A Randomized Controlled Trial of Financial Incentives for Smoking Cessation

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Abstract

Background: **Although 435,000 Americans die each year of tobacco-related illness, only ~3% of smokers quit each year. Financial incentives have been shown to be effective in modifying behavior within highly structured settings, such as drug treatment programs, but this has not been shown in treating chronic disease in less structured settings. The objective of this study was to determine whether modest financial incentives increase the rate of smoking cessation program enrollment, completion, and quit rates in a outpatient clinical setting.**

Methods: **179 smokers at the Philadelphia Veterans Affairs Medical Center who reported smoking at least 10 cigarettes per day were randomized into incentive and nonincentive groups. Both groups were offered a free five-class smoking cessation program at the Philadelphia Veterans Affairs Medical Center. The incentive group was also offered $20 for each class attended and $100 if they quit smoking 30 days post program completion. Self-reported smoking cessation was confirmed with urine cotinine tests.**

Results: The incentive group had higher rates of program enrollment (43.3% versus 20.2%; $P < 0.001$) and completion (25.8% versus 12.2%; $P = 0.02$). Quit rates at 75 days were 16.3% in the incentive group versus 4.6% in the control group ($P = 0.01$). At 6 months, quit rates in the incentive group were not significantly higher (6.5%) than in the control group (4.6%; $P > 0.20$).

Conclusion: **Modest financial incentives are associated with significantly higher rates of smoking cessation program enrollment and completion and short-term quit rates. Future studies should consider including an incentive for longer-term cessation.** (Cancer Epidemiol Biomarkers Prev 2006; 15(1):12–8)

Introduction

Smoking is the leading preventable cause of death in the United States, accounting for ~435,000 deaths each year (1). This burden is distributed widely across the United States but is disproportionately borne by those in lower socioeconomic groups who are more likely to smoke and more likely to suffer from smoking-related illness (2).

Effective treatments for tobacco addiction such as smoking cessation programs do exist (3) and are highly cost-effective (4-6). Yet, they are underutilized, as only ~5% who try to quit smoking enroll in such programs (7). A significant majority of smokers (~70%) report wanting to quit smoking (5) but only ~2.5% (8) to 3% (9) of smokers succeed in quitting each year. This suggests that if more smokers trying to quit used effective programs, quit rates could increase substantially.

Financial incentives for smoking cessation program enrollment or successful smoking cessation could be an important mechanism to increase smoking cessation rates by increasing utilization of effective programs. The use of financial incentives to this point has generally been limited to two contexts: (*a*) reducing drug use within drug treatment programs (10-13); (*b*) increasing rates of utilization of one-time beneficial services such as follow-up of abnormal pap smears (14). In the context of smoking cessation, financial incentives have been shown to increase enrollment in smoking cessation programs in worksite settings and improve short-term quit rates among pregnant women (15, 16). However, it is unknown whether such incentives can work in the populations of patients who are at highest risk for smoking-related illnesses (long-term heavy smokers), treated in the type of primary care clinical settings where most outpatient care is delivered. Previous studies to evaluate this have been limited by nonexperimental designs, self-reported cessation outcomes, and weak incentives (17, 18).

Motivational theory and previous empirical work suggest that incentives for program utilization may bring more smokers into treatment by increasing their extrinsic motivation levels but do not necessarily lead to higher cessation rates, as follow-through with program objectives may be lower in this group (19). By providing both an incentive for program enrollment and for short-term tobacco cessation, we test this premise. However, if intrinsic motivation levels are lower at baseline among short-term quitters in the incentive group compared with the control group, higher rates of relapse between short-term and long-term quitters may be observed in the incentive group. We measure intrinsic and extrinsic motivation scores and examine whether intrinsic motivation scores are lower among quitters in the incentive group than

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control group and among any incentive group participants who relapse compared with those who do not.

The continued rapid increase in health care costs has highlighted the fact that health behaviors are a substantial contributor to health care costs and preventable morbidity and mortality (1). High rates of unhealthy health habits are blamed for surging health care costs (20) and declining stock prices (21) at large employers like General Motors. There is the potential to substantially reduce rates of cancer and cardiovascular disease, as well as associated health care costs, if innovative approaches to changing health behaviors such as the use of incentives are effective in treating chronic addictions such as smoking.

In this randomized controlled trial, we tested whether provision of modest financial incentives would significantly increase rates of tobacco cessation program enrollment, program completion, and tobacco cessation among a group of predominantly low socioeconomic status patients treated within primary care clinics at a Veterans Health Administration hospital. Our primary objective was to examine the feasibility of conducting such a study in a primary care clinical setting. The study was powered to examine the primary end point of tobacco cessation program enrollment.

Materials and Methods

Study Population. This study was conducted at the Philadelphia Veterans Affairs Medical Center. Figure 1 shows the flow of participants through the enrollment, intervention, and follow-up phases of the trial. To recruit participants who were not necessarily interested in joining a smoking cessation program, we invited all self-identified smokers in waiting rooms of the outpatient clinics between February and October 2003 to complete a survey in exchange for a free Veterans Affairs baseball cap. Participants were asked to review a consent form at that time and all patients who provided written consent were screened for eligibility. Criteria were designed so that all patients deemed eligible could safely be prescribed nicotine patches. Eligible individuals were current cigarette smokers of ages $\geq$18 years who smoked $\geq$10 cigarettes per day for the prior 12 months. Exclusion criteria included current treatment for drug or alcohol use; consumption of >21 alcoholic drinks per week; current use of chewing tobacco; myocardial infarction or stroke within the past 4 weeks; severe or worsening angina; serious arrhythmias; uncontrolled severe hypertension (systolic blood pressure > 180); current addiction to prescription medicines or street drugs; current prescriptions of bupropion or medication for manic depression; rash or skin irritation when using bandages or skin adhesive tape; and current pregnancy, breast-feeding, or plans to become pregnant.

Study Protocol. The protocol was approved by the Institutional Review Board of the Philadelphia Veterans Affairs Medical Center and all participants provided informed consent. All eligible participants were included in the intent-to-treat analysis. One hundred seventy-nine patients were randomly assigned to receive either an invitation to join a free five-session smoking cessation program that met every 2 weeks at the Philadelphia Veterans Affairs Medical Center or the same free smoking cessation program at the Philadelphia Veterans Affairs Medical Center plus a series of financial incentives. All patients who enrolled in the smoking cessation program were offered free nicotine patches and a 2-week supply was received at each class. The quit date was set for midnight before the second session (2 weeks following the first session of the program). Participants then received a 21 mg/d nicotine patch for 4 weeks, followed by a 14 mg/d nicotine patch for 2 weeks and a 7 mg/d nicotine patch for 2 weeks. Participants were asked not to use any other nicotine-containing products during this study and were not offered zyban so that treatments across groups would be standardized.

Participants in the incentive group were offered $20 to attend each of the five sessions (total of $100 only if all five sessions were attended) plus $100 if they self-reported quitting smoking 30 days after program completion (75 days after scheduled quit date in the program) with biochemical confirmation with a urine cotinine test. Cessation was measured both 30 days and 6 months after program completion.

The smoking cessation program consisted of five sessions of standardized behavioral group counseling and included instruction in the management of smoking triggers, relapse prevention, and stress management techniques. The instructor for all classes was the same and the counselor was trained to follow closely a standardized protocol for each of the five sessions.

Randomization Procedures. Randomization was carried out using permuted block sizes of four and stratification using a cut point of two packs of cigarettes per day because heavy smokers are a group at highest risk for smoking-related illnesses, whose quit rates tend to be very low (22, 23). The intake surveys were numbered sequentially on collection, and allocation to groups was done using a computer-generated list of random numbers to randomize subjects to receive one of two letters: a letter inviting them to enroll in a smoking cessation program or a letter that contained the same information plus a description of the available incentives. The offering of incentives was the principal element of the intervention. Participants in the incentive group were scheduled to attend sessions separate from participants in the control group because of concerns that having participants from the two groups within the same classes would create crosstalk that could affect study participation and outcomes among those not receiving incentives.

Participants were not told that they would be randomized to a financial incentive arm versus a usual care arm. Hidden randomization was felt to be an important feature of the study design so as not to create relative disincentives to those randomized to usual care, and randomization to receive small monetary incentives was felt to create no risk of harm above usual care. Participants were fully informed about the design of the study following completion of the long-term follow-up assessment.

The same instructor taught all sessions (three separate sessions for incentive group; two separate sessions for control group) and was blinded to the assignment to condition. Study participants were not given individualized instruction between sessions to minimize potential variation in the dose of treatment received. Research staff other than the class instructor were responsible for distributing incentives to participants outside of the instructor's presence. Following completion of the five sessions, we assessed whether the counselor was successfully blinded about group assignment and whether knowledge of group assignment independently predicted better outcomes for participants in sessions the instructor thought were receiving incentives.

Data Collection Procedures. Attendance at each session of the smoking cessation program was recorded. Short-term quit rates were ascertained 75 days following the quit date, which was ~30 days following the end of the classes (mean 35.5 days incentive group, range 24-57 days; mean 35.5 days control group, range 24-50 days). At this time, all participants were contacted by phone and asked whether they had smoked at all in the previous 7 days. We attempted to reach each participant at least 10 times at different times of day before labeling participants as ''lost to follow-up.''

Participants who reported complete abstinence (not even a puff of a cigarette) for at least 7 days before the assessment were asked to come in for biochemical verification of

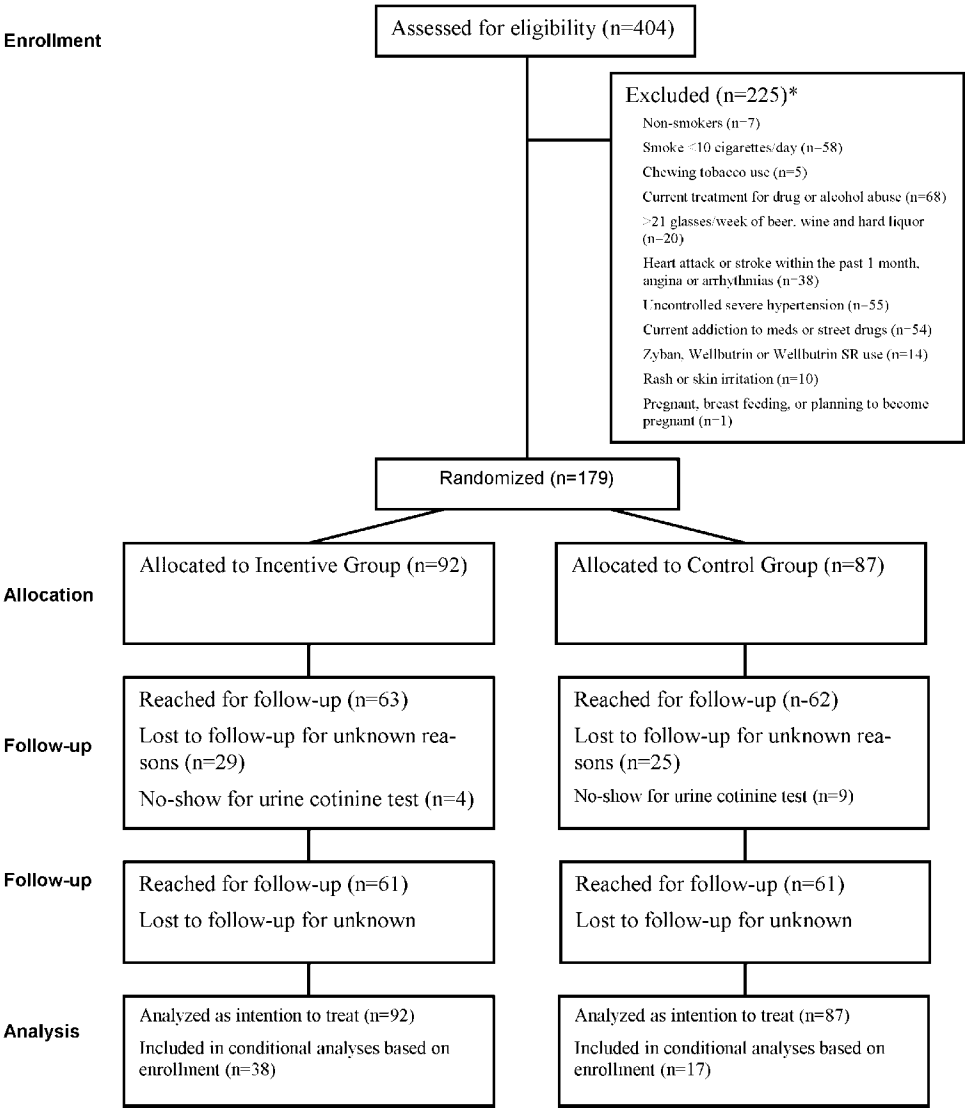

Figure 1. Flow diagram of trial participation.

abstinence using a urine cotinine test within 1 week of the follow-up interview (24). Abstinence was confirmed by a urine cotinine level of <500 ng/mL (25). All participants who completed this test were given $20 to reimburse them for their time and travel expense. Participants who attended none or only some of the classes were contacted at the same point as participants who attended all of the classes to determine whether they had quit smoking. Long-term quit rates were assessed among smokers with cotinine-confirmed short-term tobacco cessation ~6 months after program completion (mean 195 days incentive group, range 185-208 days; mean 201 days control group, range 195-210 days). This approach was applied equally to participants in the control and incentive groups.

Outcome Variables. The primary end point was initial enrollment within the smoking cessation program. Participants were recorded as having enrolled if they attended the first session of the program. Secondary end points included cumulative attendance at the smoking cessation program (zero to five sessions) and completion of the smoking cessation program. Participants were defined as having completed the smoking cessation program if they attended classes 1, 2, and 5, plus either class 3 or 4 or both.

Seven-day point-prevalence (self-reported) smoking cessation at 30 days following program completion was the main measure used to assess short-term quit status. This measure required 7 days of continuous abstinence biochemically verified by a negative urine cotinine test (24). Thirty days post program completion represented 75 days after scheduled quit dates given the timing of quit dates in the smoking cessation program. Self-reported seven-day point-prevalence smoking cessation at 6 months following program completion (~7.5 months after quit dates) among participants who had confirmed smoking cessation at 1 month was the main measure used to assess long-term quit status. Whereas only point prevalence can be confirmed using cotinine testing, it is likely that point prevalence is highly correlated with prolonged abstinence both 75 days and 7.5 months after the initial quit date (26). A successful quit outcome was not contingent on participants enrolling in the smoking cessation program as participants could receive tobacco cessation incentives without attending any of the smoking cessation classes.

Covariates. Pretreatment level of nicotine dependence was assessed with several items: the number of cigarettes smoked per day, number of years smoked, and the Fagerstrom test for nicotine dependence (ref. 27; a score of ≥7 was used to classify participants as highly nicotine dependent) (28). We also assessed other potentially important predictors of effectiveness of the incentives in increasing attendance at smoking cessation classes and quit rates such as longest quit attempt within the past year, self-reported distance lived from Veterans Affairs Medical Center (time in minutes), income, age, and intrinsic and extrinsic motivation scores (29).

Statistical Analysis. We determined the original sample size based on a projected 80% enrollment rate in the incentive group compared with 60% in the nonincentive group. A sample of 100 per group would give this study >80% power to examine smoking cessation program enrollment at a 5% level of significance with the use of a one-sided test of equality of proportions. A one-sided test was used because it was considered extremely unlikely that incentives would lower the rates of any of these end points, and we were willing to forego statistical tests rejecting the null hypothesis of no difference if incentives were observed to lower these rates.

The similarity of the treatment groups with respect to covariates at baseline was analyzed by Pearson's χ^2 test for categorical variables and Student's *t* test or Wilcoxon rank sum for continuous variables as appropriate. We used χ^2 test to compare the incentive and control groups on enrollment and tobacco cessation rates. We tested whether any of our primary or secondary outcomes were affected by income or degree of tobacco dependence by comparing the homogeneity of the odds ratios across strata (e.g., comparing the effect of incentives on quit rates among heavy and light smokers) using a Breslow-Day test. We used an intent-to-treat approach in all analyses. We assumed that any participants lost to follow-up or who did not arrive at scheduled cotinine tests had continued to smoke (24). Missing data values (<10% of the values were missing for any individual covariate) were imputed using the means for the incentive or control group, respectively. SAS statistical software was used for all calculations. All *P* values and 95% confidence intervals were two sided.

Results

Table 1 reports the characteristics of study participants at baseline. Ninety-two participants were randomized to the incentive group and 87 to the control group. The degree of nicotine dependence and the sociodemographic characteristics of participants did not differ significantly between the control and incentive groups. The average age of the participants was 52.7 years; 94% were men, 24.6% were Caucasian, and 65.4% were black. The median annual household income was below $15,000; 41.6% reported being high school graduates and an additional 42.8% had completed some college. On average, participants smoked a mean of 21.9 (SD, 11.4) cigarettes per day and had smoked an average of 30.3 years; 34.4% had high nicotine dependence as defined by a score of ≥7 on the Fagerstrom test for nicotine dependence (28); and 16.8% of smokers smoked more than two packs of cigarettes per day. The average time reported to travel to the Veterans Affairs Medical Center was 45.5 minutes. Baseline intrinsic and extrinsic motivation scores did not differ between the incentive and control groups.

Twenty-nine participants were lost to follow-up within the incentive group compared with 25 in the control group. Four of 22 patients in the incentive group and 9 of 17 patients in the control group self-reported quitting but did not report for biochemical confirmation.

Participants in the incentive group were significantly more likely to enroll (41.3% versus 19.5%; $\chi^2 = 9.95$, $P = 0.002$) and more likely to complete the program (25.0% versus 11.5%; $\chi^2 = 5.42$, $P = 0.020$) than participants in the control group. Conditional on program enrollment, both groups had similar completion rates of ~60% ($P = 0.91$) and attended similar numbers of sessions (~4; $P = 0.90$; Table 2).

Quit rates were significantly higher in the incentive group compared with the control group at 30 days following program completion (75 days after quit dates; 16.3% versus 4.6%; $\chi^2 = 6.46$, $P = 0.01$). Among participants who attended the first session, quit rates were higher within the incentive group, although not to a significant degree (39.5% versus 23.5%; $\chi^2 = 1.32$, $P = 0.25$) as the relatively small numbers attending the first class provided low statistical power for this comparison.

Quit rates were not significantly higher in the incentive group at 6 months (6.5% versus 4.6%; $\chi^2 = 0.31$, $P = 0.57$). Among the 15 confirmed nonsmokers in the incentive group at 1 month, at 6-month follow-up, 5 reported resuming smoking, 2 were lost to follow-up, and 8 self-reported remaining abstinent. Of the 8 self-reported quitters, 6 were confirmed to be abstinent by cotinine testing, 1 had a positive urine cotinine test, and 1 missed three consecutive appointments for a urine test.

Subgroup Analyses. The effects of enrollment and 30-day quit rates by incentive group based on heavy smoker status are illustrated in Fig. 2. We assessed differences in results by heavy smoking status as specified a priori in the analysis plan. Whereas the enrollment and quit rates were higher in the incentive than control group for both non-heavy smokers and

Table 1. Characteristics of patients in sample

	Control group ($n = 87$)	Incentive group ($n = 92$)	*P*, test of differences
Demographics			
Average age (y)	52.2	53.1	0.52
Male (%)	97.7	90.8	0.05
White (%)	22.4	28.4	0.36
Highest grade of school completed			
Some high school or lower (%)	12.9	18.2	0.34
Completed high school or GED (%)	43.5	39.8	0.62
Some college or higher (%)	43.5	42.1	0.84
Total annual household income from all sources			
% Total annual household income <$15,000 (%)	51.3	48.8	0.75
% Total annual household income $15,000-$29,999 (%)	27.5	34.2	0.36
Covariates			
No. cigarettes/d	20.5	23.2	0.12
Years smoked	29.2	31.4	0.24
Longest quit attempt in last year (d)	98.2	89.3	0.83
Distance from Veterans Affairs Medical Center (self-report of minutes traveled)	48.7	42.5	0.15
Fagerstrom addiction score			
≥7, high degree of dependence (%)	37.2	31.8	0.47
Heavy smokers, >2 packs/d (%)	16.1	17.4	0.82
Intrinsic motivation score	3.6	3.6	0.98
Extrinsic motivation score	2.4	2.5	0.39

Table 2. Differences in enrollment, completion, and quit rates in incentive and control groups

Outcome measures	Control, $N = 87$	Incentive, $N = 92$	P
Enrollment, N (%)	17 (19.5)	38 (41.3)	0.002
Number of classes attended			
Overall	1.7	0.8	0.002
Conditional on enrollment	4.1	4.1	0.9
Program completion, N (%)			
Overall	10 (11.5)	23 (25)	0.02
Conditional on enrollment	10 (58.8)	23 (60.5)	0.91
Confirmed quit—30 d, N (%)			
Overall	4 (4.6)	15 (16.3)	0.01
Conditional on enrollment	4 (23.5)	15 (39.5)	0.25
Confirmed quit—6 mo, N (%)			
Overall	4 (4.6)	6 (6.5)	0.57
Conditional on enrollment	4 (23.5)	6 (15.8)	0.49

heavy smokers, the differences between control and incentive group were qualitatively larger among heavy smokers. Specifically, 31.3% (5 of 16) of heavy smokers in the incentive group had negative cotinine tests at 30 days compared with 0% (0 of 14) of heavy smokers in the control group (Fisher's exact $P = 0.16$). Among non-heavy smokers, the corresponding figures were 13.2% and 5.5%. At 6 months, 12.5% (2 of 16) of the heavy smokers in the incentive group remained abstinent compared with 0% of smokers in the control group (Fisher's exact $P = 0.49$). We examined the homogeneity of odds ratios across heavy and light smokers but found no significant differences in the odds ratios between heavy and non-heavy smokers of smoking cessation at either 30 days or 6 months (not shown).

We compared intrinsic motivation scores for participants who had cotinine confirmed tobacco cessation at 30 days. Control group tobacco quitters had qualitatively higher intrinsic motivation scores than incentive group quitters (4.4 versus 3.7; $P = 0.18$) but these differences were not statistically significant. Incentive group quitters had similar intrinsic motivation scores as nonquitters (3.7 versus 3.6; $P = 0.59$) Among short-term quitters who relapsed versus those who did not, intrinsic motivation scores were also very similar (3.8 versus 3.7; $P = 0.97$). Extrinsic motivation scores at baseline were statistically no different in all three of these comparisons.

Following completion of the program, we determined that the instructor had become aware of group assignment for three of the five classes over the course of the study (two of three incentive session groups and one of two control session groups). The difference in 30-day quit rates between incentive and control sessions was greater for the sessions in which the teacher was unaware of group assignment (22.2 percentage points) than in classes in which the teacher was aware of group assignment (3.2 percentage points), indicating that differences in short-term quit rates were not due to instructor knowledge of incentive status.

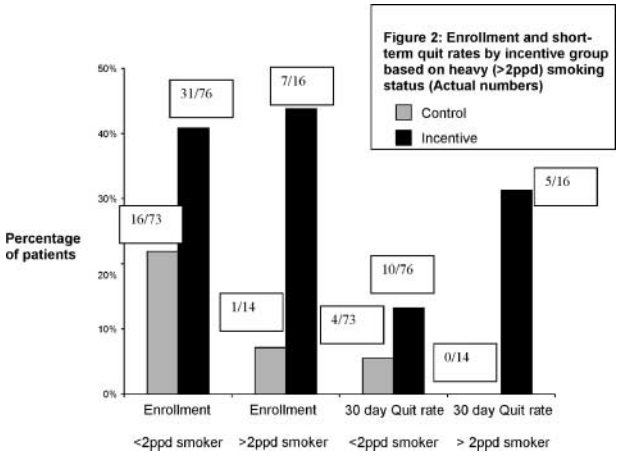

Figure 2. Enrollment and short-term quit rates by incentive group based on heavy [>2 packs per day (*ppd*)] smoking status (actual numbers). □, control; ■, incentive.

Discussion

To our knowledge, this is the first randomized trial to show that modest financial incentives can significantly increase short-term tobacco cessation rates among smokers in a primary care clinical setting. Although this study was designed as a feasibility study to test whether we could significantly increase enrollment in a smoking cessation program, we found a significantly higher smoking cessation rate at 75 days (30 days post program completion) in our incentive group (16.3%) compared with the control group (4.6%). The fact that these quit rates were measured 75 days after the target quit date indicates that these patients remained abstinent beyond the treatment phase. The quit rate in our control group of 4.6% was similar to national averages (5, 30). We did not find a significant difference in 75-day quit rates conditional on initial program enrollment. However, the difference in these rates (23.5% in control group, 39.5% in incentive group; $P = 0.25$) suggests that in a larger sample, bonuses targeted directly at quitting may have significant independent effects. Future studies will be needed to examine effects of incentives on both short-term and long-term quit rates.

Whereas there were no relapses within the control group and a high rate of relapse in the intervention group, the findings still provide some support for financial incentives for two reasons: (*a*) There is evidence from a number of studies (31-33) that the more times a smoker quits, the greater his or her chances of achieving long-term abstinence; thus, even a short-term quit attributable to financial incentives may have longer-term benefits. And (*b*) these results suggest that it is possible that incentives distributed over a longer-term period may be a cost-effective approach to support longer-term abstinence. This is important and must be further explored.

As tobacco dependence disproportionately affects low socioeconomic status patients and is associated with high rates of cancer, reducing tobacco dependence could be a mechanism for reducing health disparities in the number of deaths from lung cancer and other smoking-related diseases which disproportionately affect lower socioeconomic status populations (34). Our study was done within a Veterans hospital clinic and nearly 70% of the patients were African-American. Nearly all of the participants had incomes of <$30,000 per year.

These results represent an extension of what we know about the role of financial incentives on smoking cessation treatments. Reducing the cost of smoking cessation treatments to zero through full insurance has been associated with higher annual rates of utilization of smoking cessation programs (2.4% in group with reduced coverage, 10% among those with full coverage) and higher quit rates (0.7% per year with reduced insurance coverage to 2.8% with full coverage; ref. 35). However, this study also showed that quit rates from the 6-month follow-up of actual treatment participants were lower (28% with full coverage compared with 38% with reduced coverage; $P = 0.09$), suggesting that while incentives may increase utilization of services and thereby quit rates overall, quit rates may be lower among those who use services. It is important to consider motivational theory in this context. Study participants in the incentive group had qualitatively lower intrinsic motivation scores than control group respondents but these differences were not statistically significant. We did not find differences in intrinsic motivation scores among participants in the incentive group who quit versus those who did not and among those who relapsed compared with those who did not, but these scores might have been better measured at different points in time (e.g., closer in time to the quit dates or following short-term cessation, respectively) as opposed to measurement at baseline. Further work should seek to understand the interplay between intrinsic and extrinsic motivations in incentive-induced behavior.

The financial incentives provided in our design effectively lowered the price of smoking cessation treatment below zero. Economists have long suggested that subsidies or negative prices may be appropriate for cost-effective treatments in which expected cost savings may exceed the price of treatment (36); however, while increases in copayments are widely used to decrease utilization, reductions in copayments have yet to be used extensively to increase utilization of beneficial, cost-effective services. This study shows that smoking cessation program enrollment and completion and short-term quit rates are higher under these conditions.

There are strong incentives for employers with low employee turnover rates to consider this approach, as increasing tobacco cessation rates can result in substantial savings from reduced absenteeism and increased productivity as well as short-term reductions in future medical expenditures. It has been estimated that each adult smoker incurs annual costs of $1,760 in lost productivity and $1,623 in excess medical expenditures (37). Insurers and health care systems such as the Veterans Administration could also find this a highly cost-effective way to improve health. Although community organizations may also find this a cost-effective intervention, it may be more difficult to fund these incentive programs through community-based mechanisms. Most commonly, financial incentives have been used to promote smoking cessation in community and worksite settings through a combination of monetary payments, competitions, entries into lotteries, and prizes of cash or merchandise (17). Interpretation of quit rates in these programs is difficult as many of them measure quit rates conditional on program enrollment and are based on nonexperimental designs. Evaluation of the effectiveness of financial incentives for smoking cessation in worksite settings (38) has been limited by the widespread use of randomization by worksite with small numbers of sites, which may bias the effects of the incentives, as measured differences between sites may be attributable to differences in site-specific factors other than incentives (39). Many of the trials showed qualitative increases in enrollment or quit rates but the magnitude of the incentives was too small for these increases to be statistically significant. For example, a recent study randomized 24 worksites to one of six experimental conditions, half of which included incentives. The incentives offered included $10 for joining a cessation program, $20 for completing three fourths of the program, and $20 plus entrance into a lottery with an expected value of $0.50 to $1.50 for tobacco cessation. Smoking cessation program participation increased significantly from 12% to 22%. There was no increase in tobacco cessation in this study (15) but the incentives offered were comparatively modest.

Our study has several potential limitations. Whereas participants were randomized as individuals, they were placed by condition in different session groups because of the potential for intraclass conflict if only some participants within a given class were getting incentives. To explore the possibility of counseling group effects, we estimated the effects of counseling group on completion rates and short-term quit rates. Adjustment for counseling group (within intervention condition) did not alter the results for effects of incentive condition. We think that clustering was not a major issue because subjects were randomized individually, not by class; there were only two classes within the control group and three in the incentive group; and all classes were taught by the same instructor who was blinded about group assignment. Whereas this blinding was not completely effective, we found that there was a larger difference in quit rates between the incentive and control groups for which the instructor did not know group assignment than for the ones in which she did. We enrolled fewer participants than anticipated in our power calculations, but this made no difference in qualitative interpretation of results because our findings were either highly significant or not close to being significant. Although there are multiple measures of outcome because our P values are below the Bonferroni correction level ($0.05/3 = 0.0167$) for program enrollment and short-term smoking cessation and clearly above this level for long-term smoking cessation, the multiple comparisons do not qualitatively affect interpretation of the main results. A substantial number of patients were lost to follow-up, but given the likely low rates of tobacco cessation among such patients, we assumed that the baseline value (e.g., continuation of smoking) held true for these patients (40, 41). As is the case in any smoking cessation clinical trial, it is possible that study participants could have modified their smoking behavior in anticipation of being contacted for follow-up interviews and cotinine testing. This possibility may be greater in a study in which incentives for abstinence are provided. However, we believe this to be unlikely in most cases because participants knew that biospecimens would be tested to confirm abstinence, did not know the time period during which nicotine metabolites can be detected, and did not know the exact date at which they would be tested. Our objective in conducting 6-month follow-ups was to study sustained abstinence among subjects who initially responded to the financial incentives. Therefore, we cannot identify those subjects who may have had an initial abstinence period after the 1-month follow-up (late quitters). Finally, our study was conducted within a mostly African-American low-income population treated at the Philadelphia Veterans Affairs Medical Center. Low-income patients are likely to be more responsive to financial incentives of a given magnitude, and larger incentives would likely be necessary to have similar effects in higher socioeconomic status populations. Other characteristics of this population, such as a high percentage of men or African-Americans, would seem less likely to affect the generalizability of this intervention as there is no a priori reason why such incentives would be more or less effective in these groups independent of income.

This study shows that modest financial incentives can significantly increase smoking cessation program enrollment and short-term tobacco quit rates within community-based clinical settings. Modifying the program design to incorporate incentives at 6 months in a larger-scale study would allow testing of whether incentives could similarly improve

long-term quit rates. If successful, the payment of financial incentives for tobacco cessation could have a major effect in reducing the burden of tobacco-related illness in the United States.

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References

1. Mokdad AH, Marks JS, Stroup DF, Gerberding JL. Actual causes of death in the United States, 2000. JAMA 2004;291:1238–45.
2. Fagan P, King G, Lawrence D, et al. Eliminating tobacco-related health disparities: directions for future research. Am J Public Health 2004;94:211–7.
3. Hjalmarson A, Franzon M, Westin A, Wiklund O. Effect of nicotine nasal spray on smoking cessation. A randomized, placebo-controlled, double-blinded study. Arch Intern Med 1994;154:2567–72.
4. Eddy DM. David Eddy ranks the tests. Harv Health Lett 1992;(July suppl): 10–11.
5. Cromwell J, Bartosch WJ, Fiore MC, Hasselblad V, Baker T. Cost-effectiveness of the clinical practice recommendations in the AHCPR guideline for smoking cessation. JAMA 1997;278:1759–66.
6. Coffield AB, Maciosek MV, McGinnis JM, et al. Priorities among recommended clinical preventive services. Am J Prev Med 2001;21:1–9.
7. Zhu S, Melcer T, Sun J, Rosbrook B, Pierce JP. Smoking cessation with and without assistance: a population-based analysis. Am J Prev Med 2000;18: 305–11.
8. Bartlett J, Miller L, Rice D, Max W. Medical care expenditures attributable to cigarette smoking: United States, 1993. MMWR Morb Mortal Wkly Rep 1994;43:469–72.
9. Hughes JR. Motivating and helping smokers to stop smoking. J Gen Intern Med 2003;18:1053–7.
10. Higgins ST, Silverman K, editors. Motivating behavior change among illicit drug abusers: research on contingency management interventions. Washington (DC): American Psychological Association; 1999.
11. Higgins ST. Applying behavioral economics to the challenge of reducing cocaine abuse. In: Chaloupka F, Grossman M, Bickel WK, Saffer H, editors. The economic analysis of substance use and abuse. Chicago: University of Chicago Press; 1999. p. 157–74.
12. Petry NM, Simcic F. Recent advances in the dissemination of contingency management techniques: clinical and research perspectives. J Subst Abuse Treat 2002;23:81–6.
13. Shoptaw S, Rotheram-Fuller E, Yang X, et al. Smoking cessation in methadone maintenance. Addiction 2002;97:1317–2.
14. Marcus A, Kaplan CP, Crane LA, Berek JS, Bernstein G, Gunning JE. Reducing loss to follow-up among women with abnormal pap smears: Results from a randomized trial testing an intensive follow-up protocol and economic incentives. Med Care 1998;36:397.
15. Hennrikus DJ, Jeffery RW, Lando HA, et al. The SUCCESS project: the effect of program format and incentives on participation and cessation in worksite smoking cessation programs. Am J Public Health 2002;92:274–9.
16. Donatelle RJ, Prows SL, Champeau D, Hudson D. Randomised controlled trial using social support and financial incentives for high risk pregnant smokers: Significant Other Supporter (SOS) program. Tob Control 2000;9:11167–9.
17. Bain N, Pickett W, Hoey J. The use and impact of incentives in population-based smoking cessation programs: a review. Am J Health Promot 1998;12: 307–20.
18. Donatelle RJ, Hudson D, Dobie S, Goodall A, Hunsberger M, Oswald K. Incentives in smoking cessation: status of the field and implications for research and practice with pregnant smokers. Nicotine Tob Res 2004;9: S163–79.
19. Curry SJ, Wagner EH, Grothaus LC. Evaluation of intrinsic and extrinsic motivation interventions with a self-help smoking cessation program. J Consult Clin Psychol 1991;59:318–24.
20. Hawkins L. As GM battles surging costs, workers' health becomes issue. The Wall Street Journal. 2005 April 7; sect. A:1.
21. Hakim D, Peters JW. Shares of GM tumble on issue of health care. The New York Times. 2005 April 15; sect. C:4.
22. Hymowitz N, Cummings KM, Hyland A, Lynn WR, Pechacek TF, Hartwell TD. Predictors of smoking cessation in a cohort of adult smokers followed for five years. Tob Control 1997;6 Suppl 2:S57–62.
23. U.S. Department of Health and Human Services. The health benefits of smoking cessation. Atlanta, Georgia: Centers for Disease Control and Prevention, National Center on Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 1990.
24. SRNT Subcommittee on Biochemical Verification. Biochemical verification of tobacco use and cessation. Nicotine Tob Res 2002;4:149–59.
25. Cummings SR, Richard RJ. Optimum cutoff points for biochemical validation of smoking status. Am J Public Health 1988;78:574–5.
26. Hughes JR, Keely JP, Niaura RS, Ossip-Klein DJ, Richmond RL, Swan GE. Measure of abstinence in clinical trials: issues and recommendations. Nicotine Tob Res 2003;5:13–25.
27. Heatherton TF, Kozlowki LT, Frecker RC, Fagerstrom KO. The Fagerstrom test for nicotine dependence: a revision of the Fagerstrom tolerance questionnaire. Br J Addict 1991;86:1119–27.
28. Westman EC, Behm FM, Simel DL, Rose JE. Smoking behavior on the first day of a quit attempt predicts long-term abstinence. Arch Intern Med 1997;157:335–40.
29. Curry S, Wagner EH, Grothaus LC. Intrinsic and extrinsic motivation for smoking cessation. J Consult Clin Psychol 1990;58:310–6.
30. Centers for Disease Control and Prevention. Smoking cessation during previous year among adults—United States, 1990 and 1991. MMWR Morb Mortal Wkly Rep 1993;42:504–7.
31. MacKenzie TD, Pereira RI, Mehler PS. Smoking abstinence after hospitalization: predictors of success. Prev Med 2004;39:1087–92.
32. Hymowitz N, Cummings KM, Hyland A, Lynn WR, Pechacek TF, Hartwell TD. Predictors of smoking cessation in a cohort of adult smokers followed for five years. Tob Control 1997;6 Suppl 2:S57–62.
33. Hymowitz N, Sexton M, Ockene J, Grandits G. Baseline factors associated with smoking cessation and relapse. Prev Med 1991;19:590–601.
34. Wong MD, Shapiro MF, Boscardin WJ, Ettner SL. Contribution of major diseases to disparities in mortality. N Engl J Med 2002;347:1585–92.
35. Curry SJ, Grothaus LC, McAfee T, Pabiniak C. Use and cost effectiveness of smoking-cessation services under four insurance plans in a health maintenance organization. N Engl J Med 1998;339:673–9.
36. Pauly MV, Held PJ. Benign moral hazard and the cost-effectiveness analysis of insurance coverage. J Health Econ 1990;9:447–61.
37. Centers for Disease Control and Prevention (CDC). Annual smoking-attributable mortality, years of potential life lost, and economic costs—United States, 1995-1999. MMWR Morb Mortal Wkly Rep 2002;51:300–3.
38. Matson DM, Lee JW, Hopp JW. The impact of incentives and competitions on participation and quit rates in worksite smoking cessation programs. Am J Health Promot 1993;7:270–80, 295.
39. Klesges RC, Cirgang JA. Worksite smoking cessation programs: clinical and methodological issues. Progress in Behavior Modification 1988;23: 36–61.
40. Ware JH. Interpreting incomplete data in studies of diet and weight loss. N Engl J Med 2003;348:2136–7.
41. Hall SM, Delucchi KL, Velicer WF, et al. Statistical analysis of randomized trials in tobacco treatment: longitudinal designs with dichotomous outcome. Nicotine Tob Res 2001;3:193–202.

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