ORIGINAL INVESTIGATION

Efficacy of a Smoking Cessation Program for Hospital Patients

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Background: Hospitalization may be an opportune time to change smoking behavior because it requires smokers to abstain from tobacco at the same time that illness can motivate them to quit. A hospital-based intervention may promote smoking cessation after discharge.

Methods: We tested the efficacy of a brief bedside smoking counseling program in a randomized controlled trial at Massachusetts General Hospital, Boston. The 650 adult smokers admitted to the medical and surgical services were randomly assigned to receive usual care or a hospital-based smoking intervention consisting of (1) a 15-minute bedside counseling session, (2) written self-help material, (3) a chart prompt reminding physicians to advise smoking cessation, and (4) up to 3 weekly counseling telephone calls after discharge. Smoking status was assessed 1 and 6 months after hospital discharge by self-report and validated at 6 months by measurement of saliva cotinine levels.

Results: One month after discharge, more intervention than control patients were not smoking (28.9% vs 18.9%; $P=.003$). The effect persisted after multiple logistic regression analyses adjusted for baseline group differences, length of stay, postdischarge smoking treatment, and hospital readmission (adjusted odds ratio, 2.19; 95% confidence interval, 1.34-3.57). At 6 months, the intervention and control groups did not differ in smoking cessation rate by self-report (17.3% vs 14.0%; $P=.26$) or biochemical validation (8.1% vs 8.7%; $P=.72$), although the program appeared to be effective among the 167 patients who had not previously tried to quit smoking (15.3% vs 3.7%; $P=.01$).

Conclusions: A low-intensity, hospital-based smoking cessation program increased smoking cessation rates for 1 month after discharge but did not lead to long-term tobacco abstinence. A longer period of telephone contact after discharge might build on this initial success to produce permanent smoking cessation among hospitalized smokers.

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CIGARETTE SMOKING is the leading preventable cause of death in the United States.[1,2] The health care system is a key channel for efforts to reduce tobacco use. To date, smoking cessation interventions in health care settings have focused primarily on outpatients. These interventions have demonstrated the efficacy of brief counseling provided by a physician or nurse in a primary care practice.[3] Much less has been done to develop interventions for inpatient smokers, even though hospitalization may provide a unique opportunity for changing smoking behavior. Since 1992, the Joint Commission on Accreditation of Healthcare Organizations has required US hospitals to adopt policies prohibiting smoking, and nearly all hospitals are in compliance.[4-6] Consequently, hospitalization now requires smokers to abstain, at least temporarily, from tobacco use. At the same time, the illness that precipitates a hospital admission may make smokers more aware of their vulnerability to the health hazards of tobacco use. This may motivate them to try to quit smoking, especially if their illness is related to smoking.[7,8]

Previous work suggests that a hospital stay can trigger smoking cessation. In 1 retrospective study,[9] 16% of patients who had smoked at the time of a hospital admission were no longer smoking 1 year later. This exceeds the approximately 7% annual rate of smoking cessation among smokers in the United States.[10] Higher cessation rates have been reported by smokers with a smoking-related disease, especially cardiovascular disease. Without any smoking intervention, one third of smok-

PATIENTS AND METHODS

SETTING

This randomized controlled trial was conducted at Massachusetts General Hospital, an 860-bed teaching hospital in Boston. Hospital policy prohibited smoking in indoor areas at the time of the study.

PATIENT RECRUITMENT

Patients admitted to the medical and surgical services who reported having smoked at least 1 cigarette in the month before admission were eligible for enrollment, regardless of their interest in quitting smoking. To assemble a cohort of newly admitted adults who were able to receive the intervention and be followed up for 6 months, we excluded patients who were younger than18 years; transferred from another hospital; admitted for intensive care, transplantation, or terminal care; unable to speak English or to be reached by telephone; cognitively or psychologically impaired; or expected to be in the hospital for less than 48 hours. To avoid contaminating control patients with intervention materials, we excluded patients whose hospital roommate was enrolled in the study. The project was approved by the Massachusetts General Hospital Subcommittee on Human Studies. Consent was obtained from patients and their physicians. All but 3 of 337 staff physicians provided written consent for study staff to enroll any of their eligible patients.

During the enrollment period (August 8, 1994-August 7, 1995), study staff routinely reviewed the previous day's hospital admission log to screen for eligibility all patients admitted to the medical and surgical services. For elective admissions, smoking status was determined by admitting office staff, who were trained to ask a standard question and record the response in the hospital information system. For emergency admissions, smoking status was determined by chart review of the nursing admission note, a preprinted form with a smoking status question. (In pilot testing, the assessment of smoking status by this method agreed with patient self-report in all cases.) If a patient's smoking status was uncertain based on these data sources, study staff asked the patient directly. Each day's list of eligible smokers was put in random order and patients were recruited consecutively in this order. This avoided introducing selection bias on days when the number of eligible smokers exceeded our enrollment capacity. A research assistant visited eligible smokers within 48 hours of admission to obtain oral informed consent, administer a baseline questionnaire, and randomly assign participants to the control group or the intervention group. Patients unable to participate because of factors judged by study staff as transient (eg, postoperative drowsiness) were revisited 24 hours later to reassess eligibility.

BASELINE ASSESSMENT

Baseline information, gathered using a structured interview, included (1) sociodemographic factors; (2) medical history; (3) smoking-related symptoms in the previous month; (4) smoking history (pack-years, usual and recent cigarette use, time to first cigarette of the day, and number and duration of prior quit attempts); (5) nicotine withdrawal symptoms[25]; (6) readiness (eg, intention) to stop smoking[26-28]; (7) confidence in ability not to smoke after discharge; (8) social support for quitting smoking; (9) alcohol use (number of drinks per week and prior or current alcohol abuse); (10) health-related quality of life, SF-6 and the mental health inventory of the SF-36[29,30]; and (11) patient beliefs about the relationship between smoking and their health. The baseline interview required a mean of 13 minutes. Information on hospital length of stay, discharge diagnoses, and surgical procedures was obtained by chart review.

INTERVENTION

The intervention had 4 components: (1) a bedside counseling session, (2) written self-help material, (3) a chart prompt for physicians, and (4) counseling via telephone after discharge. Bedside counseling was conducted by a research assistant who was trained and supervised by a nurse experienced in smoking counseling. Following a structured protocol, the counselor assessed the patient's stage of readiness to stop smoking.[26,27] The counseling was tailored accordingly, incorporating motivational interviewing, cognitive-behavioral counseling, and relapse prevention techniques. The goal was to help patients identify and

ers stop smoking after experiencing myocardial infarction,[11] half quit after undergoing coronary artery bypass graft surgery,[12] and one quarter stop after other cardiovascular disease–related admissions.[13,14] Noncardiac surgery also appears to stimulate smoking cessation.[15]

It may be possible to amplify the effect of hospitalization on smokers by providing an intervention during the hospital stay. Available data suggest that most smokers are not even advised to quit smoking during their hospitalization.[7,16] Because an estimated 6.5 million smokers are hospitalized annually,[8] a smoking cessation program for hospitalized smokers has the potential to reach many smokers and yield substantial clinical and public health benefits. The new Smoking Cessation Clinical Practice Guideline,[17] released in 1996 by the Agency for Health Care Policy and Research, strongly endorses hospital-based smoking intervention. The guideline panel[18] recommended that hospitals offer smoking cessation treatment to all smokers but concluded that the optimal intervention strategy remained to be determined.

Few controlled studies of formal smoking cessation interventions for hospitalized patients have been done, and most of them were limited to patients with coronary heart disease. These studies[13,19-21] demonstrate the efficacy of brief smoking counseling in the hospital followed by telephone contact after discharge. Whether an intervention could benefit all hospitalized smokers, even those without a smoking-related disease, is less well studied. One study[22] reported a modest benefit

overcome barriers that prevented them from making a decision to stop smoking or succeeding in quitting. Since patients were temporarily not smoking, the focus was on making a decision to maintain abstinence in the hospital and after discharge. The counselors gave patients self-help booklets to read in the hospital and take home.[31,32] Patients' hospital charts were stamped with a prompt to remind the physician to advise smoking cessation. Physicians were not trained in how to give this advice. One week after discharge, the counselor called intervention group patients to offer 5 to 10 minutes of structured counseling. Up to 6 attempts were made to reach a patient. Patients who were not smoking or trying to quit were called again 2 and 3 weeks after discharge. Nicotine replacement therapy was not included because the intervention was designed for delivery by nonmedical personnel who were not trained to assess patients' medical eligibility for this therapy. Control group patients completed the baseline interview and then received usual hospital care.

OUTCOME ASSESSMENT

Self-reported smoking status was assessed by telephone interview 1 and 6 months after hospital discharge. The interviewer was blinded to patients' group assignment. Other data collected at follow-up were duration of tobacco abstinence after discharge, subsequent hospitalization and emergency department use, and other smoking cessation treatment after discharge. Self-reported nonsmoking at 6 months was validated by saliva cotinine assay.[33] Samples were not requested from patients living out of state, for logistical reasons. Staff paid $20 per sample and offered to collect it at the patient's home or workplace.

The primary outcome measure, nonsmoking for the past week, was assessed 1 and 6 months after discharge. Secondary outcome measures were continuous abstinence (no smoking since hospital discharge), duration of postdischarge abstinence, and sustained abstinence (no smoking at both 1- and 6-month follow-up interviews). A cotinine-validated cessation rate was calculated for the 6-month follow-up; nonsmokers who refused to provide saliva samples or whose cotinine concentrations exceeded 20 ng/mL were considered to be smokers.[34]

DATA ANALYSIS

Data were analyzed using SAS statistical software.[35] The effectiveness of the intervention was determined by comparing outcome measures between groups using an intention-to-treat analysis. Patients unavailable for follow-up were counted as smokers. The significance of group differences in baseline and outcome variables was assessed with the χ^2 and Fisher exact tests for categorical variables and the Student t test for continuous variables. Group differences in the duration of postdischarge abstinence were assessed with the Kaplan-Meier technique and log-rank test. All significance tests were 2-tailed.

We used multiple logistic regression analysis to generate odds ratios (ORs) with 95% confidence intervals (CIs) to adjust the effect of the intervention for potential confounding factors. Stratified analyses explored whether the effect of the intervention was modified by demographic characteristics or factors associated with smoking cessation. For each factor, a pooled summary relative risk estimate was calculated using the Mantel-Haenszel technique and homogeneity of the OR across strata was assessed with the Breslow-Day Test.[36] We also checked for effect modification by adding 2-way interaction terms to the logistic regression models.

Univariate and multivariate analyses were done to identify baseline characteristics that were associated with smoking cessation after hospital discharge. Factors associated with cessation on univariate analysis at a $P<.05$ level of statistical significance were entered into a multiple logistic regression model. The dependent variable was cotinine-validated 7-day abstinence 6 months after discharge. Models were adjusted for sociodemographic factors (age, sex, race, education, and marital status), group, discharge diagnosis, and hospital length of stay.

SAMPLE SIZE

The goal was to enroll 650 patients, which, assuming a 15% unavailability for follow-up, would provide complete data on 550 patients (275 per group). This sample size provides 80% power to detect a 10% group difference (25% vs 15%) in smoking cessation rates at 1-month follow-up, assuming $\alpha=.05$. A sample of 650 also provides 85% power to detect a 10% difference (20% vs 10%) at 6 months, assuming a 30% unavailability for follow-up.

from a low-intensity counseling program offered to all hospitalized smokers. A more intensive nurse-managed multicomponent program was effective among the subset of hospitalized patients who were interested in quitting smoking, but only if follow-up telephone contact was maintained for 3 months after discharge.[23,24]

The objective of this study was to test, in a randomized controlled trial, the efficacy of a low-intensity, low-cost smoking cessation counseling program for all hospitalized smokers that could be adopted by hospitals nationwide and was consistent with the new Agency for Health Care Policy and Research guideline. The study hypothesis was that smokers receiving the counseling program would have a higher smoking cessation rate after discharge than smokers receiving usual hospital care.

RESULTS

PATIENT ENROLLMENT

During 1 year we screened 12 785 medical and surgical admissions. Seventy percent (n=8966) of those screened met eligibility criteria. Major reasons for ineligibility were admission for intensive care or transplantation (32%), hospital stay of less than 48 hours (31%), transfer from another hospital (13%), cognitive or psychological impairment (8%), inability to speak English (4%), lack of physician consent (3%), and lack of a telephone (2%). Of 8966 eligible patients screened for smoking status, 923 (10%) reported having smoked in the previous month. As described in the "Methods" section, we recruited a ran-

Table 1. Demographic and Medical Characteristics of Patients at Baseline

Characteristics	Intervention Group (n=325)	Control Group (n=325)	P
Mean (±SE) age, y	47.7±0.9	50.5±0.9	.03
Sex, % male	56	53	.39
Race, % white	90	94	.08
Mean (±SE) education, y	12.4±0.2	12.5±0.1	.71
Married, %	42	41	.73
Employed (full-time or part-time), %	46	38	.11
History of coronary heart disease, %*	18	17	.61
History of smoking-related disease, %†	29	27	.54
Current smoking-related health problem, %‡	37	32	.19
Smoking-related symptom in the previous month, %§	56	46	.01
Admission related to smoking, %‖	19	15	.29
Cardiac or pulmonary discharge diagnosis, %	23	22	.78
Surgical procedure in hospital, %	53	47	.15
Mean (±SE) hospital length of stay, d	6.4±0.4	5.7±0.3	.13

**Patient report of physician-diagnosed heart attack or angina.*
†Patient report of prior physician-diagnosed heart attack, angina, chronic obstructive lung disease, lung cancer, peripheral vascular disease, or stroke.
‡Patient response to, "Do you currently have any health problem that you believe is caused or made worse by your smoking?" (percentage of yes answers).
§Chest pain, cough, shortness of breath, or leg pain on walking that patient considers related to smoking.
‖Patient response to, "In your opinion, is your smoking related to the reason you were admitted to the hospital?" (percentage of yes answers).

Table 2. Baseline Patient Characteristics: Smoking Behavior

Characteristics	Intervention Group (n=325)	Control Group (n=325)	P
Mean (±SE) pack-years	35.2±2.2	34.3±1.5	.76
Mean (±SE) cigarettes per day	23.3±0.7	23.7±0.7	.72
Time elapsed since last cigarette, %			
≤3 d	74	77	.53
<1 wk	94	93	.64
Smoke ≤30 min after awakening, %*	69	68	.80
Craving for a cigarette since admission, %	54	55	.64
Intend to stop smoking in the next 30 d, %	52	46	.28
Mean (±SE) (0-10) readiness to quit smoking†	6.7±0.2	6.7±0.2	.95
Mean (±SE) (0-10) confidence about quitting‡	4.6±0.2	4.5±0.2	.68
Quit for ≥1 wk in past year, %	34	36	.53
Live with a smoker, %	46	44	.58
Social support for quitting, %§	73	67	.13

**Nicotine-dependence measure.*
†Biener contemplation ladder[28] (0, no thought of quitting to 10, taking action to quit).
‡Patient response to, "How confident are you that you will not be smoking in 1 week?" (0, not at all to 10, very).
§Patient response to, "If you were to stop smoking, how helpful would the people closest to you be?" (percentage reporting helpful or very helpful).

dom 713 (77%) of the 923 eligible smokers; 650 of the patients (91%) recruited enrolled in the trial. Our enrollment capacity did not permit us to recruit all eligible smokers.

BASELINE CHARACTERISTICS

Intervention and usual care control groups were similar at baseline. There were no significant sociodemographic group differences except for age; intervention patients were slightly younger than controls (**Table 1**). Groups did not differ in medical history, reason for admission, surgical procedure in the hospital, or hospital length of stay (Table 1). Intervention patients attributed more recent symptoms to smoking than did controls, but groups did not differ in beliefs about whether they had a smoking-related health problem or whether their admission was related to smoking (Table 1). There were no significant group differences in any measure of smoking behavior, including degree of nicotine dependence, intention to quit smoking after discharge, confidence in the ability to do so, or past experience quitting smoking (**Table 2**). Additionally, groups did not differ in health-related quality of life, reported alcohol consumption, or prevalence of current or past alcohol abuse (data not shown).

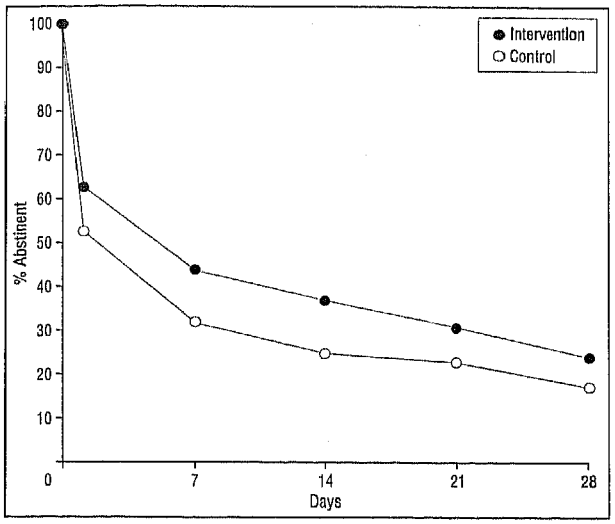
Study patients had the same sex distribution (55% male) as all patients admitted to the Massachusetts General Hospital medical and surgical services during the enrollment period, but they were younger (mean age, 49 vs 59 years) and more frequently white (92% vs 86%).

PARTICIPATION IN THE INTERVENTION

Of the intervention patients; 321 (99%) of 325 received bedside counseling, written material, and a chart prompt. Bedside counseling lasted a median of 15 minutes (mean, 18 minutes; range, 2-45 minutes). After hospital discharge, 280 intervention patients (86%) received a counseling telephone call. The mean number of completed calls per patient was 1.6 (range, 0-3), and telephone contact lasted an average of 10 minutes per patient contacted. Mean total contact time per patient (in person and by telephone) was 28 minutes (range, 2-114 minutes). To estimate physician compliance with the chart prompt, patients at 1-month of follow-up were asked if a physician had advised them to quit smoking during their hospital stay. Almost half the patients in both the intervention and control groups recalled this advice (49% vs 48%, respectively; $P=.78$). Nicotine replacement therapy was not an intervention component. According to hospital pharmacy records, 24 patients (4%) received this therapy in the hospital. Control and intervention patients had similar rates of use.

FOLLOW-UP

All patients survived to hospital discharge. Fifteen patients (2.3%) died before the 1-month follow-up and 35 (5.4%) died before the 6-month follow-up and were excluded. Intervention and control groups did not differ in mortality rates at 1 month (2.2% vs 2.5%, respectively) or 6 months (5.5% vs 5.2%, respectively). We followed up 605 (95.3%) of the 635 survivors at 1 month and 542 (88.1%) of the 615 survivors at 6 months. In-



Duration of tobacco abstinence after hospital discharge. Data include patients followed up for 1 month after hospital discharge (n=605). The difference between groups is statistically significant (P=.006, log-rank test).

Table 3. Abstinence From Cigarettes 1 and 6 Months After Hospital Discharge

Follow-up	No. (%) Intervention Group	No. (%) Control Group	Risk Difference (95% Confidence Interval)
1 mo	n=318	n=317	
7-day abstinence	92 (28.9)	60 (18.9)	10.0 (3.4 to 16.6)*
Continuous abstinence	71 (22.3)	51 (16.1)	6.2 (0.1 to 12.3)†
6 mo	n=307	n=308	
7-day abstinence	53 (17.3)	43 (14.0)	3.3 (−2.4 to 9.0)
Continuous abstinence	34 (11.1)	31 (10.1)	1.0 (−3.9 to 5.9)
Cotinine-validated 7-day abstinence	25 (8.1)	27 (8.7)	−0.6 (−5.0 to 3.8)
1 and 6 mo	n=307	n=308	
7-day abstinence‡	42 (13.7)	31 (10.1)	3.6 (−1.5 to 8.7)

*P=.003.
†P=.046.
‡Abstinence reported at both 1- and 6-month follow-ups.

tervention and control groups did not differ in unavailability for follow-up at 1 month (5.0% vs 4.4%) or 6 months (13.0% vs 10.7%).

OUTCOMES

One-Month Follow-up

Intervention patients maintained abstinence from cigarettes at a higher rate than controls throughout the first month after hospital discharge (P=.006) (**Figure**). At the 1-month follow-up, more intervention than control patients had not smoked in the previous week (28.9% vs 18.9%; P=.003) (**Table 3**). Intervention patients were also more likely than controls to have been continuously abstinent from cigarettes since hospital discharge (22.3% vs 16.1%; P=.046). Intervention and control groups did not differ in potentially confounding postrandomization events: hospital length of stay (Table 1), hospital readmission rate (13% vs 17%; P=.54), or smoking cessation treatment after discharge (21% vs 17%; P=.24). Specific smoking treatments that patients reported receiving after discharge included counseling by a physician (12%), nicotine replacement therapy (4%), formal cessation program (1%), and hypnosis (1%); none of these differed by group.

Multiple logistic regression models adjusted smoking status at 1-month follow-up for baseline group differences (age and smoking-related symptoms), patients' readiness to quit smoking, and postrandomization factors (length of stay, hospital readmission, and other smoking treatment). The favorable effect of the intervention on smoking cessation was unchanged and remained statistically significant for both end points: 7-day tobacco abstinence (adjusted OR, 2.19; 95% CI, 1.34-3.57; P=.002) and continuous abstinence for 1 month after hospital discharge (adjusted OR, 1.58; 95% CI, 1.01-2.49; P=.05).

There was no evidence that the intervention was more or less effective in any subgroup of patients examined, including subgroups defined by sociodemographic characteristics, smoking behavior (readiness to stop smoking, daily cigarette consumption, degree of nicotine dependence, cigarette craving at baseline, length of time since last cigarette, or prior quitting experience), medical factors (cardiopulmonary discharge diagnosis or surgical procedure during hospitalization), or patients' perception that the hospitalization was related to smoking.

Six-Month Follow-up

By the sixth month of follow-up, the difference in self-reported smoking cessation rates between groups had narrowed; 17.3% of intervention patients and 14.0% of controls reported not smoking in the previous week (P=.26) (Table 3). Continuous nonsmoking since discharge was reported by 11.1% of intervention patients and 10.1% of controls (P=.68). Sustained cessation (abstinence for the previous 7 days at both 1- and 6-month follow-ups) was reported by 42 (13.7%) intervention patients and 31 (10.1%) controls (P=.16).

Subgroup analysis identified 1 group of patients in whom the intervention appeared to be effective at 6 months: smokers with little prior experience quitting smoking. Among 167 patients who had not previously quit smoking for 1 week, the 6-month cessation rate was significantly higher in the intervention group than among controls (15.3% vs 3.7%; P=.01).

During 6 months of follow-up, the intervention and control groups did not differ in the rates of hospital readmission (27% vs 28%; P=.66), emergency department visits (14% vs 11%; P=.29), or smoking cessation treatment (33% vs 36%; P=.52).

To validate self-reported nonsmoking at 6 months of follow-up, we requested saliva samples from the 82 (85%) self-reported nonsmokers who lived in Massachusetts. Nonsmoking was confirmed by cotinine analysis in 44 (54%) of these patients; confirmation rates did not differ significantly between control and intervention groups (60% vs 48%, P=.19). Failure to provide a saliva sample was the main reason for nonconfirmation; 33%

of patients declined to do so and were considered smokers. Nonsmoking was confirmed in 80% of patients who provided a sample. Cotinine-validated 7-day abstinence rates were substantially lower than self-report rates in both groups, but the results did not change the conclusion of no group difference in smoking cessation rates at 6 months of follow-up (Table 3).

Two baseline factors were independently associated with cotinine-validated smoking cessation 6 months after hospital discharge: confidence in the ability to quit smoking (adjusted OR, 1.44; 95% CI, 1.21-1.77; $P<.001$, for each unit increase on a 10-point scale) and craving for a cigarette at study entry (adjusted OR, 2.83; 95% CI, 1.14-7.03; $P=.02$). These relationships were independent of sociodemographic factors, discharge diagnosis, hospital length of stay, and group assignment.

COMMENT

This randomized controlled trial demonstrated that routine brief bedside counseling of smokers admitted to an acute care general hospital increased their smoking cessation rate by 50% for 1 month after discharge. The program, offered to smokers regardless of their reason for admission or interest in quitting smoking, was effective across a wide range of subgroups defined by sociodemographic, medical, and smoking behavior characteristics. After the initial success the program efficacy diminished and it did not produce a significant long-term effect on smoking cessation. Nonetheless, this study demonstrates that it is possible to take advantage of the opportunity presented by a hospital admission to generate substantial short-term smoking cessation and to do so with an intervention that is simple, low in cost, and broadly applicable to all smokers.

There have been few randomized controlled trials of smoking cessation interventions for hospital patients. Most were limited to patients with a single diagnosis, usually myocardial infarction.[12,13,19-21,37,38] Few studies have enrolled an unselected population of smokers as we did. Stevens et al[22] assessed a similar smoking counseling program in a different setting, 2 smaller Oregon community hospitals. That study, like ours, enrolled smokers regardless of their diagnosis or interest in quitting and offered brief in-hospital counseling and up to 3 weeks of counseling via telephone after discharge. Unlike our study, the intervention also included a videotape and 6 bimonthly newsletters after discharge. The program produced sustained smoking cessation by self-report: 13.5% of intervention patients reported not smoking at both 3- and 12-month follow-up points, compared with 9.2% of those receiving usual care ($P=.02$). Our intervention had a similar magnitude of effect on sustained cessation for 6 months (13.7% vs 10.1%), but the effect was not statistically significant, partly because of our smaller sample size. The Oregon trial's multiple intervention modalities (including videotape and mailings) and longer duration of postdischarge contact may have also contributed to the difference in long-term outcome between studies.

A second study[23] that included hospitalized smokers, regardless of diagnosis, demonstrated the efficacy of a more intensive intervention consisting of bedside counseling by a nurse, counseling via telephone for 3 months after discharge, and nicotine replacement therapy for selected patients. This intervention produced a higher validated 1-year cessation rate than physician advice alone (31% vs 21%; $P=.006$).[23] In a subsequent report,[24] a less intensive intervention similar to ours (consisting of bedside counseling but only 1 telephone contact after discharge) was no better than physician advice in producing long-term smoking cessation. This suggests that permanent smoking cessation after a hospital intervention requires a longer duration of postdischarge contact than we provided. These studies[23,24] also achieved substantially higher cessation rates in both control and intervention groups than did our study or the Oregon study.[22] Patient selection most likely accounts for this difference, because the studies, unlike ours, excluded patients who were not interested in quitting smoking, a group whose likelihood of cessation is less.[26,27] These studies suggest that hospital-based interventions will achieve the highest cessation rates, and therefore be most cost-effective, if interventions are limited to patients already motivated to quit smoking. However, such interventions will ultimately have a more limited public health impact than those that include smokers with less motivation to quit. Future work needs to identify effective ways to intervene with this latter group of smokers.

This randomized controlled trial had numerous methodological strengths. Intervention and control groups were comparable at baseline and did not differ after randomization in events that might have influenced outcomes of smoking cessation. Study records confirmed that intervention patients received the program as intended. Intervention consistency was maximized by having a single counselor who followed a standardized protocol. Contamination of the control group was minimized by having research staff deliver the intervention. Outcome was assessed by an interviewer blinded to treatment assignment, and follow-up rates were equally high in both groups. Program efficacy was analyzed on an intention-to-treat basis using the conservative assumption that patients unavailable for follow-up were smoking, and statistical adjustment for a variety of potentially confounding factors did not alter the results. These strengths permit us to conclude that, in the short-term, a multicomponent intervention consisting of bedside counseling, self-help material, and telephone follow-up was superior to usual care. The study design cannot determine the relative contribution of each program element, but the combination of face-to-face counseling in the hospital and sustained contact after discharge probably accounted for most of the intervention effect. The chart prompt did not appear to be of benefit because, according to patient recall, physician advice to quit smoking was provided equally to both intervention and control groups. The prompt either had no effect or had the nonspecific effect of reminding physicians to advise all smokers to quit. It might have been more effective if it had been ac-

companied by physician training in smoking counseling techniques.

The intervention's lack of long-term efficacy does not appear to be explained by any methodological flaw. In particular, there was no evidence of a group difference in the rates of smoking treatment or hospital readmission between the 1- and 6-month follow-ups that might have confounded the final outcome. The sample size, by design, was sufficient to exclude a substantial long-term benefit of the program (eg, an increase from 10% to 20% in smoking cessation rate). Although the CI included a difference as large as 9% in self-reported smoking cessation, the similarity of the 6-month cessation rates after biochemical validation makes it unlikely that the results would be altered by a larger or longer study.

However, the program appeared to increase long-term cessation in 1 subgroup, smokers with little prior experience in trying to quit smoking, who represented 27% of our sample. For these smokers, hospitalization may have provided the motivation to try to quit and the intervention may have offered new information just when they were ready to use it. The subgroup effect has to be interpreted with caution since it was not specifically postulated before the study, but it deserves exploration in future work.

Following standard practice in smoking intervention research, we attempted to confirm patients' self-reported nonsmoking biochemically. Like another hospital-based trial,[22] we had difficulty obtaining saliva samples, despite a financial incentive and considerable outreach effort. In the analysis, we took a conservative approach, counting as smokers all patients who refused to provide a sample. Consequently, cotinine-validated cessation rates were substantially lower than self-report rates, but this did not alter the study's conclusion because confirmation rates did not differ between the control and intervention groups. The true smoking cessation rate is probably higher than our cotinine-validated estimate because some patients who declined to provide a sample no doubt did so for a reason other than smoking. We did not validate self-reported nonsmoking at 1 month, but it is unlikely that doing so would have substantially altered the study's conclusion, given that there was no evidence of differential confirmation between groups at the 6-month follow-up.

In summary, this study is an important step toward the goal of developing a cost-effective, widely generalizable, hospital-based smoking intervention, as recommended by the Agency for Health Care Policy Research's new Smoking Cessation Clinical Practice Guideline.[17,18] This study demonstrates the feasibility and short-term effectiveness of a brief smoking cessation counseling program routinely provided to all smokers admitted to an acute care general hospital. Extending the period of counseling via telephone to 3 months after discharge would likely produce long-term smoking cessation, as recent studies[23,24] have demonstrated. Including nicotine replacement therapy, whose efficacy in outpatients is well established, might also improve the intervention.[17,24,39] Since craving for a cigarette in the hospital was associated with less smoking cessation, treating nicotine withdrawal in the hospital might increase the proportion of smokers who remain abstinent after discharge, as well as relieve discomfort. A program capable of producing long-term smoking cessation would have considerable public health importance. Quitting smoking improves health and reduces subsequent health care utilization.[10,40] Hospitalized smokers may realize these benefits even sooner since they are likely to be at greater risk of subsequent morbidity and mortality. A hospital-based smoking intervention is likely to be a highly cost-effective way to reduce the enormous health burden of tobacco smoking.[41]

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