

Title: Predictors of re-engagement after relapse in a tobacco quit line intervention

Authors: Kara P. Wiseman,¹ Chase A. Aycock,² Indika Mallawaarachchi,¹ Xin-Qun Wang,¹ Daniel G. Cassidy,² Marc A. Patience,² Melissa Little,¹ G. Wayne Talcott,^{1,2} Robert C. Klesges¹

Affiliations: 1. Department of Public Health Sciences, School of Medicine, University of Virginia

2. Wilford Hall Ambulatory Surgical Center, Clinical Health Psychology, Joint Base San Antonio – Lackland

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Abstract

Background: People who smoke often make several quit attempts before successfully maintaining abstinence. Therefore, incorporating re-engagement for people who fail to initially quit could increase quit attempts and ultimately increase cessation rates. Within the context of quit line-based interventions, it remains unknown what characteristics are associated with re-engagement.

Purpose: Assess associations between demographic and motivational characteristics, tobacco use, and initial intervention engagement with re-engagement in a tobacco quit line intervention.

Methods: 372 adult smokers who reported smoking three months after initiating a quit line-facilitated quit attempt as part of a larger randomized clinical trial were included. Associations between personal characteristics (e.g., age, gender, nicotine dependence, self-efficacy to quit smoking) and initial intervention engagement (number of completed counseling sessions and use of nicotine replacement therapy (NRT)) with re-engagement (accepting an offer to re-initiate the quit line intervention) were determined using multivariable logistic regression modeling.

Results: A majority of smokers (56.3%) re-engaged with the quit line intervention. Compared to non-white participants, white participants had lower odds of re-engaging (OR: 0.42, 95% CI: 0.23, 0.75). Number of completed counseling sessions was associated with re-engaging; NRT use during the initial intervention was not associated with re-engaging.

Conclusions: Initial intervention engagement is important in the process of re-engagement, specifically participation in counseling sessions. Exploration of associations between initial intervention engagement and potentially modifiable motivational factors is needed to potentially leverage in future interventions to maintain adult smokers' continued engagement in cessation.

Keywords: Smoking cessation, quit line, re-engagement, mHealth

Introduction

Cigarette smoking remains the leading cause of preventable death in the US [1]. An estimated 14% of US adults currently smoke, but a full 68% are interested in quitting [2]. Quit line cessation interventions are effective and have the potential to reach smokers across the country. However, a single use of a quit line intervention may be insufficient for many, as smokers must often make multiple attempts before successfully quitting [3,4]. Fortunately, more than 60% of smokers report interest in re-engagement with smoking cessation after failing to quit [5,6]. Given the widespread need for multiple quit attempts and smokers' interest in continued support, incorporating re-engagement for smokers who fail to initially quit could increase quit line-facilitated quit attempts and ultimately increase cessation rates.

Some studies have attempted to increase re-engagement among smokers who initially fail to quit. For example, Vickerman et al. randomized callers to the Minnesota Quit Line into receiving or not receiving re-engagement outreach [7]. Outreach was conducted using multiple methods (i.e., phone, email, and/or text message) at one, two, or three months after initial engagement. Proactively re-engaging smokers who had failed to quit resulted in five-fold greater odds of re-engagement than those randomized to reactive (i.e., participant-initiated) contact [7]. In a series of studies by Carlini et al., using proactive re-engagement through Interactive Voice Response technology, resulted in participants having a greater odds of re-engagement relative to an automated screening of current tobacco use [8–10]. While none of these studies reported cessation as an outcome following re-engagement, these re-engagement strategies are cost-effective [7] and have the potential for scalability. Further, incorporating elements of tailoring or personalization could enhance successful re-engagement and quit line performance.

To inform tailoring strategies, the characteristics of smokers who are interested in re-engaging following a failed quit attempt need to be identified. Insight concerning who is likely to re-engage may enable resource-limited quit lines to target outreach strategies for maximum re-engagement. To our knowledge, two previous studies have examined predictors of re-engagement in a tobacco quit line. Using data from the Arizona Quit line, Nair et al. found that individuals who chose to re-engage had higher odds of both mental health and chronic health diagnoses [11]. They also found that male gender, referral to the quit line by a healthcare provider, cohabitation with other smokers, and possession of medical insurance were inversely associated with re-engagement. Beebe et al. considered the association between initial program selection and re-engagement in the Oklahoma Quit line [12]. Callers had the option to receive nicotine replacement therapy (NRT) and were asked to enroll in either a more intensive multi-call telephone intervention or enroll in less intensive cessation services (less-intensive options included a text-messaging program, an email program, and/or a booklet). Individuals who selected to enroll in a less-intensive cessation service were more likely to re-engage compared to those who initially selected the multi-call telephone intervention. When comparing user characteristics between those who re-engaged and those who did not, univariate analyses revealed that a higher proportion of those re-engaged were older, more likely to be men, had an income less than \$35,000, and had initially enrolled via telephone call (vs. the web). When examining predictors of re-engagement among the subset of users who had selected to initially use less-intensive cessation services who had also used NRT during their quit attempt, the strongest predictor of re-engagement was receiving an NRT counseling phone call.

Thus, the previous literature has assessed associations between demographic characteristics, tobacco use characteristics, and the initial mode of intervention with re-engagement. However, the paucity of research in this area warrants continued evaluation. Further, there remain additional areas for new investigation that have not been previously considered. Specifically, it is unclear if engagement in the initial intervention, or interactions between initial intervention components (e.g., attending counseling sessions and using NRT) influence re-engagement. It is also unknown if confidence in quitting or reasons for quitting influence re-engagement. Consequently, this study sought to assess the association between demographic and motivational characteristics, tobacco use, and initial intervention engagement with re-engagement in a tobacco quit line intervention.

Methods

Data and Study population. This is a secondary data analysis from a large clinical trial of 612 smokers designed to determine the efficacy of three re-engagement strategies on long-term (12 months) smoking cessation [13]. For these analyses, we excluded all participants who reported smoking abstinence at three months (n=226) or who were lost to follow-up before the three-month follow-up (n=14), leaving N=372 in the analytic sample.

Measures. The primary outcome of interest was the participant's decision to re-engage at three months (yes vs. no), thereby making another quit line-facilitated quit attempt, or to decline the opportunity to re-engage, including overt decline to re-engage (n=130), and passive refusal due to non-response to the three-month follow-up survey (n=108).

Several independent variables of interest were included. Nicotine dependence was assessed using the Fagerström Test for Nicotine Dependence [14], and calculated as total score per participant. Confidence in quitting by asking participants, “How confident are you that you will quit smoking some day?”. Response options were a five-point Likert-type scale dichotomized to extremely confident vs. all other responses [15]. Reasons to quit smoking were assessed by asking participants, “People have different reasons for wanting to quit smoking. On a scale of 1 to 5 with 1 being Not at all True and 5 being Extremely True, Please indicate how true each of the following is for you.” And provided a list of nine items, including quitting to save money, quitting due to pressure from others, quitting so that hair and clothes won't smell, etc [16]. Responses to the five-point Likert-type scale were recoded as three-level or dichotomized variables per the distribution of each item. Use of the initial intervention was expressed in terms of the number of counselling sessions participants completed (0, 1, 2, 3, or 4) and if the participant made use of NRT during the initial intervention (yes or no). Lastly, demographic characteristics (i.e., age, gender, race, education, marital status, and military status) were considered.

Statistical Analyses. All analyses were performed using SAS 9.4. Continuous variables were summarized using median and interquartile range, and compared between re-engaged vs not re-engaged using Wilcoxon rank sum test. Categorical variables were summarized using frequency and percentages and compared by re-engagement status using Fisher’s exact test. A multivariable logistic regression model to determine correlates of re-engagement (outcome referent = did not re-engage) was created, which included any independent variable of interest found to be associated with re-engagement in the univariate statistics using a cut-off of p-value of ≤ 0.20 [17]. To determine the impact of initial intervention engagement with re-engagement, an

interaction between counselling sessions completed and NRT use was also tested, however, there was no statistical interaction effect ($p = 0.980$). Therefore, the interaction term was not included in the final model. The C-index of final model was 0.76, indicating that the multivariable logistic regression model had good predictive discrimination power to model subjects who re-engaged vs did not re-engage [18].

Results

Among participants who did not re-engage, the majority were male (56.7%), White (83.1%), married or partnered (65.6%), and active duty or retired military (63.9%, Table 1). A higher percentage of participants who re-engaged used NRT during the intervention (70.2% vs. 46.2% for re-engaged vs not, respectively, $p < 0.001$) and completed all four counseling sessions (73.0% vs. 39.6% for re-engaged vs not, respectively, $p < 0.001$). A higher percentage of participants who re-engaged reported greater confidence in quitting at baseline (57.9% vs. 44.7% for re-engaged vs not, respectively, $p = 0.017$, Table 2). There were several differences between those who did, and did not, re-engage with respect to reasons for quitting.

Multivariable results indicated that race, baseline confidence in quitting, and counselling sessions completed were significantly associated with re-engagement (Table 3). Specifically, compared to non-white participants, white participants had lower odds of re-engaging (OR: 0.42, 95% CI: 0.23, 0.75). Participants who had the highest levels of confidence at baseline had 1.84 the odds of re-engaging compared to participants with lower levels of baseline confidence in quitting (95% CI: 1.12, 3.03). Participants who did not complete all the initial counseling sessions had lower odds of re-engaging at three months. NRT use during the initial intervention

was not associated with re-engagement (OR: 1.55, 95% CI: 0.80, 3.02). Specific reasons to quit smoking were not associated with re-engagement in the final model.

Discussion

The purpose of this study was to identify personal and intervention use characteristics associated with re-engagement among adults participating in a quit line intervention study. To our knowledge, this study is the first to consider personal, tobacco use, motivation, and initial intervention utilization factors that may be associated with re-engagement. We found that, among all possible characteristics of interest, non-white race and high levels of baseline confidence in quitting were associated with re-engagement at three months. Use of the intervention was also associated with re-engagement, specifically the number of initial counseling sessions completed. These results provide new information about why some smokers who fail to quit may ultimately choose to re-engage, establishing new potential directions for future intervention studies.

Our results provide information that could be used when targeting re-engagement strategies to specific groups, which might be necessary to increase re-engagement. In our study population white participants were less likely to re-engage than non-white participants. However, none of the previous research has identified race as being associated with re-engagement. Similarly, while Nair et al. found that men were more likely to re-engage, neither our study nor Beebe et al. found an association between gender and re-engagement. With this inconsistent evidence, it is unclear if targeting demographic characteristics would be effective. We are aware of only one study that has attempted to increase re-engagement by focusing on specific demographic groups.

Carlini et al. compared two mailed interventions, one was tailored to the participant's race/ethnicity and one the other was generic [10]. However, there was no difference in re-engagement between generic and tailored re-engagement messages. It is worth noting though that the rate of re-engagement with the mailed intervention was low to begin with (0.53- 0.67%); thus, it is possible that targeted interventions using a different format (e.g., phone calls or text messages) may yield different results.

We also identified previously unconsidered motivational factors that were associated with re-engagement at three months. Specifically, participants with higher levels of baseline confidence in quitting were more likely to re-engage at three months, which was roughly 6 weeks after the initial intervention ended. It is noteworthy that baseline confidence would produce such an effect, especially within a sample of adults who were all unsuccessful in their first quit attempt. It is possible that increasing confidence in quitting early in quit line counseling may increase the likelihood that those still smoking after their initial quit attempt will subsequently be open to re-engagement. To our knowledge, this concept has not been tested. However, tangentially, Danaher et al. found that positive changes in ratings on a five-point Likert scale of one's confidence of being tobacco-free in 1 year mediated the relationship between a web-based tobacco intervention and abstinence at 3- and 6-month follow-up. Relatedly, it is possible that motivational interviewing at the time of a proactive re-engagement call for callers who initially report lower confidence in quitting, might increase their desire to re-engage [19,20].

Our finding that participants who completed more initial intervention counseling sessions had increased odds of re-engagement suggests that increasing initial intervention engagement could

be a promising strategy to maximize re-engagement following an unsuccessful quit attempt. To our knowledge, no studies have sought to bolster initial engagement of quit line callers with to the goal of improving chances of eventual re-engagement intervention. Beebe et al. (2020) found that selection of a less intensive option by callers for their initial intervention predicted increased likelihood of re-engagement [12]. It could be that having a positive experience with the initial intervention led to increased interest in re-engaging in services even after failing to quit. In the context of our quit line intervention, it is possible that individuals who engaged more in the initial intervention may have grown more familiar with the rationale of the treatment, increasing their awareness of the relevance and potential utility of continuing treatment even after failing to quit. Future studies should continue to investigate the meaning of intervention engagement and consider what constructs may influence engagement with counselor-based cessation interventions.

This study estimated the effect of initial intervention engagement on re-engagement at three months independent of baseline motivational factors such as confidence in quitting some day and specific reasons for quitting smoking, including quitting to be a good role model and quitting to control one's life. Nevertheless, there remains a potential that motivation has an influence on both initial intervention engagement and interest in re-engagement after relapse. Due to missing data at three months, we were not able to consider motivational items at the time of re-engagement. However, descriptively at three months, participants who chose to re-engage had higher mean levels for seeing a benefit in quitting for their health (mean 4.88 vs 4.65 for re-engaged and non-re-engaged respectively, $p=0.037$) and confidence in quitting someday (mean 4.48 vs 4.08 for re-engaged and non-re-engaged, respectively, $p= 0.013$). Lastly, those in the re-

engaged group had higher mean levels of reporting stress as a reason for relapse (mean 4.00 and 3.61 for re-engaged and non-re-engaged, respectively, $p=0.014$) which suggests that those who re-engaged may have directly seen the benefit of having a trained counselor to guide them through the quitting process. Future research should consider exploration of these constructs in a fully powered manner to determine their relevance in the decision to re-engage when adjusting for other characteristics.

This study has several limitations that need to be considered. First, these results are from a secondary analysis of data from a randomized trial [13] and missing data precluded the inclusion of several potentially relevant constructs. We were, nevertheless, still able to address the study aims and have identified several new avenues for exploration to potentially increase re-engagement-focused cessation studies. Additionally, the results of this study may be of limited generalizability, as the study population consisted of active duty service members, retired military personnel, and military dependents. It will be important to explore the results described here in samples comprising non-military populations to determine the replicability of our findings across contexts. In this last respect, while our sample was predominantly active duty and retired military, the inclusion of military dependents allowed us to examine the association between military history and re-engagement. A lack of relationship between military status and re-engagement tentatively suggests that our results may, in fact, generalize to other populations of adult smokers.

Conclusions

This study identified predictors of re-engagement among smokers enrolled in a cessation intervention who relapsed or failed to initially quit by three months after enrolling in a cessation quit line intervention study. We identified initial intervention use and personal characteristics associated with re-engagement, including non-white race and confidence in one's ability to quit smoking someday. Our results point to the importance of initial intervention engagement in the process of re-engagement, specifically for participants who participated in all offered counseling sessions. Future studies should further explore of the associations between initial intervention engagement and potentially modifiable motivational factors that could be leveraged in future interventions to maintain adult smokers' continued engagement in cessation.

Table 1: Demographic, tobacco use, and initial intervention use overall and by three-month re-engagement

| Characteristic | Overall (N=372) n (%) | Not Re- engaged (n = 238) n (%) | Re-engaged (n = 134) n (%) | P- value |
|---|--------------------------------------|--|---|---------------------|
| Age: Median (interquartile range) | 32.1 (49.3, 62.0) | 31.4 (47.5, 61.2) | 34.0 (52.6, 63.7) | 0.138 |
| Gender | | | | 0.234 |
| Male | 202 (54.30) | 135 (56.72) | 67 (50.00) | |
| Female | 170 (45.70) | 103 (43.28) | 67 (50.00) | |
| Race ^a | | | | 0.023 |
| Non-White | 76 (21.02) | 40 (16.95) | 36 (27.07) | |
| White | 293 (78.98) | 196 (83.05) | 97 (72.93) | |
| Marital status | | | | 0.249 |
| Married/Living as married | 252 (67.74) | 156 (65.55) | 96 (71.64) | |
| Not together | 120 (32.26) | 82 (34.45) | 38 (28.36) | |
| Military status ^a | | | | 0.069 |
| Dependent | 145 (39.08) | 86(36.13) | 59(44.36) | |
| Active | 107 (28.84) | 78(32.77) | 29(21.8) | |
| Retired | 119 (32.08) | 74(31.09) | 45(33.83) | |
| Education ^a | | | | 0.665 |
| High school diploma or GED | 87 (23.58) | 59 (25.00) | 28 (21.05) | |
| Some college/vocational school/Associates Degree | 192 (52.03) | 119 (50.42) | 73 (54.89) | |
| Bachelor's Degree or post college | 90 (24.39) | 58 (24.58) | 32 (24.06) | |
| Fagerstrom nicotine dependence score: Median (Interquartile range) | 3.0 (5.0, 6.0) | 3.0 (5.0, 6.0) | 3.0 (5.0, 6.0) | 0.338 |
| NRT use during intervention | | | | <.001 |
| No | 168 (45.16) | 128 (53.78) | 40 (29.85) | |
| Yes | 204 (54.84) | 110 (46.22) | 94 (70.15) | |
| Number of initial counselling sessions completed | | | | <.001 |
| 0 | 44 (11.83) | 36 (15.13) | 8 (5.97) | |
| 1 | 49 (13.17) | 38 (18.81) | 11 (8.73) | |
| 2 | 53 (14.25) | 41 (20.30) | 12 (9.52) | |
| 3 | 54 (14.52) | 43 (21.29) | 11 (8.73) | |
| 4 | 172 (46.24) | 80 (39.60) | 92 (73.02) | |

Note: Bold indicates p-value ≤ 0.20. p-value for categorical and continuous comparisons were derived from univariate Fisher's exact test and Wilcoxon rank sum tests, respectively.

a. Sum does not add to total due to missing

Table 2. Baseline confidence in quitting and reasons for quitting by three-months re-engagement

| Characteristic | Not Re-engaged (n = 238) n (%) | Re-engaged (n = 134) n (%) | P-value |
|---|---|---|----------------|
| How confident are you that you will quit smoking some day? ^a | | | 0.017 |
| Not extremely confident ^b | 131 (55.27) | 56 (42.11) | |
| Extremely confident ^c | 106 (44.73) | 77 (57.89) | |
| Quit smoking to save money | | | 0.900 |
| Not true ^d | 49 (20.59) | 27 (20.15) | |
| Neutral ^e | 36 (15.13) | 18 (13.43) | |
| True ^f | 153 (64.29) | 89 (66.42) | |
| Quit smoking because I am getting pressure from others | | | 0.838 |
| Not true ^d | 130 (54.62) | 69 (51.49) | |
| Neutral ^e | 44 (18.49) | 26 (19.40) | |
| True ^f | 64 (26.89) | 39 (29.10) | |
| Quit smoking so that my hair and clothes won't smell | | | 0.177 |
| Not true ^d | 73 (30.67) | 38 (28.36) | |
| Neutral ^e | 59 (24.79) | 24 (17.91) | |
| True ^f | 106 (44.54) | 72 (53.73) | |
| Quit smoking because it is too difficult to find a place to smoke | | | 0.785 |
| Not true ^d | 182 (76.47) | 104 (77.61) | |
| Neutral ^e | 33 (13.87) | 20 (14.93) | |
| True ^f | 23 (9.66) | 10 (7.46) | |
| Quit smoking to improve my overall health | | | 1.000 |
| Not very true ^g | 18 (7.56) | 10 (7.46) | |
| Very true ^h | 220 (92.44) | 124 (92.54) | |
| Quit smoking to be a good role model for others ^a | | | 0.027 |
| Not true or neutral ⁱ | 84 (35.44) | 32 (23.88) | |
| True ^f | 153 (64.56) | 102 (76.12) | |
| Quit smoking so I can be in control of my life | | | 0.039 |
| Not true or neutral ⁱ | 62 (26.05) | 22 (16.42) | |
| True ^f | 176 (73.95) | 112 (83.58) | |
| Quit smoking to improve my overall physical fitness | | | 0.487 |
| Not true or neutral ⁱ | 18 (7.56) | 6 (4.48) | |
| Somewhat true ^j | 29 (12.18) | 15 (11.19) | |

| | | | |
|---|-------------|-------------|-------|
| Very true ^h | 191 (80.25) | 113 (84.33) | |
| Quit smoking because smoking may have a negative effect on my career ^a | | | 1.000 |
| Not true or neutral ⁱ | 180 (75.63) | 101 (75.94) | |
| True ^f | 58 (24.37) | 32 (24.06) | |

Note: Bold indicates p-value ≤ 0.20 . p-value derived from univariate Fisher's exact test

- a. Sum does not add to total due to missing
- b. Not extremely confident = response of 1-4
- c. Extremely confident = Response of 5
- d. Not true = Response of 1,2
- e. Neural = Response of 3
- f. True = Response of 4,5
- g. Not very true = Response of 1-4
- h. Very true = Response of 5
- i. Not true or neutral = Response of 1-3
- j. Somewhat true = Response of 4

Table 3: Association between personal characteristics, and initial intervention engagement with re-engagement at three months.

| Characteristic | OR (95% CI) |
|---|--------------------------|
| Age (a unit increase) | 1.01 (0.99, 1.03) |
| Male (vs Female) | 0.97 (0.44, 2.12) |
| White (vs Other race) | 0.42 (0.23, 0.75) |
| Education | |
| College Degree (vs High school diploma or GED) | 1.02 (0.50, 2.08) |
| Some college (vs High school diploma or GED) | 1.16 (0.62, 2.15) |
| Military status | |
| Dependent (vs Active) | 1.35 (0.52, 3.50) |
| Retired (vs Active) | 1.25 (0.54, 2.85) |
| Married or partnered (vs not) | 1.28 (0.75, 2.21) |
| Total Fagerstrom score (a unit increase) | 1.09 (0.97, 1.21) |
| Extremely confident in quitting some day (vs not) | 1.84 (1.12, 3.03) |
| Quit smoking to be a good role model for others (vs not) | 1.71 (0.95, 3.08) |
| Quit smoking so I can be in control of my life (vs not) | 1.23 (0.65, 2.34) |
| Quit smoking so that my hair and clothes won't smell (vs not) | 1.08 (0.65, 2.34) |
| Counselling sessions completed | |
| 0 (vs 4) | 0.21 (0.07, 0.60) |
| 1 (vs 4) | 0.38 (0.15, 0.97) |
| 2 (vs 4) | 0.29 (0.13, 0.65) |
| 3 (vs 4) | 0.19 (0.09, 0.43) |
| Used NRT during initial intervention (vs no) | 1.55 (0.80, 3.02) |

OR: Odds ratio, CI: Confidence interval, bold indicates statistical significance

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