A Randomized Controlled Trial of Opt-in Versus Opt-Out Colorectal Cancer Screening Outreach

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- OBJECTIVES:** Colorectal cancer (CRC) screening uptake is suboptimal, despite national efforts to increase screening rates. Behavioral economic approaches such as changing defaults may increase participation. We compare response rates to opt-in or opt-out messaging in mailed fecal immunochemical test (FIT) outreach.
- METHODS:** This is a two-arm randomized controlled trial among 314 patients aged 50–74 years who had at least two primary care visits in the 2-year pre-enrollment period and were screening-eligible but not up-to-date. Eligible patients received invitation by electronic health record (EHR) portal or mail with randomization to receive mailed FIT: (1) only if they actively opted-in to do so (opt-in) or (2) unless they opted-out of screening (opt-out). The primary outcome was FIT completion rate within 3 months of initial outreach.
- RESULTS:** Patients randomized to opt-in agreed to participate 23.1% of the time, and only 2.5% of those in opt-out chose not to participate. FIT kits were mailed to 22.4% and 93% of patients in opt-in and opt-out arms, respectively. In intention-to-screen analysis, patients in the opt-out arm had a higher FIT completion rate (29.1%) than in the opt-in arm (9.6%) (absolute difference 19.5%; 95% confidence interval, 10.9–27.9%; $P < .001$). Results were similar in subgroup analysis of those sent initial messaging through the EHR portal (9.5% opt-in versus 37.5% in opt-out).
- CONCLUSIONS:** Mailed CRC screening outreach providing an option to opt-out had significantly higher participation rates than opt-in messaging. Opt-out messaging approaches can boost participation in population health outreach efforts.

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INTRODUCTION

Colorectal cancer (CRC) remains the second leading cause of cancer death in the United States despite effective methods for prevention, early detection, and treatment [1–4]. Routine screening is available and cost-effective, but rates of patient utilization remain suboptimal at 62–65% despite public health efforts to promote uptake over the past several years [5–7]. Screening is often recommended to patients during a routine office visit, and in the U.S., the most common screening approach is a colonoscopy [8]. Some systems have boosted rates through proactive programs

that identify eligible patients and provide direct outreach outside of in-person visits [9–15]. However, these approaches are challenged by limited response rates and require repeated mailings and phone calls that are unreimbursed and costly for practices to maintain [16–19].

Nudges using behavioral economic approaches might offer solutions to mitigate biases held by people that often prevent them from engaging in behaviors that improve long-term health outcomes [20–23]. These biases are often predictable and can be harnessed to promote healthy activities [23]. For example, *present bias* causes

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individuals to place higher value on the current costs of colon cancer screening—the preparation, the perceived discomfort, the time—while discounting the important benefits of screening because they accrue in the future [24]. People also demonstrate inertia and choose the default option, a form of *status-quo bias* that often leads to no action at all [25, 26]. The behavioral economic principle of *choice architecture*, or how options are framed and offered, can be leveraged to increase response rates. For example, opt-in approaches require a person to actively agree to participate, while opt-out approaches presume participation unless the person declines. By shifting from opt-in to opt-out enrollment, studies have shown a shift in participation in health-promoting activities [27–31]. CRC screening requires more action on the part of the patient to complete the test, so it is unclear if changing the default will increase participation.

Colon cancer outreach is typically an opt-in process, where the patients agree to undergo screening with colonoscopy, stool testing, or other modalities during an office visit. Although mailed fecal immunochemical test (FIT) does not require an office visit, opportunities to screen are typically presented to patients on an “opt-in” basis. However, little data exist on the effectiveness of mailed FIT outreach that offers patients a choice between opting in (agree to receive the kit before it is sent) or opting out (a kit unless it is declined upfront). Both approaches leverage the behavioral economic principle of *precommitment*, where people are more likely to participate if they make a commitment ahead of time [32, 33], but “opt-out” may also overcome status-quo bias [23, 26]. This study compared the effect of opt-in versus opt-out messaging for mailed FIT outreach on CRC screening uptake and patients’ experience with the interventions.

METHODS

Study design

This is a two-arm pragmatic randomized controlled trial of mailed FIT comparing the following approaches: (1) the choice to receive a mailed FIT kit or to report prior CRC screening (opt-in), (2) the choice to decline a mailed FIT kit or to report prior CRC screening (opt-out). Approval was obtained from the University of Pennsylvania Institutional Review Board prior to data collection. Informed consent was waived given the research posed no more than minimal risk to participants and could not be practicably carried out without the waiver [34]. The protocol was registered at clinicaltrials.gov (NCT02929186).

Study population

The study population included primary care patients at four general internal medicine practices at the University of Pennsylvania. Patients were identified from November 2016 to December 2016 from the electronic health record (EHR). We included those between 50 and 74 years with two visits to the practice in the past 2 years who were overdue for screening and had a home zip code within the Philadelphia–Wilmington–Camden Metropolitan Statistical Area. “Overdue” was defined as not having had a colonoscopy in the past 10 years, flexible sigmoidoscopy in the last 5 years, or stool testing in the past year. We excluded patients with a history or family history of CRC, inflammatory bowel disease,

polyp syndromes, colectomy, symptoms of possible gastrointestinal bleeding, or other significant comorbidities (Supplementary Table 1). Automated EHR data extraction was performed, followed by chart review of a randomly selected sample of patients. For all patients, the primary care physicians were then contacted with the option to remove any of their patients from participation.

Interventions

Eligible patients were randomized into two arms stratified by communication modality (EHR portal versus mailed) in a 1:1 allocation ratio using a computerized random number generator. All patients received outreach describing the importance of CRC screening (risk of disease and prevalence of CRC), the opportunity to receive mailed FIT, and a phone number to call with questions. A subsample of patients was designated for EHR portal messaging if they had an active account and sent at least one message in the past year. The remaining patients received mailed outreach, all with the same content. The investigators were blinded to patient data and randomization, but the research staff were not blinded as they were administering the interventions.

Those in the opt-in arm were asked to respond with either: (1) “Yes—I want to reduce my risk of dying from colon cancer. Send me my free, at-home screening kit” or (2) “Already Screened—I’ve already reduced my risk.” In this arm, the patients received a mailed FIT kit only if they responded “Yes.” Those in the opt-out arm were asked to respond with either: (1) “No—I do not want to reduce my risk of dying from colon cancer” or (2) “Already Screened—I’ve already reduced my risk.” In this arm, the patient received mailed FIT if they did not respond “No” or “Already Screened.” Patients were asked to respond within 3 weeks from the date of outreach. Those who received an EHR portal message could respond with an electronic message and those who received a mailing could respond with an enclosed card and stamped envelope. FIT kits (Polymedco OC-Auto) with instructions were mailed to eligible patients beginning in February 2017, and messages were also sent to the primary care provider. Reminders using the same language and modality as the initial outreach were sent to those patients in the opt-in arm who did not respond within 3 weeks. No reminder was sent to non-responders in the opt-out arm whose lack of response was treated as assent to receive a FIT kit. A reminder letter was mailed to patients in either arm who had no laboratory results by 3 weeks after kit mailing. The patients’ insurance was billed for analysis of the FIT. Patients with negative FIT results were sent a letter, and primary care providers were notified of those with positive results so that they could follow-up and recommend diagnostic colonoscopy.

Post-intervention interviews

Nine weeks following initial outreach, a random subsample of 100 patients drawn equally from each arm were called and asked to complete a semi-structured interview over the phone about their experience with CRC screening and preferences for outreach (Supplementary Methods).

Study outcomes

The primary outcome was the percentage of patients with completed FIT within 3 months of initial outreach. Secondary

outcomes included percentage of patients responding to the initial outreach and percentage of those returning the mailed FIT. We also evaluated response among those who received the EHR portal message or mailings for initial outreach. We also tracked the percentage of FIT results that were positive and patients who received screening colonoscopy during the study time frame. Data was obtained from the EHR.

Statistical analysis

Considering a two-sided P -value $< .05$ as statistically significant, the study was designed to have 80% power to detect a difference between a FIT completion rate of 5% in the opt-in arm and 15% in the opt-out arm through enrollment of 320 patients. These estimates were based on pilot testing from other clinic sites in the health system. All patients who were sent outreach were included in the intent-to-screen analysis for the primary outcome. We calculated number needed to intervene (NNI) as the inverse of the absolute difference in response rates between study arms. We evaluated the cost per additional patients screened by evaluating the cost of mailing out additional FIT kits in the opt-out arm divided by the additional number of patients screened in that arm, as compared to the opt-in arm. We also performed subgroup analyses on those who received electronic outreach and female and Black patients. Analyses were performed using chi-square test of proportions with STATA version 13.0 (Stata Corp LP, College Station, TX).

RESULTS

Patient characteristics

A total of 1201 potentially eligible patients were identified through automated data extraction and 466 were randomly selected in order to achieve prespecified recruitment goals. Of those, 314 were included after chart review and randomly allocated to the two arms using a computerized random number generator (Fig. 1). A total of 127 had active EHR portal messaging and thus received information electronically, and 187 received communication by regular mail (Supplementary Table 2). One patient in the opt-in arm was not sent a kit due to ineligibility identified after response, and 5 patients in the opt-out arm were not sent kits because the initial EHR portal invitations were undeliverable, although they were included in the intent-to-screen analysis. There were no significant differences in patient characteristics across arms (Table 1) [35]. The intervention was conducted from January 2017 to April 2017, ending after meeting prespecified enrollment goals and completing follow-up for the primary outcome.

Response to outreach and FIT completion

All 314 were included in the intent-to-screen analysis. A total of 23.1% of patients in the opt-in arm requested FIT, and 2.5% declined in the opt-out arm (Table 2). In all, 5.1% and 1.3% responded that they had already been screened in the opt-in and opt-out arms, respectively. FIT kits were mailed to 22.4% of the patients in the opt-in arm and 93.0% of patients in the opt-out

Fig. 1 Flow diagram of randomized clinical trial to increase rates of colorectal cancer screening

Table 1 Demographic characteristics by group assignment

	Opt-in (n = 156)	Opt-out (n = 158)
Female (%)	82 (52.6)	85 (53.8)
Age, years (%)		
50–59	98 (62.8)	91 (57.6)
60–69	46 (29.5)	60 (38)
70–74	12 (7.7)	7 (4.4)
Race (%)		
Non-Hispanic White	71 (45.5)	70 (44.3)
Black	64 (41)	58 (36.7)
Hispanic	0 (0)	2 (1.3)
Asian	7 (4.5)	3 (1.9)
Other	14 (9)	25 (15.8)
Insurance type (%)		
Commercial	106 (68)	118 (74.7)
Medicare	36 (23.1)	28 (17.7)
Medicaid	13 (8.3)	11 (7)
Uninsured	1 (0.6)	1 (0.6)
Average median household income ^a	\$65,032	\$59,690
Active electronic messaging user ^b (%)	63 (40.4)	64 (40.5)

^aBased on 2015 American Community Survey 2011–2015 5-Year Estimates data
^bActive users are users who sent or received an electronic message within 12 months of chart review

Table 2 Response to outreach, mailing, and completion of FIT

	Opt-in (n = 156)	Opt-out (n = 158)	P-value
Response to outreach (%)			
Opted in (%)	36 (23.1)	—	
Opted out (%)	—	4 (2.5)	
Already screened (%)	8 (5.1)	2 (1.3)	
FIT kit mailed (%)	35 (22.4) ^b	147 (93.0) ^c	
FIT kit completed overall (%) ^a	15 (9.6)	46 (29.1)	<.001
Electronic message (%)	6 (40.0)	24 (52.2)	
Mailed message (%)	9 (60.0)	22 (47.8)	
Female (%)	10 (66.7)	31 (67.4)	<.001
Black (%)	7 (46.7)	19 (41.3)	.003

^aCompleted within 3 months of initial outreach (1/20/2017–4/20/2017)
^bOne requested kit not mailed (found ineligible prior to mailing)
^cAn additional 5 invitations were undeliverable

arm. Patients in the opt-in arm had a FIT completion rate of 9.6% compared to 29.1% in the opt-out arm, an absolute difference of 19.5% (95% confidence interval [CI], 10.9–27.9%; $P < .001$) and

a relative risk of 3.03 (95% CI, 1.76–5.19; $P < .001$). Based on the absolute difference in completion rate, the NNI is 5.1. This means that for every 5.1 invitees who switch from opt-in to opt-out outreach, 1 extra patient will complete CRC screening. Assuming a cost of \$5–10 per mailed FIT kit (cost of kit, mailing supplies, and postage), it would cost \$18–36 for additional person screened by switching from an opt-in to opt-out method of outreach. For example, if 100 patients are switched from opt-in to opt-out, 70.6 additional FIT kits will be mailed, but 19.5 additional patients will get screened.

Among the returned FIT kits, 3.3% (2 out of the 61) were positive. In an analysis restricted only to patients who were sent FIT kits, the completion rate as 42.9% in the opt-in arm compared to 31.3% in the opt-out arm ($P = .28$). Five patients in the opt-in arm (3.2%) and 10 patients in the opt-out arm (6.3%) received screening colonoscopy during the study time frame, and one patient in opt-out received FIT outside of the study outreach.

We performed secondary analysis to assess the comparative effectiveness of the interventions in a pre-specified subgroups of patients. Active EHR portal users were more likely to be White and have commercial insurance as compared to non-users (Supplementary Table 2). Among patients who used EHR portal messaging, 9.5% of those randomized to opt-in and 37.5% of those in opt-out completed the mailed FIT. Among those who received an initial outreach by mail had a 9.7% completion rate in the opt-in arm and 23.4% in the opt-out arm. Subgroup analysis of female (12.2% versus 36.5%) and blacks (10.9% versus 32.8%) patients showed similar results.

Post-intervention interviews

Follow-up phone interviews were conducted with 38 study patients out of 100 who were contacted. In all, 65.8% of them preferred FIT over colonoscopy, citing that it is more convenient and less uncomfortable/invasive. A total of 26.3% preferred colonoscopy citing that it is better and more accurate and less frequent than FIT. Among all surveyed, 89.5% viewed receiving CRC screening by mail as a positive experience. Among the 25 who completed the interview and did not complete FIT, 40% said that they had already scheduled CRC screening and 36% said they did not have time to complete the test.

DISCUSSION

This study evaluated the impact of different choice architecture on participation rates in mailed FIT outreach to increase CRC screening rates. We found that an opt-out messaging approach achieved significantly higher completion rates of FIT compared to an opt-in approach. Also, outreach using EHR portal was a feasible and effective alternative to mailings for active users. Mailed FIT with proactive outreach has been shown in many studies to increase CRC screening rates by 13–25 percentage points, often by using an opt-out approach [10, 11, 15, 19, 36–40]. However, this study was unique in its direct comparison of mailing out kits based on responses to opt-in or opt-out initial messaging.

Colon cancer screening is evidence based and widely recommended for all patients aged >50 years, but the complexity of the process and decision-making is often a barrier. Shifting outreach from opt-in to opt-out can increase participation rates while still maintaining patient choice. Using an opt-out approach to recruitment eliminates one step in the process for patients, and it changes the default from not participating to participating. Interestingly, less than half of patients who agreed to receive a test completed it in the opt-in group possibly due to challenges with the test or inertia, and in the opt-out group, there were a number of patients who completed the test although they would not have opted-in if asked ahead of time.

An opt-out approach has been shown to increase participation in influenza vaccinations, HIV testing, and remote monitoring interventions [27, 29–31]. However, earlier studies of active choice architecture and opt-out scheduling did not increase colonoscopy use [41, 42], possibly because colonoscopy is a more invasive and costly procedure. Stool testing, however, is easier and less costly to perform, making it easier to shift behavior. Successfully increasing use of screening tests that are perceived by patients as more costly, inconvenient, or unpleasant may require stronger interventions than shifting defaults alone.

There are also insights from behavioral economics that are embedded in the overall mailed FIT intervention, contributing to the response rate in both arms and potentiating the effect of choice architecture. The concept of *precommitment* suggests that, if an individual makes a statement about a future activity, he or she is more likely to follow through [32, 33]. In our study, most patients in the opt-out arm did not send back a message of willingness to participate, but they participated at higher rates than in the opt-in arm; this might be perceived as an implicit commitment to participate in screening. Prior studies have also shown that a prenotification can modestly increase participation in mailed FIT [43, 44]. Additionally, by mailing FIT kits directly to patients' homes, they may feel compelled to return the kit through *reciprocity*, which has been shown to increase participation as a social norm, as society expects individuals to respond to cooperative and altruistic actions with a similar action [45]. When the patient has the FIT kit in possession, the *endowment effect* suggests that he or she may place more value on it than if this were an object not yet received [46]. Finally, the framing of the choice to not screen in the opt-out arm as "I do not want to reduce my risk of dying from colon cancer" may have had a stronger impact on participation than the positive framing of the choice to screen in the opt-in arm, incorporating elements of enhanced active choice [47].

In our intervention, we also found that EHR portal messaging was feasible and acceptable to the patients who were active users of the patient portal. This is important for these types of outreach since it is lower cost to administer than mailings [12], and electronic messaging may be more amenable to changes in defaults for future interventions. In fact, among the electronic messaging users, there was a higher difference in response rate in the opt-out arm as compared to that in the opt-in arm. This may have been due to selection, as those who are electronic messaging users may be more likely to respond to colon cancer screening outreach, as they

had a higher response rate in both arms as compared to non-users. However, the rates of response in the opt-in arm between mail and electronic messaging were similar. Opt-out could have increased response rates higher in the electronic messaging group as it may have been more accessible to read. As more patients leverage the EHR portal, there will be more opportunities for outreach and also ways to include surveys or framing in the messaging.

The strengths of this study include its prospective design and randomization at the patient level. As a pragmatic trial, it demonstrates how outreach can be enhanced in the context of clinical care, which makes it generalizable to many practice settings. This intervention was offered in addition to usual care, so it shows how this type of outreach can complement existing screening strategies. This is an urban primary care population that included about 40% Blacks, who tend to have lower rates of CRC screening and worse colon cancer outcomes. Previous studies have shown that Blacks may have a lower response rate to mailed FIT [10]; in this intervention, we show similar response rates in both arms as compared to Whites. This approach also addresses an important problem, which is how to improve the efficiency and effectiveness of mailed CRC outreach. CRC screening is known to be cost-effective [48], and the cost of \$18–36 per additional person screened by changing the default is lower than hiring navigators to call patients or scheduling in-person visits to discuss screening [16, 17, 49]. These results can also be translated to other population health interventions that aim to increase patient participation in evidence-based prevention.

This study also has some limitations. First, we only focused on offering FIT outreach, and we did not include the option for screening colonoscopy. Choice of FIT or colonoscopy can increase screening rates [50], and future studies could explore this choice in mailed or electronic outreach. We did find a higher rate of screening colonoscopy participation in the opt-out arm, through usual care at the practice. Second, we only followed FIT response for 3 months after outreach, although most patients who responded completed FIT in the first 2 months. We were unable to assess the downstream diagnostic evaluation of positive results, so further research is needed to evaluate the long-term impact on identifying premalignant and malignant lesions [19].

Third, it is unknown if there are more returned FIT kits from people who are inappropriately screened with opt-out, although we did conduct chart review prior to the intervention. Fourth, the study was conducted in urban academic primary care practices, so the results may not be generalizable to other populations, and we did not have enough sample size to adequately evaluate patient subgroups. Finally, we only looked at choice architecture through outreach to patients' homes. There was not an existing process that patients had to engage in, so many could just choose not to respond, and we were not able to track if patients in the traditional mailing group received the outreach or read it. A significant portion of CRC screening promotion occurs in the clinic setting, so changing the default manner in which this choice is presented could be a useful complementary strategy to pursue in parallel. In order to achieve a high participation rate, FIT programs need a combination of mailed outreach and interventions in the clinic setting.

In conclusion, this study has demonstrated that changing the defaults for health promotion can significantly influence participation rates in CRC screening. Combining choice architecture manipulations with different forms of communication such as mailings or electronic messaging can be used to make population health management more effective and efficient. It is important to think deliberately about the choice architecture that is being used in outreach and interventions since the differences in response rates can be quite significant.

CONFLICT OF INTEREST

Guarantor of the article: Shivan J. Mehta, MD, MBA, MSHP.

Specific author contributions: S.J.M., T.K., C.G., C.R., T.M., and C.A.D. planned and conducted the study; all authors collected and/or interpreted the data; S.J.M., T.K., C.G., C.R., K.G.V., D.A.A., and C.A.D. drafted and revised the manuscript. All authors approved the final draft submitted.

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Study Highlights

WHAT IS CURRENT KNOWLEDGE

- ✓ Colorectal cancer screening is the second leading cause of cancer death, and screening rates remain limited at 62–65%.
- ✓ Behavioral economic approaches such as changing defaults have been shown to increase participation in health-promoting activities.

WHAT IS NEW HERE

- ✓ Shifting from opt-in to opt-out framing substantially increased participation in mailed colorectal cancer screening outreach.
- ✓ There was a similar response to opt-out framing across different racial/ethnic groups.

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