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Defining and Understanding Success at Smoking Reduction: A Mixed Methods Study

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Abstract

Much is known about the outcomes of different smoking reduction and cessation programs. However there is a lack of information about the degree to which such programs can achieve successes after initial failures. This study evaluated the patterns of success and failure during a smoking reduction intervention with a sample of 164 adult smokers (mean age 62; mean baseline smoking rate 21.2 cigarettes per day) who wanted to reduce their smoking but were not ready to attempt cessation. Success was defined by both self-reported number of cigarettes smoked assessed during counseling calls and carbon monoxide levels at 3 and 12 month follow-ups. There was a strong relationship between initial success/failure and eventual outcome using both assessment methods, and a moderate relationship between success categorization using the different methods ($r = .43$). Qualitative contextual data identified that types of travel, work and family environmental barriers experienced differed across success categories. This research confirms the importance of initial success in changing addictive behaviors and suggests directions for future research; including ways to enhance initial success, and the suggestion that more study is needed regarding the generalizability of these findings across settings and behaviors.

Keywords

Smoking reduction; assessment; goal setting; process; prediction

1. Introduction

Cigarette smoking is a multi-faceted behavior that is difficult to quit, particularly on a long-term basis (Ockene, Emmons, Mermelstein, Perkins, Bonollo, Voorhees, et al., 2000). The best national evidence in the U.S. is that only approximately 4–7% of smokers who try to quit on their own succeed (National Center for Chronic Disease Prevention and Health Promotion, 2006). As documented by several research groups and evidence-based reviews, there are a

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number of interventions that can enhance this 'base rate', but the vast majority of large-scale widely available applications produce success rates at one year somewhere between 20–40% cessation (Ockene, Emmons, Mermelstein, Perkins, Bonollo, Voorhees; Secker-Walker, Gnich, Platt, Lancaster, 2002). Hence, even among those smokers who attempt to quit, the vast majority will not succeed at quitting- and often return to their baseline smoking levels having experienced failure.

Against this backdrop, there has been interest in less harmful methods of nicotine consumption (Carpenter, Hughes, Solomon, & Callas, 2004; Hughes, 2000; Rodu & Godshall, 2006). This article is concerned with one of those approaches- namely the reduction in the number of cigarettes smoked per day, while working with smokers to ensure that they do not significantly 'compensate' (Shiffman, Gitchell, Warner, Slade, Henningfield, & Pinney, 2002) for this reduced number by changing their smoking topography (Hammond, Fong, Cummings, & Hyland, 2005). *Smoking Less, Living More* is an intervention that was developed to support at least a fifty-percent reduction in the number of cigarettes smoked by adults who were smoking at least 10 cigarettes per day and were not interested in making a cessation attempt at the time of study recruitment.

Smoking less, Living More derived its structure and content from reviews of behavior change interventions that found larger effects for theory-based interventions than those that do not have a comprehensive theoretical basis (Baranowski, Lin, Wetter, Resincow, & Davis Hearn, 1997; Baranowski, Anderson, & Carmack, 1998; Goldstein, Whitlock, & DePue, 2004; Whitlock, Polen, Green, Orleans, & Klien, 2004). The intervention was based on social-ecological theory and addresses personal determinants housed within an environmental context that will either facilitate or impede behavior change (Bandura, 1997; McLeroy, Bibeau, Streckler, & Glanz, 1988). Over the six month program, participants completed four tailored telephone counseling sessions, and received 5 tailored and targeted newsletters. When compared to an enhanced standard care control condition, participants in *Smoking Less, Living More* were more likely to achieve a fifty percent smoking reduction after 3 months (Glasgow, Estabrooks, Marcus, Smith, Gaglio, Levinson, et al., 2008).

Despite the program's initial success, like other smoking reduction or cessation interventions, there is a lack of information on the tailored intervention's ability to achieve successes after initial failures. That is, can a tailored intervention assist individuals who set goals to reduce their smoking behavior, and fail, to ultimately succeed? In the smoking cessation literature there is some evidence that a majority of smokers who experience a quit failure are willing to make a second attempt within the next month (Joseph, Rice, An, Mohiuddin, & Lando, 2004). However, there is no information on the potential for smokers who experience a reduction failure to recycle into a new reduction attempt.

The general goal of this paper was to determine the pathways through success and failure of *Smoking Less, Living More* participants using secondary data analyses within a concurrent nested mixed methods design (Creswell, Fetters, & Ivankova, 2004). This design allows for quantitative tracking of success and failure coupled with qualitative assessments to gather information, from the perspective of the target population, on the context within which behavior change attempts were being made (Forthofer, 2003; Onwuegbuzie & Teddlie, 2003). Further, this research design allowed us to provide responses to our two general research questions. First, does the intervention support participants who had treatment failures—as defined by self-reported smoking reduction or objective reduction assessed via expired carbon monoxide—to succeed over the course of the intervention and study? Second, are there personal contextual differences that may explain why some participants were able to successfully reduce tobacco use while others were not? Therefore, the concurrent nested mixed model design was used because the model allows the researcher to integrate quantitative data (i.e., typologies of

success/failure) with qualitative data (i.e., field notes collected concurrently with quantitative data) to identify key themes that could contribute to increased effectiveness of future harm reduction interventions (Creswell et al., 2004).

Our first three study purposes were assessed using quantitative data collected during assessment points and counseling calls while our fourth and final purpose was assessed using quantitative success/failure data integrated with qualitative data collected via research assistant and telephone counselor field notes. Thus the specific purposes of the study were:

1. To determine the number of participants that could be categorized into each of 8 potential success-failure categories (see the bottom row of Figure 1) based on information gathered across 3 counseling calls. During each call participants were queried on their progress towards their reduction goals. These data were used to determine, descriptively, the potential of the tailored smoking reduction intervention to assist participants who do not achieve their reduction goal--at any of three intervention time points--to eventually achieve a significant amount of self-reported reduction (e.g., at least a 1/3 cut in cigarettes smoked).
2. To determine the participants' success and failure at 3 and 12 months post baseline using CO reductions.
3. To determine the magnitude of CO reduction at 3 and 12 months based on participant reports of success and failure during each counseling call.
4. To understand the context within which a participant experienced success and failure. We analyzed qualitative data on participant barriers and resources using field notes from sample collection visits and end of call notes from telephone counselors to better understand an individual participant's context on a randomly selected group of participants who, based on CO measures were categorized as: (a) successful at 3 months and 12 months, (b) successful at 3 months but not at 12 months, (c) unsuccessful at 3 months and 12 months, or (d) unsuccessful at 3 months but successful at 12 months (Figure 2).

2. Methods

2.1 Procedures

The research team identified current adult smokers (aged 18+), who smoked 10 or more cigarettes a day and were scheduled for an outpatient invasive medical or diagnostic procedure in the Kaiser Permanente Colorado (KPCO) patient population. Those identified as eligible received a mailed invitation letter to participate in the research study with the opportunity to opt out with a return postcard. Telephone interviewers trained as counselors contacted eligible participants; those who consented to participate were randomized to receive the *Smoking Less, Living More* intervention or generic health education materials. See Figure 3 for an overview of the research design. A complete description of recruitment procedures is discussed elsewhere (Glasgow, Estabrooks, Marcus, Smith, Gaglio, Levinson, et al., 2008). This paper addresses data and outcomes related to participants who received the *Smoking Less, Living More* intervention.

All participants completed biochemical sample collections of expired CO and self-reported frequency of smoking measures at baseline, three months and twelve months. In addition, all participants provided self-reported frequency of smoking during each of the telephone counseling calls described below. Field notes were completed by all study personnel after each contact with a given participant. These notes included participant comments related to their progress in reducing the number of cigarettes they smoked. This study was approved by the Kaiser Permanente Colorado Institutional Review Board.

2.2 Participants

Participants (n=164) that received the *Smoking Less, Living More* intervention had a mean age of 54.8 years and most self-identified as white, non-Hispanic (Table 1). The average intervention participant had an associate level education and 73.2% were women. Mean baseline self-reported cigarette consumption was slightly over a pack per day and average duration of smoking was 36.9 years. Over 40 percent of the participants screened positive for depressive symptoms (as assessed by KP Care Institute National Depression Guidelines; sensitivity=96% and specificity=57%).

2.3 Intervention

Participants randomized to the intervention received four counseling calls, four tailored newsletters, and one targeted newsletter (see Figure 4 for an overview of the intervention components). Participants established their first one third reduction goal during the initial telephone recruitment call and were instructed to begin reducing after the baseline biochemical sample collection.

One week after the baseline sample collection, participants received their first tailored newsletter, designed to support personalized strategies and goals established during the baseline telephone call. Their initial follow-up counseling call was completed about one week after the receipt of the first newsletter (three weeks post baseline counseling call). During this call, the interviewer assessed if the participant had reached their first reduction goal. Based on their level of success, the interviewer helped the participant establish a new goal or encouraged the participant to continue working on the initial one third reduction goal. For those who were successful at achieving their first reduction goal, a second goal was set at a two-thirds reduction from baseline.

Participants then received a second tailored newsletter one week after their initial follow-up counseling call, which contained messages and goals that supported their current level of success. Interviewers delivered a third telephone call one week after the second newsletter, to again assess participants' level of success and provide encouragement. At this point, if the participant was successful at reaching their second two-thirds reduction goal, they were given the options to reduce further, maintain their current level of smoking, or quit smoking completely. Those who did not reach a one third or a two third reduction were encouraged to continue working on their current goal. Five weeks after this follow-up call, participants received a third tailored newsletter with information supporting their current reduction efforts. At each level of the intervention, if the participant decided to quit, they received cessation messages and support during phone calls and in tailored newsletters to support their quit attempt.

After the 3 months post baseline data collection visit, participants received a fourth tailored newsletter, and a week later received their final follow-up counseling call. A fifth targeted newsletter was sent ten weeks after the last follow-up call. Participants did not receive any further study communications until they were contacted for their 12 month biochemical sample collection visit.

2.4 Measures

Self-reported cigarette use, biochemical measures of smoking and qualitative field notes were collected via sample collection, participant telephone interview, survey assessment and informal discussion. Study staff collected participant self-reported cigarette use data at each sample collection visit (baseline, 3-months, 12-months) and on each of the follow-up counseling calls. Participants reported the number of cigarettes smoked on a) workdays and b) non-workdays in the past 7 days. From this self-report measure, a composite measure of

cigarettes per day was calculated based upon a weighted average. At each sample collection visit, participants completed expired carbon monoxide (CO) validation for the biochemical portion of the project. CO was assessed using a Vitalograph CO monitor (Vitalograph Inc. Lenexa, KS USA).

In an effort to establish rapport and to understand participant contextual factors, every effort was made to schedule participants with the same member of the research team for all three sample collection visits. Research staff conducted informal discussions with participants about their reduction efforts, possible barriers, and strategies used to overcome obstacles. After the completion of these visits, study staff recorded participant qualitative responses in their field notes. In addition to the sample collection visit notes, interviewers conducting the counseling calls collected subjective data including interviewer impressions, an assessment of participant engagement in the call, and contextual comments and recorded these in their field notes.

2.5 Analyses

To address the first and second study purposes, descriptive statistics on the distribution of participants across potential success/failure categories based on follow-up counseling calls were calculated (Figures 1 & 2). To determine patterns of success and failure at each of the telephone counseling interactions, participants' current self-reported number of cigarettes smoked was compared to baseline levels to provide a percent reduction score. Participants were categorized as having success or failure based upon the criteria listed in Table 2. These criteria reflected the goals participants were encouraged to set under specific goal outcome conditions as indicated by the *Smoking Less, Living More* intervention protocol.

To complete the analyses for purpose 2, participants were also categorized for success and failure based on their objective assessment of expired carbon monoxide provided during the 3 and 12 month follow-up assessments. This approach to defining success used a level of reduction that is clinically significant (Windsor, Li, Boyd, & Hartmann, 1999) rather than having success or failure tied to participants' responses during the counseling calls. Although admittedly somewhat arbitrary, especially since it tends to dichotomize a continuous variable, most experts in the area would agree that a 50% reduction in number of cigarettes smoked at baseline would be an important accomplishment. Windsor et al (1999) have proposed this 50% reduction as the cut point for meaningful reduction. In addition, to address the fact that nicotine is an addictive substance and that smokers are generally not aware of all aspects of their smoking behavior (i.e., self-report is insufficient to truly define success), we also based the 3 and 12 month assessment definitions of success and failure on expired carbon monoxide (Vitalograph Inc. Lenexa, KS USA). In addition to the reduction of 50% or more in number of cigarettes smoked, we also required a reduction of at least 33% in CO levels from baseline to be considered a success.

Analysis of variance tests were used to address the third purpose of the study. Specifically, ANOVAs were completed using dichotomous independent variables (i.e., success versus failure) for each of the 3 counseling calls and continuous measures of expired CO at 3 and 12 months post baseline as the dependent variables.

Finally, to understand contextual factors that may have influenced participants, a stratified purposive sampling technique was used to randomly select 5 participants in each of the following participant categories based on the 3 and 12 month assessments: (1) Success/Success, (2) Success/Fail, (3) Fail/Success, and (4) Fail/Fail. This procedure integrated the quantitative information on success/failure with qualitative data that provided personal context for each participant (Creswell et al., 2004). Qualitative field notes were reduced, using an inductive approach, to meaning units of a word, sentence, or statement that reflect a single idea (Rennie, Phillips, & Quartaro, 1988). Meaning units were then summarized and discussed by research

team members who were blinded to the categorization of an individual and the associated meaning units. Two staff coded field notes for each patient and research team members who had collected field notes were then included in the discussion of the validity of the meaning units in reflecting the personal context of participants. This provided an opportunity to triangulate the interpretation across research and intervention delivery personnel and to reduce bias of interpretation (Patton, 2002). Following the discussion and consensus on meaning unit derivation, there was further consensus that the meaning units reflected different aspects of a social ecological model (McLeroy et al., 1988). As a result a final deductive approach was completed arranging meaning units into themes to detail the broader participant context for all 20 participants. The final themes were presented to the staff that completed the field notes and, again, consensus was reached that the final themes resonated with the research staff experiences with participants over the course of the project. Themes were then compared across the categories of success and failure.

3. Results

3.1 Participant Success-Failure from Counseling Calls

A total of 159 intervention participants completed the first study counseling call, and 56 reported achieving the initial one-third reduction goal set prior to their outpatient visit. By the completion of the final call, based on study criteria, 21 of these 56 participants (i.e., 37.5%) achieved a magnitude of reduction to be considered successful. In contrast, of the 100 participants that experienced an initial reduction failure as reported on their first counseling call, 20 participants (i.e., 20.0%) were ultimately successful.

Table 3 highlights the percent reduction in cigarettes reported at each counseling call based upon success/failure categorization. Participants who were categorized as successful by the final counseling call, with the exception of those who reported failures during the first two counseling calls (final reduction=47 percent), exceeded a 50 percent reduction. As the final counseling call was one week after the 3 month carbon monoxide assessment, we computed a correlation between self-reported cigarette reduction during the final counseling call and objectively verified reduction and found a moderate relationship ($r=.43$) supporting the validity of self-reported reduction.

3.2 Participant Success-Failure at CO Reduction at 3 and 12 months

Categorization of participants based upon achieving an objectively verified reduction (i.e., 33% reduction in carbon monoxide) is found in Figure 2. A total of 99 participants completed the 3 month assessment of which 38 percent achieved a successful reduction. Based on study criteria, 18 (47%) of those who demonstrated success at 3 months were also successful at 12 months, while only 8 of the 61 participants (13%) who experienced failure during the 3-month assessment went on to be successful at 12 months.

3.3 Relationships between Participant Success-Failure Reports from Counseling Calls and CO Reductions at 3 and 12 Months

Participants who reported successful reduction during the initial counseling call also reduced their CO score by nearly one third ($\bar{x}=30.9\% \pm 6.97$) at the 3 month follow-up while those who did not report successful reduction, reduced their CO level on average by 13.6 percent ± 4.34 ($F(98,1)=4.66$, $p=0.03$). Similarly, those who reported a success on the initial counseling call were more likely to demonstrate a greater reduction in carbon monoxide at the 12 month follow-up than those who did not report a success ($36.2\% \pm 8.08$ versus $14.2\% \pm 5.21$; $F(1,81) = 5.40$, $p=0.02$).

When comparing participants who reported success or failure during the 2nd counseling call there were no significant differences on percent reduction in expired CO for 3 (15.2%±7.0 versus 20.5%±4.5; $F(96,1)=0.37$, $p=0.55$) or 12-month follow-up (25.4%±5.31 versus 19.9%±8.97; $F(1,81)=0.25$, $p=0.53$). Finally, those who reported success at the 3rd call reduced their expired CO by 34.1 percent±6.38 at three months and 24.79 percent±8.82 at 12 months. Those who reported that they had not achieved the third counseling call goal, reduced their carbon monoxide score by 10.1 percent±4.42 at three months and 17.5 percent±5.77 at 12 months. Only the 3 month follow-up difference between those who reported success versus those who reported failure during the 3rd counseling call was significant ($F(1,94)=10.13$, $p=.002$).

3.4 Qualitative Contextual Factors Related to Success and Failure

Qualitative data resulted in identification of 5 higher order themes that aligned to a broader social ecological framework (Table 4). The themes reflected the participants' general environment, home environment, work environment, perceptions of the intervention, and intrapersonal factors. Each of these themes was comprised of a number of categories outlined below.

Participants' general environment was made up of the categories of physical barriers (e.g., long telephone calls are a trigger for smoking) and facilitators (e.g., carrying only a set number of cigarettes), social barriers (e.g., friends smoke) and facilitators (e.g., friends support reduction/quit efforts), and travel barriers (e.g., driving long distances). As seen in Table 4, almost all of those who were not successful at 3 or 12 months (4 out of 5 randomly selected participants) indicated that they encountered travel-related barriers while none of those who were successful at both time points indicated that they encountered these barriers.

The home environment was comprised of 2 general categories—social barriers (e.g., family members smoke at home) and social facilitators (e.g., spouse participates in reduction efforts). While the frequency of endorsement of social barriers and facilitators did not differ substantially across participant categories, the types of social barriers were quite different. Those participants who did not achieve success at either time point indicated that they had family members that worked against their reduction efforts in that they attempted to convince participants that smoking a little more was okay. In contrast, the social barriers in the homes of those who were successful at each time point were described as others smoking in the home, but that those who smoked in the home neither provided support to reduce nor temptations to increase smoking. Social facilitators included the development of a no-smoking policy at home and were documented across participant success/failure patterns.

Participants' work environment was primarily made up of meaning units related to job stress. The meaning units derived from the field notes in this area were nearly universally related to worries about job security. There was also a clear difference in the field notes from participants who were successful at both time points when compared to those that were not successful at either time point. No participant that was successful at both time points indicated he/she was worried about job security, while all 5 of those who were unsuccessful indicated that job security was a real concern.

Participant perceptions of the intervention included positive views (e.g., liked getting the telephone calls), negative views (e.g., didn't like the intervention), and areas for improvement (e.g., more social support). Interestingly, the field notes from all 20 randomly selected participants indicated that some people simply did not like the telephone and newsletter based intervention (including 2 who were successful at both time points). Those who were successful at 3 and 12 months and those who were successful at 12 months only provided more

recommendations on ways to improve the intervention, such as adding social opportunities and nicotine replacement therapy.

Finally, as documented in Table 4, field notes provided a number of meaning units related to intrapersonal factors such as psychological barriers (e.g., boredom) and facilitators (e.g., general excitement to reduce), behavioral barriers (e.g., being a long time smoker) and facilitators (e.g., taking up exercise to replace smoking), physical health barriers (e.g., health issues lead to smoking to deal with stress) and facilitators (e.g., screening results), varying self-confidence, loss of motivation, general and specific quit or reduction intentions, and previous quit or reduction attempts. No clear contextual pattern difference on intrapersonal factors emerged across participants with different success/failure patterns.

4. Discussion

This study was designed to determine: (1) the number of participants that could achieve success in reducing the amount of self-reported cigarette smoking over the course of 3 intervention counseling calls based on initial success or failure, (2) the number of participants who could achieve success at 3 and 12 months based on expired CO, (3) the relationship between success and failure reported during intervention counseling calls and CO reduction success at 3 and 12 months, and (4) contextual factors reported by participants having different patterns of success and failure at the 3 and 12 month follow-up. Our results lead to four conclusions. First, a sizable but decreasing percentage of participants in the reduction program achieved success over time, and there was a moderate and significant relationship between self-reported and CO based success criteria. Second, and consistent with social cognitive theory, initial performance failure during a reduction attempt significantly reduces the likelihood of subsequent success over the course of intervention delivery. Third, participant reporting of success or failure at relatively early time points during the intervention are reasonable predictors of future objectively assessed success or failure. Fourth, our qualitative assessment indicates that successful participants were those that had a supportive home environment, job security, and did not encounter barriers related to travel.

Based on both the self-reported and objective data, those participants who did not achieve their initial goal for reduction were much less likely to achieve subsequent success than those who were initially successful. While we may be the first to report this relationship within a smoking reduction intervention, this relationship has a long history in behavioral interventions based on social cognitive theory (e.g., Shilts, Horowitz, & Townsend, 2004) and aligns with a fundamental proposition that previous performance experience is a strong predictor of future performance (Bandura, 1997). This finding also has practical relevance. During Smoking Less, Living More, patients received an initial goal for a one third reduction in cigarettes smoked, however only minimal intervention strategies were delivered between the initial goal setting and the initial intervention call follow-up. Based on our findings, we would suggest that the intervention may have been more effective if more explicit preparation of participants for challenges to reduction goals that involve travel time, interference from family members, and job security concerns to facilitate initial achievement of the one-third reduction. Qualitative contextual data suggest that more explicit preparation of participants for challenges to their reduction goals that involve travel time, interference from family members, and job security concerns might enhance success

In a related issue, it is interesting that only participant reports of success during the initial counseling call (but not later calls) were predictive of longer-term reductions in expired CO (i.e., at 12 months). This may reflect an enhanced motivation for reduction in these participants since the initial reduction attempt was aligned with an outpatient surgery or medical procedure.

An issue of interest for future research on which we did not collect data in this study is how participants judged their level of success. Marlatt and Witkiewitz (2002) have argued that persons attempting behavior change often tend to develop stringent ‘all-or-none thinking’ and criteria for success. It would be interesting to know if smokers in the present study generally adopted the intervention and caller defined success criteria or if, especially at long term follow-up, they developed their own criteria for success.

This study has both strengths and limitations. Limitations include the moderate sample size and study of a single intervention in a single health care system. An additional limitation is that our mixed methods design reflected a secondary data analysis and was not the a priori study design of the overall trial. However, the use of concurrent nested designs within trials where the emphasis is placed on either the qualitative or quantitative data is a rigorous approach to broadening the contextual understanding of intervention research housed within healthcare settings (Creswell et al., 2004). Ours is the first harm reduction study that includes strengths of longitudinal data, a nested mixed-methods approach of defining success/failure patterns and the relationship these patterns have with participants’ personal contexts.

Future research is indicated to replicate and extend these findings. In particular, experimental study of easier vs. more challenging initial goals and of provision of general coping strategies vs. strategies to address the targeted barriers identified in this study are indicated. Use of additional and more real time methods of defining success and study of immediate reactions to failure to attain goals will also be informative. Of specific practical importance, our findings suggest that there are specific contextual factors such as a supportive versus sabotorial home environment, job security, and travel related barriers that could be used as variables for intervention strategy development to enhance program effectiveness. We encourage other researchers to utilize mixed methods approaches as a primary study design to enhance the depth of understanding of the potential underlying mechanisms of intervention effectiveness. Finally, study of these issues across different addictive behaviors will allow determination of the generalizability of our findings.

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Figure 1.
Possible participant paths based on self-reported goal attainment or failure.

Figure 2. Possible participant paths based on object CO outcomes at 3 and 12 months post initiation of the intervention.

Figure 3.
Overall study flow diagram.

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Table 1

Baseline Characteristics of Intervention Participants

Characteristic	Intervention Participants ¹ (n=164)	
	Mean or %	S.D. (if applies)
<u>Demographics</u>		
• Age (years)	54.8	10.4
• Percent Female	73.2%	
• Percent Latino	3.7%	
• Years Education	14.2	2.6
<u>Smoking Characteristics</u>		
• Cigarettes Per Day	21.2	9.4
• Years Smoked	36.9	12.1
<u>Other</u>		
• % Positive on Depression	43.9%	

Table 2

Success and failure criteria used to categorize participants based on counseling call interactions.

	Success Criteria	Failure Criteria
Follow-up Call 1	1/3 reduction	<1/3 reduction
Follow-up Call 2		
Success at Call 1	2/3 reduction	<2/3 reduction
Failure at Call 1	1/3 reduction	<1/3 reduction
Follow-up Call 3		
Success at Call 1 & Call 2	2/3 reduction	<2/3 reduction
Success at Call 1 & Failure at Call 2	1/2 reduction	<1/2 reduction
Failure at Call 1 & Call 2	1/3 reduction	<1/3 reduction
Failure at Call 1 & Success at Call 2	2/3 reduction	<2/3 reduction

Note: Rates of reduction all based on number of cigarettes smoked at baseline.

Table 3

Percent of reduction in self-reported number of cigarettes by success and failure categorization across three counseling calls.

Category	Percent Reduction Call 1	Percent Reduction Call 2	Percent Reduction Call 3
Success-Success-Success (n=3)	47.5	56.3	61.6
Success-Fail-Success (n=18)	42.4	39.1	62.5
Success-Success-Fail (n=0)	N/A	N/A	N/A
Success-Fail-Fail (n=10)	47.8	25.6	28.0
Fail-Fail-Fail (n=37)	2.4	10.1	-0.9
Fail-Success-Fail (n=19)	16.6	42.1	31.2
Fail-Fail-Success (n=15)	3.4	14.7	47.1
Fail-Success-Success (n=5)	17.1	46.4	88.9

Table 4

Qualitatively derived themes and categories across participant success/failure pattern based on 3 and 12 month 1/3 reduction in carbon monoxide levels.

Themes & Categories	All (n=20)	Success-Success (n=5)	SF (n=5)	FS (n=5)	FF (n=5)
General Environment	35	9	6	7	13
physical barriers	2	1	0	0	1
physical facilitators	12	3	2	5	2
social barriers	7	3	2	0	2
social facilitators	9	2	1	2	4
travel barriers	5	0	1	0	4
Home Environment	50	9	14	13	14
social barriers	31	6	8	7	10
social facilitators	19	3	6	6	4
Work Environment	11	2	3	0	6
job stress	8	1	2	0	5
other barrier	2	0	1	0	1
other facilitator	1	1	0	0	0
Perceptions of the intervention	30	14	4	6	6
Positive	6	3	2	0	1
Negative	11	4	1	2	4
Areas for improvement	13	7	1	4	1
Intrapersonal factors	127	38	30	25	34
Psychological Barriers	9	1	3	3	2
Psychological Facilitators	25	6	8	4	7
Behavioral barriers	6	1	2	0	3
Behavioral facilitators	11	4	4	2	1
Physical barriers	13	6	2	2	3
Physical facilitators	5	2	0	2	1
Varying self-confidence	12	3	2	2	5
Loss of motivation	14	5	0	5	4
General reduction intentions	11	2	5	2	2

Themes & Categories	All (n=20)	Success-Success (n=5)	SF (n=5)	FS (n=5)	FF (n=5)
Specific reduction intentions	4	3	0	0	1
Previous reduction attempts	12	3	2	3	4