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Research Article

Cancer Epidemiology, Biomarkers & Prevention

Financial Incentives to Promote Colorectal Cancer Screening: A Longitudinal Randomized Control Trial

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Abstract

Background: Financial incentives may improve health behaviors. We tested the impact of offering financial incentives for mailed fecal immunochemical test (FIT) completion annually for 3 years.

Methods: Patients, ages 50 to 64 years, not up-to-date with screening were randomized to receive either a mailed FIT outreach ($n = 6{,}565$), outreach plus \$5 ($n = 1{,}000$), or \$10 ($n = 1{,}000$) incentive for completion. Patients who completed the test were reinvited using the same incentive the following year, for 3 years. In year 4, patients who returned the kit in all preceding 3 years were reinvited without incentives. Primary outcome was FIT completion among patients offered any incentive versus outreach alone each year. Secondary outcomes were FIT completion for groups offered \$5 versus outreach alone, \$10 versus outreach alone, and \$5 versus \$10.

Results: Year 1 FIT completion was 36.9% with incentives versus 36.2% outreach alone ($P = 0.59$) and was not statistically different for \$10 (34.6%; $P = 0.31$) or \$5 (39.2%; $P = 0.070$) versus outreach alone. Year 2 completion was 61.6% with incentives versus 60.8% outreach alone ($P = 0.75$) and not statistically different for \$10 or \$5 versus outreach alone. Year 3 completion was 79.4% with incentives versus 74.8% outreach alone ($P = 0.080$), and was higher for \$10 (82.4%) versus outreach alone ($P = 0.033$), but not for \$5 versus outreach alone. Completion was similar across conditions in year 4 (no incentives).

Conclusions: Offering small incentives did not increase FIT completion relative to standard outreach.

Impact: This was the first longitudinal study testing the impact of repeated financial incentives, and their withdrawal, on FIT completion.

Introduction

Colorectal cancer is the second leading cause of cancer death in the United States (https://seer.cancer.gov/statfacts/html/colorect.html; ref. 1). Although screening reduces colorectal cancer incidence and mortality (2), participation remains suboptimal, particularly for uninsured patients age 50 to 64 years and minorities (3). Mailed outreach—inviting patients to complete an enclosed stool occult blood test, often supported by navigation—has been shown to increase participation, including among underserved populations. Yet, mailed outreach faces at least 2 major challenges: (i) response rates are consistently suboptimal, ranging from 38% to 59% across studies (4–9); and (ii) the need to promote repeat yearly screening among individuals with normal test results.

Financial incentives have been shown to encourage a variety of health behaviors (10), including *habitual* behaviors (behaviors performed consistently and often, such as dieting and exercising; refs. 11–13), and one-time *periodic* behaviors (behaviors performed intermittently and infrequently, such as cancer screenings and physical examinations; ref. 14). Consequently, financial incentives are increasingly being offered in an effort to influence patient behaviors. Indeed, as of 2018, Medicaid programs for 18 states have implemented financial incentive programs to influence health behavior, and over one third of the 85% of large and 58% of small firms offering employer-sponsored wellness programs in 2017 included financial incentives as one strategy for influencing behavior (http://files.kff.org/attachment/Report-Employer-Health-Benefits-Annual-Survey-2017; refs. 15, 16). However, evidence on the longitudinal effectiveness of financial incentives has been primarily limited to *habitual* behaviors, leaving an important knowledge gap with respect to challenges like cancer screening (a *periodic* behavior). This gap in the literature is important to fill as screenings are done periodically (e.g., annually for stool blood tests). Thus, research demonstrating financial incentives can increase screening completion will only be clinically relevant if incentives lead to sustained, and ideally enhanced, long-run completion.

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Research examining behaviors after incentives are discontinued has also focused mostly on habitual behaviors, offering mixed results: some studies demonstrate behaviors persist for several months after incentives are discontinued (17, 18), whereas others find participants return to pre-intervention outcomes shortly after the intervention ends (11, 12, 19). Because discontinuation of incentives might unintentionally reduce future participation, it is imperative to test its effect in the context of repeated periodic behaviors.

We hypothesized that offering financial incentives would increase initial, as well as repeated fecal immunochemical test (FIT) completion (20) among low-income patients for whom even a relatively small incentive could have a substantial impact (21). We used mailed outreach to invite patients within a large safety-net health system to complete colorectal cancer screening via FIT. Invitation letters offered $5, $10, or no financial incentive for completing the test. Incentive amounts were chosen based on 3 criteria: (i) they reflect incentive sizes commonly offered in health practices (based on our anecdotal experience); (ii) they represent the maximum amount the health system deemed affordable if the intervention were to continue; (iii) if effective, we speculated they could be afforded and scaled by most other organizations. In year 2, we invited patients who completed screening and had normal results in year 1 using the same treatment, and followed the same protocol again in year 3. In year 4, all patients with normal results in the preceding year were invited to complete a FIT with no financial incentives, regardless of one's original intervention group.

The contribution of this paper is twofold: it reports the results of the first study, to-date, examining, (i) the effect of offering repeated yearly financial incentives to encourage and sustain periodic behaviors, and (ii) whether a periodic behavior is likely to persist once incentives are removed. This research focuses on colorectal cancer screening completion in response to mailed invitations to complete a FIT as part of a large, system level program at a safety-net health system. Importantly, we also measure screening completion after incentives were discontinued. The current article follows up on a previously published paper (20) in which we report the results of year 1. Specifically, whereas the previous article shows financial incentives ($5 or $10) did not increase FIT completion in the first year they were offered, this paper provides information about the effectiveness of *repeatedly* offering these financial incentives to promote FIT completion (year 2 and year 3). That is, in year 2 and year 3 patients were reinvited using the same incentive only if they had returned the kit in the year prior (and received a normal result). In addition, we test the effect of discontinuation of financial incentives on test completion in (year 4).

Materials and Methods

Study design

Prior to data collection, this trial was preregistered on ClinicalTrials.gov (identifier: NCT01946282). The 3-year randomized controlled trial (RCT) offered financial incentives as part of an outreach to complete annual colorectal cancer screening using FIT. Patients were randomly assigned to one of 3 groups: (i) outreach only; (ii) outreach + a $5 incentive upon FIT return; (iii) outreach + $10 incentive upon FIT return. Incentives were offered in the form of a Walmart gift card. The outreach included: (i) a mailed invitation to complete and return the FIT in English and Spanish; (ii) a 1-sample Polymedco OC Sensor FIT test; (iii) 2 automated telephone reminders in English and Spanish at the time invitations were mailed and 1 week later, encouraging test completion; and (iv) up to 2 live telephone reminders within 3 weeks of the invitation mailing, if the FIT was not returned or if the patient had not been reached during earlier attempts. The text of the invitations in both incentive groups included the following additional sentence: "You will receive a $5 [$10] gift card as a thank you for returning the kit." Invitation letters are included in the Supplementary Materials and Methods.

In year 1, invitations were mailed in 5 waves. We contacted patients with an abnormal FIT, defined by $\geq$50 ng hemoglobin/mL and determined using the OC-Auto Micro 80 Analyzer, by both phone and mail to arrange a diagnostic colonoscopy (20). Across all intervention groups, clinical services, FIT, and colonoscopy were provided at no cost. Patients who had a normal test received a letter with their results and a reminder that the screening would need to be repeated the following year (patients' primary care physicians also received a copy of the letter). In both incentive groups, the gift card was mailed with the results letter. Results of the year 1 intervention were previously published, and showed no difference in screening completion across all intervention groups. This report details the 3-year longitudinal results of this study, including all patients who were enrolled in year 1 (20). In year 2, we reinvited patients who completed screening in year 1 with normal results using the same intervention assignment (outreach only, $5, $10). Patients who did not complete the FIT in year 1 were not reinvited. Patients who returned their FIT in year 2 were again informed of their results and received the incentive, if applicable. Patients with an abnormal result were navigated to diagnostic colonoscopy using the same protocol employed in the preceding year. We followed the same protocol in year 3, reinviting only patients who had completed the FIT and received normal results in years 1 and 2. In year 4, we discontinued the use of financial incentives; we invited all patients with a normal result in year 3 to complete a FIT using outreach only, regardless of their original intervention group.

Study population

Participants were part of a larger outreach program initiated in 2013 at the John Peter Smith Health Network (JPS; details have been published elsewhere; ref. 20). Eligible individuals were low-income uninsured patients who were part of the health system's medical assistance program for low-income patients (JPS Connection), ages 50 to 64 years old, who were not up-to-date with colorectal cancer screening, and had one or more primary care visits in the year prior to the start of the program.

Recruitment and randomization

A computer-generated simple randomization using SQL assigned patients meeting the inclusion criteria to receive one of the following mailed interventions: (i) outreach only; (ii) outreach plus $5 for FIT return; and (iii) outreach plus $10 for FIT return. Primary care providers were blind to individual group assignment. A waiver of informed consent was approved for the study from the UT Southwestern Medical Center (STU 082012-086) and JPS (110512.007f) Institutional Review boards. A copy

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of the original approved protocol is included in the Supplementary Materials and Methods.

Study outcomes

The primary outcome was the proportion of individuals completing FIT in year 1, year 2, and year 3 receiving *any* incentive ($5 or $10) versus outreach only. Secondary outcomes were (i) the proportion of patients completing FIT in year 1, year 2, and year 3 for patients offered $5 versus outreach only, (ii) $10 versus outreach only, and (iii) $5 versus $10. We also conducted a *post hoc* analysis of patients completing FIT in year 4, comparing patients who had received incentives in the first 3 years of the trial versus those who received outreach only.

Statistical analyses

Primary and secondary study outcomes were analyzed using an intent-to-screen approach where a 2-sided P-value < 0.05 was considered statistically significant. Primary and secondary outcomes, as well as *post hoc* analyses, were analyzed using a chi-square test of proportions. To describe patient characteristics, we abstracted data including age, sex, race/ethnicity, number of primary care visits in the year prior to randomization, and primary language preference from the Electronic Medical Record system, EPIC.

Power calculations to estimate necessary sample size were conducted a priori. Based on our previous work with JPS (4), we estimated 10,000 patients would be eligible for colorectal cancer screening at JPS, of which we would randomly assign 2,000 to receive an incentive ($n = 1{,}000$ to the outreach + $5 and $n = 1{,}000$ to the outreach + $10 groups); the remaining 8,000 individuals would be assigned to the outreach only group. Assuming a FIT return rate of 29% for the outreach only group (4) at an $\alpha = 0.05$, we estimated more than 90% power to detect an absolute difference greater than 5% when using a chi-square test of proportions to compare patients who received any incentive ($5 or $10) compared with patients who received outreach only. We estimated needing 545 observations per incentive group to achieve power necessary to detect at least a 10% absolute difference in FIT return rate between patients who received the $5 incentive versus patients who received the $10 incentive, with assumed rates of 45% in the $5 incentive group and 53% in the $10 incentive group, $\alpha = 0.05$, and power = 90%. Therefore, number of patients assigned to each incentive group (n = 1,000 per group) was expected to provide more than sufficient power to detect any clinically important differences. Analyses were conducted in R (version 3.5.1; R Foundation for Statistical Computing; RRID: SCR_001905) and RStudio (version 1.0.143; RStudio; RRID: SCR_000432).

Results

Patient characteristics

Of the 18,700 patients engaged in the safety-net health system's medical assistance program for the low-income uninsured, 8,565 patients were eligible for colorectal cancer screening and were therefore invited using mailed outreach. We excluded patients from the study primarily for being up-to-date with screening, 5,316 (28.4%), or not having a primary care visit in the year prior, 3,129 (16.7%; Fig. 1).

We randomly assigned patients to the $5 ($n$ = 1,000) and $10 ($n$ = 1,000) incentive groups, leaving 6,565 in the outreach only group. Thus, the number assigned to outreach only was lower than the a priori expectation (n = 8,000). Demographic characteristics were similar across groups (Table 1).

The effect of any financial incentives on FIT completion

See Fig. 2 for FIT completion by intervention group years 1 to 4. Recall that in year 2, we only invited individuals who completed the test in year 1 and received normal results. Likewise, in year 3 we only invited individuals who completed the test in the preceding 2 years. In year 4, we mailed invitations only to individuals who completed the test in the preceding 3 years.

In year 1, there was no difference in FIT completion rates between patients who received any financial incentive, 36.9% (738/2,000), versus those who did not, 36.2% (2,379/6,565; P = 0.59). Similar results were observed for both year 2 [61.6% (394/640) for any incentive vs. 60.8% (1,248/2,051) for outreach only; P = 0.75], and year 3 [79.4% (281/354) for any incentive vs. 74.8% (856/1,144) for outreach only; P = 0.080]. Specifically, the difference in FIT completion between patients who received the $5 incentive and those who received no incentive (i.e., outreach only) was not statistically significant for year 1 [39.2% (392/1,000) for $5 vs. 36.2% (2,379/6,565) for outreach only; P = 0.070], year 2 [61.6% (210/341) for $5 vs. 60.8% (1248/2051) for outreach only; P = 0.80], or year 3 [76.6% (141/184) for $5 vs. 74.8% (856/1,144) for outreach only; P = 0.60]. Differences in FIT completion were also not significant when comparing patients who received the $10 incentive to those who received outreach only in year 1 [34.6% (346/1,000) for $10 vs. 36.2% (2,379/6,565) for outreach only; P = 0.31] and year 2 [61.5% (184/299) for $10 vs. 60.8% (1,248/2,051) for outreach only; P = 0.82]. However, we did not observe this pattern in year 3, as FIT completion was greater among patients who received the $10 incentive, 82.4% (140/170), compared with those who received outreach only, 74.8% (856/1,144; difference: 7.5%; 95% CI, 1.3%–13.8%; P = 0.033).

The effect of incentive size on FIT completion

In year 1, FIT completion was 4.6% (95% CI, 0.0.38%–8.8%; P = 0.033) higher among patients who received the $5 incentive, 39.2% (392/1,000), compared with patients who received the $10 incentive, 34.6% (346/1,000). There were no differences in completion rates between patients receiving incentives in year 2 [61.6% (210/341) for $5 vs. 61.5% (184/299) for $10; P > 0.99] or in year 3 [76.6% (141/184) for $5 vs. 82.4% (140/170) for $10; P = 0.184].

Impact of discontinuation of incentives on FIT completion (year 4)

The difference in FIT completion after discontinuing the incentives was not significant when comparing patients who had previously received any incentive, 52.6% [(133/253)] to those assigned to the outreach only group, 58.8% [(449/764); P = 0.084]. There were also no differences in FIT completion in year 4 when comparing each of the incentive groups, $5 [50.4%; (64/127)] or $10 [54.8%; (69/126)], to the outreach only group [58.8%; (449/764); P = 0.077 and 0.40, respectively]. Similarly, there was no difference in completion rates between those who had previously received the $5 and $10 incentives ($P$ = 0.49).

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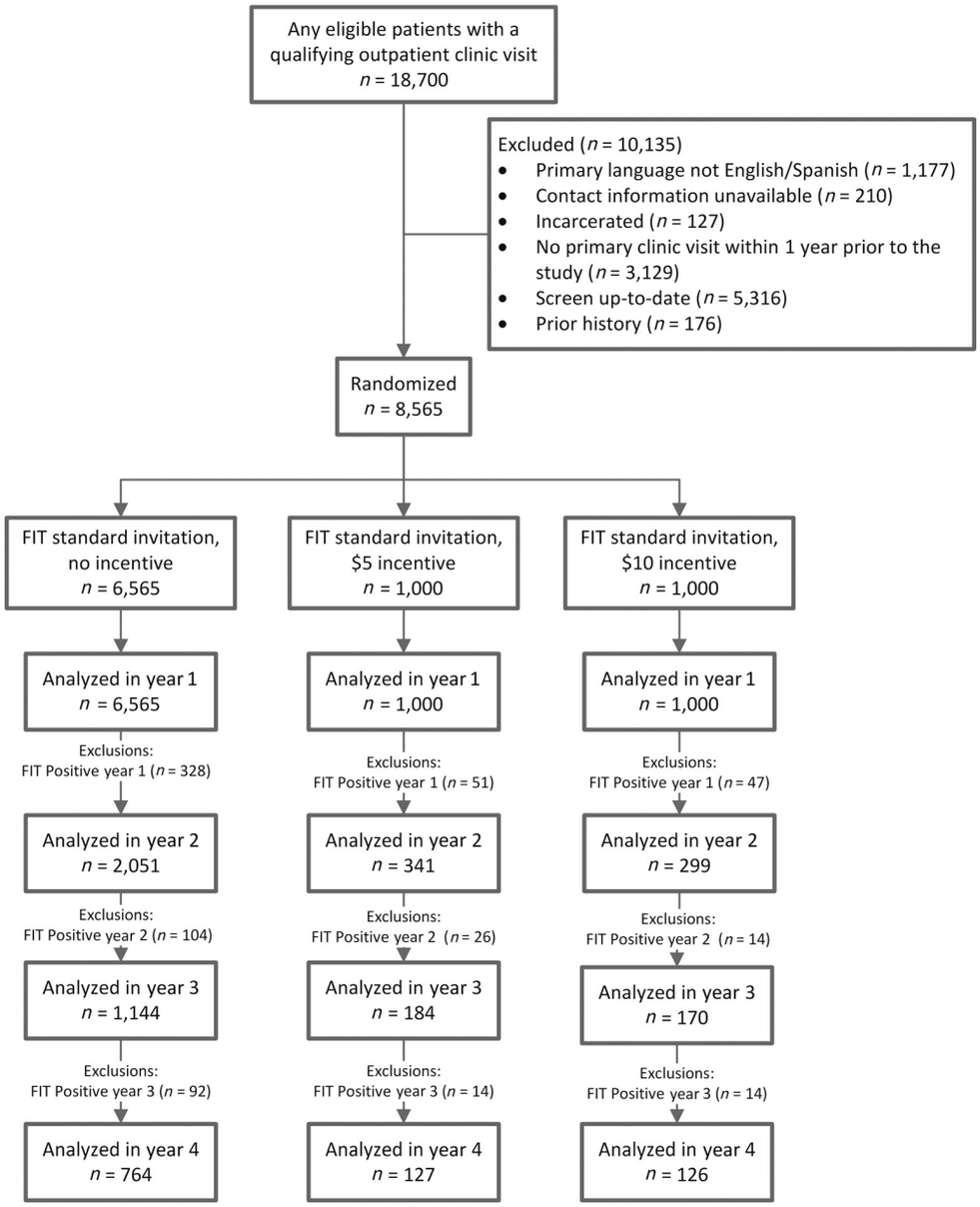

Figure 1.
Consolidated standards of reporting trials diagram. Eligible sample, exclusions, sample randomized, allocation, and sample analyzed for years 1 to 4 are depicted.

Discussion

In this large, randomized, 3-year longitudinal comparative effectiveness study, we found that adding financial incentives to mailed FIT outreach did not influence initial, or subsequent completion compared with outreach only. Further, in our *post hoc* analysis, discontinuation of incentives had no impact on response rates, regardless of intervention group to which patients had originally been assigned. These results suggest offering small monetary incentives, at least in the context of our study, qualifies as "paying for nothing"—FIT completion was equally likely without the incentive.

To our knowledge, this is the first longitudinal study assessing the impact of financial incentives on cancer screening participation using mailed outreach. Prior research suggests that monetary incentives can increase performance on effortful tasks (22), and can motivate habitual and periodic health behaviors in the short term (10, 14). Studies dedicated to testing the effectiveness of financial incentives in promoting cancer screenings have documented a variety of results (21). For example, in one study, an email offering participants a substantial incentive ($100) with active choice (opt in/opt out) to undergo a colonoscopy, led to a modest but significant increase in screening relative to participants who received an active choice email without a financial

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Table 1. Patient demographic characteristics

Patient characteristic	No incentive (n = 6,565)	$5 Incentive ($n$ = 1,000)	$10 Incentive ($n$ = 1,000)	P value
Female sex, n (%)	4,042 (61.6)	610 (61.0)	644 (64.4)	0.194
Race, n (%)				
White	2,428 (37.0)	381 (38.1)	368 (36.8)	0.779
Black	1,578 (24.0)	270 (27.0)	245 (24.5)	0.127
Hispanic	1,951 (29.7)	257 (25.7)	293 (29.3)	0.034
Asian	127 (1.9)	19 (1.9)	23 (2.3)	0.730
Other	405 (6.2)	59 (5.9)	54 (5.4)	0.623
Unknown	76 (1.2)	14 (1.4)	17 (1.7)	0.320
Language, n (%)				
English	5,447 (83.0)	852 (85.2)	830 (83.0)	0.208
Spanish	1,118 (17.0)	148 (14.8)	170 (17.0)	0.208
Median age, years (IQ range)	56 (53–60)	56 (53–60)	56 (53–60)	1.0

incentive and those in the control condition (email with a phone number for scheduling; ref. 23). Conversely, another study showed that relative to usual care, neither financial incentives ($5, $10, or $20) nor entry into a raffle for a $500 prize increased colorectal cancer screening participation, although an entry into a lottery offering a 1 in 10 chance to win $50 did (24). Considered in context of these results, our findings suggest we should not rely heavily on financial incentives for promoting FIT completion. In fact, our repeat response rates across all arms were similar to those observed in a 4-year non-incentivized cohort study with insured patients (25). Clearly, we cannot rule out the possibility that different variations of our interventions (e.g., other incentive sizes, study populations) would differentially impact completion rates.

Although largely speculative, we can think of several explanations for the lack of effect we observe in our data. First, research in behavioral sciences suggests that although incentives can be effective, their impact is far from guaranteed, and could even backfire (26). For example, it has been shown that offering incentives may introduce an external reward for the behavior which could encourage short-term change but also has potential to crowd-out intrinsic motivations, leading individuals to regress to baseline behaviors or beyond, once incentives are removed (26). In addition, introducing a monetary incentive to promote a certain behavior might shift the focus away from the health motivation toward a cost-benefit mindset that weighs the behavior (e.g., colorectal cancer screening) against the incentive value (27). Related, the incentive size could also influence

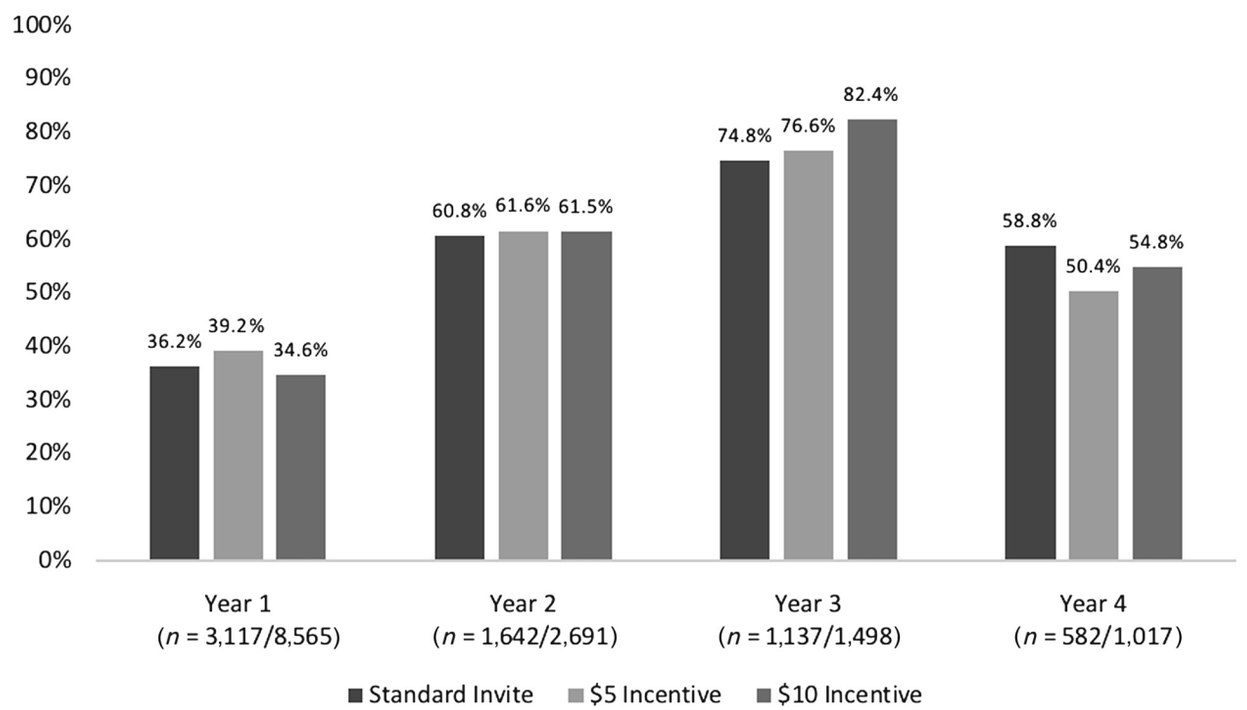

Figure 2.

FIT completion by intervention group years 1 to 4. Repeat invitations were sent each year conditional on patients having returned the FIT and receiving a normal result in the year prior. As such, the denominator shrinks over time. These results suggest that repeat participation increased in the first 3 years, but that there was little to no difference in completion across intervention groups in years 1 to 4.

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the perceived value of the behavior—a small incentive may imply the behavior is not very important (27), whereas a large incentive might suggest the cost (e.g., effort, time) required to complete the task is substantial, which might decrease participation likelihood (28). Identifying the "sweet spot," in which the financial incentive is sufficiently motivating but not dissuasive is clearly a challenge. Although we cannot rule out the possibility that the incentives we used were too low and thus viewed equally (un)attractive, we believe our data suggest that participants offered a $10 incentive did not perceive it as more attractive than the $5 incentive, possibly because they were evaluated separately (29). However, if participants in the $10 incentive arm had known, for example, that others had been offered only $5, they may have valued it more, which could have increased completion rates. In other words, it is plausible that our incentives failed to increase FIT completion because each was evaluated in isolation, suggesting that changes to the framing or presentation of the incentives may have led to different results.

To truly understand our "negative" trial, we need to dig deeper: consider the potential role of incentives in the context of the particular barriers and facilitators (e.g., cultural, psychological, social) associated with the focal health behavior. For example, if a patient does not wish to know whether they have cancer because of fear of the disease, it may be unlikely that a $5, $10, or even $20 incentive could outweigh that fear. The same may be true for an individual who is disgusted or embarrassed by the idea of collecting a sample of her stool. As health researchers continue to adopt behavioral interventions, it is crucial to start at the beginning: conduct the research necessary to understand the target population, including their thoughts, fears, beliefs, taboos, etc. as they relate to the targeted behavior. Only then, can we design a well-informed behavioral intervention, be it a financial incentive or other "nudge."

Our study has limitations. We focused exclusively on an uninsured low-income population and offered relatively modest incentives. Thus, our results may not be generalizable to other populations or incentive amounts. Further, because incentive sizes were chosen based on practical considerations, any formative work that may have suggested a higher threshold would have threatened the feasibility of the trial. In addition, year 4 was not prespecified, but rather, took advantage of an opportunity to assess FIT completion in a 4th year as the program had obtained funding to continue screening using the outreach only model. We focused exclusively on a mailed outreach intervention, with and without financial incentives. At a large integrated healthcare system, organized screening, including mailed outreach and inreach activities such as in-person reminders at time of any healthcare visits, has been shown to increase colorectal cancer screening rates beyond 80%, and reduce incidence and mortality from colorectal cancer. As such, optimizing health system and provider interventions may be an important complement to patient level behavioral interventions for increasing screening (30). Notably, our trial also has significant strengths. It is the first ever longitudinal trial assessing the effectiveness of repeated financial incentives to encourage a periodic annual behavior. Further, it is the first study assessing the use of financial incentives to encourage an increasingly common form of cancer screening among underserved populations. Finally, it is a sufficiently-powered randomized control trial, suggesting our findings capture the causal relationship between financial incentives and screening completion, and are likely to generalize to a larger sample, and possibly to similar health behaviors.

Conclusions

This study was the first longitudinal RCT assessing the effect of including financial incentives in mailed outreach for colorectal cancer screening. This is also the first RCT examining the impact of discontinuing financial incentives after a 3-year period. Our results suggest modest incentives (i.e., $5/$10) are unlikely to influence patients' colorectal cancer screening behavior: completion rates were similar regardless of whether patients were offered a monetary incentive. Previous studies have primarily tested impact of financial incentives for short-term, routine health behaviors, but none have looked at their effectiveness over time for periodic health behaviors like cancer screening. Findings from our RCT highlight the importance of considering the social, cultural, and psychological barriers inherent to a behavior (e.g., fear, disgust) and designing interventions to specifically address those barriers.

Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

Disclaimer

The funders had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; or decision to submit manuscript for publication.

Authors' Contributions

Conception and design: M. Koch, C. Ahn, B.A. Balasubramanian, K.E. Argenbright, S. Gupta
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Writing, review, and/or revision of the manuscript: A. Lieberman, A. Gneezy, E. Berry, M. Koch, C. Ahn, B.A. Balasubramanian, K.E. Argenbright, S. Gupta
Administrative, technical, or material support (i.e., reporting or organizing data, constructing databases): E. Berry, S. Miller, S. Gupta
Study supervision: E. Berry, S. Miller, M. Koch, K.E. Argenbright, S. Gupta

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