

Levels and Variation in Overuse of Fecal Occult Blood Testing in the Veterans Health Administration

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BACKGROUND: Policy-makers have called for efforts to reduce overuse of cancer screening tests, including colorectal cancer screening (CRCS). Overuse of CRCS tests other than colonoscopy has not been well documented.

OBJECTIVE: To estimate levels and correlates of fecal occult blood test (FOBT) overuse in a national Veterans Health Administration (VHA) sample.

DESIGN: Observational

PARTICIPANTS: Participants included 1,844 CRCS-eligible patients who responded to a 2007 CRCS survey conducted in 24 VHA facilities and had one or more FOBTs between 2003 and 2009.

MAIN MEASURES: We combined survey data on race, education, and income with administrative data on region, age, gender, CRCS procedures, and outpatient visits to estimate overuse levels and variation. We coded FOBTs as overused if they were conducted <10 months after prior FOBT, <9.5 years after prior colonoscopy, or <4.5 years after prior barium enema. We used multinomial logistic regression models to examine variation in overuse by reason (sooner than recommended after prior FOBT; sooner than recommended after colonoscopy, barium enema, or a combination of procedures), adjusting for clustering of procedures within patients, and patients within facilities.

KEY RESULTS: Of 4,236 FOBTs received by participants, 885 (21 %) met overuse criteria, with 323 (8 %) sooner than recommended after FOBT, and 562 (13 %) sooner than recommended after other procedures. FOBT overuse varied across facilities (9–32 %, $p < 0.0001$) and region (12–23 %, $p < .0012$). FOBT overuse after prior FOBT declined between 2003 and 2009 (8%–5 %, $p = .0492$), but overuse after other procedures increased (11–19 %, $p = .0002$). FOBT overuse of both types increased with number of outpatient visits (OR 1.15, $p < 0.001$), but did not vary by patient demographics. More than 11 % of overused FOBTs were followed by colonoscopy within 12 months.

CONCLUSIONS: Many FOBTs are performed sooner than recommended in the VHA. Variation in overuse

by facility, region, and outpatient visits suggests addressing FOBT overuse will require system-level solutions.

KEY WORDS: colorectal neoplasms; mass screening; utilization; clinical practice variation; veterans.

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INTRODUCTION

As pressure to reduce health care expenditures mounts in this country, the value of preventive health care services such as cancer screening is being increasingly scrutinized. Some have claimed that the benefits of mammography have been overstated,¹ others have documented excessive levels of cancer screening in populations unlikely to benefit from these services,^{2–8} and concern about overuse is beginning to receive attention in health policy circles. Indeed, in its initiative to transform health care delivery, the Veterans Health Administration (the nation's largest integrated health care system) has called for a number of specific efforts to reduce inappropriate utilization of cancer screening, including reducing the number of fecal occult blood tests (FOBT) ordered for patients with evidence of a colonoscopy in the past 10 years.

The U.S. Preventive Services Task Force (USPSTF) currently recommends colorectal cancer screening (CRCS) for men and women age 50–75 using either FOBT annually, sigmoidoscopy every 5 years coupled with FOBT every 3 years, or colonoscopy every 10 years.⁹ Although recently removed from the list of CRCS modalities recommended by the USPSTF,⁹ double contrast barium enema every 5 years is still endorsed by some guideline-issuing bodies.¹⁰ Rates of adherence to CRCS guidelines have increased substantially in this country over the past decade,¹¹ and in some settings¹² have surpassed the Healthy People 2020 target of 70.5 %.¹³ In settings, such as the Veterans Health Administration (VHA), where CRCS rates exceed 80 %,

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attention is increasingly shifting away from addressing underutilization, toward documenting and ameliorating potential overuse of CRCS (e.g., screening individuals unlikely to benefit or screening more frequently than recommended by guidelines).¹⁴ Overuse of CRCS is important to address, because it can unnecessarily increase: (1) patient harm from overdiagnosis,¹⁵ including colonoscopy complications such as bowel perforation, gastrointestinal bleeding, serious cardiovascular events, and death;^{16,17} (2) demand for diagnostic colonoscopy (which remains in limited supply in many settings); and (3) health care costs.

Several studies have documented levels and variation in CRCS overuse attributable to screening individuals unlikely to benefit (such as those with limited life expectancy),^{2,7,18} and two studies have documented overuse of colonoscopy associated with shorter than recommended repeat screening^{19,20} and surveillance²⁰ intervals (i.e., the timing of repeat colonoscopy following the removal of adenomatous or hyperplastic polyps.) To our knowledge, however, only two studies have examined CRCS overuse stemming from too frequent utilization of screening modalities other than colonoscopy.^{2,21} One of these studies was limited by the fact that it relied on physician self-reported rather than medical records-documented patterns of screening behavior,²¹ and the other was conducted in a single medical facility that may not generalize to other settings.² Therefore, additional research is needed to describe the prevalence and determinants of overuse of CRCS for modes other than colonoscopy.

While colonoscopy has become the dominant screening modality in many U.S. health care settings, at least two integrated health care systems in the U.S. have achieved high CRCS rates based on programs emphasizing FOBT,^{12,14} and many countries outside of the U.S. still rely primarily on FOBT for CRCS.^{22–25} Furthermore, while admittedly of less concern from a patient safety or cost perspective than colonoscopy overuse, FOBT overuse is nevertheless important to document in settings that offer more than one CRCS modality, because it may affect demand for diagnostic colonoscopy, and reveal inefficiencies in the screening system that stem from lack of coordination across services that share responsibility for delivering and monitoring CRCS procedures.

The current study adds to the nascent literature on CRCS overuse, by examining levels and correlates of FOBT overuse in a nationally representative sample of patients receiving care from 24 VHA medical facilities that historically have relied primarily on FOBT for CRCS, but have increased use of screening colonoscopy over the past 5 years. Specifically, we: (1) estimate the extent of FOBT overuse related to screening frequency by reason (too soon after a prior FOBT versus too soon after other CRCS procedures), (2) determine whether overuse varies across

facilities, regions, calendar year, or patient subgroups, and (3) document demand for colonoscopy associated with FOBT overuse.

METHODS

Participants

This study involved secondary analyses of data sources originally assembled for the purpose of assessing patient variation in the underuse of CRCS. Participants were CRCS-eligible patients recruited to participate in a survey of CRCS behavior.²⁶ The survey cohort was drawn from the population of male and female patients age 50 to 75 years who had one or more primary care visits between January 2005 and December 2006 at one of 124 VHA medical facilities. Employees, deceased individuals, and patients either enrolled in VHA adult day care or nursing home facilities, or with documentation of colorectal cancer (CRC), dementia, or Alzheimer's disease in VHA medical records were excluded.

Sampling

A two-staged hierarchical sampling strategy was used to select the survey sample (Fig. 1). In the first stage, the 124 eligible VHA facilities were grouped into 12 strata (based on size of the eligible patient population and proportion of African American patients), and two facilities were randomly selected from each stratum (yielding 24 facilities). In the second stage, a simple random sample of 156 eligible patients was selected from each of the 24 sampled facilities, generating a sample of 3,744 patients.

Data Collection

These 3,744 patients were recruited to a survey on CRCS behavior between February 2007 and May 2007. Administration of the survey involved an initial mailing including a cover letter, a 15-page questionnaire (available at http://www.hsrd.minneapolis.med.va.gov/PDF/SCREEN_NationalSurvey.pdf), and \$2 cash incentive. A reminder postcard was mailed 1 week after the first survey mailing. A second survey mailing (with no incentive) was mailed to those who did not return a questionnaire within 3–4 weeks of the first mailing. Phone administration was attempted for those who did not return a questionnaire within 3 weeks of the second survey mailing. A total of 3,025 (81 %) patients completed the survey.

The 1,844 survey respondents who received one or more FOBTs at a VHA facility between 2003 and 2009 were included in the analysis. The 4,236 FOBTs received by

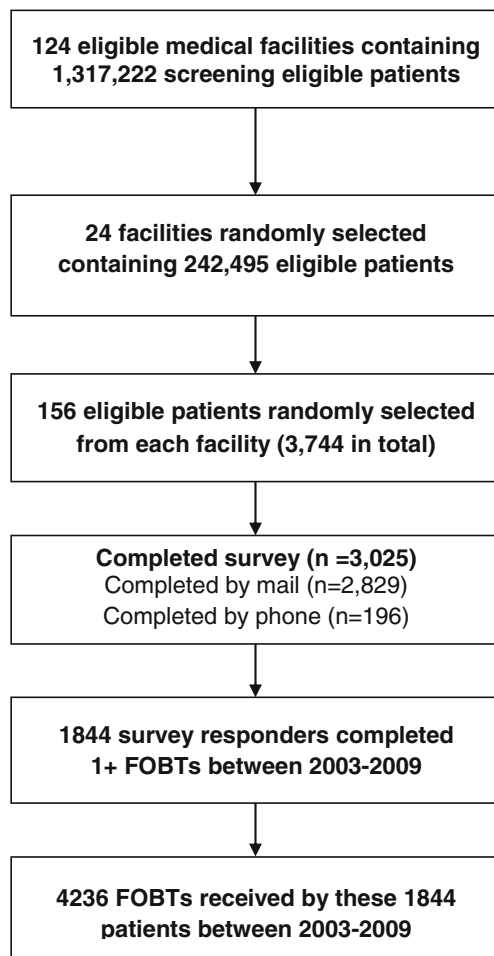


Figure 1. Subject flow diagram.

these participants were evaluated for overuse. VHA medical records information on patient demographics, diagnoses, and CRCS procedures received at the VHA were available for all participants. These data and facility-level information on region and organizational complexity were linked to patient survey data to examine variation in overuse. Physician variation was not examined because the number of screening tests per physician was too small to derive reliable estimates.

Dependent Measures

The primary dependent measure was FOBT overuse. We coded FOBTs as overused if they were conducted <10 months after a prior FOBT, <9.5 years after a prior colonoscopy, or <4.5 years after a prior barium enema. We used these intervals, rather than the screening intervals recommended by the USPSTF (12 months, 10 years, and 5 years, respectively), to account for the fact that preventing a lapse in screening adherence may require ordering a test a few months before the patient would become overdue for

screening. FOBTs conducted within 30 days of a prior FOBT were excluded. We did not consider sigmoidoscopies in our definition of overuse because until November 2008, annual FOBT coupled with sigmoidoscopy every 5 years was a USPSTF-endorsed CRCS strategy.²⁷ Therefore, between 2003 and 2008, an FOBT following a sigmoidoscopy could only be considered unnecessary if there was also an FOBT <10 months prior to the index FOBT (a criterion that is redundant with the above overuse criterion for an FOBT following a prior FOBT). Beginning in 2009, if one was following the current USPSTF guidelines⁹ and applying similar criteria as above, an FOBT following a sigmoidoscopy could be considered overused if the sigmoidoscopy was less than 4.5 years prior and there was also an FOBT less than two years and 10 months prior. However, incorporating this information into our definition of FOBT overuse would have changed the status of only three FOBTs conducted in 2009 from “not overused” to “overused”. Finally, we did not attempt to eliminate FOBTs conducted for diagnostic reasons, since prior research in the VHA suggests FOBTs are rarely used for non-screening indications,²⁸ and excluding non-screening FOBTs from overuse estimates does not alter estimates.²⁹

We used multinomial logistic regression models to examine facility and patient variation in FOBT overuse by reason (sooner than recommended after prior FOBT; sooner than recommended after colonoscopy, barium enema, or a combination of procedures). Estimates were adjusted for the clustering of procedures within patients and facilities. To document demand for colonoscopy associated with FOBT overuse, we also estimated the number and proportion of FOBTs flagged for overuse that were followed by a colonoscopy within 12 months.

Covariates

Patient characteristics obtained from VHA medical records included: age (50–64 versus 65–75 years), gender, and utilization (number of outpatient visits in the year of and year prior to the FOBT). Patient characteristics obtained from the survey included race (white versus non-white), education (\leq high school, versus $>$ high school), and income (\leq \$20,000, \$20–40,000, $>$ \$40,000). Region (southwest versus Midwest, northeast, northwest, and south) of the facility where the FOBT was conducted was included as a covariate. Whether the FOBT was completed by a patient who receives some care outside of the VHA, and facility complexity (a summary measure based on facility size, intensive care capacity, levels of patient complexity, teaching and research activity, and number of specialists)^{30,31} were included as controls in our analyses since both have been previously found to be correlated with CRCS rates^{26,32} and may vary by region.

Analysis

We calculated FOBT overuse point estimates and 95 % confidence intervals overall and by year, facility, and reason (sooner than recommended after prior FOBT, colonoscopy, barium enema, or combination of procedures). Given the stratified two-stage sampling design, we used design-weighted logistic regression models accounting for the stratification and clustering by facility to derive these overuse estimates and to examine the association of overuse with patient and facility characteristics. As described elsewhere,³³ the sample design weights were adjusted to account for survey non-response, using rereighting within propensity of response strata. Standard errors for the estimates were obtained from bootstrapping the within facility samples. Adjusted estimates of the odds of FOBT overuse by reason were derived from similar design weighted multinomial logistic regression models, controlling for facility complexity and patient use of non-VHA health care. The unit of analysis for these regressions was the FOBT test, and estimates adjusted for the clustering of procedures within patients, and patients within facilities. Among survey respondents, patient race, education, income, and receipt of non-VHA health care derived from the survey had 1 %, 4 %, 9 %, and 6 % missing responses, respectively. To avoid biases and power reductions that could result from dropping cases with missing values on any of these characteristics from the analyses, we used multiple imputation procedures^{34,35} to replace each missing value with ten plausible values (i.e., creating ten imputed data sets) and combined results from analyzing each imputed data set using standard methods for multiple imputation. The source of variation stemming from the uncertainty in imputing for missing values is reflected in our estimated standard errors and accompanying confidence intervals.

The study was approved by the Minneapolis VHA Medical Center Institutional Review Board.

RESULTS

The majority of patients in the sample were white (78 %) males (96 %) between the ages of 50–64 (61 %), with incomes ≤\$40,000 (73 %), and many (49 %) had more than a high school education (Table 1). The average number of outpatient visits in the year of and the year prior to sampled FOBTs was 3.7 per participant, and the majority of participants received their FOBTs from facilities in the northeast (34 %) and south (32 %).

Of the 4,236 FOBTs received by our cohort, 885 (21 %) met our criteria for overuse; 323 (8 %) because they were conducted sooner than recommended after FOBT, and 562 (13 %) because they were conducted sooner than recom-

Table 1. Patient Characteristics (n=1,844)

Characteristic	N	%
Age		
50–64	1,126	61.1
65 and older	718	38.9
Race		
American Indian/Alaskan Native	76	4.1
Asian	9	0.5
African American	235	12.7
Native Hawaiian/Pacific Islander	3	0.2
White	1,432	77.7
Other	67	3.6
Unknown	22	1.2
Ethnicity		
Hispanic	50	2.7
Gender		
Female	74	4.0
Male	1,770	96.0
Education		
≤High school	866	47.0
>High school	907	49.2
Unknown	71	3.9
Annual household income		
≤\$20,000	742	40.2
\$20,001–\$40,000	608	33.0
≥\$40,001	347	18.8
Unknown	147	8.0
Utilization	Mean=3.7 (range 0–38)	
Region		
Mid West	203	11.0
North East	624	33.8
North West	242	13.1
South	585	31.7
South West	190	10.3

mended after other procedures (colonoscopy, barium enema, or combination) (Table 2). Among FOBTs conducted too soon following prior FOBTs, the average time since the prior FOBT was 6.7 months (or 204 days). Among FOBTs conducted too soon following other procedures, the average interval between procedures was 36 months (or 3 years); 37 months when limited to prior colonoscopy procedures.

Total FOBT overuse varied significantly across facilities (9–32 %, $p<0.0001$), and region (12–23 %, $p=0.0012$), and increased over time (from 19 % in 2003 to 24 % in 2009), but not significantly so ($p=0.1001$). As shown in Figure 2,

Table 2. Number and Percent of FOBTs by Overuse Status and Reason

Reason	N (%)
FOBT meeting overuse criteria	885 (20.89)
Too soon after prior FOBT	323 (7.63)
Too soon after prior Barium Enema	76 (1.79)
Too soon after prior FOBT and Barium Enema	6 (0.14)
Too soon after prior Colonoscopy	394 (9.30)
Too soon after prior FOBT and Colonoscopy	45 (1.06)
Too soon after prior Colonoscopy and Barium Enema	32 (0.76)
Too soon after prior FOBT, Barium Enema, and Colonoscopy	9 (0.21)
FOBT not meeting overuse criteria	3,351 (79.11)
TOTAL FOBT	4,236 (100.00)

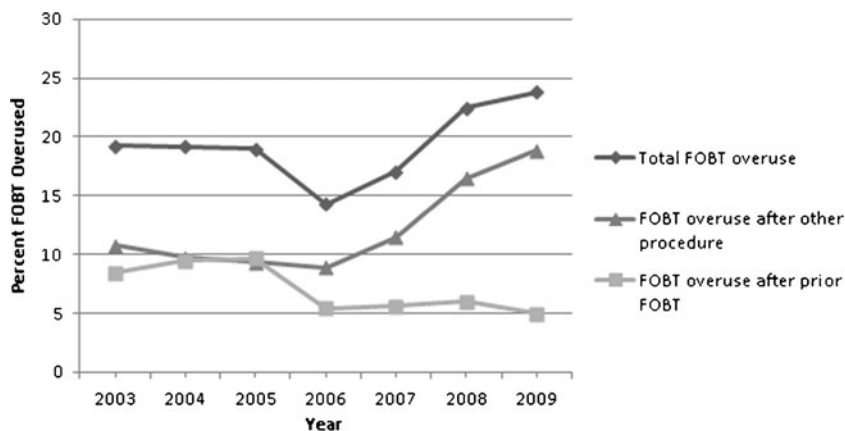


Figure 2. Percent of FOBT overused, by reason and year.

FOBT overuse after prior FOBT declined significantly between 2003 and 2009 (from 8 % to 5 %, $p=0.0492$), while FOBT overuse after other procedures increased over this same time period (from 11 to 19 %, $p=0.0002$). Therefore, the modest increase in total FOBT overuse over time is due entirely to significant increases in overuse following prior colonoscopies and other procedures. Over this same time period, the number of colonoscopies received by study participants increased dramatically, while the number of FOBTs declined (Fig. 3).

The adjusted odds of FOBT overuse did not vary significantly by patient demographic characteristics, but did vary significantly by number of outpatient visits and region (Table 3). The odds of overuse after prior FOBT increased with number of outpatient visits (OR 1.16, $p<0.0001$), and were significantly lower in the Midwest compared to the Southwest (OR 0.29, $p=0.01$). The odds of overuse after other procedures also increased with number of outpatient visits (OR 1.16, $p<0.0001$), and were significantly lower in the Midwest (OR 0.41 $p=$

0.008) and Northwest (0.42 $p=0.009$) compared to the Southwest.

The analyses to explore potential increased demand for colonoscopy associated with FOBT overuse revealed that 52 (5.58 %) of FOBTs flagged for overuse were followed by a colonoscopy within 3 months, 96 (10.85 %) within 10 months, and 102 (11.53 %) within 12 months.

DISCUSSION

We found that 21 % of FOBTs performed in the VHA are completed sooner than is considered necessary by guidelines. Although the odds of FOBT overuse did not vary by patient demographics, they did increase by 16 % with each additional outpatient visit. This pattern is consistent with prior studies documenting a positive association between health care utilization and CRCS.^{7,36-40} Given the strong association between chronic disease burden and health care utilization,⁴¹ the correlation between outpatient visits and

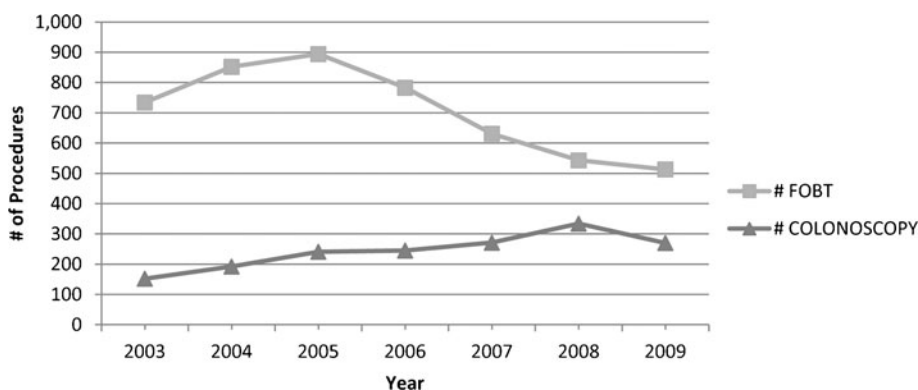


Figure 3. Number of FOBT and colonoscopy procedures by year.

Table 3. Odds of FOBT Overuse, by Reason and Characteristics of Patients and Facilities (Significant Odds Ratios in Bold)

Characteristic	Too soon after FOBT		Too soon after other procedure	
	Unadjusted odds ratio 95 % confidence interval)	Adjusted odds ratio (95 % confidence interval)*	Unadjusted odds ratio (95 % confidence interval)	Adjusted odds ratio (95 % confidence interval)*
Age 65 and older	1.06 (0.78, 1.43)	1.02 (0.75, 1.40)	1.03 (0.75, 1.41)	1.09 (0.81, 1.48)
Race White	1.06 (0.73, 1.54)	1.09 (0.72, 1.65)	1.06 (0.71, 1.57)	1.31 (0.88, 1.95)
Gender Male	1.11 (0.52, 2.40)	1.16 (0.58, 2.31)	0.55 (0.28, 1.10)	0.57 (0.26, 1.25)
Education				
≤High school	1.08 (0.78, 1.51)	0.89 (0.63, 1.26)	1.26 (0.93, 1.71)	1.24 (0.92, 1.68)
>High school	–	–	–	–
Annual household income				
\$0–\$20,000	1.15 (0.72, 1.83)	1.13 (0.71, 1.81)	1.36 (0.77, 2.39)	1.12 (0.56, 2.23)
\$20,000–\$40,000	1.27 (0.75, 2.15)	1.24 (0.78, 1.98)	1.34 (0.81, 2.23)	1.18 (0.65, 2.13)
>\$40,000	–	–	–	–
Utilization	1.14 (1.10, 1.19)	1.16 (1.11, 1.21)	1.15 (1.11, 1.19)	1.16 (1.10, 1.21)
Region				
Midwest	0.39 (0.17, 0.94)	0.29 (0.11, 0.77)	0.52 (0.31, 0.88)	0.41 (0.21, 0.77)
Northeast	1.25 (0.67, 2.33)	0.96 (0.49, 1.84)	0.77 (0.49, 1.20)	0.70 (0.42, 1.16)
Northwest	0.59 (0.28, 1.25)	0.45 (0.20, 1.02)	0.41 (0.24, 0.72)	0.42 (0.23, 0.78)
Southern States	1.06 (0.56, 2.00)	0.87 (0.45, 1.70)	0.76 (0.50, 1.14)	0.74 (0.46, 1.19)
Southwest	–	–	–	–

* Adjusting for facility complexity, whether patient receives health care outside of the VHA, and all characteristics in column 1

FOBT overuse found in the current study may explain the pattern documented by others, whereby patients with significant comorbidities who are unlikely to benefit from CRCS nevertheless receive screening procedures.^{2,7,18}

The FOBT overuse rates observed in this study are higher than those reported in the one prior published study examining FOBT overuse in the VHA.² In their study conducted in a single VHA medical facility, Fisher and colleagues² found that 5 % of patients receiving an FOBT had a colonoscopy less than 5 years prior. The differences in FOBT overuse observed in our studies may reflect differences in overuse definitions (5 year versus 9.5 year window for classifying FOBTs following a prior colonoscopy as overused), samples examined (single versus nationally representative sample of facilities), or temporal changes in CRCS patterns in the VHA (as the study by Fisher and colleagues was conducted prior to the increases in colonoscopy use within the VHA). Indeed, our findings suggest the sources and implications of FOBT overuse are closely tied to colonoscopy utilization patterns.

An important finding from this study is that the increases in FOBT overuse between 2003 and 2009 in the VHA setting were entirely attributable to increases in FOBT conducted too soon after a prior colonoscopy, as the occurrence of FOBT too soon after a prior FOBT declined over this time period. The frequency with which FOBT tests are conducted too soon following prior colonoscopies may be tied to characteristics of the computerized clinical reminders widely used within the VHA to promote adherence to CRCS guidelines.⁴² Originally developed when FOBT was the dominant screening modality in the VHA, and designed to prompt providers at each encounter until they are resolved by ordering a CRCS test, these reminders may not have been as effectively adapted in all

settings to allow modified prompting schedules for patients receiving colonoscopies. Indeed, variation in whether and how clinical reminders have been modified to adapt to the increasing use of colonoscopy may be one of the system factors that explains the significant variation across facilities and regions in FOBT overuse that we observed in this study. Another possible explanation why FOBTs are conducted sooner than recommended following prior colonoscopies is that providers disagree with the 10 year interval recommended by guidelines. However, national studies suggest high levels of primary care provider agreement with the annual FOBT screening interval,^{21,43} and a recent study found that 96 % of VHA gastroenterologists performed colonoscopy 10 years after a normal colonoscopy, suggesting high agreement with the recommended screening colonoscopy interval.⁴⁴

While FOBT (typically estimated at <\$60 per procedure)⁴⁵ is low cost and poses little risk to patients, overuse of this procedure may generate unwarranted demand for high cost, invasive follow-up colonoscopies (typically estimated at >\$1,500 per procedure),⁴⁵ which remain in limited supply nationally,⁴⁶ and can lead to serious patient harms (including bowel perforation, bleeding, and adverse cardiovascular events).^{16,17} Indeed, we found that more than 11 % of FOBTs flagged for overuse in our cohort were followed by a colonoscopy within 12 months. If appropriate screening intervals had been followed, some of these procedures would have been postponed and some would not have occurred at all.

Our findings should be qualified by the following limitations. First, because our data did not include information on colonoscopies received outside of the VHA system by patients in our cohort, and prior studies suggest that a sizable fraction of colonoscopies received by veterans are

performed outside of the VHA,⁴⁷ our results may underestimate actual levels of FOBT overuse following colonoscopy. Indeed, if the rate of outside colonoscopy usage in our national sample is similar to that reported in a prior study conducted on the Minneapolis VHA,⁴⁷ our overuse estimates would increase by approximately five percentage points. Second, because our data did not include information on colonoscopy results, we were unable to examine CRCS overuse related to repeat colonoscopy; a problem well documented by several prior studies.^{18,20,21} Third, we were not able to examine physician variation in overuse patterns. Because strategies to reduce overuse will differ depending on the extent to which variation in rates is associated with providers versus facilities, future studies should quantify the relative contribution of these two sources of variation. Finally, inappropriate use of FOBT among individuals with a family history of CRC (for whom colonoscopy is the recommended test), and overuse of CRCS due to screening individuals unlikely to benefit, such as individuals with limited life expectancy, were not examined in this study.

In conclusion, many FOBTs conducted in the VHA are performed sooner than recommended. This overuse generates unnecessary demand for colonoscopy and varies by facility, region, and outpatient utilization. This variation suggests that addressing FOBT overuse will likely require system-level solutions.

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Conflict of Interest: The authors declare that they do not have a conflict of interest.

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