Wisconsin
Department of Health Services

# Medicaid Incentives for the Prevention of Chronic Disease
# Wisconsin Striving to Quit—
# Quit Line Incentive Program
# Final Report

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**University of Wisconsin – Madison**
**Center for Tobacco Research and Intervention**

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## Abstract

**Importance:** Medicaid members and other low-income populations are especially likely to smoke, be unable to quit smoking, and suffer disproportionately from smoking-related harms. There is a great need to develop interventions that increase successful quit attempts in this population.

**Objective:** To evaluate the effectiveness of a monetary incentive to increase engagement in telephone Quit Line-based cessation treatment and improve abstinence at six-month follow-up among adult Medicaid members who smoke.

**Design, Setting, and Participants:** Two-group randomized quality improvement study recruiting adult members enrolled in Wisconsin Medicaid. Participants were recruited via two routes: clinic-based referrals (n = 920) from clinics in 18 counties and Quit Line-direct/community-based referrals from the Wisconsin Tobacco Quit Line (n = 980).

**Interventions:** Participants were randomized to either an Incentive Group (n = 948) or a Control Group (n = 952). All participants were offered five proactive Quit Line cessation counseling calls and were encouraged to obtain cessation medication (covered by Wisconsin Medicaid).

Only Incentive Group participants received compensation for taking counseling calls ($30 per call) and for biochemically verified abstinence at the six-month visit ($40). All participants received $40 for a baseline assessment and $40 for completing the six-month smoking test.

**Main Outcomes and Measures:** The primary outcome was biochemical evidence of abstinence from smoking at the six-month follow-up visit. Secondary outcomes included: lower number of proactive Quit Line calls taken, increased use of cessation medications based on Medicaid pharmacy records, and increased self-reporting of six-month smoking status.

**Results:** Incentive Group participants had significantly higher smoking abstinence rates six months after study induction than did Control Group participants (21.6% vs. 13.8%, respectively: $p < 0.0001$). A positive treatment effect of incentives was present across multiple abstinence indices, but the size of effects and levels of abstinence varied considerably. Incentive Group participants were also significantly more likely than non-incentivized Control Group participants to accept Quit Line treatment calls. Mediational analyses indicated that the primary path to achieving abstinence was the increase in engagement in treatment.

**Conclusions and Relevance:** This study shows that fairly moderate levels of incentive payments (a total possible incentive payment of $270) substantially increased adult Medicaid smokers' engagement in cessation treatment and successful smoking cessation. Findings from this study also suggest that future research or quality improvement efforts might explore the impact of a financial incentive program that only uses engagement incentives. Only using engagement incentives would simplify many of the fiscal and other resource challenges that this study encountered related to biochemical verification of smoking cessation abstinence.

## Background

Smoking and its resultant harms are increasingly concentrated in smokers who are low-income or who have relatively little educational attainment.[1] Such smokers also suffer disproportionately from the negative health and economic effects of smoking.[2-6] Unfortunately, such smokers tend to make fewer quit attempts than do other smokers[7-10] and are less successful when making such attempts.[9,11-15] Lack of quitting success among such smokers may be related to their relative lack of awareness of evidence-based treatment options,[16-18] beliefs about what is an effective treatment, or other factors. Thus, there is a strong need for strategies that increase the use of evidence-based cessation treatments among such smokers.

Various strategies have been used to increase low-income smokers' use of evidence-based treatments: for example, motivational interventions,[16,19,20] interpersonal communication,[21] and outreach via direct mailing.[22] It is unclear whether such strategies significantly increase quitting success among low-income smokers.[16,23-25]

There is a wealth of evidence from laboratory studies that use of addictive agents is decreased by incentives for abstinence.[26-31] There is also evidence that incentive programs can be effective under conditions that reflect large-scale, real-world use. Relatively large incentives for smoking abstinence ($750-800) have approximately tripled cessation rates among employee groups;[32,33] also see Kaper, 2005; Tappin, 2015; Volpp, 2006.[34-36]

However, the effectiveness of the large-scale application of incentive programs has not been convincingly demonstrated with low-income populations. DJ Hand, et al.[37], notes that incentive programs used by state Medicaid recipients have yielded disappointing results. This lack of success might be due to the population involved, the size of the incentives used, or the fact that incentives were often not delivered in a timely manner.[27,37,38] Some encouraging findings have been reported, though: for example, in a small study with no long-term follow-up.[38]

In September 2011, the Wisconsin Department of Health Services (DHS) was awarded a Centers for Medicare and Medicaid Services (CMS) Medicaid Incentives for Prevention of Chronic Diseases (MIPCD) grant. The initiative, called Striving to Quit, was designed to test the effects of incentives in smoking cessation services by adult Medicaid members who smoke. The Wisconsin study included two arms. One focused on linking non-pregnant adult Medicaid members who smoked to the Wisconsin Tobacco Quit Line, and a second focused on linking pregnant Medicaid members who smoked to in-person and telephone smoking cessation counseling. This report focuses on the first study arm.

DHS assumed the leadership role for the Striving to Quit initiative, with the Office of Policy and Budget providing Project Management services, including facilitating collaboration among both internal and external partners. Within DHS, the Division of Health Care Access and

Accountability (DHCAA – Medicaid) provided executive oversight and coordination with contracted health maintenance organizations (HMOs); it also managed the state data exchange with CMS and the national evaluator. The DHS Division of Public Health (DPH) served as the lead for marketing strategies, including social media and TV ad buys, and for development of materials (posters, brochures, postcards, etc.). The HMOs assisted in marketing and outreach to individual smokers in their health plans and in recruiting primary care clinics to participate by agreeing to screen potentially eligible members for smoking and making referrals to the Quit Line.

Additionally, the Center for Tobacco Research and Intervention (CTRI) at the University of Wisconsin (UW)-Madison School of Medicine and Public Health was given three primary roles:

1. To oversee the development and administration of the Quit Line-delivery arm of the study, including outreach activities to clinics that would refer Medicaid members.
2. To implement the proposed research design.
3. To conduct the comprehensive program evaluation.

The present research explores the effectiveness of a financial incentive intervention with low-income smokers who were adult members of the Wisconsin Medicaid program. The incentive intervention, however, was focused more on treatment engagement than on treatment outcome (abstinence). This was because it was easier to accurately assess the former and because of evidence that greater treatment exposure can increase smoking cessation success.[39,40] Other studies have reinforced treatment engagement in addition to treatment outcome, although typically such studies have focused reinforcement on the latter.[35,36] In addition, relative to some large-scale studies, [32,33] we used moderate-sized financial incentives in order to increase the translation potential of the intervention.

The study design compared two groups:

1. The Incentive Group received compensation for participating in treatment contacts (via the Wisconsin Tobacco Quit Line), attending two in-person assessment visits, and being abstinent at a six-month follow-up visit (total possible incentives = $270).
2. The Control Group received compensation only for attending the two in-person assessment visits (total possible incentives = $80).

We hypothesized that reinforcing treatment engagement for Incentive Group participants would increase their treatment exposure, which in turn would lead to increased smoking cessation abstinence.[39,41,42] The primary outcome was biochemical evidence of smoking abstinence at six months post-treatment initiation. Increased treatment engagement (number of Quit Line calls) was a secondary outcome.

# Methods

**Methods Development: Challenges and Evolution of the Study Design**

The Quit Line component of Striving to Quit was originally designed as a clinical trial. Non-pregnant adult Medicaid members who smoked and visited a participating primary care clinic in targeted areas were potentially eligible for the research study. A clinic staff member would briefly explain the availability of free treatment services and monetary incentives. Interested patients would provide an expired-air carbon monoxide measure at this baseline visit. A prescription for eight weeks of combination nicotine replacement therapy (NRT), covered by Wisconsin Medicaid, would be provided. Patients would then be referred to the Quit Line via a signed fax referral form with the patient's contact and baseline test information. Quit Line staff would proactively contact the smoker to confirm their willingness to participate and gain informed consent, at which point tobacco treatment was initiated. Follow-up expired-air carbon monoxide verification testing would occur at six-month intervals up to two years post-enrollment. The research was independently reviewed and approved by the UW Health Sciences Institutional Review Board (IRB) and the Western IRB of the Quit Line vendor (Alere Wellbeing, now Optum).

The implementation of this research as a clinical trial proved very difficult with respect to recruiting clinics to participate as a referral source using the exact same study protocol. In order to agree to participate in the research, providers, clinics, health systems, and laboratories, each with their own work processes, flow, and biochemical testing capabilities, required more flexibility than the protocol would allow. In response, several design modifications were made, including allowing clinics to conduct any type of biochemical test of smoking status covered by Wisconsin Medicaid (e.g., blood or urine cotinine). The use of expired-air carbon monoxide, which was the original project design, was not covered by Wisconsin Medicaid, so clinics did not use this method. Referral processes and forms were modified to allow clinics who wanted to refer any tobacco-using patient to do so (so that clinics would not have to apply different procedures for Medicaid-only patients). And DHS, over time, developed a financial and administrative support system to encourage and help overcome many of the barriers reported by clinics and health systems initially unable to participate.

Because of the slow rates of participation in the study by clinics, a secondary method of entry was created: existing Quit Line callers from five counties in Wisconsin with the highest numbers of Medicaid members would be invited to participate in Striving to Quit and referred to public testing sites staffed by UW-CTRI staff. Having two different entry methods created difficulty standardizing the distribution method for cessation medication: Quit Line staff were unable to provide NRT because the vendor was not a Medicaid-enrolled provider, and thus, medications dispensed by Quit Line staff were not reimbursable by Medicaid. In order to keep the study design consistent in terms of medication access, the provision of medication was eliminated as

a standard element of the study; instead, participants were encouraged to speak with their health care provider about a prescription for Medicaid-covered smoking cessation medications.

As a result of these and other smaller challenges that delayed the study launch, the time available for enrollment and service delivery specified in the grant award was substantially shortened. In order to extend the enrollment period and capture as large an enrollment as possible, the study follow-up period was reduced from two years to six months, and enrollment goals were reduced from 8,000 to 2,000 Medicaid members. Continued barriers to operationalizing the study design required rapid-cycle improvements to the protocol. Because the program remained (at that time) as a research study, there was the added burden of updating two IRBs overseeing the study; these challenges led to further delays in study launch and implementation. Following input from CMS and Striving to Quit leadership, the clinical trial was closed with the UW Health Sciences and Western IRBs, and a new application for exemption as a non-research quality improvement project was submitted and approved. This allowed more flexibility in making rapid-cycle design changes to meet the varying requests of study partners. Throughout this process, the study team attempted to preserve the core aims of the study and allow the impact of incentives on this smoking population to be effectively determined.

**Final Study Design**

All enrolled participants were provided with access to a five-call counseling treatment from the Quit Line. Participants were randomized immediately following screening and consent to either an Incentive Group or to a Control Group. Randomization was done by Quit Line staff via prepared lists provided by CTRI researchers, with order stratified by county and race. Calls followed the Quit Line standard five-call protocol for all study participants, both in timing and in content. That protocol is for a pre-quit quit day (usually two weeks later) and three more calls at two-week intervals post quit day. Quit Line staff followed a standard call script for all participants—with some flexibility based on such factors as the participant's initial success in quitting and particular challenges he or she faced, such as stress and environmental cues. All participants were incentivized for participating in baseline and six-month follow-up biochemical confirmation testing. Participants in the Incentive Group were additionally incentivized for participation in Quit Line calls and for demonstrating biochemically confirmed abstinence at the six-month follow-up visit. Counselors at the Quit Line were not blinded since the design called for Quit Line staff to mention the incentive payment that the participant would receive for taking Quit Line calls and attending the six-month follow-up testing. This was viewed as consistent with real-world delivery of an incentive intervention.

**Participant Recruitment**

Striving to Quit, as originally designed, called for participants to be screened for smoking and referred to the Quit Line via primary care clinics and providers (clinic-based referral*).* Medicaid-contracted HMOs were charged with recruiting clinics within their established networks, as well as promoting participation in the initiative via individual outreach to their Medicaid members who smoked. Member outreach was incorporated into existing efforts to meet their smoking cessation goals under Wisconsin Medicaid's pay-for-performance initiative. In addition to sending personalized letters, HMO promotional activities included: broad-based mailing of Striving to Quit brochures, telephone outreach by care management staff, announcements and other Striving to Quit information in member newsletters, and distributing Striving to Quit posters and flyers at community health fairs and within their clinic networks.

HMOs were also responsible for identifying primary care clinics serving large Medicaid populations and soliciting their engagement in screening for smoking and making referrals to the Quit Line. Clinic responsibilities included:

- Determining whether the patient was enrolled in Wisconsin Medicaid.
- Reading a brief script to each Medicaid member about Striving to Quit.
- Arranging the biochemical test.
- Obtaining patient consent for the referral to the Quit Line (Quit Line staff would call the patient within 72 hours to complete the Striving to Quit enrollment process).

Identifying high-volume clinics was fairly straightforward; the difficulty arose in engaging them in the study. Among the barriers encountered were:

- Reluctance to treat patients differently based on insurance status.
- Lack of on-site labs needed for the biochemical testing.
- Bureaucracy within the health system (e.g., layers of approval needed from health system officials).
- Complexities of modifying clinic workflow.

As a result, very few participants initially entered the study via clinic-based referrals.

Using rapid-cycle evaluation strategies, DHS, in partnership with the HMOs and interested clinics, agreed to provide:

1. On-site and online training to clinic staff on the screening, testing, and referral processes.
2. Financial support to assist clinics in modifying their work flow.

An initial payment of $1,000 was offered for staff time spent in training and process modifications. Additional payments were made for each referral: $25 to $75 per individual based on the type of biochemical test. This change resulted in Striving to Quit participation by 66 primary care clinics.

To augment clinic-based referrals, other participants were recruited without clinic involvement (via Quit Line-direct referrals or community-based referrals: see Figure 1). For Quit Line-direct

referrals, Quit Line staff screened all potentially eligible new callers (self-reported Medicaid members from participating counties) to the Quit Line for their interest in, and eligibility for, participation. Quit Line staff then contacted CTRI research staff to determine if those passing screening were, in fact, enrolled Wisconsin Medicaid members. Quit Line staff then sent a letter referring enrolled members to a nearby testing site in their county, which performed an expired-air carbon monoxide test and transmitted the results to Quit Line staff. Quit Line staff then consented cleared individuals, gave them a baseline survey, randomized them, and began proactive treatment calls**.** For community-based referrals*,* individuals presented themselves directly to the testing sites, which then confirmed their Medicaid membership and performed an expired-air carbon monoxide test. Contact information and expired-air carbon monoxide results were then transmitted to Quit Line staff, who called the person, screened them further, consented those passing screening, gave the baseline screening questionnaire, randomized them to treatment, and initiated treatment. This method of recruitment was enhanced initially by identifying and reaching out by letter to individuals who had called the Quit Line within the prior year and indicated they were Medicaid members, informing them of the program and the community testing sites.

Multiple strategies were used to increase recruitment via the Quit Line or community-based routes: for example, paid media (TV) advertisements sponsored by the DHS Tobacco Prevention and Control Program in counties having a testing site, outreach to community groups, and outreach to individuals who had previously called the Quit Line. Advertisements noted the opportunity for modest financial incentives to Medicaid members for engaging in Quit Line-based smoking treatment. In addition, word of mouth stimulated many of the community-based referrals. Initially the study catchment area comprised five medium- to large-sized counties in Wisconsin, but over time, the number of counties grew to 16 to increase enrollment. Once a county had one or more testing sites (open to anyone in that county), Quit Line staff referred any interested caller who was a Medicaid member to their county's testing site. These testing sites were located and staffed by local public health departments and local pharmacies (such sites were offered financial and administrative support from DHS to provide this service) and by CTRI staff.

**Screening Assessments**

All participants, regardless of referral route, had their Medicaid enrollment verified using DHS data. All potential participants were informed that loss of Medicaid would result in disenrollment in Striving to Quit. In addition, all participants had to answer *general screening questions* (delivered by Quit Line staff) related to other inclusion criteria:

- Participant had to be 18 years of age or older.
- Participant had to be English or Spanish speaking.
- Participant had to be a resident of a participating county (not required for clinic-based fax referrals).

- Participant had to be willing to set a quit date in the next 30 days (see Figure 1).

Additionally, biochemical confirmation of initial smoking status was required of all participants: expired air carbon monoxide test (for Quit Line-based and community-based referrals) or cotinine or nicotine test (for most clinic-based referrals).

DHS allowed participating clinics to select the form of the biochemical test used (expired air carbon monoxide, cotinine, or nicotine) and the cut score for smoking. Most clinics did not have the equipment for an expired air carbon monoxide test, and the test was not Medicaid reimbursable. Other tests were limited due to restrictions on which provider types were authorized to administer and bill for the test under Medicaid. Many labs and health systems raised concerns about using tests not already approved or used in their systems that might be difficult to incorporate into their office protocols and workflows. As a result, lab test types and smoking confirmation levels were set at different levels across clinics. However, tests performed at individual clinics were the same at baseline and follow-up, allowing for a consistent method of smoking status determination for each enrollee.

Of a total of 66 participating clinics, all but two used urine cotinine; the remaining two used NicCheck test strips. Clinics chose different cut scores for the urine cotinine test; the great majority of clinics chose to define smoking as a value that exceeded either 50 ng/ml, 100 ng/ml, or 200 ng/ml. Four of 66 clinics used 300 ng/ml as the smoking cut score. In all cases, the method of testing and the cut score used for smoking status determination was the same for initial screening and follow-up. The expired-air carbon monoxide cut score for smoking was CO ≥ 7 ppm; expired-air carbon monoxide testing was used for most community-based and Quit Line-direct referrals.

**Study Treatments**

All study participants were encouraged to use the same two types of smoking cessation treatment. The first was *Quit Line coaching* delivered by Quit Line staff over five calls. These calls included a pre-quit call (initiated by the individual or Quit Line staff depending on route of referral), which typically occurred at study enrollment, and four additional proactive calls from Quit Line staff. Participants could also initiate calls at any time to the Quit Line for additional assistance. Quit Line coaches made three attempts (per protocol) on different days to reach a participant for each proactive call, leaving messages at least twice if possible. Those participants not reached on the first two proactive calls were sent a letter urging them to call. Study participants also received a mailed quit guide, access to recorded medication information (via phone), and access to Web Coach®, an online cessation program maintained by the Quit Line.

In addition, Quit Line coaches routinely recommended that participants obtain a prescription for *a Medicaid-approved smoking cessation medication* from their primary care provider (at a

minimal fee or with no copay depending on the health plan). Participants had to actively initiate this request.

**Incentives**

Participants in the Incentive Group could receive a total incentive of $270:

- $30 per call for up to five Quit Line calls (for a total of $150).
- $40 per visit for the baseline and six-month in-person follow-up visits (for a total of $80).
- $40 for producing biochemical evidence of abstinence at the six-month in-person follow-up visit (see Figure 2).

Quit Line calls beyond the five scheduled ones were not incentivized.

Participants in the Control Group could receive a total incentive of $80:

- $40 for the baseline in-person visit.
- $40 for the six-month in-person follow-up visit.

Participants were told during enrollment about the compensation—prepaid VISA gift cards—they would receive for satisfying each reinforcement criterion. Payment generally took two to four weeks based on the scheduling of the private vendor under contract to the Quit Line.

**Data Collection and Measures**

Quit Line staff collected standard Quit Line registration data during enrollment via a baseline questionnaire, which included:

- Sociodemographic status.
- Current and past tobacco use.
- Dependence (the Fagerstrom Test of Cigarette Dependence[43,44]).
- Pregnancy status.
- Nonsmoking tobacco product use.
- Smoking environment.
- Quitting motivation and confidence.
- Chronic disease history.
- Past quit attempts and relapses.
- Basic health information (see the Minimum Data Set for Evaluating Quit Lines [NAQC]).[45]

The six-month in-person follow-up visit was used to collect biological samples for determination of smoking status from all study participants. The results of the expired-air carbon monoxide test and the urine cotinine test were recorded dichotomously by testers as either abstinent or smoking. No further data (e.g., self-report of smoking status) were collected because the IRB would have deemed all involved clinic staff to be researchers (this would have entailed human subjects training and assessment of all staff and discouraged clinic participation).

**Outcome Measures**
The primary outcome was biochemical evidence of smoking status at the six-month in-person follow-up visit. Secondary outcomes included: treatment engagement, assessed as the number of proactive treatment calls taken (range 0-5); use of cessation medications based on Medicaid pharmacy claims; and self-reported smoking status (based on assessment during the six-month follow-up call, which was separate from the six-month in-person visit).

**Analyses**
We tested for treatment group differences on demographic and smoking history characteristics via $\chi^2$ tests (for categorical variables) and independent-groups t-tests (for continuous variables). Treatment group differences in binary abstinence outcomes were tested via logistic regression models, which yielded odds ratios and 95% confidence intervals. Risk differences (i.e., differences between the Control Group and Incentive Group abstinence rates) and 95% confidence intervals for risk differences were calculated using Proc Freq (SAS Institute Inc.) via the RISKDIFF option and are reported for abstinence outcomes. Independent groups t-tests were used to test treatment group differences in treatment engagement (number of proactive calls, minutes of Quit Line counseling, and number of participant-initiated ad hoc calls). For comparisons based on type of referral route, the Quit Line-direct and community-based referral routes were contrasted with the clinic-based referral route. This was done to streamline analyses and because both Quit Line-direct and community-based referrals originate with Quit Line contact, and analyses revealed that participants from these referral routes were more similar to one another than they were to participants from clinic-based referrals. Mediation analyses were computed via the SAS PROCESS macro.[46]

The original grant proposal estimated power based on an abstinence rate for the Incentive Group of 35% versus a rate of 25% for the Control Group, with a total sample size of 4,000 (n = 4000). Power analysis showed excellent power (> .99) to detect such a difference (25% vs. 35%) with a sample size of 4,000. However, the planned sample size changed due to the pace of recruitment so that the ultimate sample size was 1,900 (n = 1900). Recalculation of power based on a sample size of 1,900 for the predicted effect size (25% vs. 35%) yielded power equal to.99.

## Results

**Demographics and Smoking History Characteristics**
Table 1 displays baseline demographic and smoking history characteristics of participants in the two experimental groups. Incentive and Control Group participants differed on two measures: Fagerstrom Test of Cigarette Dependence (FTCD) Item 1 (dichotomized as smoking within 30 minutes of awakening vs. later) and Motivation to Quit Smoking (analyzed as a continuous variable on a 1-10 scale). Participants in the Incentive Group had lower scores on both measures (i.e., scored as being less dependent and less motivated to quit than were Control Group participants). However, the magnitude of the differences was quite small. Supplemental

Table 1 shows the characteristics of those who were recruited via Quit Line-direct or community-based referrals versus those recruited via clinic-based referrals. Compared with those recruited via clinics, those recruited via the Quit Line or community were *more* likely to be older, nonwhite, less educated, and heavier smokers and *less* likely to have tried to quit on their own or used prescribed cessation medications ($p < 0.05$).

**Participants Recruited Into Treatment**

Participants (n = 1900) were smokers recruited over the course of the study recruitment period (May 2013-May 2015), including 980 (51.6%) recruited via Quit Line-direct referrals, 476 (25%) via community-based referrals, and 444 (23%) via clinic-based referrals. While 66 clinics ultimately agreed to engage in the research, only 52 made any referrals to the Quit Line. The majority of participants arose from Quit Line-direct referrals; about 12% of all Quit Line callers who were queried about interest were ultimately included (most callers were not Medicaid-enrolled). Community-based and clinic-based referrals resulted in 51% and 46%, respectively, of Medicaid-enrolled individuals entering the study (data are available only for enrolled individuals).

**Abstinence at the Six-Month Follow-Up**

*Biochemical Evidence of Smoking (Primary Outcome)*

The mean and median numbers of days post enrollment for biochemical confirmation of smoking status were 189 and 180, respectively. While the range of testing latency was substantial, 80.4% of participants had their test within +/- 40 days of the six-month target date.

Table 2 depicts the abstinence rates for the participants of both groups at six months post study implementation, adhering to the intent-to-treat (ITT) principle (n = 1900), where those with missing data were counted as smoking. Biochemically assessed abstinence for the Incentive and Control Group participants was 21.6% and 13.8%, respectively (Table 2), with a risk difference of -7.9, $p < 0.0001$. The abstinence rates were 37.1% and 23.3% for the "tested" Incentive and Control groups (where those with missing data were excluded from the analysis), respectively, with a risk difference of -13.8, $p < 0.0001$.

*Treatment Engagement*

**Quit Line calls.** Table 3 shows the number of participants in the two experimental groups taking 0-5 proactive Quit Line calls, as well as those making additional calls to the Quit Line on an ad hoc basis. Only 8% of Incentive Group participants took just a single call, while about 26% of Control Group participants took just one call. Further, while 46% of Incentive Group participants took the maximum number of proactive calls, only about 21% of Control Group participants did so. Higher percentages of Incentive Group participants made ad hoc calls, as well, despite not being incentivized for these calls. Table 2 shows that the association between the number of calls taken and the two experimental groups was statistically significant ($\chi 2 = 196.1$, $p < 0.000$). Incentive Group participants took a mean of 3.8 (SD = 1.4) proactive calls, while Control Group participants took a mean of 2.9 calls (SD = 1.5; $t[1898] = -14.6$, $p < 0.0001$).

Table 2 also shows the difference in mean number of minutes of counseling received in such calls, with Incentive Group participants receiving about 65.2 minutes (SD = 27.1) and Control Group participants receiving about 46.1 minutes (SD = 26.5; t[1898] = -15.6, p < 0.0001).

Five hundred and three of the 1,900 participants initiated calls to the Quit Line. For both experimental groups, the mean number of participant-initiated calls was < 1, and the median, zero, across the total sample. However, the means differed significantly across experimental groups: Incentive Group = 0.5 self-initiated calls (SD = 1.2) and Control Group = 0.3 self-initiated calls (SD = 0.8); t(1898) = -4.45, p < 0.0010.

**Medication use.** Medicaid pharmacy claims revealed that 55% and 48% of the Incentive and Control Group participants, respectively, filled a prescription for some form of cessation medication. Table 3 displays the numbers and percentages of participants in the two experimental groups who used either no medication or used NRT, varenicline, bupropion, or multiple medications. The distribution across these categories differed significantly between experimental groups ($\chi 2 = 11.5$, p = 0.022).

*Secondary Abstinence Outcomes*

A variety of sensitivity analyses were conducted to ascertain the robustness of the observed findings. Table 2 also shows the abstinence rates for just those individuals for whom data were available at the six-month mark. This "tested" sample (n = 1114) comprised about 58% of the total sample and showed abstinence rates for the Incentive vs. Control Group comparison of 37.1% and 23.3%, respectively, risk difference=-13.8, p < 0.0001. Also, 190 smokers left the study through withdrawal (n = 54) or loss of Medicaid eligibility (n = 136) and did not attend the six-month follow-up visit. Table 2 presents results for six-month biochemically determined abstinence for the sample with these disenrolled participants removed (n = 1710); 22.7% and 15.0% for the Incentive and Control groups, respectively, risk difference = -7.8, p < 0.0001.

We also examined findings with regard to two other types of variation imposed by the experimental protocol. The first is the type of biological assessment test used. Three types of tests were used: expired-air carbon monoxide (n = 1458; 77%), urine cotinine (n = 384; 20%), and urine test strip (n = 58; 3%). We compared outcomes obtained with the expired-air carbon monoxide and urine cotinine tests (excluding participants given test strip tests). The abstinence rates for the Incentive vs. Control Group participants were, respectively: 24.0% and 16.0%, risk difference = -8.0, p = 0.0002, for the expired-air carbon monoxide test, and 13.3% and 5.3%, risk difference = -8.0, p = 0.0076, for the urine cotinine test. Therefore, while most (75%) participants tested with urine cotinine received a test that set a very high level of cotinine (200-300 ng/mL versus the 50-100 ng/mL now recommended in the field as the measure for being determined to be a smoker), the lower level of overall abstinence assessed in the group tested with urine cotinine as compared to tested for expired-air carbon monoxide indicates that this did not bias the overall abstinence results from this study in the direction of higher abstinence rates.

The second source of experimentally imposed variation was caused by the use of two different referral routes, Quit Line-direct/community-based referrals (n = 1456, comprising both Quit Line referrals and community-based referrals) and clinic-based referrals (n = 444) (see Figures 1 and 3). While abstinence rates were lower overall for the participants who entered via clinic-based referrals, significant group effects were present for both referral routes. Abstinence rates for the Incentive vs. Control Group participants for the two types of referral routes were, respectively: 24.0% vs. 16.3%, risk difference = -7.8, p = 0.0002, for Quit Line/community-based referrals, and 13.8% vs. 5.5%, risk difference = -8.4, p = 0.0029, for clinic-based referrals.

*Self-Reported Smoking Abstinence*

Table 2 also displays abstinence rates based on self-reporting in the phone follow-up time point that occurred closest to the six-month mark. The mean and median numbers of days post study implementation until the relevant follow-up call were 160 and 152, respectively, and 87.6% of participants had their call within +/- 40 days of the six-month mark.

Table 2 shows that the six-month self-report abstinence rates for the Incentive and Control Group participants for the ITT sample (n = 1900) were 14.4% and 10.3%, respectively, risk difference = -4.1, p = 0.0072. When these rates were determined based only on participants actually contacted for the six-month call (n = 862, about 45% of the total sample), the six-month abstinence rates were 30.2% and 23.8% for the Incentive and Control Group participants, respectively, risk difference = -6.3, p = 0.0374.

*Biochemically Confirmed Self-Report*

Relatively few participants (n = 651) supplied both self-reported and biochemical evidence of abstinence at the six-month follow-up. Among those who did, the agreement of these two measures was modest. As Supplemental Table 2 shows, about 26.2% of the sample produced discordant scores on the two measures. Discordance rates were virtually identical for those in the Incentive and Control groups; 27.1% and 25.4%, respectively. Further, of those claiming abstinence via self-reporting, 37.3% were found to have shown evidence of smoking/nicotine use via the biochemical test. However, when the group effect was analyzed with abstinence defined as cases where both types of measures indicated abstinence, significant group effects were present. In the ITT (n = 1900) analysis, the abstinence rates for the Incentive and Control Group participants were 7.6% and 4.1%, respectively, risk difference = -3.5, p = 0.0012. In the responder-only sample (n = 651), where data were available for both measures, the abstinence rates for the Incentive and Control Group participants were 22.2% and 12.0%, respectively, risk difference = -10.2, p = 0.0005. The discussion section of this report provides further commentary on possible reasons for the discord among self-reported and biochemical outcomes.

Further testing was also done to determine whether any observed differences (see Table 1) in the recruited population between the Control Group and Incentive Group could have led to

differences in the primary outcome of the study. While there were differences between experimental groups on two baseline variables (Fagerstrom Test of Nicotine Dependence Item 1 and Quitting Motivation), they were about what one would expect based upon the probability of Type 1 error built into the statistical tests. The differences between the experimental groups on those two variables were quite small and are significant only because of the great deal of statistical power available. Thus, the results do not suggest a fundamental failure of random assignment. Finally, when these variables are entered into the statistical models used to compare the effects of the two treatments on the primary outcome (biochemically determined abstinence at six months), the results show that the treatment effects remain significant. In other words, the differences on those variables have no significant effect on the relation between treatment and outcome.

*The Mediation of Six-Month Abstinence by Treatment Engagement*

Mediation analyses used biochemically determined abstinence at six months (ITT sample; n = 1900) as the outcome and number of proactive Quit Line calls as the mediator. Analyses focused on whether the increase in call acceptance by Incentive versus Control Group participants could account statistically for the former group's higher abstinence rate (21.6% vs. 16.8%, respectively). A simple logistic regression (non-mediational) model testing only the relation between treatment group and the six-month outcome revealed a significant effect of treatment group, $c = -0.55$, $p < 0.0001$ (see Figure 3). When number of calls was entered in the full mediational model, the path from treatment group to number of proactive calls ($a'$) was significant ($a' = 0.96$, $p < 0.0001$), as was the path from the number of proactive calls to six-month abstinence ($b' = .40$, $p < 0.0001$). However, the direct path from treatment group to outcome ($c'$) was no longer significant in the full model ($c' = 0.21$, $p = 0.10$). The indirect, mediated effect of number of calls (the product of paths $a'$ and $b'$) was significant ($a'b' = 0.35$, $p < 0.0001$).

*Project Costs*

The primary analyses of costs for the Quit Line arm of Striving to Quit focused on first identifying the costs of all project activities that would be required to implement the incentive program on an ongoing basis. Costs of planning the project, grant administration, and research within the project are not included in the analysis.

Project costs were allocated into three categories:

1. Service costs, including billed staff time for counseling and testing, as well as all incidentals connected with services.
2. Incentives and distribution costs.
3. Service-related administrative costs, including promotion/marketing and staff time for administering the intervention.

Costs have all been calculated on a per-participant basis for the 1,900 participants in this project. All costs have been adjusted to reflect actual expense of the project in the field; no budgeted costs have been used. Table 4 summarizes the costs for this project for the three categories and overall; it further breaks down the costs for those in the Incentive and Control groups. In general, replication of the Quit Line-based smoking cessation project would probably use either the incentive or non-incentive approach, not a mixture. This makes the cost data for the two separate groups the more relevant figure for replication as compared with the overall cost for the full 1,900 participants.

As Table 4 shows, the cost of implementing the program with the full set of incentives in this protocol was $174 greater than an implementation that includes only modest incentives for attending the two biochemical confirmation visits. Specifically, the cost of the program was $715 for the Control Group and $888 for the Incentive Group.

*Cost per Quit per Participant*

The project then examined the cost per quit per participant for the two different study groups to provide a more specific analysis of whether adding the additional expense of incentives (which averaged approximately $174) produced a more (or less) expensive primary outcome. The analysis of cost per quit per group found that Control Group participants had an average cost per quit of $5,193, and Incentive Group participants averaged $4,108 per quit (see Table 4). Thus, the demonstrated effect of incentives on treatment participation and quitting behavior shown in this study outweighed the differentially higher cost of providing the incentives, yielding a $1,085 lower cost per quit.

*Costs and Costs per Quit Based on Recruitment Method*

Additionally, the project examined the costs and cost per quit based on study recruitment method. The least expensive method for generating a referral to the Quit Line was the community-based method, in which individuals were referred by fax from one of the local testing sites. This was due primarily to the lower cost of promotional activity, e.g., word-of-mouth and direct mail. Costs were $704 per participant, approximately $100 less than the other two methods. When costs per quit were examined, however, the Quit Line call method of recruitment proved to be the least costly due to having the highest percentage of quitters. At $3,870 per quit, this method was $215 per quit less expensive than the community-based method and $4,756 less expensive than the clinic referral method. Between Control and Incentive groups, the Quit Line method for the Incentive group showed the lowest cost per quit at $3,601, followed by the community-based Incentive group at $3,810 per quit. Consistent with the main study outcomes, all three Incentive groups showed lower cost per quit than the overall expense regardless of method of study recruitment. The most expensive cost per quit method was clinic referral for the Control group at $13,787.

## Discussion

This research showed that adult Wisconsin Medicaid members who smoked and received financial incentives (Incentive Group participants) for smoking cessation treatment engagement and smoking abstinence were significantly more likely than non-incentivized Control Group participants to accept Quit Line treatment calls and to be abstinent from smoking six months after study implementation. Moreover, a mediation analysis supported the hypothesis that incentives increased smoking abstinence because they increased treatment engagement; in other words, the effect of the Incentive intervention on abstinence could be accounted for statistically by its effects on acceptance of Quit Line calls (i.e., the number of Quit Line calls taken).

The population participating in this research, adult Wisconsin Medicaid members, is notable for its high prevalence of both smoking and smoking related disease.[1-4,6] Individuals in this population are especially unlikely to participate in smoking cessation treatment and to benefit from it,[16-18] which may be related to the population's low use of, and access to, health care.[39] This research suggests that financial incentives for engaging in Quit Line smoking cessation counseling is an effective strategy for increasing the rate at which Medicaid smokers enter evidence-based treatment and successfully quit smoking.

This research used three methods for participant recruitment: recruitment from Quit Line callers, the community, and primary care clinics. Community-based and clinic-based referrals both produced moderate levels of recruitment, but the former required setting up multiple testing sites across 16 Wisconsin counties and providing financial support and training to secure non-research site participation. In all, Quit Line-based referrals were the most feasible and productive route for recruiting Medicaid smokers into smoking treatment. But the success of this route no doubt benefitted from the media promotion used in this study and from the accessibility of testing sites, which permitted biochemical determination of smoking status.

Variability in methods and data creates challenges to drawing inferences from this real-world treatment effectiveness study. For instance, participating clinics chose their own methods and cut scores for biochemical evaluation of smoking abstinence. All of the clinics chose tests of urine cotinine, while the research-based testing sites used expired-air carbon monoxide tests. The use of two types of tests (and different cut scores) might have increased experimental error.[47] Also, our inability to collect self-reported smoking status at the six-month follow-up visit imposed a time gap between the collection of self-reported abstinence and the biochemical test, which may have increased the rates of discordance between self-reported and biochemical confirmation of abstinence. Other factors related to study design (e.g., participants may have mistakenly believed that abstinence was necessary for further payment/participation) or other population characteristics may also account for this higher-than-normal rate of discordance. Finally, the rate of follow-up call completion was modest (in

keeping with the population and real-world nature of the work), leading to considerable missing data. Any of these factors might have affected the experimental results by increasing error.

Despite these limitations, the outcome analyses showed that significant financial incentive treatment effects were consistently found among participants who differed across recruitment route, type of biochemical test, and self-reported vs. biochemical determination of abstinence. Significant effects were also found in ITT analyses (for the entire sample) and in analyses performed just on those who provided follow-up data (the "tested" samples). The results did reveal considerable variability in the magnitude of abstinence rates and the differences between them across these various subpopulations (see Table 2). Further research is needed to clarify the magnitude of the potential public health benefit of the tested intervention.

Of those who tested as abstinent via a biochemical test, almost half reported—during their six-month follow-up phone call—that they had smoked (Supplemental Table 2). This suggests either that the biochemical test was insensitive or that the smoker's status had changed between the call and the biochemical test (the former was generally first). The latter suggests that the abstinence detected at the six-month visit was often short lived. In addition, the data show that among those claiming abstinence via self-reporting, close to 40% provided a biochemical sample that indicated recent smoking. This level of disagreement requires that caution be used in evaluating the outcomes.

The data on treatment engagement were not vulnerable to the same threats to internal validity as were the abstinence data. The treatment engagement data were collected directly either from Quit Line records or from Medicaid pharmacy claims data. These data showed that the Incentive Group produced significantly higher rates of treatment engagement than did the Control Group—in terms of number of proactive calls taken, duration of calls, and receipt of cessation medication from a participating pharmacy. Moreover, the mediation analysis showed a significant correlation between treatment group, the number of Quit Line calls taken, and the likelihood of smoking abstinence as determined by biochemical testing. The magnitude of this indirect effect was sufficient to render the direct effect (between treatment group and abstinence) non-significant. Thus, this analysis suggests a meaningful causal signal running from treatment group to treatment engagement to the abstinence outcome.

The limitations of this research include the factors noted earlier: different biochemical analyses of smoking status were used, two types of recruitment were used, and the two different types of abstinence occurred at different points in time. In addition, Control Group participants did not receive the same *amount* of incentives as Incentive Group participants received (such incentives could have been delivered non-contingently to Control Group participants). Therefore, some of the effects of the incentives may have been due to the non-contingent effects of the amount of the incentives. In addition, we are unable to say with certainty which

features of the incentive treatment were predominant in influencing smoking outcomes since both treatment engagement and the abstinence outcome were incentivized. Moreover, there was delay in providing the actual incentive to participants. Perhaps stronger effects might have been obtained had the incentives been made more immediately.[27,37]

The economic analysis (see Table 4) is subject to limitations as well. Full-scale implementation of such a project may vary in size, and it would be anticipated that economies of scale would play a role. Per-participant expenses, such as testing costs, could be lowered with a higher number of people being tested (or be raised with a lower number of people being tested). This project enrolled a little under 1,000 people per year. Second, ongoing implementation of a project (rather than a study) may result in fewer barriers to enrollment, reducing some of those costs on a per-enrollee basis. Finally, the cost structure of this project is related to a specific public/private partnership among a state agency, a university, private health care clinics, and a private Quit Line vendor. Other arrangements would likely produce different cost structures, especially in terms of services administration and testing.

This research joins a growing list of studies suggesting that incentives can exert beneficial effects on health-related behaviors and outcomes.[28,33,49] And we believe it is the first study to demonstrate that fairly moderate levels of incentive payment (a total possible incentive payment of $270) was sufficient to increase Medicaid smokers' engagement and success in smoking cessation treatment. The fact that this study did so in a population that has been unlikely to engage in, and benefit from, smoking cessation is notable. Thus, the methods used in this research appear to have, to some extent, successfully addressed important obstacles to the effective large-scale application of incentive programs.[48]

The study documents the need to:

1. Increase program awareness among targeted participants.
2. Identify an effective incentive magnitude.
3. Clearly communicate the contingencies for incentive receipt.
4. Engage relevant recruitment and delivery systems (e.g., the Quit Line).

Future research should further test different recruitment and treatment delivery models and obtain additional data on the stability of the smoking outcomes achieved. In conclusion, modest financial incentives appear effective in motivating adult Medicaid members who smoke to engage in cessation treatment and to successfully quit.

**Figure 1: Study Recruitment and Enrollment Flowchart**

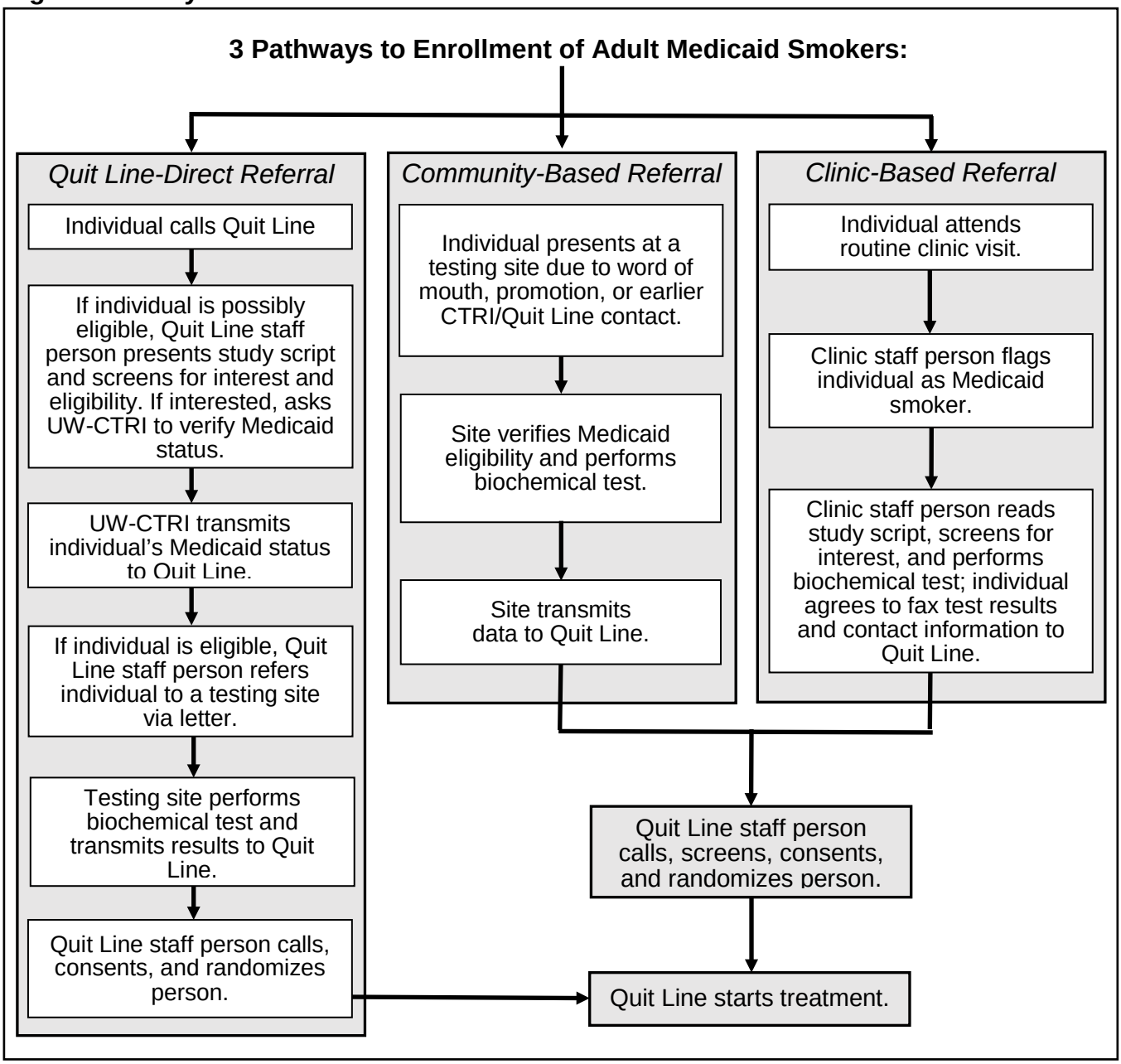
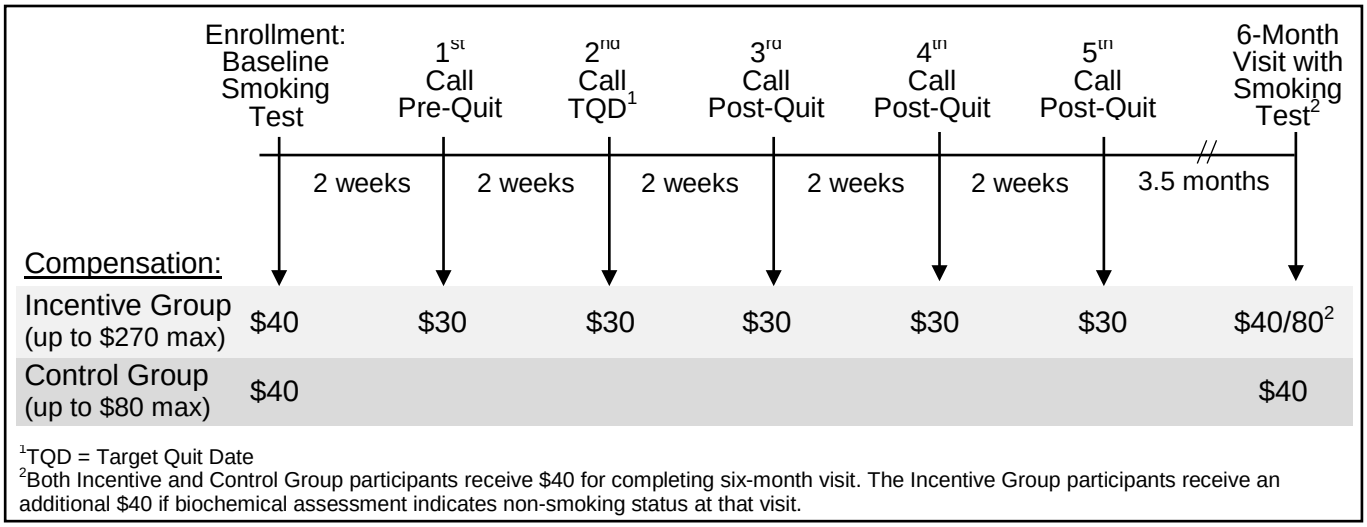
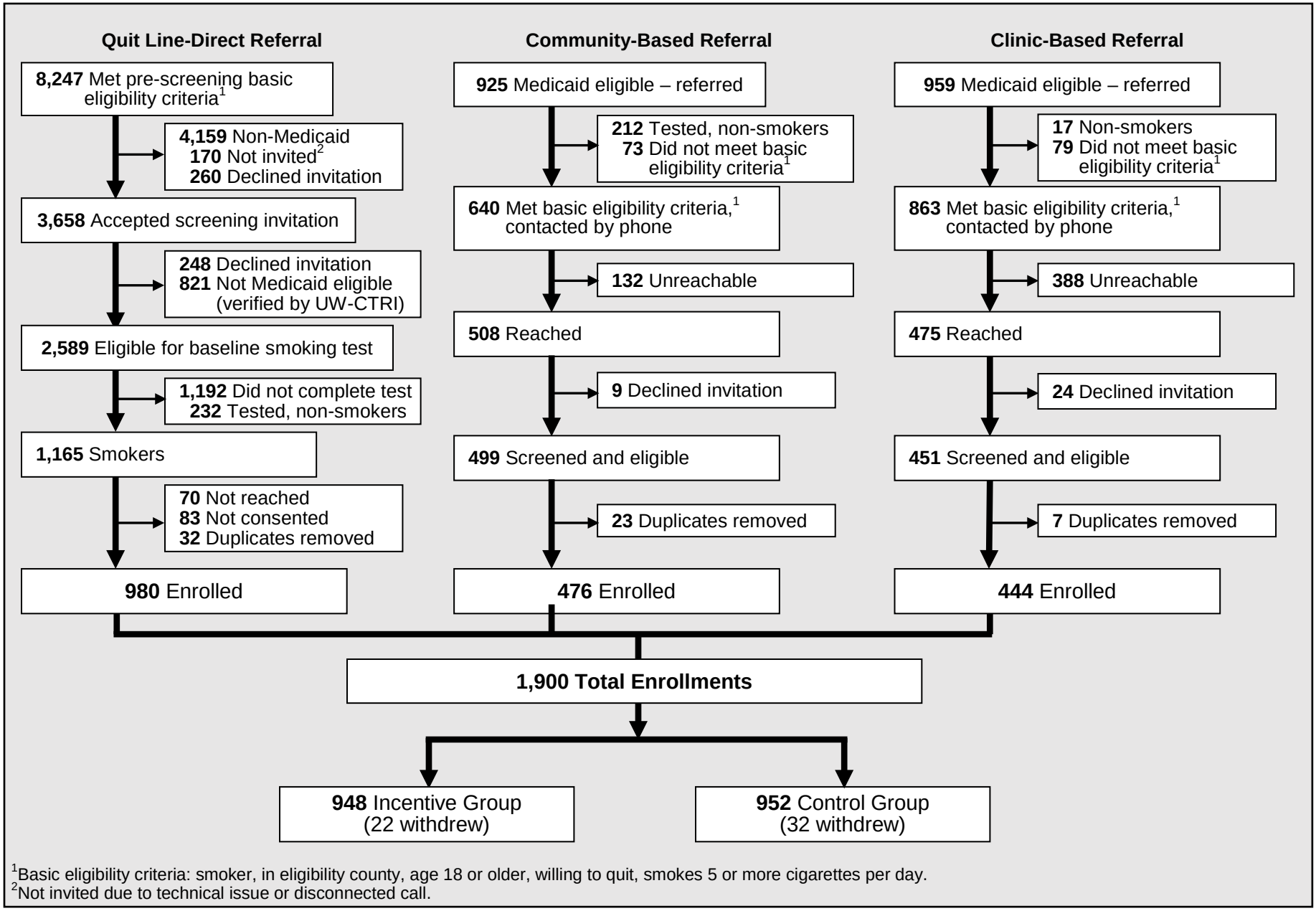


**Figure 2**: **Intervention Timeline and Compensation by Treatment Assignment**



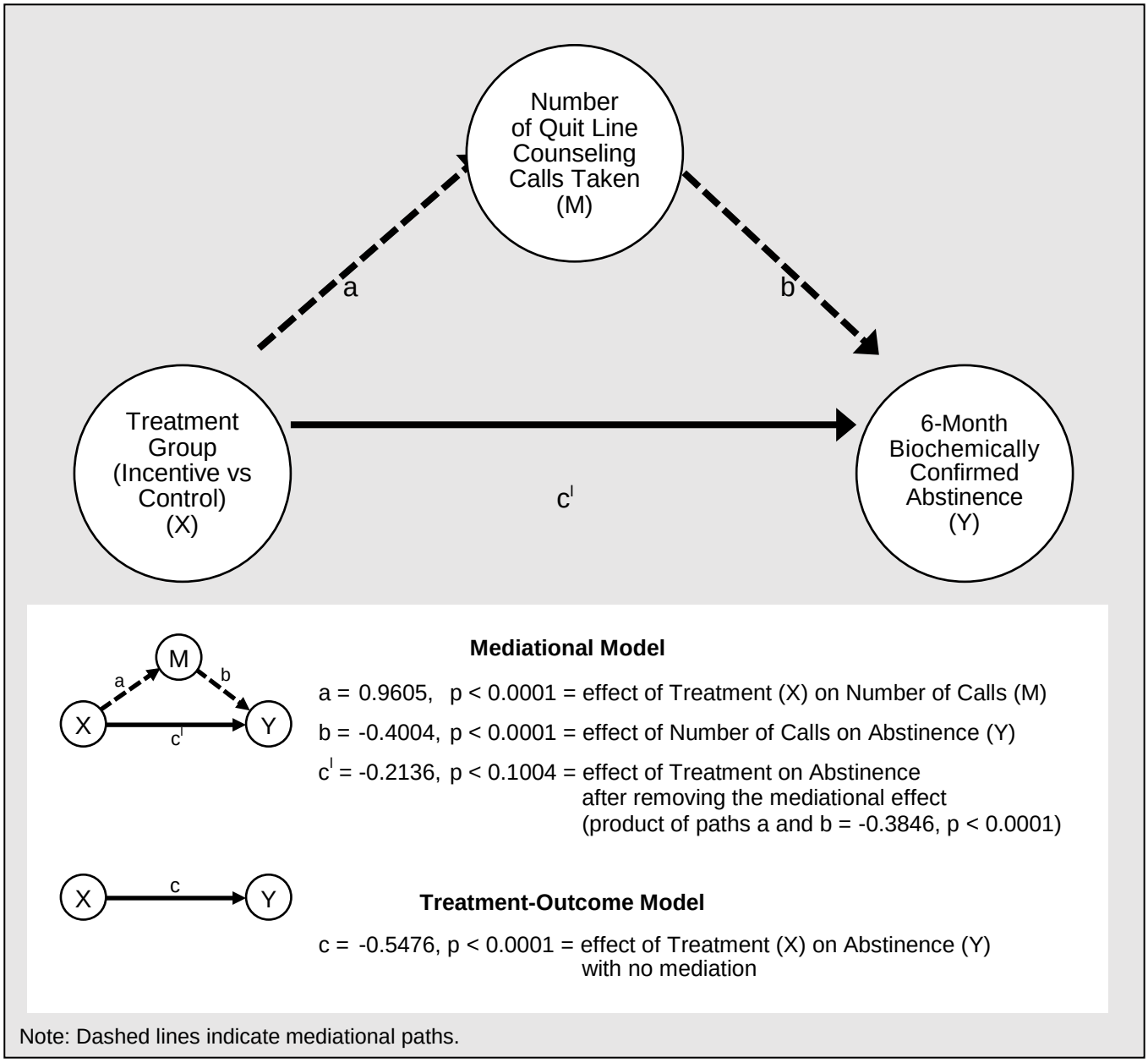

[1]TQD = Target Quit Date
[2]Both Incentive and Control Group participants receive $40 for completing six-month visit. The Incentive Group participants receive an additional $40 if biochemical assessment indicates non-smoking status at that visit.

**Figure 3: Striving to Quit – Quit Line Consort Diagram**




[1]Basic eligibility criteria: smoker, in eligibility county, age 18 or older, willing to quit, smokes 5 or more cigarettes per day.
[2]Not invited due to technical issue or disconnected call.

**Figure 4: Mediation Model of Incentive Effects on Abstinence by Quit Line Call Acceptance**




Note: Dashed lines indicate mediational paths.

**Table 1: Sociodemographic and Smoking-Related Variables by Treatment Group**

| Variable | | Treatment Group | | P-Value |
|---|---|---|---|---|
| | | Control (n = 952) | Incentive (n = 948) | |
| **Gender** | % Female | 60.6% | 60.0% | 0.7933 |
| **Age** | Mean (SD) | 44.9 (11.2) | 45.0 (11.2) | 0.8393 |
| **Race** | **%** White | 41.0% | 41.5% | 0.9186 |
| | % Black or African American | 51.2% | 51.2% | |
| | % Asian | 0.3% | 0.1% | |
| | % American Indian/Alaska Native | 1.9% | 1.7% | |
| | % Other | 3.8% | 4.0% | |
| | % Refused/Do Not know/Not Collected | 1.9% | 1.6% | |
| **Ethnicity** | % Hispanic | 4.2% | 3.7% | 0.4146 |
| **Education** | % < 9$^{tn}$ Grade | 3.6% | 3.3% | 0.0920 |
| | % Grades 9-11 | 21.6% | 20.5% | |
| | % GED | 8.8% | 9.7% | |
| | % High School Degree | 26.0% | 29.3% | |
| | % Some College | 25.6% | 20.0% | |
| | % Some Technical/Trade School | 1.6% | 1.6% | |
| | % Technical/Trade School Degree | 2.6% | 2.4% | |
| | % College/University Degree | 6.8% | 9.2% | |
| | % Refused/Do Not know/Not Collected | 3.4% | 4.1% | |
| **Cigarettes per Day** | Mean (SD) | 17.4 (10.9) | 17.0 (10.3) | 0.3595 |
| **FTND[1] Item 1** | % Smoking Within 30 Min | 87.1% | 83.8% | 0.0378 |
| **Years Smoked** | % < 1 Year | 0.5% | 0.4% | 0.8492 |
| | % = 1-5 Years | 2.7% | 3.0% | |
| | % = 6-19 Years | 25.0% | 23.4% | |
| | % ≥ 20 Years | 71.7% | 73.2% | |
| **Use Other Forms of Tobacco** | % Yes | 2.3% | 3.0% | 0.3816 |
| **Around Other Tobacco Users at Home** | % Yes | 52.1% | 54.2% | 0.3548 |
| **Prior Use of Nicotine Replacement Therapy** | **%** Yes | 28.9% | 32.5% | 0.0886 |
| **Prior Use of Varenicline** | **%** Yes | 10.8% | 12.8% | 0.1888 |
| **Prior Use of Bupropion** | **%** Yes | 5.4% | 5.6% | 0.8229 |
| **Tried to Quit on Own** | **%** Yes | 52.9% | 57.3% | 0.0574 |
| **Tried a Quit Program** | **%** Yes | 1.0% | 1.2% | 0.6462 |
| **Tried Reducing to Quit** | % Yes | 3.6% | 4.3% | 0.3990 |
| **Tried Other Unspecified Method of Quitting** | **%** Yes | 9.1% | 9.7% | 0.6728 |
| **Confidence in Quitting[2]** | Mean (SD) | 7.7 (2.1) | 7.7 (2.1) | 0.9578 |
| **Motivation to Quit[3]** | Mean (SD) | 7.9 (2.6) | 7.6 (2.8) | 0.0174 |

[1] FTCD = Fagerstrom Test of Cigarette Dependence (Fagerstrom, 2012; Heatherton et al, 1991).
[2] Confidence in Quitting was rated on a 1 to 10 scale (10 = high confidence in quitting).
[3] Prior Motivation to Quit was rated on a 1 to 10 scale (10 = high motivation to quit).

## Table 2: Abstinence Outcomes

| | Abstinence Rates, N Abstinent/Total (%) | | Abstinence Risk Difference (95% CI), P-Value | Unadjusted Odds Ratio (95% CI) |
|---|---|---|---|---|
| | Control | Incentive | Control vs. Incentive | Control vs. Incentive |
| **Primary Outcome Measure: Abstinence Based on Biochemical Test** | | | | |
| Intention to Treat (ITT) Sample (n = 1900) | 131/952 (13.76%) | 206/948 (21.62%) | -7.86 (-11.28 to -4.5) P < 0.0001 | 0.58 (0.46 to 0.74) |
| **Secondary Outcome Measures: Abstinence Based on Biochemical Test** | | | | |
| Responder Only Sample (n = 1114) | 131/562 (23.31%) | 205/552 (37.14%) | -13.83 (-19.16 to -8.49) P < 0.0001 | 0.52 (0.40 to 0.67) |
| ITT Sample Removing Participants Disenrolled from Medicaid (n = 1710) | 127/848 (14.98%) | 196/862 (22.74%) | -7.76 (-11.45 to -4.07) P < 0.0001 | 0.60 (0.47 to 0.77) |
| ITT Sample Participants Tested with Carbon Monoxide Breath Test (n = 1458) | 118/736 (16.03%) | 173/722 (23.96%) | -7.93 (-12.02 to -3.84) P = 0.0002 | 0.61 (0.47 to 0.79) |
| ITT Sample Participants Tested with Urine Cotinine Test (n = 384) | 10/188 (5.32% | 26/170 13.27% | -7.95 (-13.68 to -2.22) P = 0.0076 | 0.37 (0.17 to 0.78) |
| ITT Sample Participants: Quit Line or Community-Based Referral (n = 1456) | 119/732 (16.26%) | 174/724 (24.03%) | -7.78 (-11.9 to -3.67) P = 0.0002 | 0.61 (0.47 to 0.80) |
| ITT Sample Participants: Clinic-Based Referral (n = 444) | 12/220 (5.45%) | 31/224 (13.84%) | -8.38 (-13.81 to -2.96) P = 0.0029 | 0.36 (0.18 to 0.72) |
| **Secondary Outcome Measures: Abstinence Based on Self-Reporting** | | | | |
| ITT Sample (n = 1900) | 98/952 (10.29%) | 136/948 (14.35%) | -4.05 (-7.00 to -1.10) P = 0.0072 | 0.69 (0.52 to 0.90) |

| | Abstinence Rates, N Abstinent/Total (%) | | Abstinence Risk Difference (95% CI), P-Value | Unadjusted Odds Ratio (95% CI) |
|---|---|---|---|---|
| | Control | Incentive | Control vs. Incentive | Control vs. Incentive |
| Responder Only Sample (n=862) | 98/411 (23.84%) | 136/451 (30.16%) | -6.31 (-12.22 to -0.40) P = 0.0374 | 0.73 (0.54 to 0.98) |
| Secondary Outcome Measures: Abstinence Based on Combined Biochemical Test and Self-Reporting | | | | |
| ITT Sample (n=1900) | 39/952 (4.10%) | 72/948 (7.59%) | -3.50 (-5.60 to -1.39) P = 0.0012 | 0.52 (0.35 to 0.78) |
| Responder Only Sample (n=651) | 39/326 (11.96%) | 72/325 (22.15%) | -10.19 (-15.92 to -4.46) P = 0.0005 | 0.48 (0.31 to 0.73) |

The ITT analysis includes all participants who were randomly assigned to either the Incentive Group or Control Group, regardless of whether they later withdrew or did not provide data for all measures. In this analysis, participants with missing data on the outcome variable are counted as smoking.

The "Responder" sample includes just those participants for whom six-month testing data was obtained.

## Table 2A: Key Treatment Engagement Outcomes

| | Mean (SD) | | t-test (df) | P-Value |
|---|---|---|---|---|
| | Control | Incentive | | |
| Number of Proactive Treatment Calls Taken | 2.9 (1.5) | 3.8 (1.4) | t(1898) = -14.6 | < 0.0001 |
| Total Number of Minutes of Counseling | 46.1 (26.5) | 65.2 (27.1) | t(1898) = -15.6 | < 0.0001 |

**Table 3: Quit Line Call Acceptance and Medication Pickup Rates for Participants in the Control and Incentive Groups**

| | | Treatment Group | |
|---|---|---|---|
| | | **Control (n = 952)** | **Incentive (n = 948)** |
| | | **n (%)** | **n (%)** |
| **Proactive Quit Line Calls Completed:** | Zero Calls | 6 (0.6%) | 3 (0.3%) |
| | 1 Call | 245 (25.7%) | 76 (8.0%) |
| | 2 Calls | 179 (18.8%) | 113 (11.9%) |
| | 3 Calls | 154 (16.2%) | 122 (12.9%) |
| | 4 Calls | 165 (17.3%) | 199 (21.0%) |
| | 5 Calls | 203 (21.3%) | 435 (45.9%) |
| | 1 ad hoc Call | 139 (14.6%) | 175 (18.5%) |
| | 2+ ad hoc Calls | 51 (5.4%) | 97 (10.2%) |
| ($\chi^2 = 196.1$, $p < 0.0001$) | | | |
| **Medication Pick-Up:** | No medications picked up | 497 (52.2%) | 430 (45.4%) |
| | 1+ Nicotine Replacement Medications | 255 (26.8%) | 283 (29.9%) |
| | Varenicline Only | 78 (8.2%) | 83 (8.8%) |
| | Bupropion Only | 38 (4.0%) | 59 (6.2%) |
| | Multiple Medications | 84 (8.8%) | 93 (9.8%) |
| ($\chi^2 = 11.5$, $p = 0.022$) | | | |

## Table 4: Per-Participant Cost of Striving to Quit Wisconsin Tobacco Quit Line Incentive Program

| | Control Group (n = 952) | Incentive Group ( n = 948) |
|---|---|---|
| **Service Cost (SD)** | $474 ($65) | $523 ($66) |
| **Incentive Cost (SD)** | $64 ($20) | 187 ($58) |
| **Service Administration (SD)** | $176 ($78) | 179 ($77) |
| **Total Cost Mean (SD)** | $715 ($92) | $888 ($128) |
| **Total Cost for All Participants** | $680,310 | $842,150 |
| **Participants Who Were Abstinent Based on Biochemical Test** | 131 | 205 |
| **Cost per Quit** | $5,193 | $4,108 |

**Notes:**

- Service costs include: billed service costs from the Wisconsin Tobacco Quit Line; UW-CTRI tester costs, test costs from clinics and other testing sites.
- Incentive costs include the cost of the incentives plus administrative charges for the incentive.
- Service administration costs include promotion/marketing costs, travel costs for UW-CTRI staff to get to testing sites, materials and supplies for testing, letters and other service-related supplies, and financial support provided by DHS to clinics and other organizations agreeing to test and make referrals.
- Cost per quit was computed as the numeric sum of costs (service costs + administrative costs + incentive costs) for a given group of interest (e.g., Control group) divided by the number of participants in the given group of interest who reported being abstinent from smoking at the six-month follow-up visit. This approach to computing cost per quit yields a group-specific average cost per quit that does not take into account actual treatment costs of each individual abstinent or continuing smoker. Thus, this approach to computing cost per quit does not yield a measure of variation (e.g., standard deviation).

**Supplemental Table 1: Sociodemographic and Smoking-Related Variables by Type of Entry into the Study**

| Variable | Type of Entry into the Study | | P-Value |
|---|---|---|---|
| | **Quit Line-Direct Referral or Community-Based Referral (n = 1456)** | **Clinic-Based Referral (n = 444)** | |
| **Gender**, % Female | 59.2% | 64.0% | 0.0727 |
| **Age,** Mean (SD) | 45.4 (11.0) | 43.5 (11.6) | 0.0015 |
| **Race**, **%** White | 34.8% | 62.4% | < 0.0001 |
| % Black or African American | 57.2% | 31.1% | |
| % Asian | 0.3% | 0.0% | |
| % American Indian/Alaska Native | 2.1% | 0.9% | |
| % Other | 4.1% | 3.4% | |
| % Refused/Do Not Know/Not Collected | 1.7% | 2.0% | |
| **Ethnicity**, % Hispanic | 4.1% | 3.6% | 0.9104 |
| **Education,** % < $9^{th}$ Grade | 3.1% | 4.5% | 0.0394 |
| % Grades 9-11 | 21.5% | 19.6% | |
| % GED | 9.8% | 7.4% | |
| % High School Degree | 27.1% | 29.5% | |
| % Some College | 22.8% | 22.8% | |
| % Some Technical/Trade School | 1.4% | 2.3% | |
| Technical/Trade School Degree | 2.4% | 2.9% | |
| College/University Degree | 7.6% | 9.5% | |
| % Refused/Do Not Know/Not Collected | 4.4% | 1.6% | |

**Supplemental Table 1: Sociodemographic and Smoking-Related Variables by Type of Entry into the Study**

| Variable | Type of Entry into the Study | | P-Value |
|---|---|---|---|
| | Quit Line-Direct Referral or Community-Based Referral (n = 1456) | Clinic-Based Referral (n = 444) | |
| **Cigarettes per Day**, Mean (SD) | 17.5 (11.0) | 16.1 (9.1) | 0.0151 |
| **FTND**[1] **Item 1**, % Smoking Within 30 Min | 86.4% | 82.7% | 0.0503 |
| **Years Smoked**, % < 1 Year | 0.4% | 0.7% | 0.1073 |
| % 1-5 Years | 2.9% | 2.7% | |
| % 6-19 Years | 23.0% | 28.4% | |
| % 20+ Years | 73.8% | 68.2% | |
| **Use Other Forms of Tobacco**, % Yes | 2.6% | 2.7% | 0.9148 |
| **Around Other Tobacco Users at Home,** % Yes | 52.0% | 57.0% | 0.0651 |
| **Prior Use of Nicotine Replacement Therapy, % Yes** | 30.7% | 30.6% | 0.9777 |
| **Prior Use of Varenicline, % Yes** | 10.2% | 16.9% | 0.0001 |
| **Prior Use of Bupropion, % Yes** | 4.9% | 7.4% | 0.0382 |
| **Tried to Quit on Own, % Yes** | 53.7% | 59.7% | 0.0267 |
| **Tried a Quit Program, % Yes** | 1.1% | 0.9% | 0.7204 |
| **Tried Reducing to Quit,** % Yes | 3.8% | 4.5% | 0.4910 |

**Supplemental Table 1: Sociodemographic and Smoking-Related Variables by Type of Entry into the Study**

| Variable | | Type of Entry into the Study | | P-Value |
|---|---|---|---|---|
| | | Quit Line-Direct Referral or Community-Based Referral (n = 1456) | Clinic-Based Referral (n = 444) | |
| **Tried Other Unspecified Method of Quitting,** | **%** Yes | 9.0% | 10.8% | 0.2521 |
| **Confidence in Quitting,**[2] | Mean (SD) | 7.8 (2.1) | 7.6 (2.0) | 0.3025 |
| **Motivation to Quit,**[3] | Mean (SD) | 7.8 (2.7) | 7.6 (2.8) | 0.2142 |

[1]FTND = Fagerstrom Test of Nicotine Dependence (Heatherton et al, 1991).

[2]Confidence in Quitting was rated on a 1 to 10 scale (10 = high confidence in quitting).

[3]Prior Motivation to Quit was rated on a 1 to 10 scale (10 = high motivation to quit).

## Supplemental Table 2: Quit Line Call Acceptance and Medication Pickup Rates for Participants in the Control and Incentive Groups Including on Method of Entry

| | Quit Line-Based Referral | | Community-Based Referral | | Clinic-Based Referral | | Total Enrollment | |
|---|---|---|---|---|---|---|---|---|
| **Enrolled** | 980 | | 476 | | 444 | | 1900 | |
| | Incentive Group | Control Group | Incentive Group | Control Group | Incentive Group | Control Group | Incentive Group | Control Group |
| **Withdrew**** | 11 | 16 | 5 | 8 | 6 | 8 | 22 | 32 |
| **Participants Remaining at End of Study** | 482 | 471 | 226 | 237 | 218 | 212 | 948 | 952 |
| **Completed the Baseline Test*** | 493 | 487 | 231 | 245 | 224 | 220 | 948 | 952 |
| **Took the 1st Call** | 491 | 482 | 229 | 241 | 221 | 216 | 941 | 939 |
| **Took the 2nd Call** | 427 | 318 | 190 | 152 | 182 | 119 | 799 | 589 |
| **Took the 3rd Call** | 394 | 260 | 170 | 128 | 151 | 99 | 715 | 487 |
| **Took the 4th Call** | 344 | 221 | 160 | 103 | 135 | 70 | 639 | 394 |
| **Took the 5th Call** | 306 | 197 | 126 | 84 | 116 | 53 | 548 | 334 |
| **Completed the 6-Month Test*** | 299 | 316 | 146 | 146 | 110 | 105 | 555 | 567 |
| | | | | | | | | |
| **No Medications Picked Up** | 209 | 238 | 134 | 159 | 87 | 100 | 430 | 497 |
| **1+ Nicotine Replacement Medications** | 167 | 143 | 63 | 65 | 53 | 57 | 283 | 255 |

*Not used in the analysis of engagement

**Not including 137 who lost Medicaid eligibility

## Supplemental Table 2: Agreement of the Self-Report and Biochemical Abstinence Assessments at 6-Month Follow-Up

| **Group Participants**[a] | Self-Report: Abstinent Biochemical: Abstinent **# of Participants** | Self-Report: Abstinent Biochemical: Smoking **# of Participants** | Self-Report: Smoking Biochemical: Abstinent **# of Participants** | Self-Report: Smoking Biochemical: Smoking **# of Participants** | **% Discordance in Abstinence Ascertainment** |
|---|---|---|---|---|---|
| **Total Sample (n = 651)** | 111 | 66 | 105 | 369 | 66 + 105/651 = 26.3% |
| **Control Group (n = 326)** | 39 | 37 | 46 | 204 | 37 + 46/326 = 25.5% |
| **Incentive Group (n = 325)** | 72 | 29 | 59 | 165 | 29 + 59/325 = 27.1% |

[a]Group participants consist of study participants who completed both the 6-month follow-up call (during which self-reported smoking status was assessed) and the 6-month in-person visit (during which biochemical testing was conducted).

**Endnotes**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