The Impact of Reengagement on Long Term Smoking Cessation In Military Personnel, Retirees, and Dependents: A Randomized Clinical Trial

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DISCLAIMERS:

The views expressed are those of the authors and do not reflect the official views or policy of the Department of Defense or its Components.

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Abstract

The purpose of the current study was to determine what type of treatment reengagement after smoking relapse would increase long-term cessation. Participants were 134 TRICARE health insurance beneficiaries. At baseline, all participants received a validated, four-session tobacco cessation intervention delivered telephonically with free nicotine replacement therapy (NRT). At the three-month follow-up, participants who had failed to quit or who relapsed, were offered the opportunity to attempt to achieve tobacco abstinence again. Participants were randomized into one of three reengagement conditions: (1) Repeat the initial intervention ("Recycle"); (2) Smoking reduction with the eventual goal of cessation ("Rate Reduction"); or (3) the choice between #1 and #2 ("Choice"). Prolonged abstinence and 7-day point prevalence abstinence were measured at 12 months. Despite being a clinical trial advertised as having the opportunity for reengagement, only about 51% (134 out of 264) of participants who were still smoking at the 3-month follow-up were willing to reengage. Overall, participants randomized to Recycle had higher prolonged cessation rates at 12 months than the Rate Reduction condition (OR=16.43, 95% CI: 2.52 to 107.09, Bonferroni adjusted p=0.011, Table 2). When participants who randomly received Recycle or Rate Reduction were respectively pooled with participants who chose Recycle or Rate Reduction in the Choice group, Recycle also had higher prolonged cessation rates at 12 months than Rate Reduction (OR=6.50, 95% CI: 1.49 to 28.42, p=0.013, Table 3). Our findings suggest that smokers who fail to quit smoking and are willing to reengage are more likely to benefit from repeating the same treatment than smoking rate reduction.

Introduction

The prevalence of current cigarette smoking among U.S. adults is approximately 14%.[1] Sixty-eight percent of US adult smokers report they want to quit smoking,[2] and 55% of adult smokers make a quit attempt each year. For smokers attempting tobacco abstinence, only 7.5% successfully maintain abstinence long-term. Cigarette smokers may make 30 or more quit attempts before successfully achieving tobacco abstinence.[3]

Given the high relapse rates associated with quitting smoking, strategies are needed to reengage smokers after a failed quit attempt. Among tobacco quit lines (QLs), only 19% of report contacting relapsed smokers for re-enrollment.[4] Contact with non abstinent smokers initiated by investigators (i.e., proactive engagement) has been observed to be associated with superior abstinence rates compared to contact relying on participants to reengage on their own (i.e., reactive engagement). In telephone calls through Veteran Affairs medical centers, two-thirds of relapsed smokers endorsed a desire to recycle into treatment within 30 days and 91% of the recyclers endorsed a preference for behavioral or pharmacological smoking cessation treatment. Vickerman et al.[5] found proactive telephonic outreach to yield 5-fold greater odds of reengagement compared with no outreach. Carlini et al. found similar results when they randomized 2,985 participants to either Interactive Voice Response (IVR) screening for current smoking (control group) or IVR screening plus an IVR intervention inviting participants to reengage. Results indicated that smokers reached by the IVR intervention were 11 times more likely to re-enroll in an additional treatment ($p<.001$) and that older smokers were more likely to reengage compared to younger smokers ($p<0.013$).[6]

Attempting to increase engagement with younger smokers, Carlini et al.[7] (2015) invited 3,510 current smokers from a registry of 26,696 past tobacco QL participants to reengage. Investigators employed a 3-phased IVR approach with the second phase including post cards, e-mails, and 2 text messages. The comparison group was all registry members minus the study sample who received no form of invitation to reengage. Although results indicated that QL services were re-initiated by 12.2% of the intervention group compared with 1.9% of the comparison group ($p < .001$), no significant improvements were seen in the rates of younger smokers re-engaging. However, participants were contacted sometimes long after their initial quit line involvement, either 6-9, 10-13, or 14-17 months later.

In a 2018 retrospective study, Nair et al.[8] observed that individuals with a mental health condition, greater tobacco dependence, and self-referral were more likely to reengage in QL services. Beebe et al. (2020)[9] compared QL re-enrollment in an "Individual Services (IS)" option in which participants chose from one or more non-telephone support options versus a more intensive, multi-call (MC) service and observed that participants who received the IS option were much more likely to reengage than those in the intensive MC service (16% vs 3%, $p<.001$). Compared to those not reached, IS participants were 14.7 times more likely to re-enroll after having received a nicotine replacement therapy follow-up call checking on adherence and side effects and 7.8 times more likely to re-enroll in MC when reached by phone. Factors observed to influence reengagement included older age, male gender, lower income (under $35K/year), and enrolling via telephone vs. the web. Although informative, the authors suggest that this type of re-enrollment might be more accurately described as

“an extension of treatment, as opposed to reenrollment in treatment,” as re-enrollment was defined as any additional engagement past the first encounter. Additionally, this study did not use proactive reengagement or a random assignment.

While all these studies suggested that there are effective methods of re-engaging participants following a failed quit attempt, we are aware of only a few studies using pharmacologic treatment only,[10–12] who randomized participants to different reengagement interventions, and no studies to date that have evaluated differential reengagement strategies following a failed quit attempt. For example, Tønnesen et al. (1993) measured the effect of proactive reengagement among individuals who failed to quit in two prior interventions. At baseline, all participants received either an active or placebo nicotine patch and offered a nicotine patch (regardless of initial group assignment) at the 1-year follow-up if they continued smoking. At a 2-year follow-up, all smokers were randomized to receive the nicotine nasal spray at either a fixed dose (i.e., 1 mg per hour) or *ad libitum* dosing (i.e., up to 5 mg per hour or 40 mg per day). Only 6% of these individuals who received this additional intervention met criteria for sustained abstinence at 1-year follow-up, with no difference between the two dosing groups.

Available literature suggests that reengaging nontobacco abstinent individuals can increase their willingness to try to quit again but less clear is what treatment they should receive. We are aware of at least three potential strategies that could be leveraged to reengage cigarette smokers in treatment after initial relapse to tobacco use to increase tobacco abstinence rates. One approach is to have participants simply repeat the original intervention (“Recycle”). Indeed, many of the reengagement

strategies reviewed above have participants repeat the intervention, such as inviting participants back to tobacco QLs.[5–8,13] Another strategy for reengagement is "Rate Reduction." Rate Reduction works on sustaining significant reductions in the number of cigarettes per day with the goal of achieving long-term abstinence in smokers who report, at baseline, they are not ready to quit smoking.[14] It is unclear, however, if Rate Reduction is effective in smokers who are reporting a desire to quit at baseline. Two meta-analyses conducted by our research team found that smokers not ready to quit at baseline were as likely to achieve long-term cessation with rate reduction as those receiving smoking cessation intervention in smokers ready to quit.[14,15] Given that rate reduction interventions are designed as a precursor to cessation or a means to an end, Rate Reduction might be very attractive to participants who either failed to quit smoking or who relapsed. A third reengagement strategy would offer participants the choice between Recycle and Rate Reduction ("Choice"). Allowing choice may enhance motivation to participate in clinical interventions and, potentially, increase tobacco abstinence.[16]

The purpose of the current investigation was to evaluate which reengagement strategy was associated with the highest smoking abstinence rates at 12 months. We randomized cigarette smokers who had failed to achieve initial abstinence or who relapsed to: (1) Recycle; (2) Rate Reduction; or (3) Choice between Recycle and Rate Reduction.

Methods

Study Design

We conducted a three-arm, individually-randomized clinical trial. The independent variable was treatment assignment (Recycle, Rate Reduction, Choice) and the dependent variables were prolonged (defined as no smoking since 2 weeks after the target quit date) smoking abstinence and 7-day point prevalence (defined as no smoking in the previous 7 days) at the 12-month follow-up. Additional details of the design can be found in Little et al., 2017.[17]

Participants

Consented participants were initially 614 Department of Defense (DoD) TRICARE beneficiaries, which includes active duty and retired personnel (Army, Navy, Air Force, Marines, and Coast Guard) and their dependents. To be eligible for enrollment, participants needed to be at least 18 years of age, have expressed a willingness to attempt cessation in the next 30 days, and have smoked five or more cigarettes per day (CPD) for at least one year. Additionally, participants had to be located at a military installation (within or outside the continental U.S.) that had an adequate medical infrastructure (in the event of nicotine replacement therapy side effects) and a military postal address where nicotine replacement therapy (NRT) could be mailed. We also excluded any individual who reported an allergy to nicotine.

Procedure

All recruited participants received a validated, four-session smoking cessation intervention delivered through a tobacco QL along with an 8-week supply of NRT in the

form of the nicotine patch with dosage based on their baseline levels of smoking.[17] Participants who smoked > 20 cigarettes per day (CPD) received the 21-mg nicotine patch for 4 weeks, the 14-mg patch for 2 weeks and the 7-mg patch for 2 weeks. Participants who smoked 10-19 CPD received the 14-mg patch for 4 weeks and the 7-mg patch for 4 weeks. Participants who smoked 5-9 CPD received the 7-mg patch for 8 weeks.

Consented participants were told that they would be contacted at a 3-month follow-up and those who had either failed to quit or relapsed at that time would be offered an additional tobacco cessation intervention in a randomized fashion: (1) Recycle; (2) Rate Reduction; or (3) Choice between Recycle and Rate Reduction. Participants assigned to Recycle or who chose Recycle in the Choice condition received 8 weeks of the nicotine patch along with continued behavioral counseling the same way as in the first phase of the trial. Participants assigned to the Rate Reduction intervention or who chose Rate Reduction in the Choice condition received the nicotine gum for up to 16 weeks for reducing their tobacco use.[15] Participants received the 4-mg nicotine gum if they smoked ≥ 25 CPD and the 2-mg nicotine gum if they smoked < 25 CPD. They received 300 pieces for 8 weeks, 126 pieces for 4 weeks, and 84 pieces for 4 weeks. Gum was encouraged as a substitute for cigarette use.

This study was approved by the Wilford Hall Medical Center IRB.

Initial Intervention

The current study utilized a tobacco QL with NRT in which counselors proactively engaged participants along with 8 weeks of the nicotine patch. All participants received a four-session smoking cessation intervention. In session 1, participants were presented

with information and tools designed to increase motivation to quit and skills in preparation for a quit attempt. In session 2, participants were taught strategies to help them prepare to quit and set a quit date. Session 3 focused on short-term relapse prevention and surviving the first few days after the quit date. In session 4, long-term relapse prevention was discussed.

All participants were contacted at three months and any participants reporting current smoking were asked if they were interested in re-engaging in an intervention. Participants who expressed interest in re-engaging were randomized to one of the three conditions described below.

Randomized Intervention

Participants randomized to the Recycle condition or who chose Recycle in the Choice condition again received the same four-session smoking cessation intervention with the nicotine patch (described above).

Participants randomized to Rate Reduction or who chose Rate Reduction in the Choice condition received a validated, three-session Rate Reduction intervention.[15] Session 1 provided strategies to increase motivation to quit and to learn rate reduction strategies with a goal of reducing the number of cigarettes per day by at least 25%. They also received 4-mg nicotine gum and education about substituting gum for smoking. Session 2 focused on triggers and strategies for avoiding smoking. These strategies included spacing out the time between cigarettes, only smoking in one situation (e.g., outside) or never smoking in a situation (e.g., the car), and reducing access to cigarettes (e.g., putting the cigarettes in the garage) to reduce those "automatic" cigarettes. An additional goal of at least 25% in the number of cigarettes per

day was recommended. Finally, in session 3, strategies were discussed for long-term maintenance of reduced smoking along with preparing to quit when ready.

Attrition as a Result of Failure to Reengage

At the time that this clinical trial commenced, little data existed on how many participants would reengage at the three-month follow-up. Additionally, as part of the recruitment process, we actively discussed reengagement, and it was presented in detail in the consent form (Figure 1). Despite these efforts, of the 264 participants reached at the three-month follow-up who were eligible to reengage (e.g., had either relapsed or failed to quit), 130 (49%) declined to reengage, although the vast majority indicated they would provide 12-month follow-up information.

Based on other work on this data set,[18] we identified predictors of those who reengaged with those who chose not to reengage. Overall, participant who were a race other than white were more likely to reengage. Using the NRT provided and completing more counseling sessions during the initial intervention was also associated with an increase in the odds of being willing to reengage at 3 months.

Assessments

At baseline, participants were asked about their smoking history (e.g., years smoked, number of cigarettes per day) as well as standard demographics (e.g., age, race, military status, etc.). In addition, participants completed the Fagerstrom Test for Nicotine Dependence (FTND).[19]

Outcomes

The primary and secondary outcomes were self-reported prolonged abstinence (i.e., no smoking since 2 weeks after the target quit date[20]) and 7-day point prevalence abstinence (i.e., no smoking in the last 7 days) assessed at 12 months, respectively.

Statistical Methods

All randomized participants were included in the analysis based on intent-to-treat principal. Descriptive statistics were used to summarize participant characteristics by the three treatment groups (Recycle, Rate Reduction, and Choice) using median and interquartile range (Q1, Q3) for quantitative variables, and frequency and percentages for categorical variables. To reduce potential treatment selection bias (whether they chose to reengage or not at the 3-month follow-up) and improve the validity of our findings, a propensity score was developed as the conditional probability of being treated (reengaged) given an individual's set of risk factors that influence the decision of reengagement after the 3-month of initial treatment. The propensity score was created using a multivariable logistic regression with reengagement as a dependent variable. The independent variables included participants' demographic variables specifically age, gender, race, education, marital status, military status, baseline FTND scores, the first 3-month treatment adherence measured as number of counseling sessions attended and NRT use, and additional NRT or other medications during the first 3 months, and motivation/intention to quit smoking.

To assess if there were differences in the primary outcome of prolonged smoking abstinence rates at 12 months follow-up between the three treatment groups after 3 months, a logistic regression model was used. To take full advantage of relative ability of different propensity score methods, we employed the propensity score weighting[21] in

reducing the potential treatment selection bias. The propensity score weighting model was also adjusted for the imbalanced covariates[22] such as participants' demographic information and FTND at 3-month. A similar analytic approach was used to assess treatment effects of pooled randomized Recycle and Rate Reduction conditions. The model was also adjusted for an additional indicator of the choice of treatment condition made by participants randomized to the Choice arm. A similar statistical modeling approaches as described in the primary outcome were used to assess if there were differences in the secondary outcome of past 7-day point prevalence abstinence rates between the treatment groups. A C-index or area under the receiver operator characteristic (ROC) curve from the model was used as a measure of overall predictive discrimination, which is defined in this study as the ability to separate the reengaged participants who quit smoking cigarettes at 12-month follow-up from the reengaged participants who did not. A ROC curve of 0.5 indicates no discrimination, whereas a ROC curve of 1.0 indicates perfect discrimination. The overall significance level was specified at 0.05. All the analysis was carried out using SAS 9.4 (SAS Institute Inc., Cary, NC).

Results

Demographics

Figure 1 presents the Consort diagram for the study.

Table 1 presents the demographic statistics by condition and for the entire sample. Overall, participants averaged 47 years in age, 51% were female, 18% were

African American, and 10% were Hispanic. A full 100% had a high school degree or higher. Participants smoked a median of 20.0 cigarettes per day, had smoked for a median of 30.0 years, and had a median Fagerstrom Test for Nicotine Dependence (FTND) score of 5.0. Of the 47 participants assigned to the Choice condition, 31 (66%) chose Recycle while 16 (34%) chose Rate Reduction.

Smoking Abstinence

Regarding the primary outcome of prolonged abstinence at 12 months, a significant treatment main effect was observed (p=0.015). The Recycle group had 16.4 times higher odds of 12-month prolonged smoking abstinence compared to Rate Reduction treatment group (OR=16.43, 95% CI: 2.52, 107.09, Bonferroni adjusted p=0.011, Table 2). No significant differences were observed in the 12-month prolonged abstinence between Recycle and Choice (OR=2.77, 95%CI: 0.51, 15.01, Bonferroni adjusted p=0.707) nor between Choice and Rate Reduction (OR=5.9, 95% CI: 0.99, 35.77, Bonferroni adjusted p=0.155). The C-index of 0.86 from the multivariable logistic regression model indicated that this model had excellent predictive discrimination power between the reengaged participants with and without 12-month prolonged abstinence and had some utility in predicting 12-month prolonged abstinence of individual subjects.[23]

Regarding the secondary outcome of past 7-day point prevalence abstinence at 12 months, a significant treatment main effect was observed (p=0.045). The Recycle condition had 5.5 times higher odds of 12-month point prevalent smoking abstinence compared to Rate Reduction treatment group (OR=5.46, 95% CI: 1.43, 20.88, Bonferroni adjusted p=0.041, Table 2). However, no significant differences were

observed in 12-month 7-day point prevalence smoking abstinence between Choice and Rate Reduction (OR=3.86, 95% CI: 0.84, 17.71, Bonferroni adjusted p=0.246) nor between Recycle and Choice (OR=1.42, 95%CI: 0.37, 5.44, Bonferroni adjusted p=0.999). The C-index of 0.76 from the multivariable logistic regression model indicated that this model had very good predictive discrimination power between the reengaged participants with and without 12-month point prevalent abstinence.

Participants randomly assigned to Choice received either the Recycle or Rate Reduction depending on their selection. Compared to pooled Rate Reduction from the primary randomization and those participants who selected Rate Reduction in the Choice condition, the pooled Recycle with the Recycle in the Choice condition had a 6.5 times higher odds of 12-month prolonged abstinence (OR=6.50, 95% CI: 1.49, 28.42, p=0.013, Table 3), and 3.7 times higher odds of 12-month 7-day point abstinence (OR=3.65, 95% CI: 1.16, 11.46, p=0.027).

For our analyses, we assumed that data not present were missing at random (MAR). There were only 8 out of 134 participants loss to 12-month follow-up (about 6.0%). A logistic regression analysis indicated that there were no differences in whether or not loss to 12-month follow-up between the treatment groups (p=0.595), suggesting that there was no sufficient evidence to support missing was informative. This additional sensitivity analysis provided evidence of validity of MAR assumption.

Discussion

We observed that the Recycle condition was associated with the highest 7-day point prevalence and prolonged abstinence smoking abstinence rates at 12 months. We also observed that two-thirds of patients who elected to reengage in treatment and

received the option to select the intervention that they could repeat (Choice) chose the same intervention (Recycle).

Our results suggest that for smokers who have failed to quit or who have relapsed following a formal stop smoking program, only about half chose to re-engage and among re-engaged smokers able to choose their second treatment (Choice), most chose to repeat the intervention. Smokers may make 30 or more quit attempts before successfully achieving tobacco abstinence for at least 1 year,[3] and our data suggest that trying again successfully does not necessarily mean trying something different nor is it preferred by most smokers. Future studies should focus on the removal of whatever barriers exist to repeating a formal stop smoking program and encourage smokers to recycle in treatment following a failed quit attempt.

We also observed that Rate Reduction was inferior to Recycle through the same intervention. A recent meta-analysis concluded that smoking abstinence rates in rate reduction programs among smokers not ready to quit had smoking cessation rates as high as in stop smoking programs engaging smokers ready to quit.[15] However, virtually all of these studies were conducted with smokers initially not willing to quit and not those who at baseline, were ready to quit. We hypothesize that this may be explained through the “mismatch” between smokers’ goals of quitting smoking when they are seeking treatment through a clinical trial and receiving an intervention rate reduction with the **eventual** goal of cessation.[15] Future studies should evaluate methods of engaging <u>both</u> smokers ready and not ready to quit, with the eventual goal of one comprehensive program where different intervention targets are matched to a participant’s readiness to quit.

Despite being advertised and explained to participants as a program in which there will be an opportunity for reengagement, and proactive efforts to solicit reengagement, only half elected to reengage. While one can only speculate as to the reasons for this low re-engagement rate, it should be noted that when people were recruited, they knew that part of the intervention would be to have the opportunity to reengage in treatment at 3 months should they fail to achieve tobacco abstinence. This time point was chosen because it is the time by which the vast majority of smokers will have relapsed[24] and most relapses to smoking are known to occur within the first 8 days of quitting.[25] Self-reported motivation to quit remains high among smokers after a relapse, and the data suggest that motivation to quit is necessary to prompt action, but not sufficient to maintain abstinence.[26] Previous studies of relapsers in clinical trials have observed that one-third renew quitting within 24 hours and one-third of those are abstinent at follow-up.[27] Our investigation was designed to capitalize on post-relapse motivation for reengagement. Individual differences likely exist between participants when they are ready to attempt smoking cessation again and the three month "one size fits all" time to reengage was not effective. Previous studies have noted that the average latency to renewed quitting among relapsed smokers is 106 days.[27] Proactive weekly reminders for those who have failed to quit smoking or have relapsed that a free stop smoking program with NRT is available when they are ready to make a serious quit attempt may enhance re-engagement. Future studies should be directed at the best way to reach smokers when **they** are ready to reengage

Our study has several strengths including a novel design and a diverse study population. However, our study has some weaknesses to the study. As is the case with

most tobacco QL studies, we had to rely on self-reports of cessation. However, the literature documents that self-reported abstinence is highly reliable in lower demand studies such as this one.[28] And while participants who reengaged were randomly assigned to conditions, participants self-selected into whether or not they chose to reengage.

In summary, cigarette smokers who have failed to quit smoking appear to benefit the most by repeating an intervention based on best clinical practices[24] and not by using an intervention designed to have participants reduce their intake with the goal of eventually quitting smoking. The idea of building proactive reengagement into a treatment seems promising for increasing quit rates. Future studies, however, need to examine a variety of methods for reengaging. Perhaps text messages following the quit or a flexible reengagement plan with proactive contacts might be effective. Based on these results it appears that increased attention should be paid to handling relapse in order to increase smoking cessation among motivated smokers.

Table 1. Baseline demographic information by treatment groups

Variable		Recycle (n=43)	Rate Reduction (n=44)	Choice (n=47)	Total (n=134)
Age, years		56.4 (35.0, 65.5)	53.8 (33.6, 65.6)	46.9 (33.8, 55.7)	46.9 (33.8, 55.7)
Gender	Male	20 (46.51)	24 (54.55)	22 (46.81)	66 (49.25)
	Female	23 (53.49)	20 (45.45)	25 (53.19)	68 (50.75)
Race	White	34 (79.07)	31 (70.45)	32 (68.09)	97 (72.39)
	African American	6 (13.95)	9 (20.45)	9 (19.15)	24 (17.91)
	Others	3 (6.98)	4 (9.10)	6 (12.76)	13 (9.70)
Ethnicity	Non-Hispanic	39 (90.70)	38 (88.37)	43 (91.49)	120 (90.23)
	Hispanic	4(9.30)	5 (11.63)	4 (8.51)	13 (9.77)
Education	High school diploma or GED	11 (25.58)	7 (15.91)	11 (23.4)	29 (21.80)
	Some college/ vocational school/ Associates Degree	23 (53.49)	32 (72.73)	19 (40.43)	73 (54.89)

	Bachelor's Degree or post college	9 (20.93)	5 (11.36)	17 (36.17)	31 (23.31)
Military status	Dependent	21 (48.84)	22 (50.00)	17 (36.17)	60 (44.78)
	Active	8 (18.60)	7 (15.91)	14 (29.79)	29 (21.64)
	Retired	14 (32.56)	15 (34.09)	16 (34.04)	45 (33.58)
Marital status	Single/Widowed/Divorced/ Separated	11 (25.58)	16 (36.36)	11 (23.4)	38 (28.36)
	Married/Living as married	32 (74.42)	28 (63.64)	36 (76.6)	96 (71.64)
Cigarettes per day		18.0 (10.0, 20.0)	15.5 (10.0, 20.0)	20.0 (15.0, 20.0)	20.0 (10.0, 20.0)
Years smoked		30.0 (13.0, 44.0)	30.0 (12.5, 45.0)	25.0 (12.0, 38.0)	30.0 (13.0, 42.0)
Fagerstrom Test for Nicotine Dependence		5.0 (3.0, 6.0)	5.0 (3.0, 5.5)	5.0 (3.0, 6.0)	5.0 (3.0, 6.0)

Note: Categorical variables were displayed as frequency (%) and continuous variables were displayed as median (1^{st} quartile, 3^{rd} quartile).

Table 2. Treatment effects from multivariable logistic regression models of smoking abstinence at 12-month Follow-up

Outcome	Odds Ratio	95% CI		P-value	Bonferroni adjusted P-value
Primary outcome: Prolonged abstinence[A]					
Choice vs. Rate Reduction	5.94	0.99	35.77	0.052	0.155
Recycle vs. Rate Reduction	16.43	2.52	107.09	0.004	0.011
Recycle vs. Choice	2.77	0.51	15.01	0.236	0.707
Secondary outcome: 7-day point prevalence abstinence[B]					
Choice vs. Rate Reduction	3.86	0.84	17.71	0.082	0.246
Recycle vs. Rate Reduction	5.46	1.43	20.88	0.014	0.041
Recycle vs. Choice	1.42	0.37	5.44	0.611	0.999

Note: The propensity score weighting models were also adjusted for imbalanced covariates such as participant age, gender, race, marital status, military status, and Fagerstrom scores at 3 months.

CI: Confidence interval

[A]Prolonged abstinence defined as no cigarette smoking starting 2 weeks after the target quit date; [B]7-day point prevalence defined as no cigarette smoking in the previous 7 days of the assessment time. The Choice condition is a combination of both Recycle and Rate Reduction.

Table 3. Pooled treatment effects from multivariable logistic regression models of smoking abstinence at 12-month follow-up

Outcome	Odds Ratio	95% CI		*P*-value
Primary outcome: Prolonged abstinence[A]				
Pooled Recycle vs Pooled Rate reduction	6.50	1.49	28.42	0.013
Secondary outcome: 7-day point prevalence abstinence				
Pooled Recycle vs Pooled Rate reduction[B]	3.65	1.16	11.46	0.027

Note: The propensity score weighting models were also adjusting for the covariates described in the table 2 and an indicator of whether or not the participants had a choice to choose either treatment conditions.

[A]Prolonged abstinence defined as no cigarette smoking starting 2 weeks after the target quit date;[B] 7-day point prevalence defined as no cigarette smoking within 7 days of the assessment time.

Pooled treatment groups: pooled participants who randomly received either Recycle or Rate Reduction with participants who chose either Recycle or Rate Reduction in Choice group

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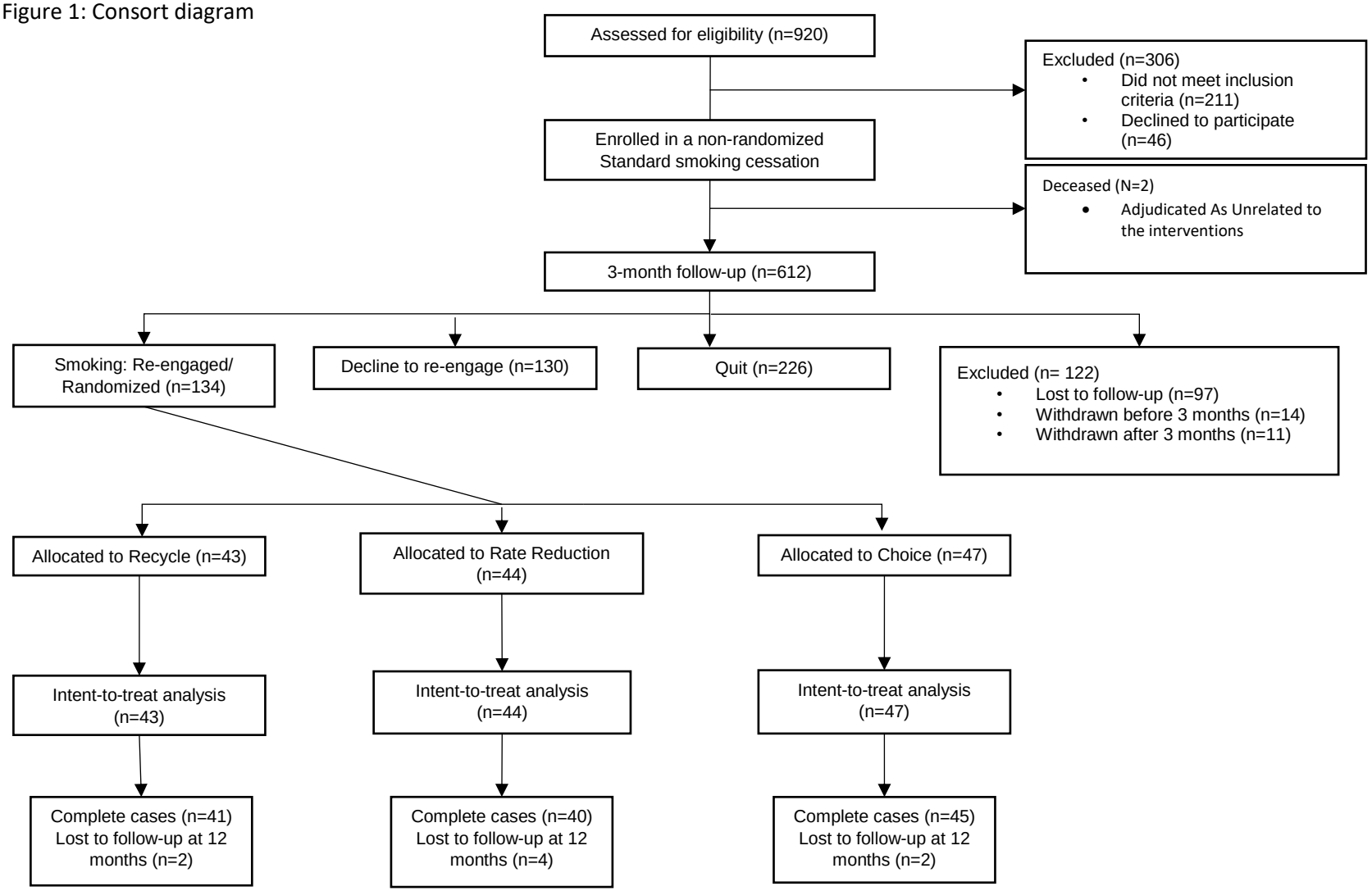
Figure 1: Consort diagram



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