Virtual Colonoscopy/Computed Tomography Colonography

POLICY
Computed tomography colonography (CTC) may be considered medically necessary for the purposes of colon cancer screening.

CTC may be considered medically necessary in patients for whom a conventional colonoscopy is indicated but who are unable to undergo conventional colonoscopy for medical reasons (see Policy Guidelines section); CTC may also be considered medically necessary for patients with an incomplete conventional colonoscopy because of colonic stenosis or obstruction.

Except for the indications outlined in the policy statements above, CTC is considered investigational.

POLICY GUIDELINES
Based on current evidence, a colon cancer screening strategy using computed tomography colonography (CTC) is likely to produce outcomes similar to those with optical colonoscopy. Therefore, the “least costly alternative” provision of the medically necessary definition may apply (see Benefit Application section).

CTC outcomes described in the literature represent outcomes under ideal conditions. This generally involves a comprehensive colon cancer screening program that includes rapid access to optical colonoscopy when necessary and systematic follow-up and surveillance of patients who generally have a more complicated follow-up schedule than do patients undergoing optical colonoscopy. Therefore, to achieve outcomes described in the literature that are similar to optical colonoscopy, CTC needs to be offered as part of a comprehensive colon cancer screening program that optimizes follow-up of patients undergoing this procedure.

CTC should be performed with a minimum 16-row detector computed tomography scanner.

Having adequate training was an important component of CTC clinical trials.

Contraindications to conventional colonoscopy may include continuous anticoagulation therapy or high anesthesia risk.
CODING
There are category I CPT codes for this procedure; see the Codes table for details.

BENEFIT APPLICATION
A screening strategy using computed tomography colonography (CTC) is likely to produce outcomes similar to those with optical colonoscopy but may be costlier. Some plans may use a definition of “medical necessity” that states a medically necessary service must not be costlier than an alternative service or sequence of services that are at least as likely to produce similar health outcomes. In these cases, when it is determined that a strategy using CTC is costlier than one using optical colonoscopy (as determined by plan pricing, provider charges, and/or other mechanisms), then CTC may be considered not medically necessary for colon cancer screening.

For contracts that do not use this definition of medical necessity, benefit or contract language describing the "least costly alternative" may also be applicable for this choice of treatment.

In addition, other contract provisions including contract language concerning use of out-of-network providers and services may be applied; eg, if the alternative therapy (eg, optical colonoscopy) is available in-network but CTC is not, CTC would not be considered an in-network benefit.

BLUECARD/NATIONAL ACCOUNT ISSUES
State or federal mandates (eg, Federal Employee Program) may dictate that certain U.S. Food and Drug Administration–approved devices, drugs, or biologics may not be considered investigational, and thus these devices may be assessed only by their medical necessity.

BACKGROUND
Computed tomography colonography (CTC), also known as virtual colonoscopy, is an imaging modality that uses thin-section helical computed tomography to generate high-resolution, 2-dimensional axial images of the colon. Three-dimensional images, which resemble the endoluminal images obtained with conventional endoscopic colonoscopy, are then reconstructed offline. CTC has been investigated as an alternative to conventional endoscopic (“optical”) colonoscopy. While CTC requires a full bowel preparation, similar to conventional colonoscopy, no sedation is required, and the examination is less time-consuming. However, the technique involves gas insufflation of the intestine, which may be uncomfortable to the patient, and training and credentialing of readers may be needed to achieve optimal performance.

Indications
Diseases of the colon and rectum for which CTC may be considered as a diagnostic or screening tool include colorectal cancer and precancerous conditions, diverticulosis and diverticulitis, and inflammatory bowel disease. The most widely studied use of CTC is as an alternative screening technique for colon cancer.

REGULATORY STATUS
Multiple computed tomography devices, including multiple CTC devices, have been cleared for marketing by the U.S. Food and Drug Administration through the 510(k) process. Food and Drug Administration product code: JAK.

RATIONALE
This evidence review was created in August 2001 and has been updated regularly with searches of the MEDLINE database. The most recent literature update was performed through July 26, 2018.
Evidence reviews assess whether a medical test is clinically useful. A useful test provides information to make a clinical management decision that improves the net health outcome. That is, the balance of benefits and harms is better when the test is used to manage the condition than when another test or no test is used to manage the condition.

The first step in assessing a medical test is to formulate the clinical context and purpose of the test. The test must be technically reliable, clinically valid, and clinically useful for that purpose. Evidence reviews assess the evidence on whether a test is clinically valid and clinically useful. Technical reliability is outside the scope of these reviews, and credible information on technical reliability is available from other sources.

**COLON CANCER SCREENING**

**Clinical Context and Therapy Purpose**
The purpose of computed tomography colonography (CTC) in patients who are asymptomatic and undergoing colorectal cancer (CRC) screening to prevent morbidity by detecting early colon cancers and detecting and removing cancer precursors such as polyps. The detection of cancer and removal of polyps ultimately requires an optical colonoscopy. CTC is an imaging procedure that can identify cancers or polyps accurately, so that all or most patients who have such lesions are appropriately referred for optical colonoscopy for diagnosis and treatment.

The question addressed in this evidence review is: Does the use of CTC improve the net health outcome in patients who are asymptomatic and undergoing CRC screening?

The following PICOTS were used to select literature to inform this review.

**Patients**
The relevant population of interest is individuals who are asymptomatic and eligible for CRC screening.

**Interventions**
The test being considered is CTC.

**Comparators**
The following tests are currently being used to make decisions about managing patients who are asymptomatic and undergoing CRC screening: optical colonoscopy, sigmoidoscopy, and fecal occult blood test.

**Outcomes**
The outcomes of interest are disease-specific morbidity and mortality. Beneficial outcomes relate to true positive testing, which leads to detection of disease that would be otherwise missed. Harmful outcomes result from false-negative testing, which may delay diagnosis and management of CRC.

**Timing**
Follow-up immediately after test results is of interest for CTC test accuracy and validity and test-related morbidity. Follow-up at 1 to 5 years is of interest for CRC outcomes for disease-specific mortality and morbidity.

**Setting**
CRC would be performed in an outpatient setting or in a hospital or an imaging facility. Results of CTC are assessed by a radiologist.
Study Selection Criteria
For the evaluation of clinical validity of the CTC test, studies that meet the following eligibility criteria were considered:

- Reported on the accuracy of the technology
- Included a suitable reference standard
- Patient clinical characteristics were described
- Patient selection criteria were described.

Technically Reliable
Assessment of technical reliability focuses on specific tests and operators and requires review of unpublished and often proprietary information. Review of specific tests, operators, and unpublished data are outside the scope of this evidence review and alternative sources exist. This evidence review focuses on the clinical validity and clinical utility.

Clinically Valid
A test must detect the presence or absence of a condition, the risk of developing a condition in the future, or treatment response (beneficial or adverse).

Systematic Reviews
The diagnostic characteristics of CTC as a colon cancer screening test have been investigated in many studies in which patients referred for optical colonoscopy agreed first to undergo a CTC. Using a second-look unblinded colonoscopy aided by the results of the CTC as the reference standard, the diagnostic characteristics of CTC and the blinded colonoscopy can be calculated and compared. The sensitivity of CTC is a function of the size of the polyp; sensitivity is poorer for smaller polyps.

Lin et al (2016) published a systematic review and meta-analysis of the literature on CRC screening, conducted for the U.S. Preventive Services Task Force. Reviewers identified 9 prospective diagnostic accuracy studies on CTC (total N=6497 patients). Seven studies involved CTC with bowel preparation and two involved CTC without bowel preparation. Five studies, including both without bowel preparation, were rated by U.S. Preventive Services Task Force as good quality and the remaining four were considered fair quality. In 4 studies of CTC with bowel preparation, the sensitivity to detect adenomas 6 mm or larger ranged from 73% to 98%, and the specificity ranged from 89% to 91%. The sensitivity of CTC to detect adenomas 10 mm or larger (7 studies) ranged from 67% to 94%, and the specificity ranged from 96% to 98%. Four (n=4821) of the 9 studies also provided data on colonoscopy. The sensitivity for adenomas 6 mm or larger ranged from 75% to 93%, and the sensitivity to detect adenomas 10 mm and larger ranged from 89% to 98%.

In addition, the Lin systematic review evaluated evidence on harms and extracolonic findings associated with CTC. Eleven fair or good quality prospective studies (total N=10,272 patients) suggested little or no risk of serious adverse events such as perforation. In contrast, reviewers estimated that, with optical colonoscopy, the risk of perforation was 4 in 10,000 procedures (95% confidence interval [CI], 2 to 5 in 10,000) and the risk of major bleeding was 8 in 10,000 procedures (95% CI, 5 to 14 in 10,000). Radiation exposure is a potential harm of CTC, but many of the studies did not report the extent of radiation exposure. Using data from 4 studies, reviewers estimated that the radiation dose of a full-screening CTC examination was 4.5 to 7 mSv. However, in more recent studies (ie, published between 2004 and 2008), the estimated radiation dose was lower, at 1 to 5 mSv. Among studies reporting this outcome, extracolonic findings occurred in 27% to 69% of CTC examinations. Approximately 1% to 11% underwent...
diagnostic evaluation, and 3% required treatment. Extracolonic cancers occurred in about 0.5% of individuals undergoing CTC examinations.

Martin-Lopez et al (2014) published a meta-analysis that included 9 studies of CRC screening. Studies conducted for the diagnosis of CRC or in elderly, high-risk, or symptomatic patients were excluded. The overall per-patient pooled sensitivity and specificity of CTC were 66.8% (95% CI, 62.7% to 70.8%) and 80.3% (95% CI, 77.7% to 82.8%), respectively. For colonoscopy, the pooled sensitivity was 92.5% (95% CI, 89.0% to 95%) and pooled specificity was 73.2% (95% CI, 67.7% to 78.1%). In the subgroup with larger lesions, the diagnostic accuracy of both approaches was less divergent. For lesions 10 mm or larger, CTC had a pooled sensitivity of 91.2% (95% CI, 86.5% to 94.6%) and a specificity of 87.3% (95% CI, 86.2% to 88.3%). The pooled sensitivity of colonoscopy for lesions 10 mm or larger was 92.9% (95% CI, 86.0% to 97.1%) and the specificity was 91.3% (95% CI, 89.9% to 92.5%).

**Randomized Controlled Trials**

Regge et al (2017) reported on a controlled trial in which 5412 individuals were randomized to CTC (n=2674) or flexible sigmoidoscopy (n=2738). The detection rate for advanced adenomas did not differ significantly between groups (p=0.52). Detection rates were 133 (5.1%) in the CTC group and 127 (4.7%) in the flexible sigmoidoscopy group. Ten CRCs were identified in the CTC group and 9 in the flexible sigmoidoscopy group. No serious adverse events were reported.

Other large RCTs have compared the diagnostic accuracy of CTC with a different method of CRC screening. In the IJspeert et al (2016) trial, 8844 individuals were invited to be screened, and 2258 (26%) agreed to participate. This included 982 (34%) of 2920 randomized to CTC and 1276 (22%) of 5924 randomized to standard colonoscopy. The analysis focused on the detection of high-risk sessile serrated polyps. Sessile serrated polyps were detected significantly more often in the colonoscopy examinations (n=55 [4.3%]) than in CTC examinations (n=8 [0.8%]). For the outcome of all sessile serrated polyps (high and low risk), significantly more were detected with the colonoscopy (n=83 [6.5%]) than with CTC (n=21 [2.1%]; p<0.001). Adverse events were not discussed.

**Nonrandomized Trials**

One of the largest studies of a screening population, the American College of Radiology Imaging Network trial, was published by Johnson et al (2008). Patients underwent CTC prior to standard colonoscopy. The study used 16- to 64-row detector computed tomography scanners, stool-tagging techniques, and minimum training standards for interpreters of the test. A total of 2600 individuals were enrolled, and data were available for 2531 (97%) of them. Trial results showed 90% sensitivity of CTC for polyps 10 mm or larger and 86% specificity; positive and negative predictive values were 23% and 99%, respectively. In a follow-up analysis of the American College of Radiology Imaging Network trial, Fidler et al (2014) demonstrated that CTC had similar sensitivity and specificity in the detection of nonpolypoid adenomas.

**Clinically Useful**

A test is clinically useful if the use of the results informs management decisions that improve the net health outcome of care. The net health outcome can be improved if patients receive correct therapy, or more effective therapy, or avoid unnecessary therapy, or avoid unnecessary testing.

**Direct Evidence**

Direct evidence of clinical utility is provided by studies that have compared health outcomes for patients managed with and without the test. Because these are intervention studies, the preferred evidence would be from RCTs.
No RCTs comparing outcomes for patients undergoing CTC screening with patients who did not undergo CTC screening were identified.

**Chain of Evidence**

Indirect evidence on clinical utility rests on clinical validity. If the evidence is insufficient to demonstrate test performance, no inferences can be made about clinical utility.

A chain of evidence involves evaluating: (1) evidence that CTC is accurate and (2) evidence that CTC identifies appropriate patients with CRC who would not otherwise be screened. The clinical validity of CTC for screening for CRC has been demonstrated in systematic reviews and meta-analysis studies as well as several large RCTs. While modeling studies have reported that optical colonoscopy is likely more beneficial than CTC, higher participation with CTC may ameliorate otherwise lower improvement in net health outcome compared with optical colonoscopy.

Compliance with recommendations for optical colonoscopy is suboptimal. As reported by Steele et al (2013), the screening rate is about 60% (in the prior 10 years) among people ages 50 to 75. CTC has been proposed as an alternative colon cancer screening technique that may improve patient compliance compared with optical colonoscopy. A literature survey of studies that attempted to determine whether the availability of CTC would improve population screening rates found survey studies, patient satisfaction studies, and focus group studies. It is unclear how such studies provide a sufficient base of evidence to demonstrate that population adherence to colon cancer screening would improve through CTC.

Stoop et al (2012) published an RCT that evaluated the impact of CTC on colon cancer screening rates. This trial was performed in the Netherlands, and members of the general population ages 50 to 75 years were randomized to an invitation for CTC or optical colonoscopy. The CTC protocol included a noncathartic preparation, consisting of iodinated contrast agent given the day before the exam and 1.5 hours before the exam, in conjunction with a low fiber diet. The participation rate in the CTC group was 34% (982/2920) compared with a rate of 22% (1276/5924) in the optical colonoscopy group (p<0.001). The diagnostic yield per-patient of advanced polyps was higher in the optical colonoscopy group, at 8.7 of 100 participants compared with 6.1 of 100 participants for CTC (p=0.02). However, the diagnostic yield of advanced neoplasia per invitee was similar, at 2.1 of 100 invitees for CTC and 1.9 of 100 invitees for optical colonoscopy (p=0.56). The data would suggest that the increased participation rates with CTC offset the advantages of optical colonoscopy and that overall outcomes would likely be similar between strategies. It is not known whether the different preparation regimens affected participation rates.

**Section Summary: Colon Cancer Screening**

There is variability in the diagnostic accuracy of CTC in the literature; this is likely due to improvements in technical reliability over time. The most recent studies have reported that the diagnostic accuracy for CTC is high and in the same range as optical colonoscopy for polyps greater than 10 mm.

No long-term comparative studies have directly reported on outcomes of CTC vs optical colonoscopy. The determination of comparative outcomes of CTC and optical colonoscopy is complex, due to the differing patterns of follow-up associated with each strategy.

At least 1 well-conducted RCT indicated that CRC screening participation rates are improved with CTC in comparison with optical colonoscopy. The improved screening rate may offset, or even outweigh, any benefit of optical colonoscopy on outcomes. However, the available study used a noncathartic preparation, and it is not certain that similar screening rates would be achieved with a cathartic preparation.
COLON CANCER DIAGNOSIS

Clinical Context and Therapy Purpose
The purpose of CTC in patients who have positive CRC screening or signs and symptoms of CRC is to identify disease.

CTC has not generally been employed as a test to identify the disease in persons with positive cancer screening tests or symptoms because, compared with screening settings, the expected probability of disease is much higher. Findings on CTC require confirmation with colonoscopy; thus it would be inappropriate to use a noninvasive test if the probability of needing a confirmatory invasive test is high.

The question addressed in this evidence review is: Does the use of CTC improve the net health outcome in patients who have positive CRC screening tests or signs or symptoms of CRC?

The following PICOTS were used to select literature to inform this review.

Patients
The relevant populations of interest are individuals with positive CRC screening tests or signs or symptoms of CRC.

Interventions
The test being considered is CTC.

Comparators
The following tests are currently being used to make decisions about patients who have positive CRC screening or signs and symptoms of CRC: optical colonoscopy and standard care without a colonoscopy.

Outcomes
The outcomes of interest are disease-specific morbidity and mortality. Beneficial outcomes relate to true positive testing, which leads to detection of disease that would be otherwise missed. Harmful outcomes result from false-negative testing, which may delay diagnosis and management of CRC.

Timing
Follow-up immediately after test results is of interest for CTC test accuracy and validity, as well as treatment-related morbidity; follow-up at 1 to 5 years is of interest for CTC outcomes for disease-specific morbidity or mortality.

Setting
CTC is administered in an outpatient setting or in a hospital or an imaging facility. Results of CTC are assessed by a radiologist.

Study Selection Criteria
For the evaluation of clinical validity of the CTC test, studies that meet the following eligibility criteria were considered:

- Reported on the accuracy of the technology
- Included a suitable reference standard
- Patient clinical characteristics were described
- Patient selection criteria were described.

Technically Reliable
Assessment of technical reliability focuses on specific tests and operators and requires review of unpublished and often proprietary information. Review of specific tests, operators, and unpublished
data are outside the scope of this evidence review and alternative sources exist. This evidence review focuses on the clinical validity and clinical utility.

**Clinically Valid**
A test must detect the presence or absence of a condition, the risk of developing a condition in the future, or treatment response (beneficial or adverse).

**Systematic Reviews**
Several studies have evaluated the role of CTC in the diagnosis of CRC in patients with symptoms or positive findings on other screening modalities (eg, fecal occult blood testing [FOBT]). Plumb et al (2014) published a systematic review and meta-analysis of studies evaluating the performance of CTC for the diagnosis of colon cancer among subjects with positive FOBT. FOBT is a recommended screening technique for CRC; positive tests are typically followed by a colonoscopy. In this meta-analysis, reviewers included only studies that used CTC in the evaluation of patients who had had a positive FOBT and compared colonography results with a reference test, conventional colonoscopy, segmental unblinded colonoscopy, or surgery with subsequent histopathology. Five articles were analyzed, representing 4 studies with 622 patients. Pooled per patient sensitivity and specificity for adenomas 6 mm or larger or CRC were 88.8% (95% CI, 83.6% to 92.5%) and 75.4% (95% CI, 58.6% to 86.8%), respectively. Reviewers commented that data were limited on CTC for patients with a positive FOBT (only 4 studies) and based on the available evidence, CTC has a reasonably high sensitivity for detecting adenomas 6 mm or larger (88.8%; 95% CI, 83.6% to 92.5%) but a relatively low specificity 75.4%; 95% CI, 58.6% to 86.8%).

**Retrospective Studies**
Simons et al (2013) evaluated the false-negative rate and sensitivity of CTC for CRC among patients who presented with symptoms of CRC. The authors included 1855 consecutive patients who underwent CTC at a single center. These data were linked to a comprehensive population-based cancer registry to determine if patients were diagnosed with CRC in the 2 years after their CTC. Fifty-three patients were diagnosed with CRC, of whom 40 patients had suspected CRC, 5 diagnosed with large polyps that appeared malignant on histology, and 5 diagnosed with an indeterminate mass on CTC. Two patients who developed cancer had not been diagnosed on CTC, and 1 patient who developed cancer had had an incomplete colonography. The overall sensitivity of CTC was 94.3% (95% CI, 88% to 100%).

Also, Plumb et al (2014) published findings of a retrospective study comparing results from CTC with optical colonoscopy in patients evaluated at a single center who were indicated for CRC diagnostic assessment because of a positive FOBT. This study was not included in the Plumb 2014 review (described above). Based on the institutional protocol, optical colonoscopy was preferred for individuals with positive FOBT; however, CTC was substituted if the subject was unable to complete colonoscopic bowel preparation safely, was too frail or immobile to undergo colonoscopy (although potentially fit for necessary treatment), had another contraindication to colonoscopy, or had an incomplete colonoscopy. The study analyzed 2731 FOBT-positive patients screened with CTC as their first screening test. Of these, 1027 (37.6%) had CRC or polyps suspected (95% CI, 33.8% to 41.4%), and 911 underwent confirmatory testing. One hundred twenty-four (4.5%) were found to have CRC and 533 (19.5%) were found to have polyps, for an overall CRC- or polyp-detection rate of 24.1% (95% CI, 21.5% to 24.1%). The positive predictive value for CRC or polyps was 72.1% (95% CI, 66.6% to 77.6%). Colonoscopy data were available for 72,817 FOBT-positive patients who underwent colonoscopy as an initial screening test, among whom 9.0% had CRC, and 50.6% had polyps. The authors attributed the difference in CRC and polyp rates between the groups to underlying differences in risk between those referred for CTC and potential biases in the interpretation of screening guidelines.
Clinically Useful
A test is clinically useful if the use of the results informs management decisions that improve the net health outcome of care. The net health outcome can be improved if patients receive correct therapy, or more effective therapy, or avoid unnecessary therapy, or avoid unnecessary testing.

Direct Evidence
Direct evidence of clinical utility is provided by studies that have compared health outcomes for patients managed with and without the test. Because these are intervention studies, the preferred evidence would be from RCTs.

Several studies have evaluated the role of CTC for patients with symptoms suggestive of CRC. Atkin et al (2013) reported on the results of an unblinded RCT comparing colonoscopy with CTC in the evaluation of patients who had symptoms suggestive of CRC. Given the challenges of conducting a trial that would be adequately powered to detect small differences between CTC and colonoscopy in CRC and large polyp detection, the authors used rates of the need for additional evaluation after CTC as a primary outcome, on the assumption that such rates would strongly affect the evaluation of the benefits of the procedure. The trial randomized patients ages 55 or older with symptoms suggestive of CRC in a 2:1 fashion to colonoscopy or CTC. Both colonoscopy and CTC procedures were conducted with a full bowel preparation. The trial’s primary outcome was the proportion of patients who had an additional colonic investigation, defined as any subsequent examination of the colon until diagnosis (usually histologic confirmation of cancer or polyp) or until a patient was referred back to his or her physician. Additional diagnostic evaluation of the colon was required in 160 (30.0%) of 533 of those assigned to CTC compared with 86 (8.2%) of 1047 of those assigned to colonoscopy (p<0.001). The overall detection rate for CRC or large polyps did not differ between the groups (relative risk, 0.95; 95% CI, 0.70 to 1.27; p=0.69).

Chain of Evidence
Indirect evidence on clinical utility rests on clinical validity. If the evidence is insufficient to demonstrate test performance, no inferences can be made about clinical utility.

Because the clinical validity of CTC for colon cancer diagnosis has not been established, a chain of evidence supporting the clinical utility of CTC for this population cannot be constructed.

Section Summary: CTC for Colon Cancer Diagnosis
There is a relatively small number of studies of CTC for diagnosing CRC in patients with a positive screening test or with symptoms of CRC. A systematic review of CTC studies in patients with a positive FOBT identified only 4 studies and found a reasonably high sensitivity for detecting adenomas 6 mm or larger but a relatively low specificity. An RCT comparing CTC with colonoscopy in symptomatic patients found a significantly greater need for additional evaluation after CTC compared with colonoscopy. Because prevalence of the disease is much higher in patients with positive screening tests or symptoms of CRC, going directly to colonoscopy is usually the preferred clinical strategy. Additional studies are needed to determine with certainty the diagnostic accuracy of CTC for diagnosis of CRC; however, for patients unable to undergo a colonoscopy, based on the available evidence, CTC may be a reasonable option.

SUMMARY OF EVIDENCE
For individuals who are asymptomatic and undergoing CRC screening who receive CTC, the evidence includes systematic reviews with meta-analysis, randomized and nonrandomized controlled trials, and modeling studies. Relevant outcomes are overall survival, disease-specific survival, test accuracy and...
validity, and treatment-related morbidity. The available evidence supports the conclusion that the diagnostic accuracy of CTC is in the same range as optical colonoscopy, with a moderate-to-high sensitivity and a high specificity for the detection of larger polyps and CRC. As a result, screening with CTC may provide similar diagnostic results to screening using conventional optical colonoscopy. Most modeling studies have reported that the overall health outcome benefits of a strategy that uses optical colonoscopy likely exceed the benefits of a strategy using CTC. However, these analyses assume equal participation rates in screening between the strategies. Participation in screening may be higher with CTC than with optical colonoscopy, and this may ameliorate or offset any improved outcomes associated with optical colonoscopy. The evidence is sufficient to determine that the technology results in a meaningful improvement in the net health outcome.

For individuals who have positive CRC screening tests or signs or symptoms of CRC who receive CTC, the evidence includes systematic reviews with meta-analysis, an RCT, and cohort studies. Relevant outcomes are overall survival, disease-specific survival, test accuracy and validity, and treatment-related morbidity. Using CTC on patients with suspected disease might be an inefficient testing strategy because CTC findings need to be confirmed with conventional colonoscopy. There are a small number of studies on CTC for diagnosis of CRC in patients with a positive screening test or with symptoms of CRC, and thus the diagnostic accuracy cannot be determined with certainty. Studies of patients with a positive fecal occult blood test have suggested a reasonably high sensitivity for detection of adenomas 6 mm or larger but a relatively low specificity. There are fewer studies of patients with CRC symptoms; the RCT found that significantly more patients required additional evaluation after CTC than after conventional colonoscopy. The evidence is insufficient to determine the effects of the technology on health outcomes.

SUPPLEMENTAL INFORMATION

PRACTICE GUIDELINES AND POSITION STATEMENTS

American College of Physicians
The American College of Physicians (ACP; 2012) updated its guidelines for colorectal cancer (CRC) screening. ACP made the following recommendations on colon cancer screening:

“ACP recommends using a stool based test, flexible sigmoidoscopy, or optical colonoscopy as a screening test in patients who are at average risk. ACP recommends using optical colonoscopy as a screening test in patients who are at high risk. Clinicians should select the test based on the benefits and harms of the screening test, availability of the screening test, and patient preferences.”

The guidelines further noted that computed tomography colonography (CTC) is an option for screening average-risk patients older than 50 years.

American Cancer Society et al
The American Cancer Society (2018) updated its guidelines on CRC screening (see Table 1). ACS made the following recommendations on colon cancer screening:

“The ACS recommends that adults aged 45 years and older with an average risk of colorectal cancer undergo regular screening with either a high-sensitivity stool-based test or a structural (visual) examination, depending on patient preference and test availability....The recommendation to begin screening at age 45 years is a qualified recommendation. The recommendation for regular screening in adults aged 50 years and older is a strong recommendation.”
Virtual Colonoscopy/Computed Tomography Colonography

CTC was listed as an option for CRC screening (see Table 1) and was acknowledged to have comparable sensitivity and specificity to a colonoscopy. Stated limitations associated with CTC included exposure to low-dose radiation as well as complications of a full bowel preparation, including rare cases of bowel perforation. It remains unclear whether incidental detection of extracolonic findings during CTC provides net benefit or harm to patients.

**Table 1. Guidelines on Colorectal Cancer Screening Options**

<table>
<thead>
<tr>
<th>Colorectal Cancer Screening Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stool-based test</strong></td>
</tr>
<tr>
<td>Fecal immunochemical test every 1 y</td>
</tr>
<tr>
<td>High-sensitivity, guaiac-based fecal occult blood test every 1 y</td>
</tr>
<tr>
<td>Multitarget stool DNA test every 3 y</td>
</tr>
<tr>
<td><strong>Structural test</strong></td>
</tr>
<tr>
<td>Colonoscopy every 10 y</td>
</tr>
<tr>
<td>Computer tomography colonography every 5 y</td>
</tr>
</tbody>
</table>

**American College of Gastroenterology**

The American College of Gastroenterology (2017) published recommendations of the U.S. Multi-Society Task Force of Colorectal Cancer made up of expert gastroenterologists from the American College of Gastroenterology, the American Gastroenterological Association, and the American Society for Gastrointestinal Endoscopy. The panel recommended CRC screening beginning at age 50 with adjustments based on race and family history using a ranked-tiered CRC screening approach in Table 2. Considerations for recommending the tiered system of current CRC screening tests included performance, cost, patient acceptance, and the lack of randomized trial results that directly compare the effects of different tests on CRC incidence or mortality.

**Table 2. Colorectal Cancer Screening Tier Strategy**

<table>
<thead>
<tr>
<th>Tier</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier 1</td>
<td>• Colonoscopy every 10 y</td>
</tr>
<tr>
<td></td>
<td>• Annual fecal immunochemical test</td>
</tr>
<tr>
<td>Tier 2</td>
<td>• Computed tomography colonography every 5 y</td>
</tr>
<tr>
<td></td>
<td>• Fecal immunochemical test–fecal DNA every 3 y</td>
</tr>
<tr>
<td></td>
<td>• Flexible sigmoidoscopy every 10 y (or every 5 y)</td>
</tr>
<tr>
<td>Tier 3</td>
<td>• Capsule colonoscopy every 5 y</td>
</tr>
<tr>
<td>Available tests not currently recommended</td>
<td>• Septin 9</td>
</tr>
</tbody>
</table>

**European Society of Gastrointestinal Endoscopy et al**

The European Society of Gastrointestinal Endoscopy and European Society of Gastrointestinal and Abdominal Radiology (2014) issued guidelines on the use of CTC. These guidelines recommended CTC as outlined in Table 3.

**Table 3. Guidelines on Use of CTC**

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>SOR</th>
<th>QOE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESGE/ESGAR recommend CTC as the radiologic examination of choice for the</td>
<td>Strong</td>
<td>High</td>
</tr>
<tr>
<td>diagnosis of colorectal neoplasia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESGE/ESGAR do not recommend barium enema in this setting</td>
<td>Strong</td>
<td>High</td>
</tr>
<tr>
<td>ESGE/ESGAR recommend CTC, preferably the same or next day, if colonoscopy is incomplete. Delay of CTC should be considered following endoscopic resection.</td>
<td>Strong</td>
<td>Moderate</td>
</tr>
</tbody>
</table>
the case of obstructing colorectal cancer, preoperative contrast-enhanced CTC may also allow location or staging of malignant lesions.

When endoscopy is contraindicated or not possible, ESGE/ESGAR recommend as an acceptable and equally sensitive alternative for patients with symptoms suggestive of colorectal cancer

ESGE/ESGAR do not recommend CTC as a primary test for population screening or in individuals with a positive first-degree family history of CRC. However, it may be proposed as a CRC screening test on an individual basis providing the screenee is adequately informed about test characteristics, benefits, and risks.

American College of Radiology

The American College of Radiology (2018) updated its 2014 appropriateness criteria on imaging tests for CRC screening. While CTC was not recommended for screening of patients at high risk for CRC, was appropriate for screening in the following populations:

- Average-risk individual, >50 years old
- Moderate-risk individual with a first-degree family history of cancer or adenoma
- Average-, moderate-, or high-risk individual with incomplete colonoscopy.

CTC was also appropriate for CRC detection in moderate-risk individuals, and in average-risk individuals after positive fecal screening tests (fecal occult blood test or fecal immunochemical test).

U.S. PREVENTIVE SERVICES TASK FORCE RECOMMENDATIONS

The U.S. Preventive Services Task Force (USPSTF; 2016) updated its recommendations on CRC screening. The recommendations included the following:

Adults 50 to 75 years old:

“The USPSTF recommends screening for colorectal cancer starting at age 50 years and continuing until age 75 years.” (Grade A)

Adults 76 to 85 years old:

“The decision to screen for colorectal cancer in adults aged 76 to 85 years should be an individual one, taking into account the patient’s overall health and prior screening history.

- Adults in this age group who have never been screened for colorectal cancer are more likely to benefit.
- Screening would be most appropriate among adults who 1) are healthy enough to undergo treatment if colorectal cancer is detected and 2) do not have comorbid conditions that would significantly limit their life expectancy.” (Grade C)

In a section on clinical considerations, USPSTF stated that evidence on CTC is limited to studies on test characteristics and that CTC can result in incidental extracolonic findings. USPSTF also noted indirect harms resulting from standard colonoscopy performed for positive CTC findings.

The 2016 USPSTF recommendations did not include a specific statement on screening with CTC.
MEDICARE NATIONAL COVERAGE
The Centers for Medicare & Medicaid Services (2009) published a decision memo on CTC screening, which stated: “The evidence is inadequate to conclude that CT colonography is an appropriate colorectal cancer screening test.... CT colonography for colorectal cancer screening remains noncovered.”

ONGOING AND UNPUBLISHED CLINICAL TRIALS
Some currently unpublished trials that might influence this review are listed in Table 4.

Table 4. Summary of Key Trials

<table>
<thead>
<tr>
<th>NCT No.</th>
<th>Trial Name</th>
<th>Planned Enrollment</th>
<th>Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ongoing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NCT01651624</td>
<td>Comparison Between Faecal Occult Blood Test (FOBT), Computed Tomographic Colonography (CTC) With Computer Aided Diagnosis (CAD) and Colonoscopy as a Primary Screening Test for Colorectal Cancer</td>
<td>14,000</td>
<td>Dec 2018</td>
</tr>
</tbody>
</table>

NCT: national clinical trial.

REFERENCES


Original Policy Date: August 2001

MP 6.01.32
Virtual Colonoscopy/Computed Tomography Colonography

### CODES

<table>
<thead>
<tr>
<th>Codes</th>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPT</td>
<td>74261</td>
<td>Computed tomographic (CT) colonography, diagnostic, including image postprocessing; without contrast material</td>
</tr>
<tr>
<td></td>
<td>74262</td>
<td>Computed tomographic (CT) colonography, diagnostic, including image postprocessing; with contrast material(s) including non-contrast images, if performed</td>
</tr>
<tr>
<td></td>
<td>74263</td>
<td>Computed tomographic (CT) colonography, screening, including image postprocessing</td>
</tr>
<tr>
<td>ICD-10-CM</td>
<td>C18.0-C18.9</td>
<td>Malignant neoplasm of colon code range</td>
</tr>
<tr>
<td></td>
<td>C19</td>
<td>Malignant neoplasm of rectosigmoid junction</td>
</tr>
<tr>
<td></td>
<td>Z12.10-Z12.13</td>
<td>Encounter for screening for malignant neoplasm of intestinal tract code range</td>
</tr>
<tr>
<td></td>
<td>Z15.09</td>
<td>Genetic susceptibility to other malignant neoplasm</td>
</tr>
<tr>
<td></td>
<td>Z80.0</td>
<td>Family history of malignant neoplasm of digestive organs</td>
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<tr>
<td>ICD-10-PCS</td>
<td></td>
<td>ICD-10-PCS codes are only used for inpatient services. There is no specific ICD-10-PCS code for this imaging.</td>
</tr>
<tr>
<td></td>
<td>BD2400Z, BD240ZZ, BD2410Z, BD241ZZ, BD24Y0Z, BD24YZZ, BD24ZZZ</td>
<td>Imaging, gastrointestinal system, computerized tomography (CT), colon, code by contrast (high osmolar, low osmolar, other contrast, none) and qualifier (unenhanced and enhanced, or none)</td>
</tr>
</tbody>
</table>

**Type of service**: Radiology
**Place of service**: Outpatient/Inpatient

### POLICY HISTORY

<table>
<thead>
<tr>
<th>Date</th>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>05/22/14</td>
<td>Replace policy</td>
<td>Policy updated with literature review through April 1, 2014. References 9, 11, 26-29, 31, and 36 added. Rationale section extensively reorganized. Policy statement amended to state that CT colonography may be considered medically necessary for colon cancer screening, with guidelines about considerations of the cost of the procedure moved to the Benefit Applications section.</td>
</tr>
<tr>
<td>05/21/15</td>
<td>Replace policy</td>
<td>Policy updated with literature review through April 16, 2015; references 8, 12, 32, 34, 38, and 40-41 added. Discussion of equivalence of outcomes added to policy guidelines. Policy statements otherwise unchanged.</td>
</tr>
<tr>
<td>09/08/16</td>
<td>Replace policy</td>
<td>Policy updated with literature review through July 24, 2016; references 2, 6-7, and 28 added. The parenthetical referring to contractual impact and language regarding equivalence were removed from the second policy statement. Policy statements are otherwise unchanged. The term “equivalent” was changed to “similar in the Policy Guidelines and Benefit Application sections.</td>
</tr>
<tr>
<td>09/28/17</td>
<td>Replace policy</td>
<td>Blue Cross of Idaho adopted changes as noted. Policy updated with literature review through July 20, 2017; no references</td>
</tr>
<tr>
<td>Date</td>
<td>Action</td>
<td>Details</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>09/19/18</td>
<td>Replace policy</td>
<td>Blue Cross of Idaho adopted changes as noted. Policy updated with literature review through July 26, 2018; reference 21 added. Policy statements unchanged.</td>
</tr>
<tr>
<td>05/16/19</td>
<td>Archive policy</td>
<td>Blue Cross of Idaho voted to archive policy, effective 08/20/2019.</td>
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