (16/556) of patients had 52 and 20 adenomatous polyps $\geq 6$ and $\geq 10$ mm, respectively. The addition of iodine significantly improved the percentage of labeled stool ( $p \leq 0.0002$ ) and specificity (80% vs 89-93%, respectively; $p = 0.046$ ). The overall sensitivity of noncathartic CTC for adenomatous polyps $\geq 6$ mm was 76% (28/37; 95% CI, 59-88%), which is similar to the sensitivity of the iodinated regimens with most patients (sensitivity: 231 patients, 74% [14/19; 95% CI, 49-91%]; 229 patients, 80% [12/15; 95% CI, 52-96%]). The negative predictive value was 98% (481/490), and the lone cancer was detected (0.2%, 1/556). EC was thought to improve conspicuity of 10 of 21 visible polyps $\geq 10$ mm.	2
56. Blakeborough A, Sheridan MB, Chapman AH. Complications of barium enema examinations: a survey of UK Consultant Radiologists 1992 to 1994. <i>Clin Radiol</i> 1997; 52(2):142-148.	Review/Other-Dx	756 respondents; 738,216 exams	Retrospective study. Consultant radiologists were sent a questionnaire regarding complications from barium enema performed during a 3-year period.	77 consultants (10.2%) reported a total of 82 complications including 13 deaths: an overall mortality rate of 1/56,786. 3/30 (10%) cases of bowel perforation died, as compared with 9/16 (56%) cases of cardiac arrhythmia.	4
57. Steine S, Stordahl A, Lunde OC, Loken K, Laerum E. Double-contrast barium enema versus colonoscopy in the diagnosis of neoplastic disorders: aspects of decision-making in general practice. <i>Fam Pract.</i> 1993; 10(3):288-291.	Observational-Dx	190 patients	To compare DCBE with colonoscopy in the diagnosis of neoplastic disorders.	Sensitivity for polyps was 70%, increasing to 81% for polyps $\geq 10$ mm. The predictive value was 93%-97% for the exclusion of polyps. The caecum was reached in 187 patients by DCBE (98%) and in 164 patients (86%) by colonoscopy. DCBE is associated with a number of false-positive cases, while colonoscopy is associated with technical difficulties; both techniques may lead to repeated examinations, regardless of which was the first choice.	3

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
58. Saito Y, Slezak P, Rubio C. The diagnostic value of combining flexible sigmoidoscopy and double-contrast barium enema as a one-stage procedure. <i>Gastrointest Radiol.</i> 1989; 14(4):357-359.	Observational-Dx	675 patients; 193 polyps	Prospective study to analyze the diagnostic value of combining flexible sigmoidoscopy with DCBE. The diagnostic values of these techniques were compared.	Histological examination of 93 polyps showed half of polyps <5 mm and 93.3% of those <6 mm were adenomas. DCBE combined with flexible sigmoidoscopy gives the most reliable and precise diagnosis of various disorders of the rectum and sigmoid colon.	3
59. Kung JW, Levine MS, Glick SN, Lakhani P, Rubesin SE, Laufer I. Colorectal cancer: screening double-contrast barium enema examination in average-risk adults older than 50 years. <i>Radiology.</i> 2006; 240(3):725-735.	Observational-Dx	276 exams	Retrospective study to determine the diagnostic yield of DCBE performed for CRC screening of neoplasms =1 cm or advanced neoplastic lesions of any size in average-risk adults >50 years.	Barium enema examinations performed in average-risk adults >50 years of age have a diagnostic yield of 5.1% for neoplastic lesions =1 cm and 6.2% for advanced neoplastic lesions, regardless of size.	3
60. Betes M, Munoz-Navas MA, Duque JM, et al. Use of colonoscopy as a primary screening test for colorectal cancer in average risk people. <i>Am J Gastroenterol.</i> 2003; 98(12):2648-2654.	Review/Other-Dx	2,210 patients	Build a predictive model to identify average risk adults suitable for examination with colonoscopy as a primary screening test for CRC.	Neoplastic lesions were found in 617 subjects (27.9%), including 259 with at least one neoplasm that was =10 mm, villous, or with moderate-to-severe dysplasia, and 11 with invasive cancers. Advanced lesions were more frequent among men, older people, and those with a higher body mass index.	4
61. Harewood GC, Lieberman DA. Prevalence of advanced neoplasia at screening colonoscopy in men in private practice versus academic and Veterans Affairs medical centers. <i>Am J Gastroenterol.</i> 2003; 98(10):2312-2316.	Review/Other-Dx	9,109 men total; community (5,625), academic (2,269), and VA (1,215)	To define the prevalence of advanced neoplasia in male patients undergoing screening colonoscopy in diverse practice settings.	Age- and race-adjusted prevalence of polyps >9 mm in men who receive screening colonoscopy was significantly lower in academic sites compared to VA and community practice sites.	4
62. Lieberman DA, Weiss DG, Bond JH, Ahnen DJ, Garewal H, Chejfec G. Use of colonoscopy to screen asymptomatic adults for colorectal cancer. Veterans Affairs Cooperative Study Group 380. <i>N Engl J Med.</i> 2000; 343(3):162-168.	Review/Other-Dx	3,196 patients	To determine the prevalence and location of advanced colonic neoplasms and the risk of advanced proximal neoplasia in asymptomatic patients.	Colonoscopy showed one or more neoplastic lesions in 37.5% of the patients, an adenoma with a diameter of at least 10 mm or a villous adenoma in 7.9%, an adenoma with high-grade dysplasia in 1.6%, and invasive cancer in 1.0%. 52% of the patients with advanced proximal neoplasia had no distal adenomas.	4

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
63. Imperiale TF, Wagner DR, Lin CY, Larkin GN, Rogge JD, Ransohoff DF. Results of screening colonoscopy among persons 40 to 49 years of age. <i>N Engl J Med.</i> 2002; 346(23):1781-1785.	Review/Other-Dx	906 patients	Review procedure and pathology reports to measure the yield of screening colonoscopy for cancer and polyps among persons 40-49 years of age.	78.9% had no detected lesions, 10% had hyperplastic polyps, 8.7% had tubular adenomas, and 3.5% had advanced neoplasms, none of which were cancerous.	4
64. Brady AP, Stevenson GW, Stevenson I. Colorectal cancer overlooked at barium enema examination and colonoscopy: a continuing perceptual problem. <i>Radiology.</i> 1994; 192(2):373-378.	Review/Other-Dx	161 patients	Retrospective study to examine reasons for missed diagnosis of CRC at barium enema examination and colonoscopy.	27 were overlooked at barium enema and 7 at colonoscopy. 15% of barium enema errors were perceptible and 15% were technical. Combined perceptible and technical errors occurred in 45% of cases. Interpretive errors occurred in 25% of cases.	4
65. Johnson CD, Carlson HC, Taylor WF, Weiland LP. Barium enemas of carcinoma of the colon: sensitivity of double- and single-contrast studies. <i>AJR Am J Roentgenol.</i> 1983; 140(6):1143-1149.	Observational-Dx	1,084 patients; 1,140 CRCs	Review CRCs in patients during a 5 1/2-year period to compare the accuracy of double- and single-contrast barium enema examinations.	Both methods were equally sensitive. The error rate (ulcerative colitis excluded) was 4.8% for the single-contrast enema and 4.7% for the double-contrast study. Neither type of examination was superior in finding smaller lesions or earlier staged lesions.	3
66. Rex DK, Rahmani EY, Haseman JH, Lemmel GT, Kaster S, Buckley JS. Relative sensitivity of colonoscopy and barium enema for detection of colorectal cancer in clinical practice. <i>Gastroenterology</i> 1997; 112(1):17-23.	Observational-Dx	2,193 patients	Review medical records of 20 hospitals to determine relative sensitivity of colonoscopy and barium enema for detection of CRC in clinical practice.	Sensitivity of colonoscopy for CRC (95%) was greater than that for barium enema (82.9%). The sensitivity of DCBE (85.2%) was not different from that of single-contrast (81.8%).	3
67. Toma J, Paszat LF, Gunraj N, Rabeneck L. Rates of new or missed colorectal cancer after barium enema and their risk factors: a population-based study. <i>Am J Gastroenterol.</i> 2008; 103(12):3142-3148.	Observational-Dx	13,849 patients	Population-based study to evaluate the rate of new or missed CRC following double-contrast barium enema and the associated risk factors.	Overall rate of new or missed cancers was 22.4%. Independent risk factors were older age, female sex, previous abdominal or pelvic surgery, diverticular disease, right-sided CRC, and having the DCBE in an office setting.	4

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
68. Sosna J, Sella T, Sy O, et al. Critical analysis of the performance of double-contrast barium enema for detecting colorectal polyps > or = 6 mm in the era of CT colonography. <i>AJR Am J Roentgenol.</i> 2008; 190(2):374-385.	Meta-analysis	Barium enema–11 studies (5,995 patients, 1,548 polyps) CT–30 studies (6,573 patients, 2,348 polyps)	Meta-analysis comparing accuracy of DCBE with CTC for the detection of colorectal polyps =6 mm with endoscopy as gold standard. Prospective studies were identified.	Polyps =10 mm; 0.121-per-patient sensitivity difference favored CTC (DCBE 0.702; CTC 0.823). Polyps =10 mm; 0.031-per-polyp sensitivity difference favored CTC (DCBE 0.715; CTC 0.746). Polyps =10 mm; specificity difference of 0.104 favored CTC (DCBE 0.850; CTC 0.954). DCBE has lower sensitivity and specificity than CTC for detecting colorectal polyps = 6 mm.	Good
69. Ott DJ, Chen YM, Gelfand DW, Wu WC, Munitz HA. Single-contrast vs double-contrast barium enema in the detection of colonic polyps. <i>AJR Am J Roentgenol.</i> 1986; 146(5):993-996.	Observational-Dx	139 patients; 234 polyps	5-year review of radiographic and colonoscopic records to compare the sensitivity of single-contrast with DCBE in the detection of colonic polyps.	Sensitivity for DCBE for adenomas >1 cm was 96%. Sensitivity for single-contrast barium enema for adenomas >1 cm was 94%. DCBE was more effective than single-contrast examination only for detection of polyps <1 cm.	3
70. Luboldt W, Bauerfeind P, Wildermuth S, Marincek B, Fried M, Debatin JF. Colonic masses: detection with MR colonography. <i>Radiology.</i> 2000; 216(2):383-388.	Observational-Dx	132 patients	To examine the accuracy of MRC in the detection of colorectal masses. Conventional colonoscopy was the reference standard.	MRI quality was sufficient for diagnosis in 127 (96%) patients. 19/31 6-10 mm lesions and 26/27 large (>10 mm) lesions were correctly identified. MRC had sensitivity of 93%, specificity of 99%, PPV of 92%, and NPV of 98% for detection of large masses. MRC is useful in detecting colorectal mass lesions >10 mm.	2
71. Pappalardo G, Poletini E, Frattaroli FM, et al. Magnetic resonance colonography versus conventional colonoscopy for the detection of colonic endoluminal lesions. <i>Gastroenterology.</i> 2000; 119(2):300-304.	Observational-Dx	70 patients	To assess the diagnostic ability of a promising alternative technique for detecting endoluminal masses using MRC.	In detecting endoluminal lesions, MRC achieved a diagnostic accuracy similar to conventional colonoscopy (sensitivity, 96%; specificity, 93%; PPV, 98%; and NPV, 87.5%).	2

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
72. Ajaj W, Pelster G, Treichel U, et al. Dark lumen magnetic resonance colonography: comparison with conventional colonoscopy for the detection of colorectal pathology. <i>Gut</i> . 2003; 52(12):1738-1743.	Observational-Dx	70 patients	Comparative study to examine MRC vs conventional colonoscopy for the detection of colonic endoluminal lesions.	In detecting endoluminal lesions, MRC had sensitivity 96%; specificity 93%; PPV 98%; and NPV 87.5%. MRC could be useful in screening programs of patients at high risk for colon cancer.	2
73. Hartmann D, Bassler B, Schilling D, et al. Colorectal polyps: detection with dark-lumen MR colonography versus conventional colonoscopy. <i>Radiology</i> . 2006; 238(1):143-149.	Observational-Dx	100 patients	To prospectively compare dark-lumen MRC with conventional colonoscopy in the detection of colorectal polyps.	92/100 had complete MRC and conventional colonoscopy examinations. 43/92 (47%) had normal findings at conventional colonoscopy. At per-polyp analysis, sensitivity of MRC was 100% for polyps at least 10 mm and 84.2% for polyps 6-9 mm. At per-patient analysis, accuracy of MRC was 93.1% (sensitivity 89%; specificity 96%). Dark-lumen MRC is a promising modality with high accuracy for detecting colorectal polyps >5 mm in diameter.	2
74. Sambrook A, McAteer D, Yule S, Phull P. MR colonography without bowel cleansing or water enema: a pilot study. <i>Br J Radiol</i> . 2012;85(1015):921-924.	Observational-Dx	29 patients	To assess the feasibility of MR colonography (MRC) without bowel preparation or water enema for the detection of colorectal neoplasia.	29 patients were studied. Colonoscopy revealed 25 mass lesions in 13 patients. MRC correctly identified four of the nine lesions >10 mm in diameter (sensitivity 44%; specificity 100%). Although specificity remained high for smaller lesions, sensitivity was poor.	2



**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
75. Keeling AN, Morrin MM, McKenzie C, et al. Intravenous, contrast-enhanced MR colonography using air as endoluminal contrast agent: impact on colorectal polyp detection. <i>Eur J Radiol.</i> 2012;81(1):31-38.	Observational-Dx	46 patients	To compare diagnostic accuracy and patient tolerance of MR colonography with intravenous contrast and luminal air (MRC) to conventional colonoscopy (CC).	Twenty-four polyps were detected in eighteen patients with CC (5 polyps $\geq$ 10 mm, 4 polyps 6-9 mm, 15 polyps $\leq$ 5 mm). MRC was 66.7% (12/18) sensitive and 96.4% (27/28) specific for polyp detection on a per-patient basis. When analyzed by polyp size, sensitivity and specificity of MRC was 100% (5/5) and 100% (19/19), respectively, for lesions greater than 10mm, 100% (4/4) and 100% (20/20) for lesions 6-9 mm, and sensitivity of 20% (3/15) lesions less than 5mm. The sensitivity and specificity of MRC for detecting significant lesions ( $>$ 6mm) was 100% (9/9) and 100% (15/15), respectively. Regarding tolerance of the exams, there were no significant differences between MRC and CC. Thirty-five percent (n=16) of patients preferred MRC as a future screening test compared to 33% (n=15) for CC.	2
76. Zijta FM, Bipat S, Stoker J. Magnetic resonance (MR) colonography in the detection of colorectal lesions: a systematic review of prospective studies. <i>Eur Radiol.</i> 2010; 20(5):1031-1046.	Meta-analysis	13 studies	To determine the diagnostic accuracy of MRC for the detection of colorectal lesions through a systematic review and meta-analysis.	37 studies were found to be potentially relevant and 13 fulfilled the inclusion criteria. The study population comprised 1,285 patients with a mean disease prevalence of 44% (range 22%-63%). Sensitivity for the detection of CRC was 100%. Significant heterogeneity was found for overall per patient sensitivity and specificity. For polyps with a size of 10 mm or larger, per patient sensitivity and specificity estimates were 88% (95% CI, 63%-97%; I (2) = 37%) and 99% (95% CI, 95%-100%; I (2) = 60%). On a per polyp basis, polyps of 10 mm or larger were detected with a sensitivity of 84% (95% CI, 66%-94%; I (2) = 51%). The data were too heterogeneous for polyps $<$ 6 mm and 6-9 mm.	Good

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
<p>77. Graser A, Melzer A, Lindner E, et al. Magnetic resonance colonography for the detection of colorectal neoplasia in asymptomatic adults. <i>Gastroenterology</i>. 2013;144(4):743-750 e742.</p>	<p>Observational-Dx</p>	<p>286 patients</p>	<p>To investigate whether magnetic resonance colonography (MRC) can be used to screen for colorectal adenomas and cancers.</p>	<p>We detected 133 adenomas and 2 cancers in 86 patients; 37 adenomas were <math>\geq 6</math> mm, and 20 adenomas were advanced. Sensitivities of MRC and colonoscopy for adenomas <math>\geq 6</math> mm were 78.4% (95% confidence interval [CI], 61.8-90.2) and 97.3% (95% CI, 85.8-99.9); for advanced adenomas these values were 75% (95% CI, 50.9-91.3) and 100% (95% CI, 83.2-100.0), respectively. MRC identified 87.1% (95% CI, 70.2-96.4), colonoscopy 96.8% (95% CI, 83.3-99.9), and FOBT 10.0% (95% CI, 2.1-26.5) of individuals with adenomas <math>\geq 6</math> mm and 83.8% (95% CI, 58.6-96.4), 100% (95% CI, 81.5-100.0), and 17.6% (95% CI, 3.8-43.4) of individuals with advanced neoplasia. Specificities of MRC, colonoscopy, and FOBT for individuals with adenomas <math>\geq 6</math> mm were 95.3% (95% CI, 91.9-97.5), 96.9% (95% CI, 93.9-98.6), and 91.8% (95% CI, 87.6-94.9), respectively.</p>	<p>1</p>

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
78. Pickhardt PJ, Mbah I, Pooler BD, et al. CT Colonographic Screening of Patients With a Family History of Colorectal Cancer: Comparison With Adults at Average Risk and Implications for Guidelines. <i>AJR Am J Roentgenol.</i> 2017:1-7.	Review/Ot her-Dx	9013 patients	To compare rates of lesion detection at CT colonographic (CTC) screening of adults without symptoms who had and who did not have a family history of colorectal cancer according to American Cancer Society guidelines and to consider the clinical implications.	For the family history versus no family history cohorts, the frequency of all nondiminutive polyps ( $\geq 6$ mm) reported at CTC was 23.7% versus 15.5% ( $p = 0.007$ ); small polyps (6-9 mm), 13.5% versus 9.1% ( $p = 0.068$ ); and large polyps ( $\geq 10$ mm), 10.2% versus 6.5% ( $p = 0.068$ ). The rate of referral for colonoscopy was greater for the family history cohort (16.0% vs 10.5%; $p = 0.035$ ). However, the frequencies of proven advanced adenoma (4.5% vs 3.2%; $p = 0.357$ ), nonadvanced adenoma (5.1% vs 2.6%; $p = 0.070$ ), and cancer (0.0% vs 0.4%; $p = 0.999$ ) were not significantly increased. The difference in positive rates between the two cohorts (11.5% vs 4.3%; $p < 0.001$ ) was primarily due to nonneoplastic findings of no colorectal cancer relevance, such as small hyperplastic polyps, diverticular disease, and false-positive CTC findings.	4
79. Jarvinen HJ, Mecklin JP, Sistonen P. Screening reduces colorectal cancer rate in families with hereditary nonpolyposis colorectal cancer. <i>Gastroenterology.</i> 1995; 108(5):1405-1411.	Observatio nal-Dx	133 screened; 118 controls without screening	To evaluate the effectiveness of long-term screening by comparing screened and unscreened subjects with HNPCC for incidence CRC.	CRC occurred in 6 study subjects (4.5%) and 14 controls (11.9%; $P=0.03$ ), a difference of 7.4% in favor of the study group, which corresponds to a reduction by 62% that is presumably because of polypectomies. The 3-year interval screening more than halves the CRC rate in at-risk members of families with HNPCC and prevent CRC deaths.	3

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
80. Florie J, Jensch S, Nievelstein RA, et al. MR colonography with limited bowel preparation compared with optical colonoscopy in patients at increased risk for colorectal cancer. <i>Radiology</i> . 2007;243(1):122-131.	Observational-Dx	200 patients	To prospectively evaluate the diagnostic performance of magnetic resonance (MR) colonography by using limited bowel preparation in patients with polyps of 10 mm or larger in diameter in a population at increased risk for colorectal cancer, with optical colonoscopy as the reference standard.	Two hundred patients (mean age, 58 years; 128 male patients) were included; 41 patients had coexistent symptoms. At colonoscopy, 12 patients had 22 polyps of 10 mm or larger. Per-patient sensitivity was 58% (seven of 12) for observer 1, 67% (eight of 12) for observer 2, and 75% (nine of 12) for both observers combined for polyps of 10 mm or larger. Per-patient specificity was 95% (178 of 188) for observer 1, 97% (183 of 188) for observer 2, and 93% (175 of 188) for both observers combined. Per-polyp sensitivity was 55% (12 of 22) for observer 1, 50% (11 of 22) for observer 2, and 77% (17 of 22) for both observers combined. Interobserver agreement was 93% for identification of patients with lesions of 10 mm or larger.	1
81. Plumb AA, Halligan S, Pendse DA, Taylor SA, Mallett S. Sensitivity and specificity of CT colonography for the detection of colonic neoplasia after positive faecal occult blood testing: systematic review and meta-analysis. <i>Eur Radiol</i> . 2014;24(5):1049-1058.	Meta-analysis	5 articles	To estimate the sensitivity and specificity of CTC for colorectal cancer and adenomatous polyps following positive FOBt via systematic review.	Of 538 articles considered, 5 met inclusion criteria, describing results from 622 patients. Research study quality was good. CTC had a high per-patient average sensitivity of 88.8 % (95 % CI 83.6 to 92.5 %) for $\geq 6$ mm adenomas or colorectal cancer, with low between-study heterogeneity. Specificity was both more heterogeneous and lower, at an average of 75.4 % (95 % CI 58.6 to 86.8 %).	Good

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
82. Plumb AA, Halligan S, Nickerson C, et al. Use of CT colonography in the English Bowel Cancer Screening Programme. Gut. 2014;63(6):964-973.	Observational-Dx	2731 screenees	To examine use of CT colonography (CTC) in the English Bowel Cancer Screening Programme (BCSP) and investigate detection rates.	2731 screenees underwent CTC. Colorectal cancer (CRC) or polyps were suspected in 1027 individuals (37.6%; 95% CI 33.8% to 41.4%); 911 of these underwent confirmatory testing. 124 screenees had CRC (4.5%) and 533 had polyps (19.5%), 468 adenomatous (17.1%). Overall detection was 24.1% (95% CI 21.5% to 26.6%) for CRC or polyps and 21.7% (95% CI 19.2% to 24.1%) for CRC or adenoma. Advanced neoplasia was detected in 504 screenees (18.5%; 95% CI 16.1% to 20.8%). PPV for CRC or polyp was 72.1% (95% CI 66.6% to 77.6%). By comparison, 9.0% of 72 817 screenees undergoing colonoscopy had cancer and 50.6% had polyps; advanced neoplasia was detected in 32.7%. CTC detection rates and PPV were higher at centres with experienced radiologists (>1000 examinations) and at high-volume centres (>175 cases/radiologist/annum). Centres using three-dimensional interpretation detected more neoplasia.	3

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
83. Halligan S, Wooldrage K, Dadswell E, et al. Computed tomographic colonography versus barium enema for diagnosis of colorectal cancer or large polyps in symptomatic patients (SIGGAR): a multicentre randomised trial. <i>Lancet</i> . 2013;381(9873):1185-1193.	Experimental-Dx	3804 patients	To compare CTC and BE for diagnosis of colorectal cancer or large polyps in symptomatic patients in clinical practice.	3838 patients were randomly assigned to receive either BE (n=2553) or CTC (n=1285). 34 patients withdrew consent, leaving for analysis 2527 assigned to BE and 1277 assigned to CTC. The detection rate of colorectal cancer or large polyps was significantly higher in patients assigned to CTC than in those assigned to BE (93 [7.3%] of 1277 vs 141 [5.6%] of 2527, relative risk 1.31, 95% CI 1.01-1.68; p=0.0390). CTC missed three of 45 colorectal cancers and BE missed 12 of 85. The rate of additional colonic investigation was higher after CTC than after BE (283 [23.5%] of 1206 CTC patients had additional investigation vs 422 [18.3%] of 2300 BE patients; p=0.0003), due mainly to a higher polyp detection rate. Serious adverse events were rare.	1
84. Kalra L, Hamlyn AN. Comparative evaluation of investigations for colorectal carcinoma in symptomatic patients. <i>Postgrad Med J</i> . 1988; 64(755):666-668.	Observational-Dx	154 patients	To compare relative efficacy of FOBT, DCBE, flexible fibresigmoidoscopy and colonoscopy in the diagnosis of CRC.	DCBE identified lesion in 32% of Dukes' A, 79% of Dukes' B and 81% of Dukes' C carcinomas. Fibresigmoidoscopy diagnosed colorectal malignancy in 84% of patients with Dukes' A, 90% with Dukes' B and 81% with Dukes' C stage. A diagnostic yield of 88% for Dukes' A, 96% for Dukes' B and 100% for Dukes' C carcinomas was seen with colonoscopy. Detection rate for all stages of carcinoma was >95% when fibresigmoidoscopy and DCBE were combined.	3

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
85. Kewenter J, Brevinge H, Engaras B, Haglind E. The yield of flexible sigmoidoscopy and double-contrast barium enema in the diagnosis of neoplasms in the large bowel in patients with a positive Hemoccult test. <i>Endoscopy</i> . 1995; 27(2):159-163.	Observational-Dx	1,831 flexible sigmoidoscopy and DCBE exams; 135 patients had colonoscopy	To compare the results of flexible sigmoidoscopy and DCBE in the rectum and the sigmoid colon, and to evaluate the benefit of DCBE in patients with a positive Hemoccult test.	Flexible sigmoidoscopy and DCBE detected 235 adenomas =1 cm and 81 cancers which were in Dukes stages A (n=29), B (n=22), and C (n=23). Approach helps in the diagnosis of significant colonic tumors (larger adenomas and cancers) in 17.7% of cases; only 2/83 cancers (2.4%) were overlooked with this method.	2
86. Winawer SJ, Flehinger BJ, Schottenfeld D, Miller DG. Screening for colorectal cancer with fecal occult blood testing and sigmoidoscopy. <i>J Natl Cancer Inst</i> 1993; 85(16):1311-1318..	Observational-Dx	21,756 patients: Trial 1: 9,277 patients; Trial II: 12,479 patients	To evaluate the effectiveness of using the FOBT and sigmoidoscopy to screen for CRC.	FOBT and sigmoidoscopy can increase the likelihood of early detection in average-risk individuals (50 years and older).	3
87. Irvine EJ, O'Connor J, Frost RA, et al. Prospective comparison of double contrast barium enema plus flexible sigmoidoscopy v colonoscopy in rectal bleeding: barium enema v colonoscopy in rectal bleeding. <i>Gut</i> 1988; 29(9):1188-1193..	Observational-Dx	71 patients	Prospective study to compare the diagnostic properties of combined flexible sigmoidoscopy plus DCBE vs colonoscopy in a cohort of patients with overt rectal bleeding.	Sensitivity and specificity of colonoscopy were 0.69 and 0.78 respectively for different colonic lesions. For combined flexible sigmoidoscopy and DCBE, sensitivity and specificity were 0.80 and 0.56, respectively. When assessing adenoma or carcinoma, colonoscopy was more sensitive at 0.82 vs 0.73, while flexible sigmoidoscopy plus DCBE was superior for detecting diverticular disease. The PPV for colonoscopy was 0.87 against 0.81 for flexible sigmoidoscopy and DCBE. Study recommends colonoscopy as initial test.	3
88. Mandel JS, Bond JH, Church TR, et al. Reducing mortality from colorectal cancer by screening for fecal occult blood. Minnesota Colon Cancer Control Study. <i>N Engl J Med</i> . 1993; 328(19):1365-1371.	Experimental-Dx	46,551 patients	Evaluate in a randomized trial the effect of a FOBT on mortality from CRC.	13-year cumulative mortality per 1,000 from CRC was 5.88 in the annually screened group (95% CI: 4.61 to 7.15), 8.33 in the biennially screened group (95% CI: 6.82 to 9.84), and 8.83 in the control group (95% CI: 7.26 to 10.40).	3

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
89. van der Paardt MP, Zijta FM, Boellaard TN, et al. Magnetic resonance colonography with automated carbon dioxide insufflation: Diagnostic accuracy and distension. <i>Eur J Radiol.</i> 2014;83(5):743-750.	Observational-Dx	98 patients	To evaluate the diagnostic performance of MR colonography using automated carbon dioxide (CO <sub>2</sub> ) insufflation for colonic distension, with colonoscopy serving as the reference standard.	Per-patient sensitivity for lesions $\geq 10$ mm was 91.7% (11 of 12) (reader 1), 75.0% (9 of 12) (reader 2), and 75% (9 of 12) (reader 3). Specificity was 96.5% (82 of 85) (reader 1), 97.7% (83 of 85) (reader 2), 95.3% (81 of 85) (reader 3). Per-patient sensitivity for lesions $\geq 6$ mm was 85.7% (18 of 21) (reader 1), 57.1% (12 of 21) (reader 2), and 57.1% (12 of 21) (reader 3). Specificity was 86.8% (66 of 76), 98.7% (75 of 76), 90.8% (69 of 76), respectively. Per-patient sensitivity for advanced neoplasia of $\geq 10$ mm and $\geq 6$ mm was 88.9% (8 of 9) for all readers. Specificity for $\geq 10$ mm and $\geq 6$ mm was 98.9% (87 of 88) (reader 1), 97.7% (86 of 88) (reader 2), 96.6% (85 of 88) (reader 3). 94.4% of the colon segments were adequate to optimal distended with dual positioning.	2
90. Lauenstein TC, Goehde SC, Ruehm SG, Holtmann G, Debatin JF. MR colonography with barium-based fecal tagging: initial clinical experience. <i>Radiology.</i> 2002;223(1):248-254.	Observational-Dx	24 patients	To assess a strategy for fecal tagging with barium sulfate as an inexpensive tagging agent in conjunction with magnetic resonance (MR) colonography in patients suspected of having colorectal lesions.	On the basis of MR colonography, 15 polyps of 5-20 mm and 10 carcinomas were detected and later confirmed with conventional colonoscopy. Conventional colonoscopy depicted three additional lesions less than 8 mm in diameter. Thus, sensitivity of MR colonography was 89.3% (25 of 28) for lesions and 91.7% (22 of 24) for patients.	2



**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
91. Eaden JA, Abrams KR, Mayberry JF. The risk of colorectal cancer in ulcerative colitis: a meta-analysis. <i>Gut</i> . 2001;48(4):526-535.	Meta-analysis	116 studies and 54,478 patients were studied.	To give an overall estimate of the risk in all patients with UC by decade, define the risk for children and those with extensive colitis, and give CRC incidence rates by country where possible.	The overall prevalence of CRC in any UC patient, based on 116 studies, was estimated to be 3.7% (95% CI 3.2-4.2%). Of the 116 studies, 41 reported colitis duration. From these the overall incidence rate was 3/1000 person years duration (pyd), (95% CI 2/1000 to 4/1000). The overall incidence rate for any child was 6/1000 pyd (95% CI 3/1000 to 13/1000). Of the 41 studies, 19 reported results stratified into 10 year intervals of disease duration. For the first 10 years the incidence rate was 2/1000 pyd (95% CI 1/1000 to 2/1000), for the second decade the incidence rate was estimated to be 7/1000 pyd (95% CI 4/1000 to 12/1000), and in the third decade the incidence rate was 12/1000 pyd (95% CI 7/1000 to 19/1000). These incidence rates corresponded to cumulative probabilities of 2% by 10 years, 8% by 20 years, and 18% by 30 years. The worldwide cancer incidence rates varied geographically, being 5/1000 pyd in the USA, 4/1000 pyd in the UK, and 2/1000 pyd in Scandinavia and other countries. Over time the cancer risk has increased since 1955 but this finding was not significant (p=0.8).	Good
92. Giardiello FM, Allen JI, Axilbund JE, et al. Guidelines on genetic evaluation and management of Lynch syndrome: a consensus statement by the US Multi-society Task Force on colorectal cancer. <i>Am J Gastroenterol</i> . 2014;109(8):1159-1179.	Review/Other-Dx	N/A	To assist health care providers with the appropriate provision of genetic testing and management of patients at risk for and affected with Lynch syndrome	No results stated in abstract.	4

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
93. Macari M, Berman P, Dicker M, Milano A, Megibow AJ. Usefulness of CT colonography in patients with incomplete colonoscopy. <i>AJR Am J Roentgenol.</i> 1999; 173(3):561-564.	Review/Ot her-Dx	10 patients	To examine the usefulness of CTC after incomplete colonoscopy. Report initial experience with both CTC and DCBE in finishing the colonic examination of patients with incomplete colonoscopy.	In 2 patients, CTC demonstrated solitary polyps in the portion of the colon not evaluated by colonoscopy. CTC is effective in evaluating portions of the colon not seen during colonoscopy and may have an adjunctive role.	4
94. Morrin MM, Kruskal JB, Farrell RJ, Goldberg SN, McGee JB, Raptopoulos V. Endoluminal CT colonography after an incomplete endoscopic colonoscopy. <i>AJR Am J Roentgenol.</i> 1999; 172(4):913-918.	Observatio nal-Dx	40 patients	Prospective study to evaluate the clinical usefulness of CTC after incomplete colonoscopy. 26 patients (65%) had barium enema after endoluminal CTC.	CTC adequately demonstrated 96% of all colonic segments while barium enema revealed 91% of all segments.	2
95. Neri E, Giusti P, Battolla L, et al. Colorectal cancer: role of CT colonography in preoperative evaluation after incomplete colonoscopy. <i>Radiology.</i> 2002; 223(3):615-619.	Observatio nal-Dx	34 patients; 20 controls	To evaluate CTC in patients with clinical suspicion of CRC in whom colonoscopy was incomplete.	CTC demonstrated 10 CRC and 3 synchronous cancers that were missed at colonoscopy. Sensitivity and specificity for detection of CRC were 56% and 92%, respectively, for incomplete colonoscopy and 100% and 96%, respectively, for CTC (P<.01). Sensitivity and specificity of CTC in detection of polyps were 86% and 70%, respectively, for diameters =5 mm; 100% and 80%, respectively, for 5-10 mm diameters; and 100% for diameters =10 mm. Spiral CT of the liver revealed 4 metastases (2-5 cm); sensitivity and specificity were 100% and 43% for nonenhanced scans and 100% for contrast-enhanced scans (P<.01).	2
96. Sali L, Falchini M, Bonanomi AG, et al. CT colonography after incomplete colonoscopy in subjects with positive faecal occult blood test. <i>World J Gastroenterol.</i> 2008; 14(28):4499-4504.	Observatio nal-Dx	42 patients	A prospective study to report results of CTC after incomplete colonoscopy in subjects with positive FOBT.	CTC correctly identified 2 colonic masses and 20 polyps. PPV for masses or polyps >9 mm was 87.5%. Per-lesion and per-segment PPV were, respectively, 83.3% and 83.3% for polyps =10 mm, and 77.8% and 85.7% for polyps of 6-9 mm. CTC has potential to become a useful technique for evaluation of the nonvisualized part of the colon after incomplete colonoscopy.	3

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
97. Copel L, Sosna J, Kruskal JB, Raptopoulos V, Farrell RJ, Morrin MM. CT colonography in 546 patients with incomplete colonoscopy. <i>Radiology</i> . 2007; 244(2):471-478.	Observational-Dx	546 patients	To retrospectively evaluate the PPV of CTC in patients referred for further examination after incomplete colonoscopy.	Per-patient and per-lesion PPV of CTC for masses, large polyps, and medium polyps were 90.9% and 91.7%, 64.7% and 70%, and 33.3% and 30.4%, respectively.	3
98. Spada C, Hassan C, Barbaro B, et al. Colon capsule versus CT colonography in patients with incomplete colonoscopy: a prospective, comparative trial. <i>Gut</i> . 2015;64(2):272-281.	Experimental-Dx	100 patients	To compare colon capsule endoscopy (CCE) and CT colonography (CTC) in a prospective cohort of patients with incomplete colonoscopy.	100 patients were enrolled. CCE and CTC were able to achieve complete colonic evaluation in 98% of cases. In a per-patient analysis for polyps $\geq 6$ mm, CCE detected 24 patients (24.5%) and CTC 12 patients (12.2%). The relative sensitivity of CCE compared to CTC was 2.0 (95% CI 1.34 to 2.98), indicating a significant increase in sensitivity for lesions $\geq 6$ mm. Of larger polyps ( $\geq 10$ mm), these values were 5.1% for CCE and 3.1% for CTC (relative sensitivity: 1.67 (95% CI 0.69 to 4.00)). Positive predictive values for polyps $\geq 6$ mm and $\geq 10$ mm were 96% and 85.7%, and 83.3% and 100% for CCE and CTC, respectively. No missed cancer occurred at clinical follow-up of a mean of 20 months.	1

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
99. Pullens HJ, van Leeuwen MS, Laheij RJ, Vleggaar FP, Siersema PD. CT-colonography after incomplete colonoscopy: what is the diagnostic yield? <i>Dis Colon Rectum</i> . 2013;56(5):593-599.	Review/Other-Dx	136 consecutive CT-colonographies	To investigate the yield of CT-colonography of relevant intra- and extracolonic findings in patients after incomplete colonoscopy.	Major indications for colonoscopy included iron-deficiency anemia (25.7%), hematochezia (20.6%), change in bowel habits (18.4%), and colorectal cancer screening or surveillance (11.0%). Major reasons for incomplete colonoscopy were a fixed colon (34.6%) and strong angulation of the sigmoid colon (17.6%). Introduction of the colonoscope was limited to the left-sided colon in 53.7% of cases. Incomplete colonoscopy detected colorectal cancer in 12 (8.8%) patients and adenomatous polyps in 27 (19.9%) patients. CT-colonography after incomplete colonoscopy additionally revealed 19 polyps in 15 (11.0%) and a nonsynchronous colorectal cancer in 4 (2.9%) patients. CT-colonography also detected extracolonic findings with clinical consequences in 8 (5.9%) patients, including fistulizing diverticulitis (n = 3), gastric tumor (n = 2), liver abscess (n = 1), osteomyelitis (n = 1), and an infected embolus in both renal arteries (n = 1).	4

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
100. Theis J, Kim DH, Lubner MG, Munoz del Rio A, Pickhardt PJ. CT colonography after incomplete optical colonoscopy: bowel preparation quality at same-day vs. deferred examination. <i>Abdom Radiol (NY)</i> . 2016;41(1):10-18.	Observational-Dx	15 patients	To objectively compare the volume, density, and distribution of luminal fluid for same-day oral-contrast-enhanced CTC following incomplete optical colonoscopy (OC) vs. deferred CTC on a separate day utilizing a dedicated CTC bowel preparation.	Opacified luminal fluid extended to the rectum in 56% (58/103) of same-day CTC vs. 100% (151/151) of deferred separate-day CTC ( $p < 0.0001$ ). For same-day CTC, contrast failed to reach the colon in 11% (11/103) and failed to reach the left colon in 26% (27/103). Volumetric colonic fluid segmentation for fluid analysis (successful in 80 same-day and 147 separate-day cases) showed significantly more fluid in the same-day cohort (mean, 227 vs. 166 mL; $p < 0.0001$ ); the actual difference is underestimated due to excluded cases. Mean colonic fluid attenuation was significantly lower in the same-day cohort (545 vs. 735 HU; $p < 0.0001$ ). Similar findings were identified in the smaller cohort with direct intra-patient CTC comparison.	3
101. Kao KT, Tam M, Sekhon H, Wijeratne R, Haigh PI, Abbas MA. Should barium enema be the next step following an incomplete colonoscopy? <i>Int J Colorectal Dis</i> . 2010;25(11):1353-1357.	Review/Other-Dx	233 patients	To determine the value of DCBE following an incomplete colonoscopy.	The incomplete colonoscopy rate was 1.6%. The mean age was 62 years with a predominance of females. The most common indication for colonoscopy was screening. The most frequent reason attributed to an incomplete colonoscopy was patient discomfort. Two hundred thirty three patients underwent DCBE and 42 patients underwent a repeat colonoscopy without DCBE; 13.3% of the DCBE were of poor quality and could not be interpreted. A repeat colonoscopy following DCBE was performed in 7% of patients. In 50% of these patients, the repeat colonoscopy revealed significant findings not noted on the DCBE or ruled out positive DCBE findings. In patients who had repeat colonoscopy without DCBE, completion rate was 95%.	4

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
102. Brown AL, Skehan SJ, Greaney T, Rawlinson J, Somers S, Stevenson GW. Value of double-contrast barium enema performed immediately after incomplete colonoscopy. <i>AJR Am J Roentgenol.</i> 2001;176(4):943-945.	Observational-Dx	103 patients	To evaluate the ease, completeness, and clinical utility of double-contrast barium enema (DCBE) performed immediately after incomplete colonoscopy.	DCBE revealed the entire colon in 97 patients (94%). Incomplete DCBE was a result of obstruction and incontinence in three patients each. The mean score for ease of performing DCBE was 5.0. In 14 patients (14%), significant additional diagnostic information was provided by the immediate DCBE. In eight patients, abnormalities were identified on DCBE that had not been seen at colonoscopy (five malignant neoplasms, one diverticular mass, two extrinsic masses, and multiple strictures). In four patients, a suspected colonoscopic abnormality was excluded with DCBE findings; and in two patients, a colonoscopic abnormality was further characterized with DCBE.	4
103. Martinez F, Kondylis P, Reilly J. Limitations of barium enema performed as an adjunct to incomplete colonoscopy. <i>Dis Colon Rectum.</i> 2005;48(10):1951-1954.	Observational-Dx	485 patients	To assess completion barium enema for both completeness and quality of proximal visualization.	In 485 patients (2.9 percent), colonoscopy was incomplete. One hundred eighteen patients underwent barium enema after incomplete colonoscopy. In these patients, sharp angulation (42 percent) or redundancy/looping (31 percent) most often limited endoscopy. Among the barium enema studies, 91 (77 percent) were technically adequate. Twenty-seven studies were suboptimal (poor preparation/intolerance = 7, redundancy = 6, poor filling = 6, stricture/narrowing = 6, severe diverticulosis = 2). Two patients demonstrated additional polyps. There was no correlation between reasons for endoscopic failure and inadequacy of barium enema. Completeness of barium enema was not affected by previous pelvic surgery. Immediate barium enema was no less complete than a delayed study.	3

**Colorectal Cancer Screening  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
104. Hartmann D, Bassler B, Schilling D, et al. Incomplete conventional colonoscopy: magnetic resonance colonography in the evaluation of the proximal colon. <i>Endoscopy</i> . 2005;37(9):816-820.	Observational-Dx	32 patients	To evaluate dark-lumen magnetic resonance (MR) colonography prospectively in patients with incomplete conventional colonoscopy.	All high-grade stenoses were confirmed on MR colonographic data sets. Of the 26 patients with high-grade stenosis, 19 underwent surgery with histopathological confirmation of the initial diagnosis. Follow-up colonoscopy was carried out in 14 patients with surgically treated high-grade stenosis. In six of these 14 patients, nine polyps identified at the initial MR colonography were confirmed and removed during a postoperative conventional colonoscopy. Two polyps (5 mm and 8 mm in diameter) identified on postoperative conventional colonoscopy had not been seen preoperatively at MR colonography. One polyp seen on MR colonography was not identified in the follow-up colonoscopy.	3
105. American College of Radiology. ACR Appropriateness Criteria® Radiation Dose Assessment Introduction. Available at: <a href="https://www.acr.org/-/media/ACR/Files/Appropriateness-Criteria/RadiationDoseAssessmentIntro.pdf">https://www.acr.org/-/media/ACR/Files/Appropriateness-Criteria/RadiationDoseAssessmentIntro.pdf</a> .	Review/Other-Dx	N/A	Guidance document on exposure of patients to ionizing radiation.	No results stated in abstract.	4

## Evidence Table Key

### Study Quality Category Definitions

- *Category 1* The study is well-designed and accounts for common biases.
- *Category 2* The study is moderately well-designed and accounts for most common biases.
- *Category 3* There are important study design limitations.
- *Category 4* The study is not useful as primary evidence. The article may not be a clinical study or the study design is invalid, or conclusions are based on expert consensus. For example:
  - a. The study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description);
  - b. The study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence;
  - c. The study is an expert opinion or consensus document.
- Meta-analysis
  - a. *Good quality* – the study design, methods, analysis, and results are valid and the conclusion is supported.
  - b. *Inadequate quality* – the study design, analysis, and results lack the methodological rigor to be considered a good meta-analysis study.

## Abbreviations Key

Dx = Diagnostic

Tx = Treatment