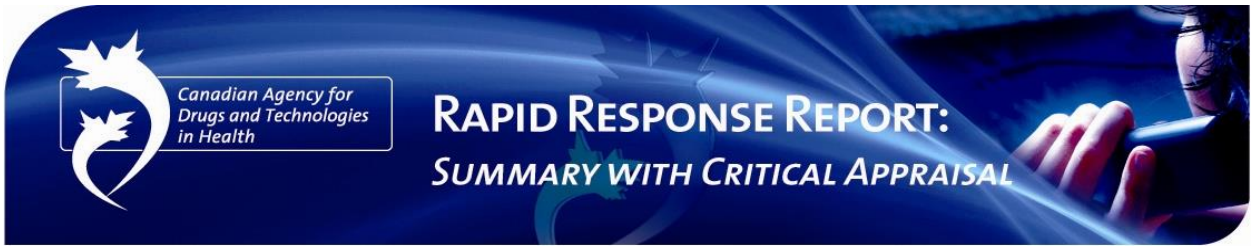

TITLE: Urgent, Non-Screening Fecal Occult Blood Testing for Patients with Suspected Gastrointestinal Bleeding: A Review of Clinical Effectiveness and Guidelines

DATE: 03 January 2017

CONTEXT AND POLICY ISSUES

Gastrointestinal (GI) bleeding can be a common cause of hospitalization, particularly in elderly patients.[1] GI bleeding can be overt (where the patient and physician can detect the presence of blood without testing), occult (where there are symptoms of bleeding such as anemia, but that a test is needed to confirm bleeding), or obscure (where the bleeding or source of bleeding is not identified despite invasive testing).[2] Occult bleeding is often caused by colorectal cancer (CRC) lesions whereas other bleeding could be caused by small bowel diseases or upper GI conditions.[1,3]

One commonly accepted method to screen for CRC is the fecal occult blood test (FOBT).[4] FOBT may be guaiac-based (gFOBT) or immunochemical (iFOBT or FIT). Guaiac-based FOBT detects hemoglobin by the presence of a peroxidase reaction. Immunochemical tests use antibodies to detect the globulin portion of human hemoglobin.[5] FOBT is known to be effective in detecting colorectal lesions[3] by identifying occult blood in the stool. It is not well known, however, whether or not FOBT is effective in identifying other gastrointestinal bleeding.[3] In fact, FOBT is validated for use in asymptomatic patients for CRC screening and has generally not been recommended for use in symptomatic patients.[6] Despite being generally recommended for screening use, a survey of Canadian gastroenterologists and specialists in the Winnipeg Regional Health Authority showed that FOBT was commonly ordered in hospitalized patients with black stools and anemia with or without iron deficiency.[7]

This review seeks to determine the clinical effectiveness of urgent non-screening FOBT for hospitalized patients with suspected GI bleeding and to identify relevant evidence-based guidelines for the use of FOBT in those patients.

RESEARCH QUESTIONS

1. What is the clinical effectiveness of urgent non-screening fecal occult blood testing for patients with suspected gastrointestinal bleeding?

2. What are the evidence-based guidelines regarding the use of fecal occult blood testing for patients with suspected gastrointestinal bleeding?

KEY FINDINGS

Overall, due to the limited number of studies and the retrospective nature of the data, it is unclear whether FOBT is clinically effective for use in hospitalized patients with gastrointestinal bleeding. While three of the four studies found that patients with a positive FOBT were more likely to be referred for further GI follow-up, none of the studies measured patient health outcomes and it is therefore unknown if the testing had any impact on health status. No relevant evidence-based guidelines regarding urgent FOBT testing were identified.

METHODS

Literature Search Methods

A limited literature search was conducted on key resources including PubMed, The Cochrane Library, University of York Centre for Reviews and Dissemination (CRD) databases, Canadian and major international health technology agencies, as well as a focused Internet search. No filters were applied to limit the retrieval by study type for research question 1. A methodological filter was applied to limit retrieval to guidelines for research question 2. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between September 1, 2012 and November 30, 2016.

Rapid Response reports are organized so that the evidence for each research question is presented separately.

Selection Criteria and Methods

One reviewer screened citations and selected studies. In the first level of screening, titles and abstracts were reviewed and potentially relevant articles were retrieved and assessed for inclusion. The final selection of full-text articles was based on the inclusion criteria presented in Table 1.

Table 1: Selection Criteria

Population	Adult patients and Pediatric patients who are in the hospital (emergency room, intensive care, acute care unit) and have suspected gastrointestinal bleeding (and are being tested urgently, not as a part of colorectal cancer screening programs)
Intervention	Fecal Occult Blood Testing (FOBT), Immunochemical FOBT (iFOBT) (point of care or lab) being performed outside of a screening program.
Comparator	No active or any active comparator
Outcomes	Q1 – evidence that urgent FOBT leads to improved patient outcomes or changes in care pathways e.g. further GI testing, findings of testing,

Table 1: Selection Criteria	
	change in hospital length of stay, improved health outcomes as a result of testing or diagnosis Q2 – guidelines regarding the use of FOBT and iFOBT for urgent or non-screening purposes in adult and pediatric patients with suspected GI bleeding
Study Designs	Health Technology Assessment, Systematic Review/Meta-Analysis, Randomized Controlled Trials, Non-Randomized Studies, Evidence-Based Guidelines.

Exclusion Criteria

Articles were excluded if they did not meet the selection criteria outlined in Table 1, they were duplicate publications, or were published prior to September 2012, as this report is an update to a previous CADTH report published in September 2012.[5]

Critical Appraisal of Individual Studies

The included non-randomized studies were critically appraised using the SIGN 50 checklist.[8] Summary scores were not calculated for the included studies; rather, a review of the strengths and limitations of each included study were described.

SUMMARY OF EVIDENCE

Quantity of Research Available

A total of 324 citations were identified in the literature search. Following screening of titles and abstracts, 313 citations were excluded and 11 potentially relevant reports from the electronic search were retrieved for full-text review. Two potentially relevant publications were retrieved from the grey literature search. Of these potentially relevant articles, nine publications were excluded for various reasons, while four publications met the inclusion criteria and were included in this report. Appendix 1 contains the PRISMA flowchart of the study selection.

Summary of Study Characteristics

Full detail of study characteristics is provided in Appendix 2, table A1.

Study Design
The included studies were all cohort studies.[4,9-11] Three were retrospective cohorts[4,10,11] and in one study it was not clear if the study was retrospective or prospective.[9] One study used a before and after design to examine the impact of removing FOBT from hospitals.[9]

Country of Origin
Two of the studies were conducted in Canada,[10,11] one in the United States,[9] and one in the Netherlands.[4] The Canadian studies took place in Winnipeg, Manitoba[10] and in Hamilton, Ontario.[11]

Patient Population
All of the studies examined hospital inpatients with overt or suspected GI bleeding.[4,9-11]

The before and after study by Mosadeghi et al., [9] conducted in the United States, examined patients for whom FOBT was ordered during the study period as well as patients with similar symptoms who underwent endoscopic procedures once FOBT had been discontinued. In the FOBT period, 23,162 patients were admitted, 207 (0.9%) of whom underwent FOBT. The mean age of patients was 56 years and only adult patients were represented in the sample. Reasons for undergoing FOBT included anemia, GI bleeding, and GI bleeding with anemia. The reason for FOBT was not recorded or was not known in 34% of the cases.

In the study by Ip et al.,[10] the cohort of patients who underwent FOBT in the study of hospitals in Winnipeg were admitted to one of four academic or two community hospitals. There were 1,904 patients who underwent FOBT, 327 (17.2%) (n = 230 with a positive result, 97 with a negative result) of whom were randomly selected for examination in the study. Approximately 50% of the patients were female, the mean age was 76 years, and the sample included only adult patients. Reasons for undergoing FOBT included anemia, black stools, overt GI bleeding, or other GI symptoms.

In the study by Narula et al.,[11] the 229 patients examined in the Hamilton hospital region had a mean age of 49 years, 18 of the patients were pediatric. Approximately 52% of the population was female and reasons for undergoing FOBT were anemia, overt GI bleeding, suspected GI bleeding, and one patient was asymptomatic. Three percent of the FOBT tests were performed for reasons unknown to researchers. This study did not include patients in the emergency department.

The Dutch study by Van Rijn et al.,[4] included 216 patients who underwent FOBT, 201 (93.1%) of whom were included in the analysis (records were incomplete for 15 patients). Approximately 48% of the cohort was female, had a mean age of 47 years, and 23% of patients (n = 46) were pediatric (18 years of age or younger). Reasons for undergoing FOBT included suspicion of dark stools, anemia, change in bowel habits, and abdominal pain.

Interventions and Comparators

One study used the Hemoccult laboratory test (a guiac-based FOBT) compared with no FOBT testing.[9] One study used the Hemmocult II Sensa test and compared outcomes for those who had a positive test result with those who had a negative test result.[10] One study did not specify the type of FOBT used and there was no active comparator; the test was not a point of care test, however, as authors specified that they did not include patients who received a point of care test in the emergency department.[11] One study used the 3-day guiac based Hematest, that was evaluated in the central laboratory.[4]

Outcomes

All of the included studies examined the impact of FOBT on further endoscopic testing.[4,9-11] This was measured by the number of patients who underwent endoscopic testing after undergoing FOBT. Three studies also examined whether there were clinically significant findings or a change in clinical management that resulted from the findings of testing.[9-11]

Length of study

The length of the studies ranged from three months[11] to four years.[9]

Summary of Critical Appraisal

Common strengths in all of the studies included clearly focused research questions and well defined outcomes.[4,9-11] One of the common weaknesses of the included studies was the use of patient records which may pose limitations such as incomplete record keeping or difficulty reading files.[4,9-11] It is possible that referrals to gastroenterology and changes in clinical management were missed.

The before and after study[9] was the only included study to clearly indicate that there was an attempt to blind the researcher assessing outcomes. In this case, the assessor was blind to the result of the FOBT when interpreting endoscopic outcomes, thus it is less likely that there was information bias. The populations being studied, however, were not consistent; those who were admitted to the hospital in the two years after the discontinuation of FOBT were younger and there were fewer patients admitted than in the two years preceding the removal of FOBT. Additionally, data regarding the reason for FOBT was missing in approximately 33% of patients.

The study of FOBT in hospitals in the Winnipeg area[10] did not indicate the blinding of outcome assessors, did not present the findings of statistical testing and the authors indicated that many of the patients did not receive dietary or medication advice prior to FOB testing. As the test results are sensitive to certain medications and foods, the test results may therefore have been unreliable. The study is, however, likely generalizable to other urban Canadian populations, as the data represented multiple hospitals within an urban Canadian setting.

Similar to the other Canadian study,[10] many patients who were analyzed in the study in Hamilton hospitals[11] did not conform to medication and dietary restrictions and FOBT results may also have been unreliable (and more likely to be false positives). While outcomes were assessed by a separate researcher, it was not clear if the researcher was blinded to test results or outcomes. Additionally, the authors of this study did not report the limitations of their study. The study of Dutch patients[4] had similar limitations as it was not clear if the researcher assessing outcomes was blinded and the authors did not report the limitations of their study. Additionally, the authors did not consider or report potential confounders such as medication or dietary adherence and the results of statistical testing was not reported.

Summary of Findings

What is the clinical effectiveness of urgent, non-screening fecal occult blood testing for patients with suspected gastrointestinal bleeding?

<u>FOBT leading to Further Examination</u>
In three of the four studies,[9-11] patients with a positive FOBT result were more likely to be referred for further examination.

Mosadeghi et al.[9] found that patients with a positive FOBT result were statistically significantly more likely to be followed-up with an endoscopic evaluation than those who had a negative result (34% vs. 11%; $P < 0.01$). Once FOBT was discontinued in the hospital, the odds of undergoing endoscopic procedure decreased (odds ratio [OR] 0.80, 95% confidence interval [CI] 0.75 to 0.85).

Ip et al.[10] found that patients who had a positive FOBT result were more likely than those who had a negative FOBT to be referred for further gastroenterology examination (47% vs. 19%, $P <$

0.01) or for a general surgery consultation (16% vs. 5%, *P* = 0.01). Patients with a negative FOBT result were more likely to have no referral than those who had a positive result (71% vs. 28%, *P* < 0.01). Patients with a positive FOBT result were significantly more likely to undergo a gastrointestinal endoscopic procedure (33% vs. 9%, *P* < 0.01).

Of the 44 patients in the study by Narula et al.[11] who were referred for further gastroenterology examination (n = 28 to upper GI endoscopy, n = 17 to colonoscopy), 40 (90.9%) had a positive FOBT result.

For patients in the study by Van Rijn et al.,[4] a positive FOBT result was not a statistically significant indicator for gastrointestinal follow-up investigation. Patients with a positive FOBT were not more likely to receive a follow-up order than those who were FOBT negative (38% vs. 41%, *P* = 0.86).

Clinically Significant Endoscopic Findings

In the study by Modsadeghi et al.,[9] there were more clinically significant endoscopic findings (defined as a result contributing to a change in clinical management or if on retrospective analysis, the findings justified the need for endoscopy) in those who had a positive FOBT than negative FOBT, but the results were not statistically significant (85% vs. 57%; *P* = 0.77).

For patients in the study by Ip et al.,[10] 38% of both FOBT positive and negative patients were found to have ulcers upon gastroscopy. Results of colonoscopies showed that 32% of patients with a positive and 25% of those with a negative FOBT had diverticular disease, while 29% of positive and 25% of negative patients were found to have polyps. Statistical significance, however, was not reported. Endoscopic findings were considered significant if a diagnosis or problem could be found upon undergoing the procedure.

For patients in the study by Narula et al.,[11] who underwent upper GI endoscopy, many of the clinically significant results were found in patients who had a positive FOBT result (100% of ulcer [n=12] 66% of gastritis [n=3], 100% of esophagitis [n=3] findings), however, there was no indication of statistical significance. Similarly, many patients undergoing colonoscopy following a positive FOBT result had clinically significant findings (100% of colitis [n=3], 100% of diverticular bleeding [n=2], 100% of polyp [n=2], 100% of ulcer [n=1], 100% of Crohn's disease findings [n=1]).

Other Outcomes

Mosadeghi et al.[9] reported that the length of hospital stay did not significantly change after FOBT was discontinued, though, after adjusting for baseline anemia, age, and sex, the number of inpatient procedures significantly decreased after the removal of FOBT (*P* > 0.01).

For patients with overt bleeding in the study by Narula et al.,[11] 27% of the referrals to gastroenterology were delayed due to waiting for FOBT results and 30% of patients had their length of hospital stay extended due to the results of FOBT (mean extension: 26 days; standard deviation not reported), mostly due to preparation for endoscopy or complications resulting from endoscopy. Additionally, 85% of patients were taking at least one medication that could have interfered with FOBT results – primarily by resulting in false-positive results.

What are the evidence-based guidelines regarding the use of urgent fecal occult blood testing for patients with suspected gastrointestinal bleeding?

No relevant evidence-based guidelines were identified regarding the use of urgent fecal occult blood testing for hospitalized patients with suspected gastrointestinal bleeding.

Limitations

Two primary limitations of this review are the lack of randomized data and the lack of prospective data. Although one study did randomly select the files of patients who received FOBT in the study periods, there were no prospective randomized studies identified. One study did use a before and after design whereby the 'after' data may have been prospective, but this was unclear. The remaining studies relied on retrospective cohorts. Thus, conclusive statements regarding the effectiveness of urgent FOBT in hospitalized patients cannot be drawn.

Most of the studies used central laboratory FOBT testing and one study explicitly did not include point of care FOBT results, therefore, this review likely does not generalize to point of care fecal occult blood testing. Additionally, as the included studies were primarily conducted in urban areas, the results likely do not generalize to rural or remote settings in Canada, where point of care testing may be the norm, or where further endoscopy or GI testing may not be readily available.

The included studies used guiac-based FOBT and no clinical studies regarding immunochemical-based FOBT (iFOBT or fecal immunochemical tests) were identified. Fecal immunochemical tests (FIT) are increasingly replacing gFOBT as preferred methods of testing, thus the tests used in the included studies may not be the most commonly used tests currently or going forward.[6,12,13]

One study[9] was clearly reported as including an ethnically diverse patient population, however, this study was conducted in the United States and may not represent ethnicities that are more likely to make up the Canadian population (e.g. Indigenous Canadians, Canadians of Asian descent).

CONCLUSIONS AND IMPLICATIONS FOR DECISION OR POLICY MAKING

Three of the four included studies[9-11] found that patients with a positive FOBT were more likely to be referred for further GI follow-up, and one study found a decrease in the number of endoscopic procedures following discontinuation of FOBT,[9] none of the studies measured patient health outcomes and it is therefore unknown if the testing had any impact on health status.

The authors of the included studies came to the conclusions that FOBT may not influence further diagnosis[4] or clinical decision making,[11] may not have a positive impact on clinical management,[10] and seems to be used inappropriately in some hospitals[9] – particularly in pediatric patients.[4] Further, despite being hospitalized and having diet and medication regimens more likely to be able to be restricted, FOBT preparation protocols may still not be followed, making FOBT results potentially unreliable.[10,11]

No clinical evidence regarding immunochemical-based FOBT was identified and no relevant evidence based guidelines regarding the use of urgent, non-screening FOBT were identified.

Overall, due to the limited number of studies and the retrospective nature of the data, it is unclear whether FOBT is clinically effective for urgent use in hospitalized patients with suspected gastrointestinal bleeding.

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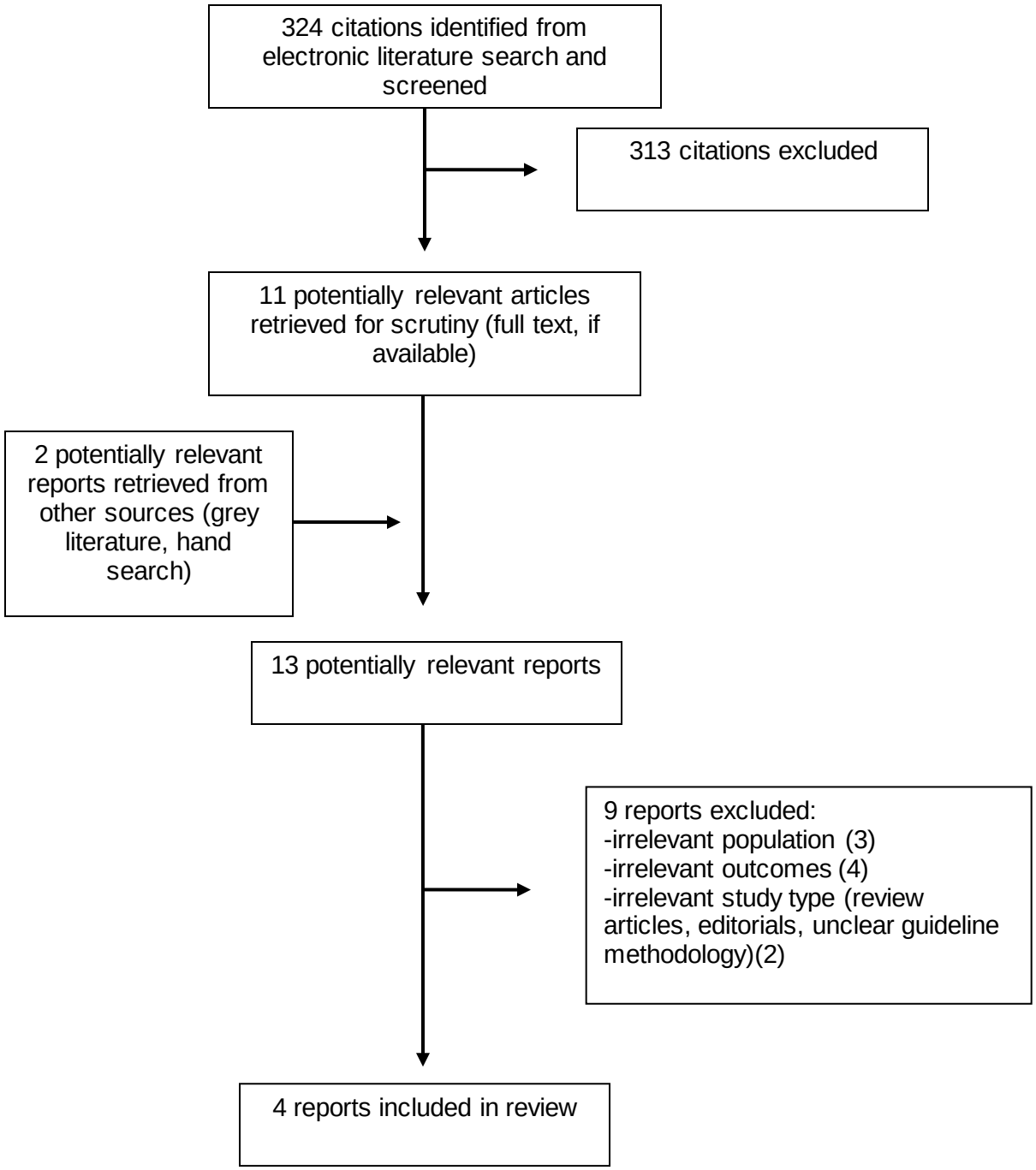
APPENDIX 1: Selection of Included Studies



APPENDIX 2: Characteristics of Included Publications

Table A1: Characteristics of Included Clinical Studies

First Author, Publication Year, Country, Study Period	Study Design	Patient Characteristics	Intervention(s)	Comparator(s)	Clinical Outcomes
Mosadeghi, 2016,[9] USA May 1, 2010 to May 1, 2012 (FOBT in use) April 30, 2012 to April 30, 2014 (FOBT discontinued)	Cohort (pre/post) to evaluate the trends in prescribing and the impact of FOBT on clinical management.	207 in-patients received FOBT Age (mean, SD): 56 years ±12.3 Race: Black: 38%; White: 29%; NA/Eskimo: 16%); Asian Pacific Islander: 14%; Unknown: 1%. Ethnicity: non-Hispanic: 77%; Hispanic: 18%; Unknown: 5% Reasons for FOBT: anemia (n = 74); GI bleeding (n = 55); GI bleed + anemia (8); unknown reason (70)	FOBT (Hemoccult) 23,162 patients admitted in the 'FOBT period'	FOBT no longer offered 24,061 patients admitted after FOBT discontinued	number of endoscopic examinations Clinically significant endoscopic examinations (signaled by a change in clinical management)
Ip, 2014,[10] Canada April 1, 2011 to May 30, 2012	Retrospective cohort to examine the use of FOBT in an urban regional health authority. (4 academic, 2 community hospitals)	650 admissions with a positive FOBT – 230 of which were randomly selected for examination in the study. 1,254 admissions with negative FOBT – 97 randomly selected for comparison. Female sex: FOBT+: 52% FOBT-: 51%	Hemoccult II Sensa positive result	Hemoccult II Sensa negative result	Endoscopic findings, rectal examination findings, Significant endoscopic findings

Table A1: Characteristics of Included Clinical Studies

First Author, Publication Year, Country, Study Period	Study Design	Patient Characteristics	Intervention(s)	Comparator(s)	Clinical Outcomes
		Age: FOBT+: 76 (67 to 85) FOBT-: 75 (65 to 86) Academic hospital admission: FOBT+: 46% FOBT-: 28% Indication for FOBT: Anemia FOBT+: 87% FOBT-: 85% Black Stools: FOBT+: 28% FOBT-: 6% (*P* < 0.01) Overt GI bleeding: FOBT+: 13% FOBT-: 4% (*P* = 0.01) GI symptoms: FOBT+: 17% FOBT-: 14%			
Narula 2014,[11] Canada 3 months in 2011 (months not specified)	Retrospective cohort to examine the impact of hospital use of FOBT.	229 patients who underwent FOBT (351 test performed) Mean age: 49 years (1 to 104; 18 patients were pediatric) Female sex: 52.4% Indication for FOBT: Anemia: 117 (51%) Overt GI	FOBT (type not specified)	No active comparator	Further testing (e.g. endoscopic examination) Endoscopy findings Impact on patient care

Table A1: Characteristics of Included Clinical Studies

First Author, Publication Year, Country, Study Period	Study Design	Patient Characteristics	Intervention(s)	Comparator(s)	Clinical Outcomes
		bleeding: 44 (18%) Suspected GI bleeding: 63 (28%) Asymptomatic (cancer screening): 1 (0.4%) Unknown reason: 7 (3%) 53% of patients were taking ASA, and 54% of patients heparin. No patients were emergency department patients (the ED used POCT and this analysis was done on central laboratory tests)			
Van Rijn,[4] 2012, Netherlands January 2004 to April 2006	Retrospective cohort to investigate FOBT results in 1 hospital (part of a larger study investigating the use of FOBT in hospitals in the Netherlands).	216 patients (297 tests); 201 with complete data. Female sex: 48% (n = 97) Mean age: 47 years (0 to 90 years) Younger than 18 years: 23% (n = 46) Indication for FOBT: suspicion of melaena or	Hematest	No active comparator	Further testing (e.g. endoscopy)

Table A1: Characteristics of Included Clinical Studies					
First Author, Publication Year, Country, Study Period	**Study Design**	**Patient Characteristics**	**Intervention(s)**	**Comparator(s)**	**Clinical Outcomes**
		rectal blood loss: 33 (17%) Anemia: 79 (41%) Changed bowel habits: 20 (10%) Abdominal pain: 28 (14%) Other: 39 (14%)			

ASA = acetylsalicylic acid; ED = emergency department; FOBT = fecal occult blood test; GI = gastrointestinal; NA = Native American; POCT = point of care test

APPENDIX 3: Critical Appraisal of Included Publications

Table A2: Strengths and Limitations of Randomized Controlled Trials using the SIGN 50 checklist[8]

Strengths	Limitations
Mosadeghi[9]	
• Clearly focused question • Researcher who evaluated whether there was a change in clinical management was blinded to the results of FOBT. • Outcomes are clearly defined and reliable. • Confidence intervals presented when appropriate. • Population of the hospital was ethnically diverse.	• Patients before and after the discontinuation of FOBT were not completely similar (post-discontinuation group was younger and there were fewer admissions). • Data limited by that which was contained in patient charts and electronic health records, which often lacked in detail. • Indication was not given for approximately 1/3 of patients who underwent FOBT. • Longitudinal outcomes could not be assessed. • Unclear whether the study was prospective or retrospective.
Ip[10]	
• Clearly focused question • Diverse population in the hospital • Likely generalizable to other urban settings	• Unclear if outcome assessors were blinded to the FOBT result • Retrospective collection of data – some data was incomplete. • Point of care testing results were not part of the database entries • Confidence intervals not reported • Patients did not receive dietary advice or restrictions prior to FOBT test so the results could be unreliable
Narula[11]	
• Clearly focused question • Outcomes clearly defined • Exposure was mostly reliable however it did rely on retrospective records and there were some difficulties in deciphering hand written orders.	• Unclear if outcomes were assessed by a researcher blind to exposure status – a separate researcher analyzed data, but blinding was not mentioned. • Confounders not taken into account in the analysis but are mentioned as limitations. • Some non-compliance with the food and medication restrictions – this could have resulted in false positives. • Reasons for FOBT and gastroenterology referral were often poorly documented.
Van Rijn[4]	
• Clearly focused question • Intervention well described • Exposure status mostly reliable, however relied on retrospective records	• No discussion of the limitations of the study • Although the outcome assessor was an experienced gastroenterologist, no mention of blinding to results of FOBT or final diagnosis. • Potential confounders not taken into account or considered • Confidence intervals not provided

APPENDIX 4: Main Study Findings and Author's Conclusions

Table A3: Summary of Findings of Included Studies

Main Study Findings	Author's Conclusions
Mosadeghi, 2016[9]	

FOBT results (n = 207):
• positive: 70 (30%)
• negative: 131 (63%)
• indeterminate: 6 (0.03%)
 	
Procedures following FOBT:
• endoscopic examination: 39 (19%)
  ○ EGD: 17
  ○ EGD + colonoscopy: 18
  ○ flexible sigmoidoscopy: 3
  ○ EGD + flexible sigmoidoscopy: 1
 	
• Patients with a positive FOBT were more likely to undergo endoscopic examination than those with negative FOBT (34% vs. 11%; *P* = 0.0001)
• For patients with a positive FOBT:
  ○ malignancy identified: 2.9%
  ○ adenomas identified: 2.9%
• For patients with negative FOBT:
  ○ malignancy identified: 0.8%
  ○ adenomas identified: 0.2%
• More clinically significant endoscopic findings were found in those who had a positive FOBT than negative FOBT, but the results were not statistically significant (85% vs. 57%; *P* = 0.77)
• LOS in hospital did not significantly change between when FOBT was present and discontinued.
• After adjusting for baseline anemia, age and sex, the number of inpatient procedures significantly decreased after the removal of FOBT (*P* = 0.0001)
• After the discontinuation of FOBT: odds of undergoing endoscopic procedure decreased (OR 0.80, 95% CI 0.75 to 0.85)
	• The inappropriate use of FOBT (considered FOBT for non-screening reasons) is not uncommon in an urban hospital.

Ip, 2014[10]	

Consults ordered:
• Any:
  ○ FOBT+: 165 (72%)
  ○ FOBT-: 28 (29%)
  ○ *P* < 0.01
• Gastroenterology
	• Investigation often performed before FOBT result was known
	• 2/3 of positive FOBT results did not lead to further GI investigation
	• FOBT in hospitalized patients may not

Table A3: Summary of Findings of Included Studies	
Main Study Findings	**Author's Conclusions**
○ FOBT+: 108 (47%) ○ FOBT-: 18 (19%) ○ *P* < 0.01 • General Surgery ○ FOBT+: 37 (16%) ○ FOBT-: 5 (5%) ○ *P* = 0.01 • Hematology ○ FOBT+: 20 (4%) ○ FOBT-: 5 (5%) ○ *P* = 0.36 • None ○ FOBT+: 65 (28%) ○ FOBT-: 71 (71%) ○ *P* < 0.01 Consult Completed Before FOBT Reporting: • Gastroenterology ○ FOBT+: 34/108 ○ FOBT-: 5/18 ○ *P* = 1.00 • General Surgery ○ FOBT+: 14/37 ○ FOBT-: 2/5 ○ *P* = 1.00 • Hematology ○ FOBT+: 11/20 ○ FOBT-: 3/5 ○ *P* = 1.00 GI Endoscopies Performed: ○ FOBT+: 77 (33%) ○ FOBT-: 9 (9%) ○ *P* < 0.01 • Gastroscopy ○ FOBT+: 68 (30%) ○ FOBT-: 6 (6%) ○ *P* < 0.01 • Colonoscopy ○ FOBT+: 35 (15%) ○ FOBT-: 4 (4%) ○ *P* < 0.01 • Other ○ FOBT+: 1 (1%) ○ FOBT-: 1 (1%) ○ *P* = 0.51 • No endoscopy ○ FOBT+: 153 (67%) ○ FOBT-: 88 (91%)	have a positive impact on clinical management; other laboratory tests may be a better use of resources.

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○ $P < 0.01$ Common Gastroscopy findings: • Ulcer: 38% in each group • Normal finding: 18% in FOBT+; 38% in FOBT- • Esophagitis: 15% in FOBT+; 38% in FOBT- Common colonoscopy findings: • Diverticular disease: 32% in FOBT+; 25% in FOBT- • Polyps: 29% in FOBT+; 25% in FOBT- • Normal findings: 13% in FOBT+; 0% in FOBT-	
Narula, 2014[11]	
• 195 (85%) of patients were taking at least one medication that could have interfered with FOBT results; evidence of medication restriction prior to FOBT in 9% • 44/229 (19%) received gastroenterology referrals (this included 4 patients who had a negative FOBT test) Upper GI endoscopy findings: (n = 28 patients) • Ulcer: 12 (all FOBT+) • Normal findings: 9 (8 FOBT+) • Gastritis: 3 (2 FOBT+) • Esophagitis: 3 (all FOBT+) • Polyps: 1 (all FOBT-) Colonoscopy findings: (n = 17 patients) • Normal findings: 5 (3 FOBT+) • Colitis: 3 (all FOBT+) • Diverticular bleeding: 2 (all FOBT+) • Hemorrhoids: 2 (all FOBT+) • Polyps: 2 (all FOBT+) • Ulcer: 1 (all FOBT+) • Crohn's disease: 1 (all FOBT+) • Cancer: 1 (FOBT-) Of those who had overt bleeding (n = 44) 12 patients (27%) had a referral to gastroenterology delayed due to waiting for FOBT findings. 13 patients (30%) had hospital stay prolonged based on FOBT findings (mean 26 days extended); due to preparation for endoscopy,	• FOBT often misused in hospital inpatients • FOBT results do not frequently have an impact on clinical decision making • Diet and medication use modifications are often not followed in the inpatient setting and can lead to a high rate of false positives.

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endoscopy complications such as sedation complications. 4 patients referred to gastroenterology despite FOBT- (1 had overt bleeding, 3 anemia and suspected bleeding).	
Van Rijn, 2012[4]	
Total FOBT+: 66 Total FOBT-: 133 Total inconclusive: 2 Gastrointestinal follow-up investigation ordered: • 25/66 FOBT+ (38%) • 55/133 FOBT- (41%) • *P* = 0.86 For 25 patients (FOBT+: 13; FOBT-: 12) the possible reason for occult blood loss was identified (angiodysplasias in the colon, large polyp, active Crohn's disease, proctitis, duodenal ulcer, cancer)	• Result of the FOBT did not seem to have influence on further diagnosis. • A high percentage of patients with FOBT+ result were not referred to endoscopy; authors hypothesized that some patients may have been too sick to undergo further testing, may have died, or were undergoing other testing (such as CT) that may have revealed the cause of bleeding.

CI = confidence interval; CT = computed tomography; EGD = esophagogastroduodenoscopy; FOBT = fecal occult blood test; FOBT + = positive fecal occult blood test result; FOBT- = negative fecal occult blood test result; GI = gastrointestinal; LOS = length of stay; OR = odds ratio