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Financial incentives and proactive calling for reducing barriers to tobacco treatment among socioeconomically disadvantaged women: A factorial randomized trial

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ABSTRACT

Improved strategies and scalable interventions to engage low-socioeconomic status (SES) smokers in tobacco treatment are needed. We tested an intervention designed to connect low-SES smokers to treatment services, implemented through Minnesota's National Breast and Cervical Cancer Early Detection Program (Sage) in 2017; the trial was designed to last 3 months (July through October). Participants were female smokers who were 250% below the federal poverty level (randomized $N = 3723$; analyzed $N = 3365$). Using a factorial design, participants were randomized to six intervention groups consisting of a proactive call (no call vs call) and/or a financial incentive offered for being connected to treatment services ($0 vs $10 vs $20). Simple randomization was conducted using Stata v.13. All individuals received direct mail. Participants and staff were blinded to allocation. The outcome was connection via phone to QUITPLAN Services®, Minnesota's population-based cessation services. Groups that received $10 or $20 incentives had higher odds of treatment engagement compared to the no incentive group [respectively, OR = 1.94; 95% CI (1.19–3.14); OR = 2.18; 95% CI (1.36–3.51)]. Individuals that received proactive calls had higher odds of treatment engagement compared to individuals not called [OR = 1.59; 95% CI (1.11–2.29)]. Economic evaluation revealed that the $10 incentive, no call group had the best cost-benefit ratio compared to the no incentive, no call group. Direct mail with moderate incentives or proactive calling can successfully encourage connections to population-based tobacco treatment services among low-SES smokers. The intervention could be disseminated to similar programs serving low-SES populations. This trial is registered at ClinicalTrials.gov (NCT03760107).

1. Introduction

Tobacco use is the leading preventable cause of morbidity and mortality in the U.S. (Islami et al., 2018; McAfee et al., 2013). Moreover, high smoking rates persist among certain subgroups (Drope et al., 2018; Higgins et al., 2016). Women and men below the U.S. federal poverty level (FPL) smoke at higher rates compared to individuals above it (Centers for Disease Control and Prevention, 2014). Smoking accounts for nearly half of male mortality disparities associated with low socioeconomic status (SES; Jha et al., 2006), and a similar trend is occurring among women (Gregoraci et al., 2017). Due to multiple barriers (Pampel et al., 2010), low-SES smokers are also less likely to use evidence-based tobacco treatment (Ku et al., 2016; Okuyemi et al., 2013; Fraser et al., 2017). It is now a public health priority to reduce tobacco-related disparities by establishing scalable interventions that connect low-SES smokers to evidence-based services (U.S. National Cancer Institute, 2017; Niederdeppe et al., 2008).

Greater exposure to evidence-based treatment services, such as quitlines, increases the likelihood of quit attempts and successful cessation (Fraser et al., 2017; Slater et al., 2016; Zhu et al., 2012; Stead et al., 2007; Stead et al., 2013; Fiore et al., 2008). Connections to quitlines can also be effective among low-SES populations who have access to phones (Burns et al., 2011; Slater et al., 2016; Fiore et al., 2008). Yet quitline utilization rates remain low across the U.S. (Zhu et al., 2012), and communication strategies such as direct mail are needed to increase quitline utilization (Zhu et al., 2018).

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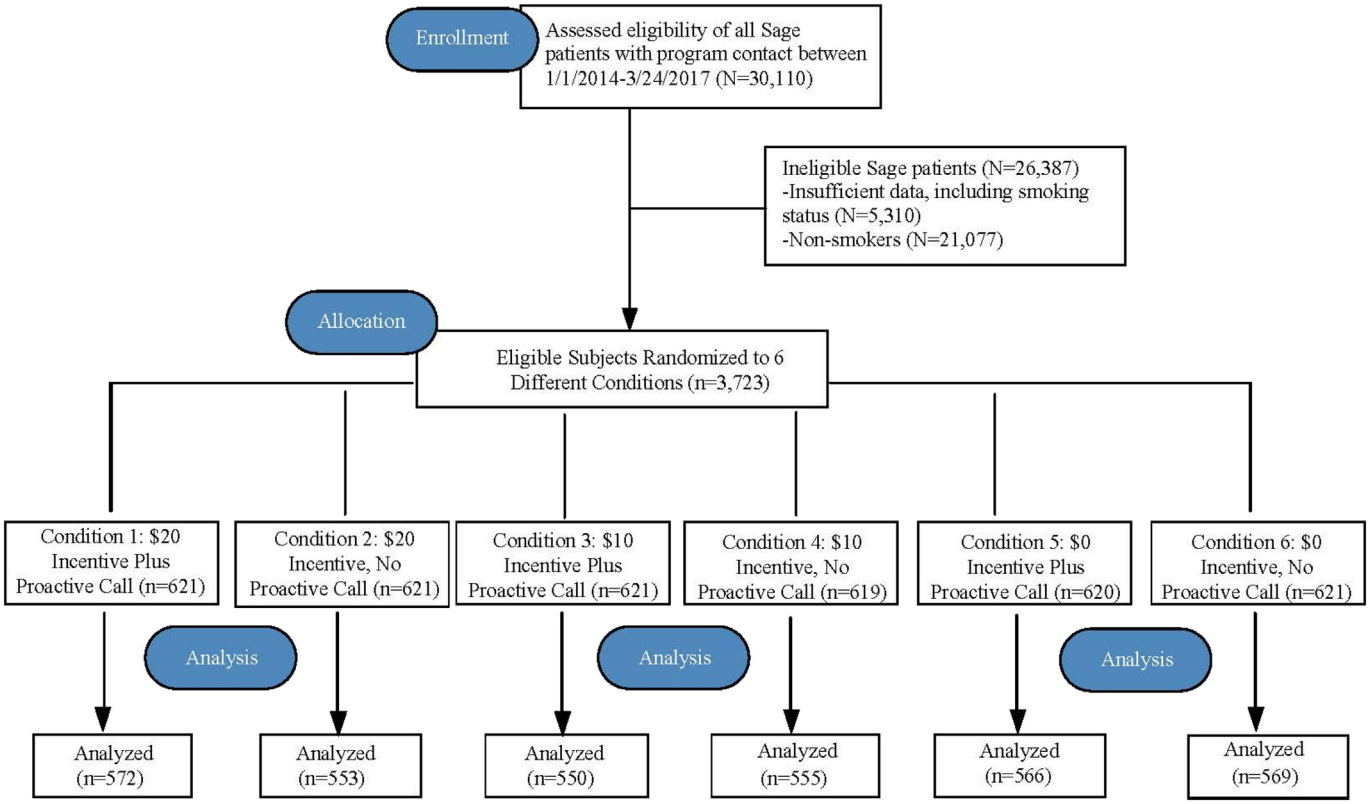

Fig. 1. CONSORT diagram.

Proactive telephone outreach also reduces barriers to tobacco treatment among socioeconomically disadvantaged populations (Fu et al., 2014; Haas et al., 2015). Furthermore, financial incentives encourage smoking abstinence (Sigmon and Patrick, 2012; Volpp et al., 2009), and they are effective for cessation compared to other intervention components among low-SES populations (Bryant et al., 2011; Tong et al., 2018). Incentives can effectively promote tobacco treatment engagement and cessation among low-SES populations (Fraser et al., 2017; Tong et al., 2018).

In general, tobacco-related health communication interventions are less effective in low-SES populations (Niederdeppe et al., 2008), but multicomponent interventions are more effective (Lasser et al., 2017; Robinson et al., 2014). A burgeoning literature demonstrates that coupling direct mail with other intervention components such as financial incentives or proactive calling is a promising approach among low-SES smokers (Tong et al., 2018; Fu et al., 2014; Slater et al., 2016; Slater et al., 2018). However, more randomized trials are needed to assess the impact of individual intervention components such as incentives and proactive calling on quitline connection, particularly when they are coupled with direct mail (Slater et al., 2016; Fraser et al., 2017; Anderson et al., 2018).

Using a factorial experimental design (Collins et al., 2014), we evaluate how coupling a population-based, direct mail intervention with financial incentives and proactive telephone outreach influences quitline connections among low-SES smokers. We implemented the intervention through “Sage,” Minnesota's National Breast and Cervical Cancer Early Detection Program (NBCCEDP). NBCCEDPs serve un- and underinsured women with household incomes at or below 250% of the U.S. FPL (Lee et al., 2014; Slater et al., 2016). Sage provides free breast and cervical cancer screening services to over 10,000 unique women each year, and it has a central call center staffed by patient navigators (Freund et al., 2008).

Participants were connected to QUITPLAN® Services, Minnesota's free population-based cessation services. QUITPLAN Services is funded and administered by ClearWay Minnesota[SM]. QUITPLAN Services offers the QUITPLAN® Helpline (telephone counseling, nicotine replacement therapy [NRT], and text, email, and mailing quit guides for enrollees) and Individual QUITPLAN Services® (NRT starter kit, email, text, and/or printed quit guide for enrollees). Services are provided to enrollees who register for them (Keller et al., 2016); they are not proactively provided to non-users (see Mathew et al., 2015; Slater et al., 2016). Services are promoted by paid media campaigns; mailings are not used. The quit rate for QUITPLAN Services matches rates found in systematic reviews (i.e., between 25% and 30%; Keller et al., 2016; Stead et al., 2013), and demographic data show that QUITPLAN Services enrollees have moderate to high levels of education (82% have a high school degree or more). A description of QUITPLAN Services has been published (Keller et al., 2016).

2. Methods

2.1. Design

2.1.1. Participants and setting

Sage maintains a database of patient information. The database is regularly checked for data quality by specialists and Sage staff. Patients' contact information is retrievable by Sage staff and is updated every clinic visit. Due to Sage's target population, the current sample was strictly female. We included individuals for whom self-reported smoking status was available (from 2014 to 2017). Smoking status was determined using Sage data, which come from clinics and Sage's call center. Using a uniform measure (“Do you currently smoke cigarettes?”—yes/no), smoking status was based on cigarette use at the time of contact (i.e., clinic visit/contact with Sage call center). Since not all clinics record smoking status with fidelity, smoking status is not always recorded and smoking rate estimates are unreliable. Some Sage patients did not have full information needed for the current intervention, including smoking status. Approximately 17.6% of Sage patients were not

Table 1
The 3-by-2 factorial design.

Groups	Factor A: financial incentive levels (3 levels)	Factor B: proactive call (2 levels)
1	$20	Yes
2	$20	No
3	$10	Yes
4	$10	No
5	$0	Yes
6	$0	No

included because of missing information (including smoking status); 3.4% of patients had missing smoking status but had all other required information. There were 3723 smokers who met selection criteria for the current study (Fig. 1). The principal investigator randomized participants using simple randomization (Stata v.13). Participants, Sage staff, and quitline staff were blinded to conditions.

2.1.2. Intervention components

Individuals were randomized to one of six conditions (Table 1). The design was a two-factor, three-by-two factorial design: three levels of financial incentives, and two levels of proactive calls. Participants were assigned to one of three levels of the incentive factor: (1) no incentive, (2) $10 incentive, or (3) $20 incentive condition. We aimed to replicate a previous program that offered $20 incentives to all participants (Slater et al., 2016). We generated an intervention arm that received $20, and one that did not receive an incentive offer to determine the effect of the incentive. We also assessed incentive effectiveness when the budget for incentives was halved by adding a third level and including an arm that received a $10 incentive offer. Participants were also assigned to one of two levels of the proactive call factor: (1) did not receive a call, and (2) received a proactive call.

The intervention was implemented from June through October 2017. Fig. 2 outlines the sequence of the intervention. All groups received two direct mail mailers. The second mailing was sent two weeks after the first mailing. Both mailers used similar emotionally evocative messages depicting the risk of continued smoking. Mailers consisted of a folded card, which contained messages rooted in a loss-frame approach (Rothman and Salovey, 1997). Loss-frame messaging can be more effective for smoking cessation compared to gain-frame messaging (Witte and Allen, 2000; Rothman and Salovey, 1997). The loss-frame approach indicates that certain behaviors lead to unhealthy outcomes, and we paired the message with clear behavioral steps that included calling Sage and using free cessation tools (Rothman and Salovey, 1997; Witte and Allen, 2000; Slater et al., 2016). Since tailored messaging influences effectiveness, the mailers only included women (see Slater et al., 2016). A first-round mailer is displayed in Appendix 1.

Incentives were advertised via small cards affixed to the inside of mailers, which read, for example: “Get free tools to quit smoking plus $10! Contact us at 1-888-643-2584 or quit.mnsage.com” (see Appendix 1). The card gave the option of enrolling via a unique online landing page, which was created by a Sage staff member. This card was affixed to all direct mail pieces, with only the incentive groups receiving the incentive offer. Receipt of the incentive was contingent on being connected to treatment services (Slater et al., 2016). The incentive was a VISA gift card, which was administered and delivered to eligible participants via mail by Sage staff.

When participants called Sage's number, patient navigators followed a script, recorded callers' promotion code, determined callers' desire to participate, and made connections to the quitline for willing participants. After two rounds of direct mail, patient navigators placed proactive outreach calls to eligible participants. Proactive calling lasted approximately 3 months. Each participant received one proactive call; navigators left voicemails for participants who were unavailable. Messages were only left for participants with a working voicemail. One callback was attempted. Implementation fidelity was assessed by observing navigators, tracking call rates, and listening to calls via a phone tracking system.

As noted, all groups were offered free tobacco treatment once they were connected to QUITPLAN Services. Participants could choose the QUITPLAN Helpline or one or more Individual QUITPLAN Services.

2.2. Data

2.2.1. Outcomes

Our primary outcome was phone-only connections, which was defined as a confirmed connection between participants and QUITPLAN Services staff via three-way calls conducted by patient navigators (1 = yes, 0 = no). For willing participants, patient navigators called QUITPLAN Services and confirmed that a patient would be connected via a three-way call. Navigators remained on the line until

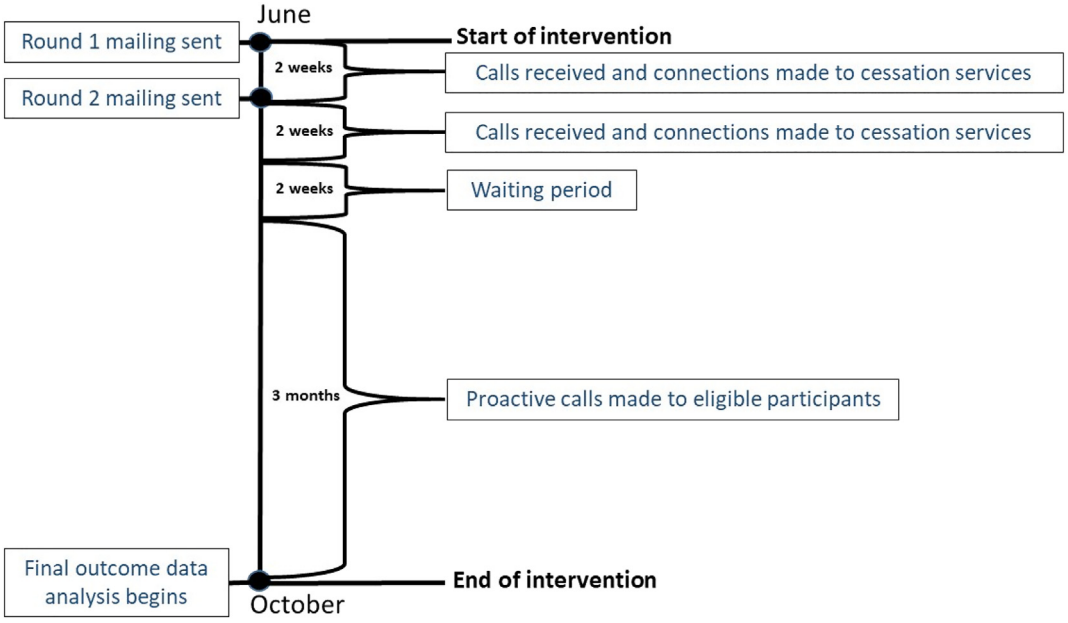

Fig. 2. Intervention sequencing and flow.

Table 2
Demographic characteristics of low-income smokers across intervention groups.

Variable	Intervention groups:	$0, no call		$10, no call		$20, no call		$0, call		$10, call		$20, call		*p*-value*
Age (yrs)	Mean (SD)	52.8	(10.7)	52.7	(10.3)	52.9	(10.1)	52.7	(10.2)	52.9	(10.3)	52.9	(10.3)	0.0.999
		N	%	N	%	N	%	N	%	N	%	N	%	
Race/ethnicity	White	275	48.3	236	42.5	267	48.3	276	48.8	243	44.2	265	46.3	0.268
	African American	58	10.2	64	11.5	55	10.0	62	11.0	42	7.6	48	8.4	
	Hispanic	129	22.7	149	26.9	144	26.0	124	21.9	154	28.0	143	25.0	
	American Indian	56	9.8	56	10.1	44	8.0	50	8.8	55	10.0	67	11.7	
	Other	51	9.0	50	9.0	43	7.8	54	9.5	56	10.2	49	8.6	
Spanish speaking	No	531	93.3	515	92.8	514	93.0	524	92.6	508	92.4	525	91.8	0.948
	Yes	38	6.7	40	7.2	39	7.1	42	7.4	42	7.6	47	8.2	
Lives with smoker	No	393	69.1	377	67.9	369	66.7	385	68.0	374	68.0	398	69.6	0.936
	Yes	176	30.9	178	32.1	184	33.3	181	32.0	176	32.0	174	30.4	
Time since last contact	2014	83	14.6	77	13.9	83	15.0	80	14.1	91	16.6	83	14.5	0.884
	2015	147	25.8	166	29.9	177	32.0	160	28.3	157	28.6	162	28.3	
	2016	256	45.0	233	41.9	215	38.9	253	44.7	229	41.6	250	43.7	
	2017	83	14.6	79	14.2	78	14.1	73	12.9	73	13.3	77	13.5	
Metro area location	No	354	62.2	340	61.3	350	63.3	350	61.8	356	64.7	361	63.1	0.874
	Yes	215	37.8	215	38.7	203	36.7	216	38.2	194	35.3	211	36.9	

* *p* value represents $\chi 2$ test for categorical variables and ANOVA for age variable.

communication between participants and QUITPLAN Services staff was established. QUITPLAN Services staff delivered cessation services.

A secondary measure captured both phone and web connections (1 = connection via phone or web, 0 = no connection). The web connection assessed whether participants entered their individual promotion codes on the online landing page. Once participants entered their individual codes, they were directly connected to the QUITPLAN Services webpage where they entered their personal information and chose tailored services. Online enrollment counted as a connection; each code was counted only once. (No participants connected via both phone and web.) The confirmed phone connection was our primary outcome because it was a more conservative measure.

2.2.2. Covariates

We examined age (continuous; range: 20 to 88), race/ethnicity (five dichotomous measures: white, African American, Hispanic, American Indian, and other races/ethnicities), whether participants spoke Spanish (1 = yes, 0 = no), whether respondents lived with a fellow smoker (1 = yes, 0 = no), time since last contact with Sage (four dichotomous variables: 2014, 2015, 2016, or 2017), and urban residence (1 = metro region, 0 = other). All measures are displayed in Table 2.

2.3. Analytic strategy

Using a per-protocol approach, we eliminated all individuals with bad addresses according to returned mail (n = 358; 9.6%). There were no differences in bad addresses across intervention groups ($\chi^2 = 7.82$; $p > 0.10$). Individuals with bad addresses were more likely to be white, slightly younger, urban, and to have last contacted Sage prior to 2016. A total of 3365 participants were included in final analyses. Descriptive statistics were used to compare connection rates and demographics across intervention arms. We used dummy variables in the regression analysis to capture whether participants were assigned to the different levels of financial incentives (1 = yes, 0 = no). The no incentive group served as the reference group. The proactive calling measure was assessed using a dichotomous measure (1 = proactive calling, 0 = no proactive calling). We assessed the components' combined effect by generating interaction terms. Using dummy coding (0, 1) rather than effect coding (−1, 1) means that the coefficients represent effects when all other coefficients in the model are equal to zero (Chakraborty et al., 2009; Kugler et al., 2012).

Logistic regression is the optimal method for examining unbalanced factorial designs with a binary outcome (Chakraborty et al., 2009). We ran four logistic regression models that examined: (1) incentive levels, (2) proactive calling, (3) the main effects of financial incentives and proactive calling, and the interaction between incentive levels and proactive calling, and (4) the effect of intervention components adjusted for covariates. For secondary analyses, we ran logistic regression using the same predictors as the primary regression models but with the alternative outcome that measured connections via phone or web. We report any differences between primary and secondary analyses. We used Stata v.13.

2.4. Economic evaluation

For the economic evaluation (Rabarison et al., 2015), we used an economic perspective (program cost relative to participants recruited; Slater et al., 2017; Brown and Buxton, 1998; Rabarison et al., 2015). We did not take a societal perspective (Sanders et al., 2016). We assessed cost-effectiveness ratios without a comparator (i.e., average cost-effectiveness ratios [ACER]; Bang & Zhao, 2012) by calculating total costs for each separate intervention arm divided by the number of quitline connections for each arm. Comparative ratios are more informative for comparing interventions (see Rabarison et al., 2015). Therefore, we also examined cost effectiveness ratios with a comparator (i.e., incremental cost-effectiveness ratios [ICER]; Bang & Zhao, 2012), which were ratios based on the comparator of the no incentive, no call group (i.e., direct mail only). ICERs were calculated as the increase in cost for each intervention arm relative to the direct mail only arm divided by the increase in quitline connections for each intervention arm relative to the direct mail only arm. All costs and ratios are listed in Table 4. We calculated costs and ratios separately for the primary outcome of phone-only connections and the secondary measure. Costs were in 2017 US dollars and based on receipts and labor hours; hourly rates were based on national averages for respective positions.

The Minnesota Department of Health Institutional Review Board (#00000945) approved this project, and it is registered at ClinicalTrials.gov (NCT03760107). The work was in accordance with the Code of Ethics of the World Medical Association.

3. Results

3.1. Participants and intervention groups

Mean age was 52.8. The sample was 46.4% white, 25.1% American Indian, 9.8% African American, 9.8% Hispanic, and 9% other

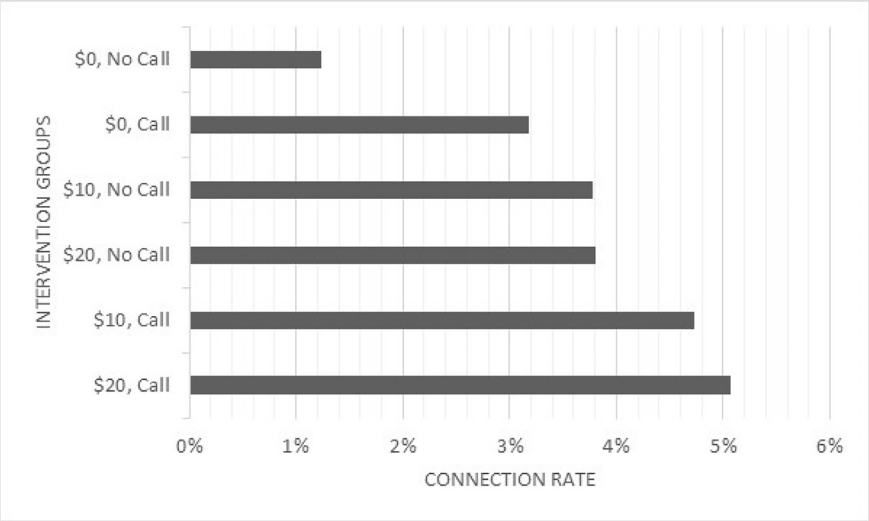

Fig. 3. Rates of phone connections to QUITPLAN® Services by intervention groups.

ethnicities/races. The majority of participants lived outside of the metro area (62.7%). Approximately 31.8% of the participants lived with a smoker, and most participants last contacted Sage within 18 months prior to the intervention (2017 = 13.8%, 2016 = 42.7%, 2015 = 28.8%, 2014 = 14.8%). There were no differences across randomized groups (Table 2).

3.2. Connection rates

Out of the total sample ($N = 3365$), 147 participants were connected to services (4.37%). Most participants were connected by phone ($N = 122$) versus web ($N = 25$). We found significant differences across intervention groups for phone-only connections ($\chi^2 = 15.1$; $p < .05$). Fig. 3 displays connection rates across intervention groups (in ascending order). The raw total of phone-only connections ranged from seven for the direct mail only group to 29 for the $20 incentive, proactive call group. In secondary analyses, differences across intervention groups in connections via phone or web were significant ($\chi^2 = 11.8$; $p < .05$).

A total of 24.6% of participants randomized to receive a proactive call (regardless of incentive arm assignment) were successfully reached; all other participants were left voicemails (44.4%) or were not reached (31.0%). Final outcomes for phone-only connections were substantially higher for those who were successfully reached compared to individuals who were left voicemails/not reached (8.81% vs. 0.49%; $\chi^2 = 83.7$; $p < .05$). The difference between not reached and left a voicemail was non-significant. Individuals who were reached were more likely to be African American and to live within the metro region.

3.3. Intervention component effects

Table 3 shows results for phone-only connections. Models 1 and 2 report main effects for incentive level and proactive calls. In comparison to no incentives, receiving a $10 or a $20 incentive increased the odds of phone connections, as did receiving a proactive call versus not receiving a proactive call. The full model (Model 3) displays results for the incentive and proactive call. As noted, we used dummy coding with a factorial design, and the odd ratios in Model 3 and 4 for the incentive and proactive call are interpreted as the effect when all other variables in the interaction are equal to zero. Similarly, the odds ratios for the interaction are interpreted as the test for whether the relationship between proactive calling and being connected depended on incentive levels. In Model 3, the odds of phone connections increased for the $10 and $20 groups compared to no incentive (respectively, OR = 3.16, 95% CI = 1.33, 7.49; OR = 3.17, 95% CI = 1.34, 7.52). The proactive call group was more likely to be connected than the no call group (OR = 2.64, 95% CI = 1.09, 6.36). The interactions between $10 incentive and proactive call, and $20 incentive and proactive call, were not significant in Model 3.

There were minimal increases in effect sizes for both incentives and proactive calling after including covariates (Model 4). Age was positively related to connections (OR = 1.02, 95% CI = 1.01, 1.04). Compared to white participants, African Americans were more likely to be connected (OR = 1.75, 95% CI = 1.02, 2.99) and American Indians were less likely to be connected (OR = 0.42, 95% CI = 0.23, 0.79). Living with a smoker was negatively related to connections (OR = 0.60, 95% CI = 0.37, 0.97). More recent contact with Sage was positively related to connections.

Secondary analyses (not shown) assessing phone *or* web connections showed no major changes; however, adjusted effect sizes for each component of $10 incentive, $20 incentive, and proactive calling decreased (respectively, OR = 2.19, 95% CI = 1.06, 4.54; OR = 2.81, 95% CI = 1.39, 5.68; OR = 2.25, 95% CI = 1.09, 4.63).

3.4. Economic evaluation results

ACER and ICER values indicate that the $10 incentive, no call group was most cost effective (Table 4). In reference to all intervention groups that combined an intervention component with direct mail, the ICER values indicate that the $10 incentive, no call group was most efficient relative to the direct mail only group. We visually display these findings for ICERs in Fig. 4. The figure plots total costs and phone-only connections, allowing the slope between any two points to represent incremental values between those points. The line/slope represents the standard for cost-connection ratios—values above the line indicates lower efficiency, and values below the line indicate higher efficiency. All conditions fell along the slope, except for the $10 incentive, no call condition, which fell below the slope (indicating an efficient use of money). Fig. 4 also shows that among the no-call conditions, significant gains resulted from a $10 incentive over no incentive. There was no additional gain in using a $20 incentive. Among the proactive call conditions, the absolute gain in phone connections between $10 and $20 incentive groups was minimal compared to the absolute gain between no incentive and $10 incentive groups.

4. Discussion

This population-based intervention successfully connected low-SES

Table 3
Logistic regression results for phone-based connections to QUITPLAN® services across intervention components among low-income smokers in Minnesota, 2017.

	Model 1: incentive level		Model 2: proactive calling		Model 3: intervention components only		Model 4: covariates added	
Variables	Odds ratio (95% CI)		Odds ratio (95% CI)		Odds ratio (95% CI)		Odds ratio (95% CI)	
Intervention components								
Incentive level								
$0 (reference)	~	~	~	~	~	~	~	~
$10	1.94	(1.19, 3.14)	~	~	3.16	(1.33, 7.49)	3.31	(1.39, 7.88)
$20	2.18	(1.36, 3.51)	~	~	3.17	(1.34, 7.52)	3.39	(1.42, 8.08)
Proactive call (1,0)	~	~	1.59	(1.11, 2.29)	2.64	(1.09, 6.36)	2.66	(1.09, 6.45)
Incentive and proactive call								
$10 × proactive call	~	~	~	~	0.48	(0.17, 1.38)	0.50	(0.17, 1.47)
$20 × proactive call	~	~	~	~	0.51	(0.18, 1.47)	0.50	(0.17, 1.45)
Covariates								
Age	~	~	~	~	~	~	1.02	(1.01, 1.04)
Race/ethnicity								
White (reference)	~	~	~	~	~	~	~	~
African American	~	~	~	~	~	~	1.75	(1.02, 2.99)
Hispanic	~	~	~	~	~	~	0.67	(0.32, 1.41)
American Indian	~	~	~	~	~	~	0.42	(0.23, 0.79)
All other races/ethnicities	~	~	~	~	~	~	1.40	(0.75, 2.59)
Spanish speaking	~	~	~	~	~	~	1.00	(0.25, 3.90)
Lives with smoker	~	~	~	~	~	~	0.60	(0.37, 0.97)
Time since last contact								
2014 (reference)	~	~	~	~	~	~	~	~
2015	~	~	~	~	~	~	1.46	(0.77, 3.17)
2016	~	~	~	~	~	~	2.32	(1.20, 4.49)
2017	~	~	~	~	~	~	2.28	(1.06, 4.91)
Metro area (vs. other)	~	~	~	~	~	~	1.35	(0.87, 2.07)

Notes. $N = 3365$; 95% confidence intervals are in parentheses; Model 1 includes only measures for incentive levels; Model 2 includes only measure for proactive calling; Model 3 includes measures for incentive level, proactive calling, and their interaction; Model 4 includes all measures from Model 3 in addition to covariates; ~ = indicates each respective variable does not have an odds ratio to report for that particular model.

Table 4
Economic evaluation results.

Intervention group:	$0, no call	$10, no call	$20, no call	$0, call	$10, call	$20, call
Intend to treat population	621	621	621	621	621	621
Number of phone connections	7	21	21	18	26	29
Number of web connections	4	2	8	6	4	1
Total (phone and web) number of connections	11	23	29	24	30	30
Costs and ratios without web connection						
Total cost	$2241.04	$2799.23	$3191.10	$3009.11	$3558.69	$3885.52
Average cost-effectiveness ratio (no reference)	$320.15	$133.30	$151.96	$167.17	$136.87	$133.98
Incremental cost-effectiveness ratio	(Reference)	$39.87	$67.86	$69.82	$69.35	$74.75
Costs and ratios with web connection						
Total cost	$2736.04	$3294.23	$3686.10	$3504.11	$4070.67	$4380.52
Average cost-effectiveness ratio (no reference)	$248.73	$143.23	$127.11	$146.00	$135.12	$146.02
Incremental cost-effectiveness ratio	(Reference)	$46.52	$52.78	$59.08	$69.35	$86.55
Costs of individual components						
Printing of mailer and inserts	$348.32	$348.32	$348.32	$348.32	$348.32	$348.32
Landing webpage	$495.00	$495.00	$495.00	$495.00	$495.00	$495.00
Mailing postage and addressing	$591.00	$591.00	$591.00	$591.00	$591.00	$591.00
Mailing list (in-house)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Incentives	$0.00	$293.25	$659.75	$0.00	$382.50	$682.50
Labor						
Meetings	$253.04	$253.04	$253.04	$253.04	$253.04	$253.04
Mailing list generation	$134.16	$134.16	$134.16	$134.16	$134.16	$134.16
Mailing coordination	$117.39	$117.39	$117.39	$117.39	$117.39	$117.39
Applying inserts/filling envelopes	$268.32	$268.32	$268.32	$268.32	$268.32	$268.32
Processing return mail	$5.59	$5.59	$5.59	$5.59	$5.59	$5.59
Managing/training call center	$402.48	$402.48	$402.48	$402.48	$402.48	$402.48
Other training/technical assistance	$67.08	$67.08	$67.08	$67.08	$67.08	$67.08
Receiving calls (in response to mail)	$53.66	$154.28	$154.28	$60.37	$100.62	$127.45
Making proactive calls	$0.00	$0.00	$0.00	$694.28	$694.28	$694.28
Generating incentive lists	$0.00	$58.34	$73.56	$0.00	$76.10	$76.10
Ordering and preparing incentives	$0.00	$67.08	$67.08	$0.00	$67.08	$67.08
Generate incentive letter/stuff envelopes	$0.00	$38.90	$49.04	$0.00	$50.73	$50.73
Material storage/transportation, phone lines	Sunk	Sunk	Sunk	Sunk	Sunk	Sunk

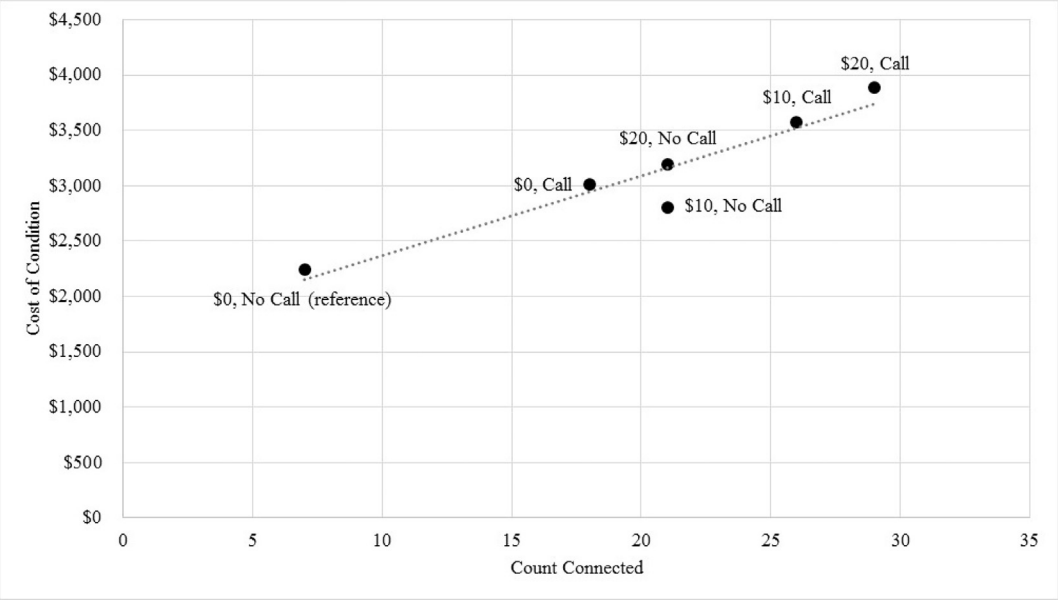

Fig. 4. Graphic depicting cost effectiveness ratio results for phone connections to QUITPLAN® Services, comparative cost (Y) over comparative benefit (X) per condition.

women smokers to tobacco treatment services. We found that financial incentives or proactive calling increased connections to services, and incentives had the most marked impact.

Recent research has shown that incentives encourage both treatment engagement and abstinence among low-income women and men (Tong et al., 2018; Slater et al., 2016; Fraser et al., 2017). Yet questions remain about how incentives can be scaled to generate population-level impact among low-SES smokers (Anderson et al., 2018; Slater et al., 2016; Blumenthal et al., 2013). We found that women who received an incentive were more likely to connect to treatment services, regardless of whether they received a proactive call. Additionally, receiving a proactive call from patient navigators increased treatment engagement, supporting previous research (Fu et al., 2014; Haas et al., 2015). The interaction between financial incentives and proactive calls was not significant, suggesting each component had a robust main effect across the different component combinations. However, the small cell sizes made significance tests for the interaction terms less reliable.

Using financial incentives in public health practice is both effective and cost-effective (Fraser et al., 2017; Loewenstein et al., 2013), and there are multiple reasons why incentives influence behavior change (Gneezy et al., 2011). In this study we used modest incentives relative to previous research (e.g., Volpp et al., 2009; Fraser et al., 2017), and we found offering $10 or $20 can encourage quitline connections. Using $10 can be as effective as using $20; moreover, coupling direct mail with a $10 incentive without a proactive call had the best outcomes relative to costs.

4.1. Implications for practice

Similar to other quitlines, QUITPLAN Services reaches between 1% and 2% of Minnesota smokers per year (Zhu et al., 2012; North American Quitline Consortium, 2016; Keller et al., 2016; Kerr et al., 2019). Research indicates that quitline connection rates are lower among low-SES populations (e.g., Burns et al., 2011; Babb et al., 2017). The connection rates for the current study (ranging from 1.2% to 5.1%) indicate that the intervention components could help to bolster quitline connections, particularly among low-SES smokers.

We used previous research on direct mail and research conducted through Sage as a benchmark for success (Slater et al., 2005; Slater et al., 2018; Slater et al., 2016). We expected response and connection rates between 2% and 3%. Connection rates for the incentive arms all exceeded 3%. Similar interventions have produced response and connection rates between 0.1% and 7.8% (Vidrine et al., 2013; Anderson et al., 2018), indicating the current intervention produced moderate to high quitline connection rates according to previous research (Tong et al., 2018).

Interventions conducted within primary care settings are more intensive and can produce quitline connection rates up to 7.8% (Vidrine et al., 2013), but these interventions tend to be more difficult to scale. In contrast, the current intervention produced moderately lower connection rates but could be scaled to population-based practice, particularly within organizations that serve low-income populations such as NBCCEDPs and state Medicaid programs (Anderson et al., 2018; Tong et al., 2018).

Early and ongoing collaboration among the research team, Sage staff, and staff who administer the state quitline was vital. All parties collectively developed a protocol for connecting participants to services that fit with ongoing operations. Close coordination ensured that all parties could accurately communicate with participants, especially about the incentives, which were administered and delivered by Sage staff. Organizations considering this approach should consult with quitline staff early in the planning process to ensure alignment with operations.

4.2. Limitations

We did not assess cessation and we lacked abstinence data. Previous research demonstrates that cessation rates of smokers (i.e., 30-day point prevalence) who connect to quitlines in response to programs designed to increase uptake of quitline services is between 20% and 25% (Miller et al., 2003; Slater et al., 2016). Future research should assess the relative impact of proactive calling and financial incentives on long-term cessation outcomes in order to identify cessation rates in response to the current intervention.

The raw total of women connected to the quitline in our study was small. Participants might have considered the direct mail piece to be junk mail. In addition, the context within which an incentive is offered and the wording used to describe an incentive can impact effectiveness (Thirumurthy et al., 2019; Parks et al., 2016; Gneezy et al., 2011). The wording of the incentive offer and its placement on a direct mail piece

in the current project might have been less clear to participants, potentially limiting impact. Other forms of communication could have potentially made the incentive offer clearer. Future research should test these alternative approaches, such as social media or texting. These alternative approaches should also be considered for populations without a permanent address, and future research should test new methods for administering incentives within populations who do not have access to phones.

This was a one-off trial and the outcomes may change if the program was sustained over time; the experimental effects may not remain consistent over an extended period of time. Finally, our sample was strictly low-income females, and results should be interpreted in that vein.

5. Conclusion

The tobacco epidemic disproportionately affects low-SES women. Our randomized trial demonstrated that a population-based intervention that coupled direct mail with a modest financial incentive successfully connected low-SES women smokers to tobacco treatment services. Coupling direct mail with a proactive call also increased connections to treatment services. This intervention has potential for widespread dissemination, and programs should choose components based on capacity and budget. Our recommendation is that connecting low-SES smokers to quitline services using direct mail coupled with $10 incentives is optimal in terms of both effectiveness and cost.

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Declaration of competing interest

The authors declare that there is no conflict of interest.

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