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Financial Incentives for Promoting Colorectal Cancer Screening: A Randomized, Comparative Effectiveness Trial

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OBJECTIVES: **Offering financial incentives to promote or "nudge" participation in cancer screening programs, particularly among vulnerable populations who traditionally have lower rates of screening, has been suggested as a strategy to enhance screening uptake. However, effectiveness of such practices has not been established. Our aim was to determine whether offering small financial incentives would increase colorectal cancer (CRC) screening completion in a low-income, uninsured population.**

METHODS: **We conducted a randomized, comparative effectiveness trial among primary care patients, aged 50–64 years, not up-to-date with CRC screening served by a large, safety net health system in Fort Worth, Texas. Patients were randomly assigned to mailed fecal immunochemical test (FIT) outreach (*n*=6,565), outreach plus a $5 incentive (*n*=1,000), or outreach plus a $10 incentive (*n*=1,000). Outreach included reminder phone calls and navigation to promote diagnostic colonoscopy completion for patients with abnormal FIT. Primary outcome was FIT completion within 1 year, assessed using an intent-to-screen analysis.**

RESULTS: **FIT completion was 36.9% with vs. 36.2% without any financial incentive (*P*=0.60) and was also not statistically different for the $10 incentive (34.6%, *P*=0.32 vs. no incentive) or $5 incentive (39.2%, *P*=0.07 vs. no incentive) groups. Results did not differ substantially when stratified by age, sex, race/ethnicity, or neighborhood poverty rate. Median time to FIT return also did not differ across groups.**

CONCLUSIONS: **Financial incentives, in the amount of $5 or $10 offered in exchange for responding to mailed invitation to complete FIT, do not impact CRC screening completion.**

SUPPLEMENTARY MATERIAL is linked to the online version of the paper at http://www.nature.com/ajg

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INTRODUCTION

Colorectal cancer (CRC) is the second leading cause of cancer death in the United States (1). Screening can prevent CRC mortality, but participation is limited, particularly among underserved populations such as the uninsured (2). Recently, there has been a significant interest in utilizing principles of behavioral economics, such as offering financial incentives, to "nudge" behavior change, including participation in cancer screening (3,4). Despite interest in these strategies, financial incentives have undergone limited study for promoting cancer screening, and, to our knowledge,

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have not been tested rigorously in safety net health settings caring for low-income populations, where incentives might be hypothesized to be particularly effective. Our aim was to test the impact of offering financial incentives on CRC screening completion in response to a large-scale mailed outreach program offering a fecal immunochemical test (FIT), among uninsured patients cared for at a large safety net health system.

METHODS

Setting and study participants

We conducted a randomized comparative effectiveness trial of financial incentives for increasing participation in mailed invitation to complete CRC screening with a FIT at John Peter Smith Health Network (JPS). JPS includes a large public hospital and a network of more than 60 community clinics that serves the population of Tarrant County, Texas, including Fort Worth. Primary and tertiary care services are provided. JPS offers a medical assistance program, JPS Connection, for uninsured individuals in need of medical care with insufficient financial resources. Qualifying individuals must live in Tarrant county and be a US citizen or a legal permanent resident meeting required income guidelines. The trial was nested within a larger outreach program initiated in 2013. The program offers mailed FIT invitations to all uninsured individuals served by JPS. **Figure 1** describes study enrollment. We included patients aged 50–64 years who were not up-to-date with CRC screening and uninsured but participating in JPS Connection. All had one or more visits to a primary care clinic within the year prior to program initiation. We excluded individuals with a prior history of CRC or colonic resection, missing address or phone number, or who were incarcerated at baseline. Patients were identified through a query of the health system's electronic health record, as previously described. Being up-to-date with CRC screening for baseline exclusion was defined by having an administrative billing code consistent with a guaiac fecal occult blood test or FIT in the year prior to baseline, sigmoidoscopy 5 years prior to baseline, or colonoscopy 10 years prior to baseline, based on criteria modified from the 2011 Healthcare Effectiveness Data and Information set criteria (see **Supplementary Appendix A** online for codes used) (5).

Randomization

Individuals meeting the inclusion criteria were randomly assigned via computer-generated simple randomization to receive the following: (1) mailed outreach; (2) mailed outreach plus a $5 incentive for FIT completion; or (3) mailed outreach plus a $10 incentive for FIT completion. We elected to test the effect of offering small incentives, i.e., $5 and $10 because it was the maximum amount that the JPS health system could cover beyond the time frame of grant funding to increase the likelihood of sustaining the intervention, if effective.

Interventions

For all groups, mailed FIT outreach consisted of the following: (1) invitation in English and Spanish to use and return a FIT; (2) an enclosed 1-sample Polymedco OC Sensor FIT test; (3) two automated telephone reminders in English and Spanish to encourage test completion, delivered at the time of invitation and 1 week later; (4) up to two "live" telephone reminders attempted within 4 weeks post invitation if screening was not completed or the patient was not reached on the initial call attempt. Mailed invitations for patients assigned to receive an incentive offer included a single line stating: "You will receive a $xx Walmart gift card as a thank you for returning the kit" (See **Supplementary Appendix B** for the three invitation letters used).

Invitations were distributed in five mail out "rounds" over a 1-year period. A cutoff of ≥50 ng hemoglobin/ml buffer was used to define an abnormal positive FIT and determined using the OC-Auto Micro 80 Analyzer. Patients with normal tests (as well as their primary care providers) were sent a letter informing them of results and the need for repeat screening in 1 year. All patients with abnormal tests were contacted by phone and mail to arrange for diagnostic colonoscopy. Strategies for promoting diagnostic colonoscopy after abnormal FIT included the following: (1) telephone navigation consisting of results reporting, aid with appointment scheduling, review of bowel prep instructions, appointment reminders 5 days and 2 days prior to the scheduled colonoscopy appointment, and aid in rescheduling incomplete visits; (2) certified letters to inform patients of the need to schedule diagnostic colonoscopy if not reached by phone; (3) informing participant's primary care provider of the abnormal test result and the need for diagnostic colonoscopy; (4) for patients not completing diagnostic colonoscopy, a note added to the patient's electronic health record problem list noting the presence of abnormal FIT without subsequent diagnostic colonoscopy. FIT tests and colonoscopies for abnormal FIT were provided free of charge/without financial copay.

Study outcome

Primary outcome was the proportion of individuals completing FIT within 1 year of baseline randomization, analyzed using an intent-to-screen approach.

Power and sample size

Sample size and power calculations were conducted *a priori* (initial institutional review board approved protocol available upon request, trial registered at ClinicalTrials.gov identifier: NCT01946282). We estimated a target eligible sample of 10,000 individuals for the FIT outreach program at JPS. Of these, we planned for 2,000 individuals to be randomized to the incentive group ($5 or $10) and the remaining 8,000 individuals to the no incentive group. Assuming an expected FIT completion rate of 29% for the no incentive group based on prior work (6), and alpha=0.05, we predicted over 90% power to detect a >5% absolute difference in FIT completion between the any incentive and no incentive groups, using a Chi-square test of proportions. We then computed a minimum sample size needed to detect a >10% absolute difference in screening participation between the $5 and $10 incentive groups. Assuming participation rates of 43% for the $5 incentive group and 53% for the $10 incentive group, alpha=0.05,

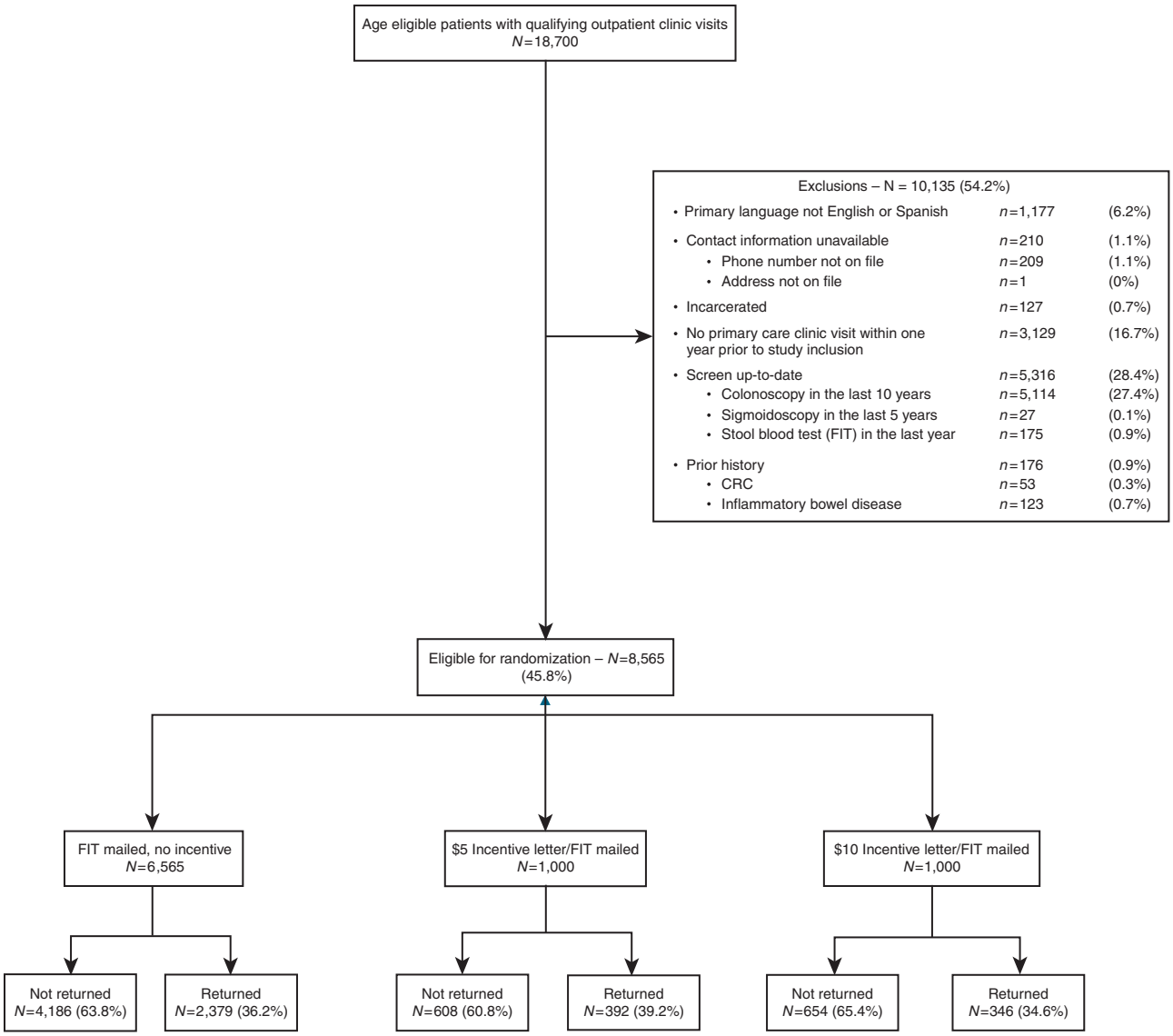

Figure 1. Patient eligibility criteria for incentive group randomization to participate in organized outreach program.

and beta=0.9, we estimated needing 545 patients/incentive group. Thus, as both the $5 and $10 incentive groups were assigned 1,000 patients, we expected more than enough power to detect clinically important differences in participation between the two incentive groups.

Statistical analysis

We described patient characteristics using abstracted EHR data including age, sex, race/ethnicity, number of primary care visits in year prior to randomization and primary language preference. Because patient socioeconomic status is not recorded in the EHR, we also assessed the neighborhood poverty rate as follows. We successfully geocoded 96.9% of the addresses from randomized patients using ArcMap (ArcGIS, Version 9.3.1; ESRI (Redlands, CA). The proportion of the population living at or below 99% of the federal poverty level was measured at the block group-level using a 5-year estimate (2009–2013) drawn from the American Community Survey. The primary outcome comparison was FIT completion for the any incentive group versus the no incentive group, using an intention-to-screen approach, considering a two-sided P-value <0.05 as statistically significant. In secondary analyses, we compared FIT completion for the $5 vs. $10 incentive groups. To test for differential effects of the intervention by the population group, we examined FIT completion across intervention groups separately by sex, race/ethnicity, and the neighborhood poverty rate (categorized as <10%, 10–19.9%, 20–29.9%, and ≥30%). For secondary comparisons, a two-sided P<0.05 was considered statistically significant.

A waiver of informed consent was approved for the study from the UT Southwestern Medical Center and John Peter Smith Health System Institutional Review boards. Thus, the study was a pragmatic trial and is less subject to participation bias across invitation and

control groups, which may occur when consent is required as a prerequisite to receiving a health promotion intervention, although we recognize *a priori* that seekers of health care may be more likely to complete screening than those not seeking care at institutions such as our health system. The Cancer Prevention and Research Institute of Texas (PP120229) was the primary funding source for the study and had no role in the design, conduct, or reporting of the study.

RESULTS

Study population

After applying inclusion and exclusion criteria, 8,565 patients were identified for mailed outreach (**Figure 1**) from a pool of 18,700 patients participating in the safety-net health system's medical assistance program for uninsured Tarrant County residents. The two most common reasons for exclusion were being up-to-date with screening (*n*=5,316, 28.4%) and not having a primary care visit in the year prior to randomization (*n*=3,129, 16.7%; **Figure 1** for full details regarding exclusion criteria).

Of the 8,565 patients identified for mailed outreach, we randomly assigned 1,000 to receive the $5 incentive, 1,000 to receive the $10 incentive, and the 6,565 remaining patients to FIT outreach alone. As such, the number of individuals qualifying for and receiving FIT outreach alone was lower than anticipated during program planning and power computation. Across the incentive vs. no incentive groups, there were no clinically significant differences by age, sex, race/ethnicity, preference for Spanish language, number of primary care visits in the year prior to study inclusion, or the neighborhood poverty index (**Table 1**).

FIT participation

FIT participation was 36.9% with vs. 36.2% without any financial incentive (*P*=0.60) and was also not statistically different for the $10 incentive (34.6%, *P*=0.32 vs. no incentive) or $5 incentive (39.2%, *P*=0.07 vs. no incentive) groups (**Figure 2**).

In subgroup analyses stratified by sex, race/ethnicity, and neighborhood socioeconomic status, very few statistically significant differences emerged across intervention groups (**Table 2** shows

Table 1. Baseline Demographic Characteristics

	Overall (*n*=8,565)		No incentive (*n*=6,565)		Any incentive (*n*=2,000)		$5 incentive (*n*=1,000)		$10 incentive (*n*=1,000)	
Gender, n *%*										
Males	3,269	38.2	2,523	38.4	746	37.3	390	39.0	356	35.6
Females	5,296	61.8	4,042	61.6	1,254	62.7	610	61.0	644	64.4
Race, n *%*										
White	3,177	37.1	2,428	37.0	749	37.5	381	38.1	368	36.8
Black	2,093	24.4	1,578	24.0	515	25.8	270	27.0	245	24.5
Hispanic	2,501	29.2	1,951	29.7	550	27.5	257	25.7	293	29.3
Asian	169	2.0	127	1.9	42	2.1	19	1.9	23	2.3
Other	518	6.1	405	6.2	113	5.7	59	5.9	54	5.4
Unknown	107	1.3	76	1.2	31	1.6	14	1.4	17	1.7
Language, n *%*										
English	7,137	83.3	5,455	83.1	1,682	84.1	852	85.2	830	83.0
Spanish	1,428	16.7	1,110	16.9	318	15.9	148	14.8	170	17.0
Neighborhood poverty, n *%*[a]										
<10	2,440	28.5	1,862	28.4	578	28.9	287	28.7	291	29.1
10–19.9	1,699	19.8	1,295	19.7	404	20.2	203	20.3	201	20.1
20–29.9	1,541	18.0	1,200	18.3	341	17.1	168	16.8	173	17.3
≥30	2,618	30.6	2,002	30.5	616	30.8	302	30.2	314	31.4
Unknown	267	3.1	206	3.1	61	3.1	40	4.0	21	2.1
Median age, years (IQ range)	56	(53, 60)	56	(53, 60)	56	(53, 60)	56	(53, 60)	56	(53, 60)
Median # (IQ range) primary care health system visits in last year[b]	3	(2, 4)	3	(2, 4)	3	(2, 4)	3	(2, 4)	3	(2, 4)

IQ, interquartile; JPS, John Peter Smith Health Network.

[a]Percentage living at or below 99% of the federal poverty line in the patient's residential block group.

[b]Includes non-JPS sponsored payor programs (i.e., Self Pay, Medicare, private insurance).

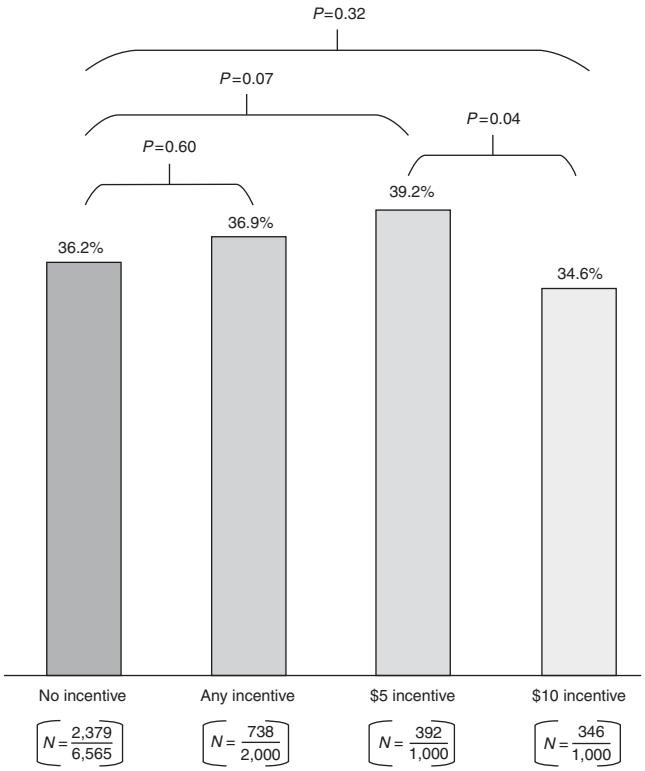

Figure 2. FIT participation by intervention group. No significant difference in FIT participation was noted for any incentive vs. no incentive, no incentive vs. $5 incentive, or no incentive vs. a $10 incentive for FIT completion. No incentive (Participated in screening: *n*=2,379; Invited: *n*=6,565). Any incentive (Participated in screening: *n*=738; Invited: *n*=2,000). $5 Incentive (Participated in screening: *n*=392; Invited: *n*=1,000). $10 Incentive (Participated in screening: *n*=346; Invited: *n*=1,000). FIT, fecal immunochemical test.

any incentive vs. no incentive; **Supplementary Appendix C** shows data for all groups). Of the few significant differences, there was a lack of consistency in the direction of effect (e.g., stronger effect for $5 vs. $10 incentive for Blacks) and sample sizes used for some comparisons were very small.

Process outcomes and diagnostic colonoscopy follow-up

Among individuals returning a FIT, median number of phone reminders did not differ across groups (range 50–67). Among FIT completers, the median number of days between invitation and FIT return was 19 days for all groups. Proportion of patients with returned mail was 6% and similar across groups (p comparison any incentive vs. no incentive=0.42). Proportion of patients reached with live phone call reminders was 22% and similar across groups (p comparison any incentive vs. no incentive=0.40). In addition, among participants with abnormal FIT, the proportion completing colonoscopy showed a trend toward higher completion in the incentive vs. no incentive group but was not statistically significant (57% for control; 63% for $5 incentive; 62% for $10 incentive; *P*=0.40 for any incentive vs. control). Among patients completing colonoscopy after abnormal FIT, the rates of adenomas, any advanced neoplasia, and any cancer were 45% (*n*=130 (*n*=130/287), 7% (*n*=21/287), and 3% (10/287), respectively. Sample size precluded meaningful statistical comparisons of neoplasia outcomes across groups.

Adverse events

As a result of study interventions, no adverse events were observed.

DISCUSSION

CRC screening rates are suboptimal, particularly among underserved populations (2,6–8). Currently, there is an interest in using behavioral economic principles to "nudge" underserved populations to participate in cancer screening. One of these principles has been the use of financial incentives, but there have been few studies examining the impact of this approach for promoting cancer screening.

Our randomized trial found that offering small financial incentives, in the form of a $5 or $10 gift card, had no clinically significant effect on the proportion of people completing FIT screening. Results were consistent across subgroups, and the sample size of the study makes it unlikely that a larger study would produce different results. No downstream effects such as decreased time to return of FIT kits or decreased need for phone calls to promote screening completion was observed in the incentive vs. no incentive groups. The results suggest that, in safety net settings, offering small financial incentives is unlikely to result in clinically important increases in screening completion.

To date, there have been a limited number of randomized trials testing the impact of financial incentives on cancer screening participation, and, among those that exist, results are mixed (9). A 2002 meta-analysis found that patient financial incentives may improve preventive health behaviors (e.g., immunizations and cancer screenings (10)). Similarly, another meta-analysis suggested that financial incentives were associated with 1.5–2-fold increased rates of behavior change over usual care, but the analysis included a diverse range of behaviors, including smoking cessation, vaccination, and cancer screening for breast and cervical cancer (11). In contrast, and specific to CRC screening, Kullgren *et al.* (3) conducted a cluster-randomized trial among United States Veterans testing the impact of different financial incentives on CRC screening completion. The results showed that, compared with usual care, neither offering a fixed incentive ($5, $10, or $20) nor an entry into a raffle for a $500 prize improved cancer screening participation. Interestingly, a lottery offering a 1 in 10 chance to win $50 did significantly improve screening completion by 19.6% over usual care. In contrast to our study population, which was composed of uninsured, underserved patients, the Kullgren study was conducted among US Veterans receiving health care as a benefit through the Veterans Affairs Healthcare system.

Research in social sciences offers a broader context to consider our results and in particular explains why financial incentives are not always effective. Similar to most interventions and programs, the effectiveness of financial incentives is multiply determined.

Table 2. Screening completion, stratified by demographic characteristics

	No incentive			Any incentive			
	n	%	95% CI	*n*	%	95% CI	*P* value
Overall	2,379	36.2	(34.4, 38.0)	738	36.9	(35.1, 38.7)	0.60
Sex							
Male	844	35	(33.2, 36.9)	248	33.2	(29.9, 36.8)	0.38
Female	1,495	37	(35.5, 38.5)	490	39.1	(36.4, 41.8)	0.18
Race/ethnicity							
Non-Hispanic white	695	28.6	(26.8, 30.5)	222	29.6	(26.4, 33.1)	0.61
Black	608	38.5	(36.1, 41.0)	206	40.0	(35.8, 44.2)	0.57
Hispanic	833	42.7	(40.5, 44.9)	236	42.9	(38.7, 47.2)	0.96
Asian	59	46.5	(37.6, 55.5)	15	35.7	(21.6, 52.0)	0.28
Other	152	37.5	(32.8, 42.5)	47	41.6	(32.4, 51.2)	0.44
Unknown	32	42.1	(30.9, 54.0)	12	38.7	(21.9, 57.8)	0.83
Neighborhood poverty, % living at or below 99% of the federal poverty line							
<10	638	34.3	(32.1, 36.5)	224	38.8	(34.8, 42.9)	0.05
10-19	464	35.8	(33.2, 38.5)	145	35.9	(31.2, 40.6)	1.00
20-29	415	34.6	(31.9, 37.4)	114	33.4	(28.4, 38.7)	0.75
≥30	794	39.7	(37.5, 41.8)	228	37.0	(33.2, 41.0)	0.26
Unknown	68	33	(26.6, 39.4)	27	44.3	(31.6, 57.6)	0.13

CI, confidence interval.

For example, although financial incentives can positively impact behavior, the level of incentive offered might influence individuals' inferences about the test such that a low incentive might imply that the test is not that important, thereby decreasing participation relative to baseline or not influencing it at all (12). Although larger incentives might be motivating, a large incentive, on the other hand, could be interpreted as suggesting that the effort associated with that test is high, perhaps resulting in negative impacts on behavior (13). In addition, research has shown that offering an external incentive might crowd out individuals' intrinsic motivation for engaging in that behavior. The absence of intrinsic motivation can lead to a rebound effect for long-term behavior change, especially when the financial incentive is not high enough or is removed (12). Finally, it is important to note that the introduction of any financial incentive necessarily assigns a price tag to the behavior (or lack of behavior) of interest. This price tag in turn tells individuals what the cost/value associated with the behavior is, which could have a detrimental impact on behavior (14). Considered in the context of the current paper, offering a financial incentive to complete a FIT test might have led patients to assess whether the request is worth the value of the incentive, rather than being motivated to engage in the behavior for their own health. Overall, it is clear that potential impacts of financial incentives are complex. The results of our study, as well as those reported by Kullgren and colleagues (3), show that small financial incentives may not increase CRC screening completion, but we cannot exclude the possibility that other financial incentives (e.g., larger amounts, additional lotteries; different gift cards) might prove effective. However, in the real-world safety-net system in which we conducted this trial, incentives any larger than $5 or $10 probably could not have been sustained, and therefore whether larger amounts might have made a difference may not be relevant.

Several limitations may be considered when interpreting this work. First, because we focused on an uninsured, generally low-income population and could offer only relatively small incentives, results are not generalizable to other, more affluent populations or experiments that offer larger incentives. Also, the lack of response observed might be specific to the health behavior under study (CRC screening). Further, in the current work, we were unable to determine the potential impact of withdrawing incentives on engagement in healthy behavior; some may theorize that, if unsustained, initially offering incentives could have a long-term negative impact. Negative results across the incentive vs. no-incentive groups might be attributable to the inability to achieve incremental improvement over the multi-component baseline intervention included for all participants, which included automated and live telephone reminders, and mailed invitation to complete a no cost FIT. Compared with mailed FIT response rates of 38–59% reported in randomized trials of mailed FIT versus usual care (6,15–19), our response rate range of 35–39% for all three groups was lower, perhaps reflecting the global challenge of increasing screening in our uninsured population.

Several strengths may also be noted. We used a large sample size and a pragmatic trial design and focused on a population at high risk for non-completion of screening. Results were consistent across subgroups, suggesting that the results should be generalizable to diverse populations within other safety net systems considering mailed FIT outreach.

In conclusion, we found that offering small financial incentives did not increase completion of CRC screening with FIT offered via mailed outreach. Results were consistent across subgroups. Future research should explore whether larger incentives or the use of other principles of behavioral economics can impact the rates of CRC completion.

CONFLICT OF INTEREST

Guarantor of the article: Samir Gupta, MD, MSCS.

Specific author contributions: Planning and/or conducting the study, collecting and/or interpreting data, and drafting the manuscript: all authors.

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Potential competing interests: None.

Study Highlights

WHAT IS CURRENT KNOWLEDGE

- ✓ Colorectal cancer (CRC) screening saves lives but is underutilized.
- ✓ Offering financial incentives has been suggested as an intervention to promote CRC screening but is untested.

WHAT IS NEW HERE

- ✓ In a large group of patients not up-to-date with CRC screening, we found offering $5 or $10 incentives had no impact on response to complete screening with mailed outreach offering fecal immunochemical test (FIT).
- ✓ Small financial incentives are unlikely to improve response to outreach promoting CRC screening.

REFERENCES

1. American Cancer Society Cancer Facts & Figures 2015. http://www.cancer.org/acs/groups/content/@editorial/documents/document/acspc-044552.pdf, 2015.
2. Klabunde CN, Joseph DA, King JB *et al.* Vital signs: colorectal cancer screening test use--United States, 2012. *MMWR* 2013;**62**: 881–8.
3. Kullgren JT, Dicks TN, Fu X *et al.* Financial incentives for completion of fecal occult blood tests among veterans: a 2-stage, pragmatic, cluster, randomized, controlled trial. Ann Intern Med 2014;161:S35–43.
4. Purnell JQ, Thompson T, Kreuter MW *et al.* Behavioral economics: "nudging" underserved populations to be screened for cancer. Prev Chronic Dis 2015;12:E06.
5. National Center for Quality Assurance HEDIS Measures for Colorectal Cancer Screening. http://www.ncqa.org/Portals/0/HEDISQM/HEDIS%202011/HEDIS%202011%20Measures.pdf, 2011.
6. Gupta S, Halm EA, Rockey DC *et al.* Comparative effectiveness of fecal immunochemical test outreach, colonoscopy outreach, and usual care for boosting colorectal cancer screening among the underserved: a randomized clinical trial. JAMA Intern Med 2013;173:1725–32.
7. Gupta S, Sussman DA, Doubeni CA *et al.* Challenges and possible solutions to colorectal cancer screening for the underserved. J Natl Cancer Inst 2014;106:dju032.
8. Sabatino SA, White MC, Thompson TD *et al.* Cancer screening test use - United States, 2013. MMWR 2015;64:464–8.
9. Sutherland K, Christianson JB, Leatherman S. Impact of targeted financial incentives on personal health behavior: a review of the literature. Med Care Res Rev 2008;65(6 Suppl):36S–78S.
10. Stone EG, Morton SC, Hulscher ME *et al.* Interventions that increase use of adult immunization and cancer screening services: a meta-analysis. Ann Intern Med 2002;136:641–51.
11. Giles EL, Robalino S, McColl E *et al.* The effectiveness of financial incentives for health behaviour change: systematic review and meta-analysis. PLoS ONE 2014;9:e90347.
12. Gneezy U, Meier S, Rey-Biel P. When and Why Incentives (Don't) Work to Modify Behavior. J Econ Perspect 2011;25:191–210.
13. Kamenica E. Behavioral Economics and Psychology of Incentives. Ann Rev Econom 2012;4:427–52.
14. Gneezy U, Rustichini A. Fine is a price, a. J Legal Stud 2000;29:1.
15. Singal AG, Gupta S, Tiro JA *et al.* Outreach invitations for FIT and colonoscopy improve colorectal cancer screening rates: A randomized controlled trial in a safety-net health system. Cancer 2016;122:456–63.
16. Hendren S, Winters P, Humiston S *et al.* Randomized, controlled trial of a multimodal intervention to improve cancer screening rates in a safety-net primary care practice. J Gen Intern Med 2014;29:41–9.
17. Levy BT, Xu Y, Daly JM *et al.* A randomized controlled trial to improve colon cancer screening in rural family medicine: an Iowa Research Network (IRENE) study. J Am Board Fam Med 2013;26:486–97.
18. Myers RE, Bittner-Fagan H, Daskalakis C *et al.* A randomized controlled trial of a tailored navigation and a standard intervention in colorectal cancer screening. Cancer Epidemiol Biomarkers Prev 2013;22:109–17.
19. Myers RE, Sifri R, Hyslop T *et al.* A randomized controlled trial of the impact of targeted and tailored interventions on colorectal cancer screening. Cancer 2007;110:2083–91.