Fecal Occult Blood Testing: Laboratory Aspects of FIT

Pesquisa de sangue oculto nas fezes: aspectos laboratoriais do FIT

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Abstract

Fecal occult blood testing is an important tool for detecting gastrointestinal bleeding that is not visible to the naked eye and may be associated with a wide range of conditions, from benign lesions such as hemorrhoids, erosive gastritis, esophagitis, peptic ulcers, and angiodysplasias to inflammatory and infectious intestinal diseases, polyps, and colorectal neoplasms. Although the presence of occult blood is not specific for cancer, its detection plays an important role in the early identification of individuals who require further investigation. Among the available methods, the fecal immunochemical test (FIT) uses antibodies specific to human hemoglobin and has analytical and preanalytical characteristics that differ from those of the traditional guaiac-based fecal occult blood test (gFOBT). With the recent incorporation of FIT into the Brazilian Unified Health System (SUS) as the reference method for colorectal cancer screening, clinical laboratories should ensure the use of the recommended method, and gFOBT should not be substituted for FIT. This study aims to present the main laboratory aspects related to fecal occult blood testing, with emphasis on methodological principles, test characteristics, preanalytical aspects, interfering factors, specimen stability, quality control, and FIT interpretation. The lack of harmonization among different methods represents an important laboratory challenge. Standardization of specimen collection, control of transport and storage conditions, verification of analytical performance, quality control, and context-based interpretation of results are essential for the appropriate use of FIT in routine laboratory practice.

Keywords: Occult Blood; Feces; Colorectal Neoplasms; Immunoassay; Immunologic Tests.

Resumo

A pesquisa de sangue oculto nas fezes constitui uma importante ferramenta para a detecção de sangramento gastrointestinal não visível, cuja origem pode estar relacionada a diferentes condições, desde lesões benignas, como hemorroidas, gastrite erosiva, esofagite, úlceras pépticas e angiodisplasias, até doenças intestinais inflamatórias e infecciosas, pólipos e neoplasias colorretais. Embora a presença de sangue oculto não seja específica para o câncer, sua detecção desempenha papel relevante na identificação precoce de indivíduos que necessitam de investigação complementar. Entre os métodos disponíveis, o teste imunoquímico fecal (FIT, do inglês *fecal immunochemical test*) utiliza anticorpos específicos para a hemoglobina humana e apresenta características analíticas e pré-analíticas distintas das do método tradicional baseado em guaiaco (gFOBT, do inglês *guaiac-based fecal occult blood test*). Com a recente incorporação do FIT ao Sistema Único de Saúde como método de referência para o rastreamento do câncer colorretal, os laboratórios devem assegurar a realização do método preconizado, não sendo apropriada a substituição do FIT pelo gFOBT. Este trabalho tem como objetivo apresentar os principais aspectos laboratoriais relacionados à pesquisa de sangue oculto nas fezes, com ênfase nos princípios metodológicos, características dos testes, aspectos pré-analíticos, fatores interferentes, estabilidade da amostra, controle da qualidade e interpretação do FIT. A ausência de harmonização entre os diferentes métodos constitui um importante desafio laboratorial. A padronização da coleta, o controle das condições de transporte e armazenamento, a verificação do desempenho analítico, o controle da qualidade e a interpretação contextualizada dos resultados são fundamentais para a utilização adequada do FIT na rotina laboratorial.

Palavras-chave: Sangue Oculto; Fezes; Neoplasias Colorretais; Imunoensaio; Testes Imunológicos.

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INTRODUCTION

Fecal occult blood testing aims to detect low-volume gastrointestinal bleeding that is not apparent on visual inspection and may be associated with a broad spectrum of clinical conditions, including hemorrhoids, erosive gastritis, esophagitis, peptic ulcers, angiodysplasias, and parasitic infections, as well as potentially more serious conditions such as inflammatory bowel diseases, adenomatous polyps, and colorectal neoplasms.[1-3]

In the context of colorectal cancer screening, fecal occult blood testing is recognized as a population-based screening tool rather than a definitive diagnostic test. A positive result indicates the presence of blood in the gastrointestinal tract but, by itself, is not pathognomonic for colorectal cancer because of its lack of specificity.[4] Following a positive result, colonoscopy is recommended as a confirmatory examination to determine the etiology of the bleeding, as recommended by current guidelines.[5,6]

Stool-based colorectal cancer screening tests include the guaiac-based fecal occult blood test (gFOBT), the fecal immunochemical test (FIT), and the multitarget stool DNA test (mt-sDNA). Direct visualization screening tests include computed tomography colonography, flexible sigmoidoscopy, and conventional colonoscopy. Another strategy combines flexible sigmoidoscopy with FIT, integrating a stool-based test with direct visualization. Emerging screening tests include colon capsule endoscopy (also referred to as capsule colonoscopy), blood-based screening tests (such as microRNAs and protein biomarkers), fecal microbiome studies, and urinary metabolomics.[6]

The traditional gFOBT is based on the chemical activity of the heme group and may react with hemoglobin from different sources. FIT, in turn, uses antibodies specific to the globin portion of human hemoglobin. This difference results in distinct characteristics regarding analytical specificity, interferences, and the number of specimens required. Compared with gFOBT, FIT has greater sensitivity for colorectal cancer and advanced neoplasia, with similar or slightly lower specificity, depending on the study. In addition, FIT is associated with higher screening adherence because it generally requires collection of a single specimen and does not impose dietary restrictions. Studies have demonstrated greater adherence and higher detection rates of advanced neoplasia in population-based programs using FIT.[7–9]

Consistent with organized colorectal cancer screening programs implemented in countries across Europe, the Western Pacific, East Asia, and the Americas, CONITEC (National Committee for Health Technology Incorporation into the Brazilian Unified Health System) recommends FIT as the preferred option for detecting occult blood in stool for colorectal cancer screening.[10] Accordingly, the Brazilian Ministry of Health included FIT for colorectal cancer screening in the SUS procedure table. This measure was published in the Brazilian Federal Official Gazette (*Diário Oficial da União*, in Portuguese) on August 10, 2026, and the new procedure will be registered in SUS information systems starting in September 2026.[11]

The present study is a narrative literature review aimed at synthesizing the main laboratory aspects related to fecal occult blood testing, with emphasis on FIT. The literature search was conducted in the PubMed/MEDLINE, SciELO, LILACS, and ScienceDirect databases. Controlled vocabulary terms (Occult Blood; Colorectal Neoplasms; Mass Screening; Immunologic Tests), selected from the Health Sciences Descriptors (DeCS) and Medical Subject Headings (MeSH), as well as free-text terms (Fecal Immunochemical Test [FIT]; Fecal Occult Blood Testing), were used in Portuguese and English. The inclusion criteria comprised original articles, literature reviews, clinical guidelines, and technical documents published between 1996 and 2026, available in full text, and addressing diagnostic, laboratory, and clinical aspects related to the topic. Conference abstracts and publications that did not present clinical or laboratory data relevant to the topic were excluded.

PRINCIPLES AND CHARACTERISTICS OF THE METHODS

Guaiac-Based Method (gFOBT)

The gFOBT is based on the pseudoperoxidase activity of the heme group in hemoglobin. In the presence of hydrogen peroxide, heme catalyzes the oxidation of guaiac, producing a blue color. Thus, the test indirectly detects the presence of blood in stool through a chemical reaction and is not specific to human hemoglobin. However, the disadvantages of gFOBT include the need to collect specimens on three consecutive days, the inability to distinguish the source of bleeding (upper or lower gastrointestinal tract), and the need for dietary restrictions before testing. The diagnostic performance of

gFOBT is inferior to that of the fecal immunochemical test (FIT), and many experts recommend replacing gFOBT with FIT. However, gFOBT has been shown to reduce colorectal cancer mortality and therefore represents a reasonable alternative when immunochemical tests are unavailable.[7,8,12]

Fecal Immunochemical Test (FIT)

FIT uses antibodies specific to the globin portion of human hemoglobin to detect and, in quantitative methods, measure the concentration of hemoglobin in stool. Hemoglobin originating from the upper gastrointestinal tract undergoes degradation during gastrointestinal transit, particularly in its globin portion, which is recognized by the antibodies, thereby reducing its detection by FIT. In contrast, hemoglobin originating from the colon and rectum tends to remain sufficiently intact to be recognized by the test, thereby increasing the specificity of FIT for colorectal bleeding. Unlike gFOBT, FIT does not depend on the pseudoperoxidase activity of heme and is not subject to the same interferences related to the consumption of meat or foods containing peroxidases. Specimen collection is performed using a dedicated collection device, generally with a single stool specimen per screening round.[7,8,13-15]

Colonoscopy has greater sensitivity than FIT and gFOBT; however, it is an invasive procedure and is associated with a risk of complications.[16]

Table 1 presents a comparison between the gFOBT (guaiac-based) and FIT (immunochemical) methods.

COMPARISON OF FIT WITH STOOL DNA TESTING

The next-generation multitarget stool DNA test showed greater sensitivity than FIT for colorectal cancer and advanced precancerous lesions in the BLUE-C study, but lower specificity[17] A subsequently published meta-analysis showed a similar trend, with greater sensitivity for the multitarget stool DNA test and greater specificity for FIT.[18]

However, a Chinese multicenter study comparing two stool DNA tests with FIT found no significant advantage of the DNA tests over FIT when the tests were adjusted to equivalent specificity.[19]

QUALITATIVE AND QUANTITATIVE FIT

FIT can be performed using qualitative or quantitative methods. Qualitative FIT generally uses lateral flow immunochromatography, in which the presence of human hemoglobin above the device's limit of detection produces a test line, allowing the specimen to be classified as reactive (positive) or nonreactive (negative). Visual reading, particularly when the intensity of the test line is close to the decision threshold, may be subject to variability in interpretation.[4,7]

Quantitative FIT uses automated analyzers, frequently employing immunoturbidimetric methods, to quantify the concentration of hemoglobin in stool, generally expressed as µg Hb/g of feces. By providing a quantitative measurement of fecal hemoglobin, FIT allows different cutoffs to be established

Table 1

Comparison between gFOBT and FIT.

Characteristic	gFOBT	FIT
Analytical target	Chemical activity of heme	Human hemoglobin
Origin of detected blood	Human and animal	Human
Dietary restriction	Required	Not required
Medication-related interference	More frequent	Less frequent
Predominant source of bleeding	Gastrointestinal tract	Colon and rectum
Number of specimens	Usually three	One
Sensitivity for colorectal cancer	Lower	Higher

Source: Adapted from [7,8,15].

for defining positivity. The cutoff may be adjusted according to test performance and the capacity of the screening program to perform colonoscopies. Automation also provides greater standardization of result interpretation, quality control, and high-throughput processing.[4,7]

Differences in performance exist between qualitative and quantitative FITs and should not be attributed exclusively to the test format. In a population-based study conducted in South Korea involving 1,181,904 participants, quantitative FIT had a lower positivity rate than qualitative FIT (2.5% vs. 8.1%) but was associated with a higher colorectal cancer detection rate among individuals who underwent colonoscopy, demonstrating that differences in positivity rates do not necessarily correspond to equivalent differences in the ability to detect neoplasia.[4,20,21] However, comparative studies have shown that diagnostic performance is also strongly influenced by the cutoff used. In a study comparing qualitative and quantitative FIT, when the cutoffs were adjusted to produce similar positivity rates, differences in performance between the methods were reduced, indicating that some of the observed differences may be related to the decision threshold rather than solely to the qualitative or quantitative test format.[22]

Thus, the choice between qualitative and quantitative FIT should consider not only the analytical performance of the device but also the cutoff used, the screening strategy, available resources, processing capacity, and, most importantly, the availability of colonoscopy for the investigation of positive results.[4,7,21]

CUTOFF AND LABORATORY IMPLICATIONS

The cutoff is a key variable affecting FIT performance and the planning of screening programs. In quantitative tests, the positivity threshold may be adjusted according to program objectives and the available capacity for colonoscopic investigation. In general, increasing the cutoff reduces the proportion of positive results and, consequently, the demand for colonoscopies, but is associated with reduced sensitivity for detecting colorectal cancer and precursor lesions.[23,24] A systematic review and meta-analysis involving 46 studies and approximately 2.4 million participants demonstrated that increasing the FIT cutoff is associated with reduced sensitivity for colorectal cancer and advanced adenomas, accompanied by increased specificity.[23,24]

FIT cutoffs used internationally vary widely. In a survey of 38 population-based screening programs using quantitative FIT, thresholds ranged from 8.5 to 120 µg Hb/g of feces, with 20 µg Hb/g being the most frequently used value. Threshold selection was primarily related to the need to maximize sensitivity for colorectal cancer and precursor lesions or, alternatively, to align demand with the available capacity to perform colonoscopies.[24] A subsequent international study demonstrated that this wide variation in cutoffs is associated with important differences in positivity rates and the diagnostic performance of screening programs: at the extremes evaluated, sensitivity for colorectal cancer ranged from 98.1% to 55.6%, whereas specificity ranged from 86.3% to 98.9%.[23,24]

In Brazil, the Preliminary Report on the Brazilian Guidelines for Colorectal Cancer Screening issued by CONITEC recommends the use of qualitative or quantitative FIT for asymptomatic, average-risk individuals aged 50 to 75 years, with a cutoff of 50 ng/mL. The document states that this value corresponds to approximately 10 µg Hb/g of feces. This standardization allows comparison with values used in international programs, provided that the specific characteristics of the collection device and analytical system are taken into account.[10]

The unit used to express the FIT cutoff depends on the collection system and analytical method. A concentration expressed in ng/mL represents the amount of hemoglobin in the extraction buffer, whereas µg Hb/g of feces estimates the concentration of hemoglobin in fecal material, taking into account the amount of stool transferred and the volume of buffer used. Therefore, conversion between these units should not be performed by simple dimensional equivalence; the relationship established for the collection device and analytical system used should be applied.[10]

The US Multi-Society Task Force on Colorectal Cancer, comprising experts from three US gastroenterology organizations, namely, the American Gastroenterological Association, the American College of Gastroenterology, and the American Society for Gastrointestinal Endoscopy, recommends that the cutoff be defined according to the performance characteristics of the test, the device used, cost-effectiveness, and the available capacity to perform colonoscopies. The Task Force suggests a threshold of ≤20 µg Hb/g of feces, although this is a weak recommendation based on low-quality evidence.[15]

Regarding screening intervals, CONITEC recommends FIT every two years for asymptomatic, average-risk individuals aged 50 to 75 years. This is a conditional recommendation based on low-certainty evidence and on acceptability and

feasibility criteria. The report emphasizes that no randomized clinical trials or systematic reviews directly comparing annual and biennial FIT were identified; therefore, the biennial recommendation also takes into account indirect evidence, experience from international programs, and considerations related to the feasibility and sustainability of screening.[10]

The heterogeneity of cutoffs across screening programs underscores that FIT results should not be interpreted independently of the analytical system, collection device, reporting unit, cutoff, and screening strategy. Thus, fecal hemoglobin concentration should always be interpreted in the context of the method and cutoff used by the screening program or specified by the manufacturer.

VARIABILITY AMONG METHODS AND BRANDS

There is no harmonization among commercially available FIT assays. Performance may vary across brands, even when nominally similar cutoffs are used. Differences in antibodies, buffers, and collection devices contribute to this variability.[25,26]

A study comparing five FITs demonstrated an approximately fourfold variation in positivity rates among brands, as well as significant differences in sensitivity and specificity. The authors concluded that different FITs should not be regarded as interchangeable methods.[26]

A meta-analysis of different brands of quantitative FIT showed, however, that some of the heterogeneity observed among assays may be related to the cutoff used. The positivity rate showed a strong correlation with sensitivity and an inverse relationship with specificity.[27] Thus, both the assay-specific analytical characteristics and the definition of the cutoff should be considered when comparing methods.

PREANALYTICAL ASPECTS

Fecal Hemoglobin Stability

The stability of fecal hemoglobin represents an important preanalytical limitation of FIT. Because the method uses antibodies directed against the globin portion of hemoglobin, the integrity of this component is essential for reliable analyte detection. Globin is relatively unstable and undergoes progressive degradation after specimen collection, which may compromise hemoglobin recovery and, consequently, the test result.[28] In specimens with hemoglobin concentrations close to the cutoff, this degradation may have a greater impact on the result. A progressive decrease in positivity has been observed in specimens stored at room temperature, whereas refrigeration helped preserve hemoglobin stability, although it did not completely prevent hemoglobin loss over time.[28]

Stability may also vary among different commercial systems. A study comparing different kits showed that hemoglobin recovery was influenced by storage time and temperature. Likewise, freeze–thaw cycles produced heterogeneous effects across systems, indicating that storage conditions should not be generalized to all devices.[29]

Studies conducted in population-based screening programs have indicated that specimen storage for periods of up to 10 days did not always result in significant changes in positivity rates. These findings do not diminish the importance of controlling storage time and conditions, particularly because hemoglobin degradation may reduce the detectable hemoglobin concentration and primarily affect specimens with values close to the cutoff. Therefore, specimens should be transported and processed as promptly as possible, in accordance with the storage conditions established for the system used.[4]

Specimen Collection

The amount of stool introduced into the collection device is an important preanalytical factor in FIT because it affects the relationship between the amount of stool sampled and the volume of buffer and, consequently, the measured hemoglobin concentration. Undersampling may reduce hemoglobin recovery and increase the risk of false-negative results, whereas an excessive amount of stool may alter the measured concentration and interfere with the result. Specimen collection should therefore strictly follow the technique recommended by the manufacturer, with standardized patient instructions regarding the appropriate specimen amount and the correct use of the collection device.[30,31]

Medication-Related Interference

FIT is less affected by dietary and medication-related factors than gFOBT.[7] However, evidence regarding the use of acetylsalicylic acid (ASA), nonsteroidal anti-inflammatory drugs (NSAIDs), antiplatelet agents, and anticoagulants is heterogeneous. While one meta-analysis found no significant difference in positive predictive value between users and nonusers of these medications, other studies reported a reduced positive predictive value for advanced colorectal neoplasia, particularly among users of ASA, antiplatelet agents, and oral anticoagulants.[7,32] In a larger study, users of ASA and direct oral anticoagulants also had a lower positive predictive value.[33]

Despite these associations, routine discontinuation of antithrombotic therapy before FIT is not recommended. The use of these medications should be considered when interpreting the results but, by itself, does not constitute a reason to disregard a positive result, which should be followed by the indicated diagnostic evaluation.[24,33]

ANALYTICAL ASPECTS

In qualitative FITs based on lateral flow immunochromatography, very high hemoglobin concentrations may produce the hook effect, characterized by a paradoxical reduction in test-line intensity and the possibility of a false-negative result. This phenomenon represents a limitation of qualitative systems and reinforces the advantages of quantitative methods when available.[34]

Another limitation is related to hemoglobin variants. Different FITs may vary in their ability to recognize these variants, and some variants were detected less efficiently by all systems evaluated, potentially leading to false-negative results in certain subgroups.[14] In addition, differences in the ability of antibodies to recognize partially degraded forms of globin may contribute to differences in sensitivity among platforms, even when the same cutoff is used.[35]

These findings reinforce that quantitative results obtained using different platforms should not automatically be considered interchangeable and should be interpreted according to the analytical system and cutoff used.[35]

QUALITY CONTROL

Quality control of FIT presents challenges related to the lack of standardization among methods, the absence of an international reference material for fecal hemoglobin, and the difficulty of developing control materials that adequately reproduce the characteristics of stool.[25]

Internal Quality Control

The availability of manufacturer-independent control materials for internal quality control is limited. This limitation hampers the daily assessment of analytical performance. The Fecal Immunochemical Test Working Group of the International Federation of Clinical Chemistry and Laboratory Medicine has proposed alternatives for the development of third-party control materials, but their availability remains limited.[25,28]

Comparative studies of automated quantitative systems have demonstrated good precision, recovery, and linearity, but have also identified differences in control results among platforms.[36]

External Quality Assessment

An international survey identified 24 external quality assessment schemes for FIT, with responses obtained for 16. Differences were observed in the matrix used, the buffer employed, and the units used to report results.[37] Stool-like matrices showed greater variability, primarily because of material heterogeneity, whereas liquid matrices, although more stable, are less representative of clinical specimen conditions.[38]

As an alternative, the use of artificial stool containing stable hemoglobin and an internal standard has been proposed, allowing estimation of specimen weight and correction of the measured hemoglobin concentration.[39]

In the absence of fully standardized materials and procedures across platforms, external quality assessment should primarily be regarded as a tool for monitoring the stability and consistency of each system's performance over time, rather than as a means of directly comparing results across different methods.[25]

METHOD VERIFICATION AND VALIDATION

Verification or validation of a FIT method should follow the general principles applicable to quantitative methods in clinical chemistry, while taking into account the specific characteristics of the assay.[25,40] Relevant parameters include the limit of detection, limit of quantification, precision, reproducibility, preanalytical variables, and method comparison.[41]

The cutoff reported by the manufacturer should be evaluated within the context of the system used, taking into account the characteristics of the antibodies, buffers, and collection devices. In the absence of a primary reference material and standardization among manufacturers, equivalence among different systems should not be assumed.[25,40]

The evaluation should also include the reproducibility of sampling and measurement and, when applicable, agreement between results obtained by automated and visual reading.[25]

When replacing one kit with another, the comparability of the results with those obtained using the previously employed method should be evaluated, taking into account

the characteristics of each system and, when relevant, their relationship with colonoscopic findings.[26,42]

INTERPRETATION OF RESULTS

Hemorrhoids

The contribution of hemorrhoids to false-positive FIT results remains uncertain. Studies have reported different findings: while a Korean study identified a significant association between hemorrhoids and false-positive results,[43] a Dutch study found a much smaller contribution, with isolated hemorrhoids present in only a small proportion of these cases.[44] Another study identified several factors associated with a positive FIT in the absence of neoplasia, without demonstrating a strong association with hemorrhoids alone.[45]

Among individuals with rectal bleeding, FIT also shows a high ability to detect colorectal cancer. A Swedish study demonstrated similar test performance in individuals with and without a history of rectal bleeding.[46] In the NICE FIT study, undetectable fecal hemoglobin concentrations were associated with a low risk of colorectal cancer in patients with rectal bleeding,[47] a finding consistent with a meta-analysis demonstrating high FIT sensitivity in symptomatic patients.[48]

Therefore, neither the presence of hemorrhoids nor rectal bleeding should be used in isolation to interpret a positive or negative FIT result; the result should be considered within the clinical context and, when positive, should be followed by the indicated diagnostic evaluation.

Inflammatory Bowel Disease

FIT is associated with endoscopic disease activity in inflammatory bowel disease, particularly in ulcerative colitis, but its performance is lower in Crohn's disease with isolated ileal involvement.[41]

In a comparative study, fecal calprotectin showed greater sensitivity for endoscopic and histological activity, whereas FIT showed greater specificity. In isolated ileal Crohn's disease, FIT sensitivity was particularly low compared with that of fecal calprotectin, whereas its performance was better in cases with colonic involvement.[41]

In ulcerative colitis, studies have demonstrated a correlation between fecal hemoglobin concentration and endoscopic activity, including an association with mucosal healing in certain settings.[49,50]

Colorectal Cancer

A Cochrane systematic review demonstrated superior performance of FIT compared with gFOBT in discriminating advanced colorectal neoplasia and colorectal cancer. At prespecified specificities of 90% and 95%, FIT sensitivities were 0.97 and 0.89, respectively, compared with 0.80 and 0.73 for gFOBT.[7] Randomized clinical trials of gFOBT have also demonstrated reductions in colorectal cancer mortality and incidence, although equivalent randomized head-to-head trials evaluating FIT are not available.[8]

Interpretation of FIT should take into account the characteristics of the method, the cutoff used, and preanalytical conditions. A positive result indicates the presence of fecal hemoglobin but does not confirm colorectal cancer; hemorrhoids, inflammation, and other conditions may also be associated with FIT positivity.[43-48]

In patients taking anticoagulants or antiplatelet agents, these medications should not constitute a reason to disregard a positive FIT result because, although they may reduce the positive predictive value in some populations, the association between FIT positivity and colorectal neoplasia remains relevant.[33,51]

Fecal hemoglobin concentration may also vary according to population characteristics, such as sex and age, as well as geographic region and the FIT system used.[52] Elevated values may occur in the absence of an identifiable colorectal lesion and in different conditions associated with inflammation.[52]

Therefore, laboratory results should be interpreted within the clinical context and in conjunction with the specific characteristics of the method and analytical system used.

FINAL CONSIDERATIONS

FIT is a sensitive and specific immunochemical method for detecting human hemoglobin in stool and offers advantages over gFOBT, including the absence of dietary restrictions and the possibility of collecting a single specimen.[7,8,15]

The lack of harmonization among commercial systems represents an important limitation. Different antibodies, devices, and cutoffs may produce different results; therefore, different FITs should not automatically be considered interchangeable. In addition, clinical and biological factors may also influence result interpretation.[14,25-27,32,33,41,43,44,46-48,51,52]

Thus, the quality of fecal occult blood testing depends not only on hemoglobin detection but also on the integration

of a controlled preanalytical phase, analytical performance, quality control, an appropriate cutoff, and context-based interpretation of results.

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