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Home health care nurses as a new channel for smoking cessation treatment: Outcomes from project CARES (Community-nurse Assisted Research and Education on Smoking)

Belinda Borrelli, Ph.D. [a,*], Scott Novak, Ph.D. [a], Jacki Hecht, R.N., M.S.N. [a], Karen Emmons, Ph.D. [b], George Papandonatos, Ph.D. [c], David Abrams, Ph.D. [a]

[a] *The Centers for Behavioral and Preventive Medicine, Brown Medical School/The Miriam Hospital, Coro West Building, Suite 500, One Hoppin Street, Providence, RI 02903, USA*
[b] *Harvard School of Public Health, Boston, MA 02215, USA*
[c] *Center for Statistical Sciences, Brown University, Providence, RI 02912, USA*

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Abstract

Background. Clinical guidelines for smoking cessation may not be sufficient for helping some subgroups of smokers quit. Incorporating smoking cessation into home-based medical care can proactively reach high-risk smokers who may not have access to (or spontaneously seek) smoking cessation.

Method. Home health care nurses (N = 98) were randomly assigned to deliver either Motivational Enhancement (ME; Motivational Interviewing + Carbon Monoxide Feedback) or Standard Care (AHCPR Guidelines for smoking cessation) to their patients. Seventy percent of patients were eligible and willing to participate (N = 273; 54% female, mean age = 57 years, 83% Caucasian, 41% < high school education). The study was conducted in Providence, RI, USA from 1998 to 2003.

Results. Biochemically verified continuous abstinence rates at the 12-month follow-up were 4.2% (SC) and 8.7% (ME) for intent to treat analyses, and 5.2% (SC) and 11.8% (ME) using all available cases ($P > 0.05$). ME reported more quit attempts and significantly greater reductions in the number of cigarettes smoked per day at all follow-ups through 12 months of post-treatment (all P values < 0.05).

Conclusions. Use of an existing public health channel such as home health care to reach smokers who vary in their motivation to quit could have the potential for large public health impact.

Keywords: Smoking cessation; Motivational interviewing; Nurses; Medically ill smokers; Older smokers; AHRQ guidelines; AHCPR guidelines

Introduction

Home health care services are growing exponentially due to a cost-conscious managed care environment. Few attempts have been made to conduct research that incorporates clinical theories of health behavior change into home health care. Home health care is an ideal channel to promote smoking cessation: 1) it provides access to hard to reach and difficult to treat populations who are at the highest risk for smoking-related diseases; 2) it proactively reaches those who may not have access to (or spontaneously seek) smoking cessation services; 3) it fosters motivation for change through repeated contacts; 4) it capitalizes on the teachable moment induced by the medical visit, 5) it is disseminable as approximately 30% of patients are discharged from the hospital into home care; 6) patients are counseled in their homes, the environment in which they receive cues to smoke; and 7) it provides access to patients requiring chronic disease management at home as well as those requiring acute care post-hospital discharge.

In a prior paper, we surveyed 98 home health care nurses and found that, without any training or intervention, 36% spent 1 to 3 min counseling their patients about smoking, and 55% spent 3 to 10 min (Borrelli et al., 2001). Less than 2% of nurses reported that they "never discussed" smoking with their patients. Therefore, the majority of home health care nurses are already primed and ready to deliver smoking cessation counseling. Although home health care nurses have been used to promote

* Corresponding author. Fax: +1 401 793 8078.
E-mail address: Belinda_Borrelli@Brown.edu (B. Borrelli).

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other health behaviors (Dougherty et al., 1999; Brooten et al., 2001; Olds et al., 1997; Borrelli et al., 2002; Greenberg et al., 1994), to our knowledge, no published randomized controlled trials exist that utilize home health care nurses to deliver smoking cessation to adults receiving medical home care.

The current study randomized home health care nurses to deliver one of two different smoking cessation interventions to their home health care patients who smoke, during the course of regular, home-based medical care. Medically ill and older smokers face some unique barriers to quitting: 1) they are usually heavier smokers and have smoked for a longer time (Rimer and Orleans, 1993); 2) they have decreased confidence in their ability to quit (Kviz et al., 1994; Rimer et al., 1994); 3) depression and lack of social support are prevalent; 4) they are more likely to believe that quitting will *not* improve their health (Orleans et al., 1991) and may fail to see the connection between smoking and their current illness; and 5) they may believe they are no longer at risk for smoking-related diseases (US Department of Health and Human Services, 1989). We hypothesized that an intervention (Motivational Enhancement, ME) that targets motivation to quit and the above barriers to quitting would outperform an intervention based on the guidelines developed by the Agency for Health Care Policy and Research (AHCPR; Standard Care).

Methods

Treatment setting and nurse characteristics

Nurses were employees of the Visiting Nurse Association (VNA) of Rhode Island (RI), which provides both acute and chronic medical care to patients who are either unable to visit their physician or who require frequent daily care. We randomly selected 104 of 160 nurses to participate in the study. Although we had managerial support for mandatory nurse participation, 6 nurses could not participate because of anticipated medical leave. Ninety-eight nurses (*M* age = 44 years, SD = 9.5; *M* education = 16 years, SD = 1.4; *M* = 19 years in Nursing, SD = 11.2; *N* = 93 Caucasian) were randomized to deliver one of two smoking cessation interventions to their medically ill patients who smoke. 31% were former smokers (>100 cigarettes in lifetime), and 13% reported current smoking. Additional details regarding these nurses' attitudes, beliefs, and counseling behaviors are found in Borrelli et al. (2002).

Participants

This study received ethical approval from the Human Subjects Review Board at the Miriam Hospital. Approximately 11.8% of VNA patients were identified as smokers, comparable to national data (Centers for Disease Control, 1999). Smokers, regardless of whether or not they wanted to quit, were referred by nurses to Project CARES for screening. Of those identified as smokers, 83.5% (*N* = 484) were referred. Of those, we were able to contact 82.4% (*N* = 399) for eligibility screening (Fig. 1). To be eligible for the study, patients had to be on VNA service, over 18 years old, smoke ≥3 cigarettes/day for the past year, English speaking, not currently using nicotine replacement or receiving treatment for smoking, Mini Mental state score >20, and not receiving hospice care. Approximately 70% (*N* = 278) of those screened were eligible and agreed to participate, 7.2% (*N* = 29) were eligible but refused participation, and 23.1% (*N* = 92) were ineligible. Reasons for ineligibility were: non-smoker (26.1%), discharge from home care (22.8%), smoked < three cigarettes/day (14.1%), not alert/oriented (12.0%), pipe or cigar smoker (8.7%), non-English speaking (3.3%), and nurse recommendation (2.2%).

Five of the 278 smokers were removed from analyses because they quit smoking in between the screening and the first nursing visit. The sample (Table 1) consisted of 54.3% females, and the mean age was 57.2 years (SD = 14.3). The

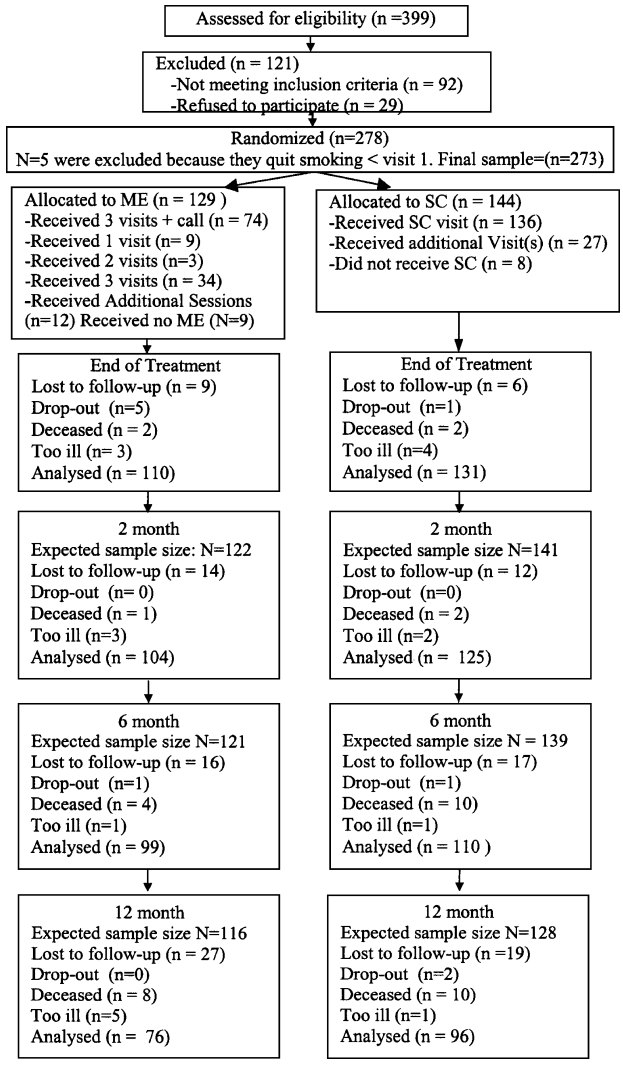

Fig. 1. Patient flow (1998–2003; Providence, RI, USA).

ethnic composition was 83.5% Caucasian, 12.2% African-American, 2.2% Hispanic, 1.4% American Indian, and 0.7% Cape Verdian. Forty-one percent had less than a high school education, and 91% were unemployed. Sixty percent earned <$10,000 per year in income; 24% earned $10,000–$24,000. Marital status was: 27% married, 22% widowed, 19% never married, 3% living together, and 29% were divorced or separated. Approximately 36% of our sample had no plans to quit at baseline (≤5 on the Contemplation scale); the remainder were thinking about quitting in the future.

At baseline, the mean number of days of VNA service was 103 (SD = 207, median = 23 days). The median number of home care visits was 14, and the median number of days since hospital discharge was 24. Medical diagnoses were lung diseases (38.3%), hypertension (34.9%), cardiovascular disease (41.7%), diabetes (28.1%), other cancers (11.9%), depression (12.3%), and other mental disorders (13.4%). Approximately 61.9% reported that their health was "fair" or "poor".

Treatment

Overview

At the first visit, patients in both groups received a self-help quit smoking manual tailored for older and medically ill smokers (Clear Horizons). ME consisted of 3 intervention visits plus a follow-up telephone call; SC was delivered during a single visit. Both treatments were integrated into the regular medical visit, such that patients were not being seen exclusively for smoking cessation. The content of the smoking portion of the visit was delivered in 20 to 30 min for each of the three ME sessions and 5 to 15 min for the single SC session (Table 2).

Table 1
Demographic characteristics of study participants

Variable	Total sample			Standard care		Motivational enhancement	
	N	Mean (range) (median)	SD	Mean	SD	Mean	SD
Age	273	57.2 (21–89) (58)	14.3	57.5	13.9	56.9	14.8
Smoking rate (cigarettes/day)	271	21.1 (3–100) (20)	13.9	21.6	14.1	20.5	13.8
Fagerstrom	273	6.3 (1–11) (6.0)	3.1	6.4	2.0	6.3	4.0
Years of smoking	273	41.8 (3–74) (42)	13.6	42.4	13.4	41.2	13.8
# of 24-h life quits in life	273	8.5 (0–150) (3.0)	20.2	8.1	20.9	9.0	19.6
# of quits in last year	272	1.4 (0–25) (0)	3.1	1.5	3.2	1.3	3.2
Contemplation Ladder	273	5.9 (1–10) (6)	1.7	5.7	1.8	6.2	1.6
Mini Mental State	272	26.5 (21–30) (27.0)	3.0	26.8	2.9	26.2	3.2
Self-efficacy*	273	84.6 (15–150) (86)	31.9	79.0	31.7	90.8	31.1
SF-12 physical health	260	32.0 (15.4–56.1) (30.9)	9.0	32.2	9.1	31.7	8.9
SF-12 mental health	260	44.6 (11.9–67.9) (45.9)	11.6	44.7	11.5	44.5	11.7

* $P = 0.002$.

Motivational enhancement treatment (ME)

The intervention was developed from focus groups with home care nurses and supervisors and tailored to older and medically ill smokers with sensitivity to their degree of readiness to change. ME was based on the principles of Motivational Interviewing (Miller and Rollnick, 1991, 2002), delivered in a client-centered manner and focused on exploring and resolving ambivalence about quitting smoking. ME focused on building intrinsic motivation for change by: 1) exploring patients' perspectives and concerns regarding the consequences of smoking; 2) discussing "the good things" and the "less good things" about smoking; 3) helping patients to perceive smoking as discrepant with values and goals; and 4) exploring patients' beliefs regarding how cigarettes affect his/her health. Nurses obtained expired air CO from the patient, discussed how the level was related to specific diseases and changes in quality of life for "people in general," and asked the patient for his or her interpretation of the results and how this information might apply to their own experience. This also included a discussion of how physiological damage and disease risk from smoking can be attenuated by quitting smoking.

Because older smokers have lower self-efficacy from repeated unsuccessful quit attempts (Grembowski et al., 1993), ME also included building self-efficacy through: 1) setting patient-determined proximal subgoals; 2) reframing past quit attempts as learning experiences instead of failures; 3) affirming small changes in behavior or attitude; 4) evocation of patient stories of confidence building experiences; and 5) vicarious experience (e.g., success stories of older smokers). ME also consisted of cognitive and behavioral strategies for enhancing mood and social support, including discussion of feelings of loss and other ways of obtaining pleasure in their lives.

Standard Care treatment (SC)

SC patients were given "Clear Horizons" plus AHCPR guidelines for counseling (5 As: Ask about smoking, Assess motivation to quit, Advise to quit, Assist with quitting, Arrange follow-up). Counseling was provided during one visit, but nurses provided brief support at subsequent visits for smokers who were ready to quit and desired more assistance, consistent with clinical guidelines (Fiore et al., 2000).

Table 2
Treatment components

Standard Care	Motivational Enhancement
1 visit	• 3 visits + 5 min follow-up call
Clear Horizons Manual	• Clear Horizons Manual
AHCPR guidelines (5 As of quitting: Ask about smoking, Assess motivation to quit, Advise to quit, Assist with quitting, Arrange follow-up)	• Motivational Interviewing • Explore ambivalence about quitting • Clarify goals/values and relation to smoking • Carbon Monoxide Feedback to increase risk perception • Build self-efficacy or confidence to quit

Training and evaluation of skill acquisition

Nurses in ME ($N = 46$) and SC ($N = 52$) were trained in groups of 10. We determined acquisition of counseling skills by pre- and post-tests of nurse knowledge and skills and simulated patient interviews. Nurses were given brief booster sessions throughout the study to minimize drift and maintain counseling skills. The trainers were a licensed Clinical Psychologist (B. Borrelli) and a Master's level oncology nurse educator (J. Hecht), both trained in Motivational Interviewing. Only ME nurses were trained in MI.

Internal validity

We monitored the delivery of the intervention by: (1) live and audiotaped supervision on a sub-sample of counseling sessions; (2) patient exit interviews (conducted by the research assistant); (3) nurse documentation of time spent discussing smoking and components delivered, and (4) monthly meetings with nurses.

Measures

Research Assistants blind to condition administered the measures over the telephone. Patients were compensated $25.00 for completing four follow-up assessments: end of treatment (end of nurse smoking cessation counseling) and 2, 6, and 12 months after the end of treatment.

Sociodemographics and smoking history

Sociodemographics and smoking history were assessed by self-report (Table 1). Nicotine dependence was assessed with The Fagerstrom Test for Nicotine Dependence (Heatherton et al., 1991), which is internally consistent (alpha = 0.70) (Pomerleau et al., 1994) and associated with several biochemical markers of nicotine dependence (Pomerleau et al., 1990).

Mental status

The 11-item Mini-Mental State Examination (Folstein et al., 1975) was given as part of eligibility. Patients had to score >20 for eligibility (range = 0–30).

Psychosocial variables

Motivation to quit was assessed with the Contemplation Ladder, an ordinal measure with 10 answer choices that correspond to different levels of readiness to quit smoking. It has demonstrated reliability and validity and found to be associated with cognitive and behavioral indices of readiness to quit smoking (Biener and Abrams, 1991; Abrams and Biener, 1992; Herzog et al., 1999). *Self-efficacy* to quit smoking was assessed using the 15-item Confidence Questionnaire at baseline, which has good reliability (alpha: 0.85) and validity (Condiotte and Lichtenstein, 1981). Each item measures confidence to resist smoking in a variety of situations (Likert scale, 0 = not confident; 10 = very confident), and the range of possible scores is 0–150.

Smoking status

Expired air carbon monoxide (CO) assessments were given to those who reported abstinence ≥7 days. Abstainers were defined as those obtaining <10 ppm (Bedfont, CO Ecolyzer). Because of participant availability, only 60% of those reporting no smoking were given CO assessments to verify their self-report. Informants were also called to verify smoking status. We also examined continuous abstinence, defined as those subjects who refrained from any smoking since the most recent prior wave of data collection.

Quality of life

Quality of life was assessed with a shortened version of Medical Outcomes Study (MOS) Short-Form General Health Survey (SF-12) (McHorney et al., 1993). This scale measures physical health and mental health functioning, and both demonstrate good validity and reliability (alpha > 0.85). The population means for these scales are: physical: 50.12 (SD = 9.45, range 13–69); mental: 50.04 (SD = 9.59, range 10–70).

Intervention dose

Nurses recorded time spent discussing smoking and components delivered at each visit.

Analytic plan

Nurses had an average of 4 participants (range = 1 to 13 patients), and the within-nurse cross-sectional correlations for the primary outcomes were less than 0.05 for all time points. Extensions to multilevel models that account for both the clustering of patients within nurses and the repeated measures aspects of the design were deemed unlikely to affect the significance of the findings.

To estimate the influence of treatment (coded as 0 = Standard Care, 1 = Motivational Enhancement) on smoking outcomes (1 = abstinent, 0 = smoking), we used logistic regression (Hosmer and Lemeshow, 1989). For continuous outcomes, difference scores were calculated between baseline and each follow-up. Positive values represent desired improvements in the outcomes for motivation and self-efficacy; negative values for change in smoking indicate a reduction in the number of cigarettes smoking per day since baseline. To test for differences between conditions in the amount of change, difference scores were calculated (e.g., t2–t1) and regressed using ordinary least squares estimation procedures on treatment assignment and the baseline value of the outcome. This covariate, which was grand mean centered, was included to control for initial baseline differences. Therefore, the treatment group means and standard errors presented in Table 5 are derived from the intercepts from two separate models that only differed in the coding of the referent category for treatment assignment. The resulting intercepts are interpreted as the average amount of change within each group among those reporting the mean level of the variable at baseline.

Results

Retention rates were: 89.5% end of treatment, 87.0% at the 2 month, 80.4% at the 6 month, and 70.5% at the 12-month follow-up (Fig. 1). These rates exclude 39 subjects who died after randomization. Dropouts and those who could not be reached were considered smokers in our intention to treat analyses. Dropouts were significantly more likely ($P < 0.05$) to be male, non-White, and younger than non-dropouts. There were no differences between conditions in the rate of attrition over time.

Primary smoking outcomes

Statistical comparisons were conducted on baseline variables in order to test for equivalency between conditions. After a Bonferroni correction for the number of tests (alpha = 0.05/20 = 0.0025), there were two statistically significant variables: number of days since hospital discharge ($P = 0.009$) and self-efficacy ($P = 0.002$). We conducted sensitivity analyses by first including only the effect of condition assignment (e.g., unadjusted) and then replicating all analyses with these two covariates (e.g., controls for balance). No appreciable differences were observed between the two sets of analyses, so we present only the unadjusted effects. Three participants with self-reported past week abstinence had a level of >10 ppm on the CO assessment, and these data were recoded to reflect an affirmative past week smoking status.

The data in the top portion of both Tables 3 and 4 (all available cases and intent to treat, respectively) indicate that approximately twice as many participants were *continuously abstinent* in ME vs. SC at the end of treatment, 2-month, and 12-month follow-ups. Continuous abstinence rates at 6 months were higher in ME than in SC. As indicated in the bottom half of Tables 3 and 4, ME achieved higher rates of *7-Day Point Prevalence Abstinence* than SC across all time points. These group differences were not significant in GEE analyses (continuous abstinence: OR 2.2, 95% CI 0.4–11.5); Point Prevalence Abstinence: OR 1.01, 95% CI 0.4–2.2). Both ME and SC demonstrated significant increases in rates of continuous abstinence between end of treatment through the 12-month follow-up ($Z = 2.5$, 1 *df*, $P < 0.05$). Intent to treat analyses for both the within time and between time analyses were non-significant at all time points for both continuous abstinence outcomes.

Secondary smoking outcomes

The number of quit attempts was dichotomized into "≥1 quit attempt" vs. "no quit attempts" since the previous wave of data collection and included only those who reported smoking during the prior week. ME was more likely to make a quit attempt than SC at every time point (Table 5), and significant differences were achieved at both the 2-month and 12-month follow-ups (2 months: ME = 57.1%; SC = 43.1%, OR = 1.7; 95% CI 1.01–3.0; 12 months: ME = 75.8%, SC = 54.8%, OR = 2.5; 95% CI 1.2–5.4). Additionally, those in ME reported significantly greater reductions in the number of cigarettes smoked per day vs. SC at every time point (Table

Table 3
Smoking outcomes for all available cases (1998–2003; Providence, RI, USA)

TIME	SC (*N*)	ME (*N*)	SC (%)	ME (%)	OR	95% CI
Continuous abstinence						
End of treatment	131	110	0.7	1.8	2.4	0.2–26.9
2-month follow-up	123	104	2.4	6.7	2.8	0.7–11.4
6-month follow-up	110	98	3.6	6.1	1.7	0.4–6.3
12-month follow-up	96	76	5.2	11.8	2.4	0.7–7.6
(7) Day Point Prevalence Abstinence						
End of treatment	131	110	8.4	10.04	1.2	0.5–2.3
2-month follow-up	125	104	10.4	10.5	1.0	0.4–2.3
6-month follow-up	110	99	11.8	13.1	1.1	0.4–2.5
12-month follow-up	96	76	10.4	17.1	1.7	0.7–4.3

ME = Motivational enhancement; SC = Standard Care; OR = Odds ratio; CI = Confidence internal.

Table 4
Smoking outcome analyses using intent to treat, N = 273 (1998–2003; Providence, RI, USA)

TIME	SC (%)	ME (%)	OR	95% CI
Continuous abstinence				
End of treatment	0.7	1.6	2.2	0.2–25.0
2-month follow-up	2.2	5.9	2.7	0.7–10.9
6-month follow-up	3.1	5.2	1.7	0.4–6.2
12-month follow-up	4.2	8.7	2.1	0.6–6.6
(7) Day Point Prevalence Abstinence				
End of treatment	7.9	8.8	1.1	0.4–2.6
2-month follow-up	8.8	9.3	1.0	0.4–2.5
6-month follow-up	10.1	11.2	1.1	0.4–2.5
12-month follow-up	8.5	12.6	1.5	0.6–3.6

ME = Motivational enhancement; SC = Standard Care; OR = Odds ratio; CI = Confidence internal.

5) and collapsed across all time points (Z = 1.98, 1 df, P < 0.05), after adjusting for the average number of cigarettes smoked per day at baseline. We also tested the possibility that treatment differentially impacted levels of motivation and self-efficacy to quit, but there were no main effects in GEE models.

Treatment exposure

Overall, 57% (74/129) of the ME participants received full treatment (3 visits plus one follow-up phone call), 26% (34/129) received only three visits, 8% received one or two visits. Nine percent (12/129) received additional sessions. Full adherence in SC (one visit) was 94% (136/144), and 18.7% received additional sessions (27/144). In both conditions, neither receipt of the full intervention nor extra contact was not associated with smoking outcome. Receipt of a follow-up phone call in the ME condition was unrelated to outcomes.

Discussion

Our study demonstrated that home health care is a feasible and effective channel for nurse-delivered smoking cessation counseling. The ME intervention outperformed SC at every time point in both intent to treat analyses and all available cases analyses, with ME showing twice the amount of continuous abstinence vs. SC. Our 12-month continuous abstinence rate is an achievement (intent to treat: 4.2% in SC and 8.7% in ME; all available cases 5.2%, SC; 11.8%, ME), especially in light of the fact that we did not provide nicotine replacement, and our population had a number of risk factors associated with difficulty quitting (i.e. high levels of depressed mood, average of 42 years of smoking, high nicotine dependence; low education, low income). We achieved group differences even though our comparison group, SC, was much stronger than a minimal contact intervention or no-treatment control. Significant differences between the groups emerged for smoking reduction, with the ME group smoking significantly less cigarettes per day vs. SC at each time point.

Despite lack of statistical significance in quit rates between groups, our findings could have significant public health implications. Approximately 36% of our sample had no plans to quit at baseline. Despite this, patients were willing to receive counseling from their nurse. This far exceeds the number of patients with low intentions who would enroll in reactive programs, which are biased towards a self-selected sample with high motivation to quit. Using Rose's theorem (Rose, 1992), Abrams et al . (1996) state that impact, reach, and efficacy must be considered when evaluating smoking cessation interventions. Thus, impact is the efficacy of an intervention (E) multiplied by its reach (R), where reach is defined as the percent penetration of the intervention into a population. The result is multiplied by "10" to obtain an impact rating. For example, a clinical intervention that has high efficacy (40%) but reaches only 5% of the population has an impact rating of 0.20 (40% × 5% × 10). A public health intervention that has a modest efficacy of 5% but reaches 80% of the population will double the impact of the clinical approach (0.40). If we apply this equation to the current results, we find that 11.8% efficacy (using 12 months of all available cases) × 0.70 reach (participation rate among eligible patients) = 0.83 population impact. Thus, "Reach" is a necessary component in evaluating the efficacy of population-based intervention studies. Glasgow et al. (1999, 2001) extend this model with their REAIM framework, whereby Reach, Efficacy, Adoption (by organizations), Implementation (by providers), and Maintenance (institutionalization over time) are combined to determine overall public health impact.

One explanation for the differences between ME and SC was that ME nurses were required to provide three counseling visits plus a follow-up call, while those in SC nurses were required to provide only one counseling visit. We intentionally designed the study with this confound. If we equated the contact time between conditions, then the SC would no longer

Table 5
Secondary smoking outcomes (1998–2003; Providence, RI, USA)

	End of treatment		2 months		6 months		12 months	
	SC	ME	SC	ME	SC	ME	SC	ME
% attempting to quit[a]	52.1%	56.8%	43.1%	57.1%	56.9%	62.2%	54.8%	75.8%
Mean reduction in cigarettes smoked[a,b]	M −3.8	M −6.9	M −4.0	M −7.5	M −3.0	M −6.2	M −3.1	M −7.8
	SE (0.84)	SE (0.93)	SE (1.04)	SE (1.13)	SE (1.05)	SE (1.10)	SE (1.1)	SE (1.3)

ME = Motivational enhancement; SC = Standard Care.
[a] Among those who reported any smoking in the previous week.
[b] Calculated as the change in the number of cigarettes smoked since baseline (e.g., Ti−Tb where i = average number of cigarettes smoked at the time point of interest and b = baseline average number of cigarettes smoked per day).

be "usual" or "standard" care. We analyzed the effect of both number of contacts and contact time on smoking outcomes, and there was no relationship between intervention intensity and smoking outcomes. Therefore, the higher quit rates achieved by ME are more likely due to intervention content.

There are two plausible explanations for lack of significant differences between the groups: 1) insufficient group differences in intervention intensity and 2) lack of statistical power. Regarding the former, 18.7% of SC patients received more than the one intervention contact prescribed by the study protocol vs. 9.3% of ME patients who received additional sessions over and above the 3 sessions and one phone contact as prescribed by the study protocol. However, intervention dosage and intensity were unrelated to smoking outcomes. The study was powered to have 1000 subjects, given the dichotomous primary outcome (smoking) and the possibility of a high intra-class correlation within nurses. Though the intra-class correlation was low, we still did not have a sufficient amount of subjects to detect an effect. This was due to several organizational upheavals that occurred within the VNA (three changes of CEOs and layoffs of 1/3 of our trained nurses). Fortunately, the VNA of RI has achieved greater stability under new leadership.

The strengths of our study included excellent retention rates, randomization by nurse, proactive patient outreach, unique intervention channel, and delivery of a theory-based intervention within a public health context. Our intervention was integrated into ongoing medical care, increasing external validity. Future studies could attempt to dismantle the active ingredients of ME, for example, whether or not the provision of biomarker feedback is related to better smoking outcomes and the cognitive processes underlying such changes.

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