Predictors of Long-Term Smoking Cessation in Head and Neck Cancer Patients


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Abstract

Cigarette smoking is a major risk factor for head and neck cancer, and individuals who continue to smoke past diagnosis and treatment are at elevated risk for further disease. In a randomized controlled trial, a state of the art provider-delivered smoking cessation intervention was compared to a usual care advice control condition. The intervention consisted of surgeon- or dentist-delivered advice to stop smoking, a contracted quit date, tailored written materials, and booster advice sessions.

Subjects were 186 patients with newly diagnosed first primary squamous cell carcinomas of the upper aerodigestive tract who had smoked cigarettes within the past year. At randomization, 88.2% of subjects were current smokers. At 12-month follow-up, 70.2% of subjects completing the trial (n = 114) were continuous abstainers; among baseline smokers alone the continuous abstinence (CA) rate was 64.6%. The cotinine validation rate at 12 months was 89.6%. Modeling techniques were utilized in order to derive expected CA rates, which included noncompleter subjects (n = 72). The CA rate expected at 1 year for the entire patient population was 64.2%, and for smokers alone the expected CA rate was 59.4%. Logistic regression analysis carried out on baseline smokers identified predictors of 12-month CA status.

These included medical treatment, stage of change, age, nicotine dependence, and race. The intervention effect was not significant, although the sign of the effect was positive. Based on these findings, we recommend systematic brief advice to stop smoking for head and neck cancer patients, with a stepped care approach for patients less able to quit.

Introduction

For patients with life-threatening diseases, the risks of continued smoking and the benefits of cessation are well known. Specifically, with regard to cancers of the upper aerodigestive tract, Slaughter et al. (1) were the first to describe the “condemnation” of oral mucosa due to multiple carcinogens, including tobacco. Subsequent studies have reported an increased risk of new oral and laryngeal malignancies in patients who continue to smoke following a first primary cancer (2–7), although this was not universally observed (8, 9). In addition, rates of disease recurrence (5), overall mortality (3, 4, 10), and radiation-induced morbidity (11) are higher in continuing smokers. Thus, there is a cogent need for more effective smoking cessation interventions, particularly in this patient population.

In general, smoking cessation rates in medical patients increase with severity of disease; quit rates are highest in cardiovascular and oncologic populations (12–15). The benefits of cessation are particularly important for patients with smoking-related cancers who are diagnosed with early-stage or curable disease. Since current 5-year survival rates are 51% for oral and pharyngeal cancers and 67% for laryngeal malignancies (16), a smoking cessation intervention with head and neck cancer patients offers considerable potential for improved prognosis. Previous research has cited quit rates for head and neck cancer survivors ranging from 40% to 71%, at varying periods of follow-up (4, 17, 18). However, all of these studies have relied on self-reported smoking cessation.

The diagnosis and treatment of head and neck cancer offer an opportune time for intervention, a “teachable moment,” when presumably there is a high motivation for cure and prevention of further disease. Furthermore, bonding between doctors and patients could potentially reinforce and sustain changes in smoking behavior. But while the head and neck oncology team (surgeons, radiotherapists, and maxillofacial prosthetists) that treats this patient population is well aware of the risks of smoking, there has been a dearth of collaborative efforts between psychologists and clinicians in smoking cessation research.

We developed a physician- and dentist-delivered smoking cessation intervention for head and neck cancer patients.
When a patient is diagnosed with head and neck cancer, smoking cessation becomes a crucial aspect of their treatment. The intervention, which included self-help materials, was randomized controlled trials sponsored by the National Cancer Institute.

A major goal of the study was to compare the smoking cessation rates of experimental (intervention) and control (usual care) groups at 1 year postintervention and to identify predictors of long-term abstinence. An earlier publication has outlined the study design, discussed patients and accrual, and described characteristics of the sample to identify predictors of long-term abstinence. An earlier publication has outlined the study design, discussed patients and accrual, and described characteristics of the sample to identify predictors of long-term abstinence. An earlier publication has outlined the study design, discussed patients and accrual, and described characteristics of the sample to identify predictors of long-term abstinence.

Subjects. One hundred eighty-six patients with newly diagnosed, first primary squamous cell carcinomas of the oral cavity, pharynx, and larynx were recruited from 10 participating hospital-based medical and dental clinics in the southern California area. Eligibility criteria related to smoking history variables (see Table 1).

One hundred fourteen of the initial 186 patients who were randomized completed the 12-month follow-up (61.3%). The remaining 72 subjects did not complete the trial for the following reasons: (a) death (n = 33); (b) progressive illness precluded participation (n = 4); (c) refused further participation (dropped out) (n = 16); (d) lost to follow-up (moved, address unknown) (n = 14); (e) provider noncompliance (initial advice not delivered) (n = 4); and (f) subsequently determined not to satisfy eligibility criteria (illiterate) (n = 1).

The 114 subjects who completed the 12-month follow-up were compared with the 72 noncompleters on a variety of demographic and recruitment, disease, and smoking history variables (see Table 1). Observed rates of completion of the trial did not differ by treatment condition (intervention, usual care). Hospital site, certain smoking history variables, and stage of disease were related to trial completion. However, only if there were strong interactions among smoking cessation outcomes, treatment condition, and some of the variables associated with completion of the trial would we expect substantial "noncompletion" bias in our comparison of intervention and control conditions. In our data analyses, we investigate the possible presence of such interactions.

The noncompleter subjects were further subdivided into those who died or were too ill to complete the study (n = 37) and those who did not complete for reasons cited above. These two subgroups were compared on

Table 1. Comparison of baseline descriptors of head and neck cancer patients completing 12-month follow-up (n = 114) versus noncompleters (n = 72): demographics, disease and treatment variables, and smoking history variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Completers (n = 114)</th>
<th>Noncompleters (n = 72)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td></td>
</tr>
<tr>
<td>Male vs. Female</td>
<td>57.8 (9.3) 59.5 (9.5)</td>
<td>57.8 (9.3) 59.5 (9.5)</td>
<td>NS</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married vs. Not married</td>
<td>56.1 (6.4) 43.1 (11.1)</td>
<td>56.1 (6.4) 43.1 (11.1)</td>
<td>0.083</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White vs. Black</td>
<td>76.1 (6.7) 66.7 (4.8)</td>
<td>76.1 (6.7) 66.7 (4.8)</td>
<td>NS</td>
</tr>
<tr>
<td>Hospital site</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UCLA vs. Others</td>
<td>34.5 (6.1) 34.7 (2.5)</td>
<td>34.5 (6.1) 34.7 (2.5)</td>
<td>0.012</td>
</tr>
<tr>
<td>Disease and medical treatment variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment condition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental vs. Control</td>
<td>50.9 (58) 50.0 (36)</td>
<td>50.9 (58) 50.0 (36)</td>
<td>NS</td>
</tr>
<tr>
<td>Primary site of diseasec</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buccal cavity vs. Larynx</td>
<td>52.7 (59) 58.3 (42)</td>
<td>52.7 (59) 58.3 (42)</td>
<td>NS</td>
</tr>
<tr>
<td>Pharvyn vs. Larynx</td>
<td>5.4 (6) 5.9 (5)</td>
<td>5.4 (6) 5.9 (5)</td>
<td></td>
</tr>
<tr>
<td>Stage of diseasec</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I and II vs. III vs. IV</td>
<td>17.5 (42) 21.1 (13)</td>
<td>17.5 (42) 21.1 (13)</td>
<td>0.113</td>
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<tr>
<td>Medical treatment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiation only</td>
<td>25.7 (27) 36.1 (26)</td>
<td>25.7 (27) 36.1 (26)</td>
<td>NS</td>
</tr>
<tr>
<td>Total laryngectomy</td>
<td>25.4 (29) 23.6 (17)</td>
<td>25.4 (29) 23.6 (17)</td>
<td></td>
</tr>
<tr>
<td>Other surgery, radiation</td>
<td>50.9 (58) 40.3 (29)</td>
<td>50.9 (58) 40.3 (29)</td>
<td></td>
</tr>
<tr>
<td>Smoking history variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cigarettes smoked/day</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24.0 (12.4)</td>
<td>21.4 (11.3)</td>
<td>24.0 (12.4) 21.4 (11.3)</td>
<td>NS</td>
</tr>
</tbody>
</table>

Notes: *NS, not significant.  
† Completer cohort; data from two subjects are missing on two variables.  
‡ Ref. 43.
were collected at baseline and follow-up. abstinence, were mailed in conjunction with the six tune spaces for both subject and provider. Finally, six third was a social support booklet for the patient's to smoking cessation ("Team Up to Stop Smoking") and these cancer patients, and provided various social support strategies. Two of the booklets were self-help guides to smoking cessation ("Team Up to Stop Smoking") and maintaining abstinence ("Team Up to Stay Off"). The third was a social support booklet for the patient's spouse, family member, or other caretaker ("Team Up to Help a Friend"). A formal stop smoking/stay quit contract contained the project logo ("Team Up") and had signature spaces for both subject and provider. Finally, six reminder postcards, containing helpful tips for cessation/abstinence, were mailed in conjunction with the six booster sessions.

Materials. Special written materials were designed for the experimental (intervention) condition. These consisted of three booklets, a smoking cessation/abstinence contract, and reminder postcards. The three booklets specifically addressed the problems of head and neck cancer patients trying to stop smoking and to stay off cigarettes. The booklets explained the relationship of smoking to the development of head and neck cancer, addressed cessation and maintenance techniques tailored to the physical limitations of the target population, addressed the psychological and adaptive problems of these cancer patients, and provided various social support strategies. Two of the booklets were self-help guides to smoking cessation ("Team Up to Stop Smoking") and maintaining abstinence ("Team Up to Stay Off"). The third was a social support booklet for the patient's spouse, family member, or other caretaker ("Team Up to Help a Friend"). A formal stop smoking/stay quit contract contained the project logo ("Team Up") and had signature spaces for both subject and provider. Finally, six reminder postcards, containing helpful tips for cessation/abstinence, were mailed in conjunction with the six booster sessions.

Measures. The following measures of smoking behavior were collected at baseline and follow-up.

At baseline, self-report questionnaires solicited data on descriptive and predictive variables. Personal information included demographics; general and smoking-related health; smoking history and dosage; the Fagerstrom Tolerance Questionnaire (21), a scale measuring perceived nicotine dependence; attitudes and beliefs about smoking; and social support for quitting. Readiness to stop using tobacco was measured by questionnaire and classified according to the Stage of Change theory (22) into four stages: precontemplator (not currently thinking about stopping smoking), contemplator (thinking of stopping within 1 year), action (quit within the past 6 months), and maintenance (quit for 6–12 months). A urine specimen was collected to validate self-reported smoking abstinence via the measurement of cotinine, the principal metabolite of nicotine, utilizing a cutoff of 50 ng/ml for abstinence (23, 24).

Follow-up interviews assessed outcome variables pertaining to smoking behavior, including smoking status at interview, cessation and relapse history since prior interview, dosage, and Stage of Change. A urine specimen was collected for cotinine analysis.

Other measures related to quality-of-life outcomes and determinants of adherence will be reported in separate publications.

Research Design. Eligible subjects were assigned at random to either the experimental (intervention) or usual care (control) condition. Hospital site and type of medical treatment (radiation only, total laryngectomy, or other-than-total laryngectomy with or without radiation) were used as stratification factors in the randomization.

All study providers (head and neck surgeons and maxillofacial prosthodontists) delivered advice to both experimental and control subjects. This design aspect was necessary because access of patients to doctors (faculty and resident surgeons and dentists) could not be restricted within hospitals without unacceptably affecting patient care. Precautions taken in an effort to minimize contamination across conditions included using distinctive medical chart stickers to identify the study condition, supplying intervention materials to providers just prior to delivery of experimental initial advice, tape recording and reviewing advice sessions, and obtaining exit interview checklists from subjects following the initial advice session.

All subjects were interviewed in person by a study staff member prior to the beginning of medical treatment (i.e., at baseline). Verbal and written informed consent were obtained from subjects at the beginning of the baseline interview. In-person follow-up interviews were conducted at 1, 6, and 12 months after the initial smoking cessation advice was delivered. In the rare instances when subjects had moved out of the area, interviews were obtained by mail or telephone.

Control and Experimental Intervention Procedures. Standardized advice protocols were designed to guide study providers in delivering smoking cessation advice, both for the experimental (intervention) and for the usual care (control) conditions. The decision to standardize usual care advice was made because advice-giving practices varied widely among providers from none at all to inquiries and warnings about smoking behavior at every visit. Providers delivered initial advice to surgical subjects 2 to 3 days before hospital discharge and, to radiation-only subjects, prior to treatment initiation.

Subjects in the control condition received standarized “usual care” advice consisting of information on the risks of continued smoking and the benefits of cessation for head and neck cancer patients, which was followed by strong advice to stop smoking or to stay off cigarettes. No specific guidelines were given regarding additional advice sessions; providers were free to follow their usual practice regarding discussing patient smoking practices.

The experimental intervention consisted of an enhanced initial advice session augmented by six booster sessions, which were integrated into the first six monthly medical visits posttreatment. The initial advice session contained the same basic components as the control advice session, but providers supplemented the usual care advice with a discussion of the subject’s receptivity to quitting; a statement of confidence in the subject’s ability to stop; presentation of the three self-help booklets (see Materials); a discussion of tobacco withdrawal; a discussion to determine a target quit date, including joint signature of the quit-smoking contract; and an affirmation of continuing provider support during follow-up care.

The six booster sessions consisted of debriefing subjects regarding their smoking cessation efforts prior to the visit and then tailoring advice to the subject’s current smoking status (abstainer, relaper, continuing smoker) according to the provider advice guidelines. The general idea of the tailored advice was to help subjects deal with situations in which there was a high risk of relapse and to offer continued support for smoking cessation.

Provider Training. Providers were introduced to the study design and procedures at a 2-h training session, held at the individual participating institutions. A total of 110 doctors participated, of whom 103 were head and neck surgeons and 7 were maxillofacial prosthodontists, and of whom 26 were attending physicians and 84 were residents. Provider training included a baseline question-
Predicting Smoking Cessation in Head and Neck Cancer Patients

We also use an imputation approach to account for baseline differences between completers and noncompleters in developing an estimate of the continuous abstinence rate in this patient population. Some smoking cessation studies “conservatively” classify subjects as smokers when data are missing, presuming these subjects are refusing participation as a result of continued smoking. In this case however, such an approach would lead to predictable biases, since only 8.6% (16 of 186) of all subjects refused further participation at some point during the follow-up. Our approach includes predicting a probability for each noncompleter that they would have remained abstinent had they been followed throughout the trial and then to average the probabilities. Baseline ex-smokers are predicted to remain abstinent with probability 1.0, and baseline smokers receive imputed probabilities based on the fitted logistic-regression model.

P values in Table 1 were assessed with χ² tests of independence and with two sample t tests.

Results
Definitions of Smoking Cessation Outcomes
Three smoking cessation outcomes are reported in this paper: (a) ever quit, i.e., abstinent for 48 consecutive h or longer at any time during the 12-month follow-up period after receiving initial smoking cessation advice; (b) point prevalence abstinence, i.e., abstinent for 48 h or longer at the time of the 1-, 6-, or 12-month interviews; and (c) continuous abstinence, i.e., abstinent at the 1-, 6-, and 12-month interviews, with no smoking at all after cessation.

Objective Validation of Smoking Status
The study protocol called for objective validation of self-reported abstinence from smoking at each follow-up interview, via cotinine determination from a urine sample. Across all time points, urine samples were collected from 83.8% (258 of 308) of subjects who reported abstinence: 90.2% (111 of 123) at 1-month follow-up; 78.2% (80 of 101) at 6-month follow-up; and 79.8% (67 of 84) at 12-month follow-up. The remaining 50 urine samples (16.2% of total) were not collected for the following reasons: interview not in person (36 subjects); refusal (one subject); patient too ill to provide sample (2 subjects); and sample missing for unidentified reason, e.g., interviewer error, mislabeled samples, etc. (11 subjects). Cotinine validation rates, based on the 258 samples collected, ranged from 85.6% to 91.3% at different time points (see Table 2). Assignment to experimental condition was not related to cotinine level.

Smoking Cessation Outcomes
Smoking cessation outcomes for subjects interviewed at each follow-up are reported in Table 2, overall and by experimental condition. Cessation rates, as measured by self-report and supported by cotinine validation, are very high from 1-month follow-up onward. The 1-month interview data reveal that the majority of subjects quit smoking prior to or at initial advice. Without any attempt to adjust for covariates, there are no significant differences between intervention and control at any follow-up on any of the three smoking cessation outcomes.
In this paper, in-depth analyses of cessation rates and the predictors of cessation focus primarily on those subjects completing the trial. Although tobacco use during the last year was an eligibility criterion for entry into the study, only 96 of the 114 subjects who completed the 12-month follow-up were defined as smokers at baseline; the others had already quit prior to study entry. All 18 ex-smokers remained abstinent throughout the study. Fig. 1 provides a graphic illustration of the results (ever quit, PPA and CA rates) for baseline smokers as contrasted with all subjects.

An estimate of the continuous abstinence rate that may be more generalizable than one based on completers alone would take into account differences between the completers and noncompleters populations. One way of accomplishing this is to model the dependence of the outcome on baseline covariates, to use the fitted model to predict outcomes for noncompleters, and then to average the observed and predicted values. The result could then be interpreted as the expected continuous abstinence rate among patients from this population. Proceeding in this way, we estimate the continuous abstinence rate at 1 year hence for this patient population at 64.2%. This includes an estimated 100% continuous abstinence rate among ex-smokers and an estimated 59.4% CA rate among smokers. Analogous calculations carried out for subjects surviving 1 year produced an estimated continuous abstinence rate for survivors of 68.7%. A more conservative estimate of the smoking cessation rate, obtained by counting as smokers the 16 subjects who refused further participation and the 14 subjects who were lost to follow-up, led to a 12-month CA rate of 55.5%.

Subjects who were smoking at 12-month follow-up (n = 30) had significantly reduced their consumption during the study, from 25.4 cigarettes/day (SD = 12.8) at baseline to 12.5 (SD = 8.1) at 12 months (t = 7.67; P = 0.0001). There were no differences between intervention and usual care subjects; both groups approximately halved their smoking rates.

We further examined smoking cessation in terms of whether subjects relapsed or not during the study, considering only the 96 baseline smokers (Table 3). Twelve-month smoking status is cross-tabulated by intervention versus control and by baseline stage of change. No effect of intervention is seen, although there is clearly a relationship between cessation behavior and baseline readiness to change (P = 0.002). The latter result was due to a much higher proportion of continuous abstainers and a much lower proportion of relapers among those who were in the action stage at baseline as compared to the other two groups.

Predictors of Continuous Abstinence

Table 4 summarizes results from the stepwise logistic regression procedure applied to the 96 baseline smokers who completed the trial, with variables listed in the order they entered the model.

The model can be interpreted as follows. A 50-year-old white baseline smoker in the control group who had a laryngectomy, who was a precontemplator, and who typically had a cigarette within 30 min of waking up, would have a predicted probability of 0.47 of being continuously abstinent (calculated by transforming the predicted value of the model from the log-odds scale to the probability scale). By contrast, a 65-year-old with the same profile would have a predicted probability of 0.14 of being continuously abstinent. A 65-year-old with the same profile of control group, precontemplator, and laryngectomy who typically waits more than half an hour for the first cigarette of the day is predicted to have a probability of 0.58 of being continuously abstinent, and so on.

The sign of the effect of intervention is positive, although the effect is not significant. The estimated coefficient would imply a shift from an estimated probability of 50% to an estimated probability of 66% of continuous abstinence. A simple calculation suggests that to halve the SE (so that the intervention effect, were it to hold up, would then approach statistical significance) we would need to quadruple the sample size.

In Table 5, we show the marginal rates of continuous abstinence for different classification factors among the 96 baseline smokers. Considering the simple fraction of continuous abstinence in the intervention and control groups without adjusting for differences in background covariates, which showed a higher abstinence rate in the control group at 12 months, the positive sign of the estimated intervention effect in the logistic-regression model may seem surprising. However, further investigation revealed that the intervention group had a larger number of precontemplators, while the control group had a larger number of subjects in the action stage of change. A x^2 test of the discrepancy yielded P = 0.017. No other variable we investigated showed a significant difference. The higher marginal rate of continuous abstinence in the control group is apparently due to disproportionate numbers of subjects farther along in their stage of change; when this effect is controlled for, the estimate of the intervention effect was positive. This underscores the importance of performing analyses, such as our logistic regression, that

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*The abbreviations used are: PPA, point prevalence abstinence; CA, continuous abstinence.*
Predicting Smoking Cessation in Head and Neck Cancer Patients

Table 1: Classification of smoking status at 12-month follow-up for subjects who were current smokers at baseline (n = 96).

<table>
<thead>
<tr>
<th>Baseline variable</th>
<th>Smoker*</th>
<th>Relapsera</th>
<th>Point prevalence abstainer</th>
<th>Continuous abstainer</th>
<th>Fisher exact test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% (n)</td>
<td>% (n)</td>
<td>% (n)</td>
<td>% (n)</td>
<td></td>
</tr>
<tr>
<td>Study condition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intervention</td>
<td>10.0</td>
<td>26.0</td>
<td>6.0</td>
<td>58.0</td>
<td>0.318</td>
</tr>
<tr>
<td>(5)</td>
<td>(11)</td>
<td>(3)</td>
<td>(29)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>11.0</td>
<td>13.0</td>
<td>2.2</td>
<td>71.7</td>
<td></td>
</tr>
<tr>
<td>(6)</td>
<td>(6)</td>
<td>(11)</td>
<td>(13)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage of change</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Precontemplator</td>
<td>12.5</td>
<td>37.5</td>
<td>4.2</td>
<td>45.8</td>
<td>0.002</td>
</tr>
<tr>
<td>(13)</td>
<td>(9)</td>
<td>(11)</td>
<td>(11)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contemplator</td>
<td>18.2</td>
<td>20.5</td>
<td>2.3</td>
<td>79.1</td>
<td></td>
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<tr>
<td>(8)</td>
<td>(9)</td>
<td>(11)</td>
<td>(12)</td>
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<tr>
<td>Action</td>
<td>0.0</td>
<td>3.6</td>
<td>7.1</td>
<td>89.5</td>
<td></td>
</tr>
<tr>
<td>(0)</td>
<td>(1)</td>
<td>(2)</td>
<td>(25)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>11.4</td>
<td>19.8</td>
<td>4.2</td>
<td>64.6</td>
<td></td>
</tr>
<tr>
<td>(111)</td>
<td>(19)</td>
<td>(4)</td>
<td>(62)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Current smoker at all interviews.
Abstinent at 1 month and/or 6 months, smoker at 12-month interview.
Abstinent at 12-month interview, smoker at 1- and/or 6-month interview.
Abstinent throughout study.
Subjects who had stopped smoking within 1 month of diagnosis were classified as current smokers in the action stage.

An attempt to identify the independent effect of each factor potentially misleading interpretations may result from looking at only the marginal success rates.

**Prediction of Point Prevalence Abstinence and Ever Quit**

A parallel set of analyses were carried out on 12-month PPA for the 12-month completer cohort and the 12-month imputed cohort. The findings were similar to those from the analysis of continuous abstinence status, but total laryngectomy treatment entered the model as significant ($P = 0.0274$), and time to first cigarette in the morning was only weakly significant ($P = 0.0717$). The estimated intervention effect was still positive but nowhere near significance ($P = 0.8082$), and the other variables were the same.

We attempted to analyze ever quit as an outcome in our logistic regression framework, but the high proportion of subjects who quit at some point in the study made even main effects of certain covariates inestimable, so we provide only descriptive summaries.

**Program Evaluation**

**Exit Checklists.** Subjects completed exit checklists directly following the delivery of initial smoking cessation advice. These checklists were reviewed to verify the delivery of each intervention condition component (four advice content components, three self-help smoking cessation booklets, and a contract with quit date) and to ensure that contamination did not occur via delivery of intervention materials to control subjects. Results revealed that booklets were delivered to all intervention subjects during initial advice and to no control subjects. Similarly, the written contract was signed by 97.7% (85 of 87) of intervention subjects (two subjects may have not been ready or willing to stop) and by no control subjects. The other elements of the initial smoking cessation advice, common to both conditions, included

Table 4: Summary of stepwise logistic regression* for 12-month continuous abstinence outcome, baseline smokers (n = 96).

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Estimated coefficient (b)</th>
<th>SE</th>
<th>p</th>
<th>Odds ratio (b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>5.62</td>
<td>2.56</td>
<td>0.0170</td>
<td>276.70</td>
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<tr>
<td>Intervention</td>
<td>0.632</td>
<td>0.473</td>
<td>0.0334</td>
<td>1.92</td>
</tr>
<tr>
<td>Radiation-only treatment</td>
<td>-2.947</td>
<td>0.792</td>
<td>0.0002</td>
<td>0.05</td>
</tr>
<tr>
<td>Action stage of change</td>
<td>3.999</td>
<td>1.128</td>
<td>0.0004</td>
<td>54.30</td>
</tr>
<tr>
<td>Age</td>
<td>-0.177</td>
<td>0.042</td>
<td>0.0065</td>
<td>0.89</td>
</tr>
<tr>
<td>&gt; 40 min to first cigarette</td>
<td>2.178</td>
<td>0.834</td>
<td>0.0090</td>
<td>8.83</td>
</tr>
<tr>
<td>Race = nonwhite</td>
<td>1.620</td>
<td>0.748</td>
<td>0.0104</td>
<td>5.05</td>
</tr>
<tr>
<td>Contemplator state of change</td>
<td>1.109</td>
<td>0.750</td>
<td>0.0806</td>
<td>3.70</td>
</tr>
</tbody>
</table>

* Variables listed by order of entry into model.
Odds ratio for categorical predictor (i.e., all covariates listed other than age), multiplier of the odds of continuous abstinence for unit change in continuous predictor (i.e., age).
discussing smoking history, describing the harmful effects of smoking and benefits of quitting, and delivering strong advice to stop. Each component of advice was delivered to almost all subjects (range = 96.2–99.2%).

There was some evidence of contamination, i.e., elements of advice meant only for the intervention condition which were delivered to control subjects. Setting a target quit date and discussing withdrawal symptoms were reported, respectively, by 7.25% and 48.5% of controls. Feedback was delivered to the appropriate providers to prevent further protocol violations.

**Satisfaction Questionnaires.** As part of the 12-month follow-up interview, intervention subjects completed a brief questionnaire assessing their use of and reaction to the intervention components. The questionnaire was filled out by 48 of the 58 subjects completing the 12-month follow-up (82.8%). (The remaining 10 subjects did not receive a questionnaire, due to interviewer error.) One or more booklets were read by 34 of 48 (70.8%) intervention subjects completing the questionnaire, and 75.8% of these subjects (25 of 33) read all three self-help booklets.

Subjects were asked to rate booklets on a 5-point scale where scores reflected appropriate adjectives describing the quality of the booklets, from 1 (not at all) to 5 (very). More than half of the subjects who read the booklets gave a rating of 4 or 5 on the following aspects: interesting (57.6%), readable (63.6%), practical (54.5%), helpful (62.5%), useful for stopping smoking (53.1%), and useful for staying off cigarettes (51.5%). And 84.4% of the readers said they would recommend the booklets to other patients who wanted to stop smoking.

Three-fourths of the subjects (75.6%) remembered receiving four or more of the six reminder postcards mailed following each of the six monthly booster advice sessions. Finally, subjects were queried about the frequency of receiving provider-delivered advice to stop smoking or stay off cigarettes. The median frequency reported was 4.5 times, although 9 of 46 (19.6%) subjects reported never receiving advice. Seventeen subjects (37.0%) reported receiving advice six or more times (the frequency of study protocol delivery). The most prominent memory the patients had of the advice sessions was that providers expressed confidence in their ability to quit/stay off cigarettes, which was recalled by 76.3% (29 of 38) of the respondents.

**Discussion**

The lack of a significant experimental intervention effect in this trial deserves comment. It is plausible that there is no effect of intensive advice to quit, over and above the standardized advice taught to providers in the control condition, but there are other possible interpretations of our results.

Contamination of the control condition was a concern since providers delivered advice in both conditions. The patient exit checklists for the initial advice session showed little contamination of the control condition. The discussion of withdrawal symptoms was the only element meant solely for experimental condition subjects that occurred frequently on control subjects’ checklists. However, prior to this study, several senior surgeons routinely delivered extensive smoking cessation advice to patients, including discussion of withdrawal symptoms, both prior to treatment and at post-op visits. While we attempted to standardize the advice delivered in the control condition, it is possible that some providers continued to deliver additional advice that was “routine” in their patient management style. The best way to guard against control condition contamination would be to randomize clinic sites and thus have providers deliver only one type of advice, a design feature which was not practical in this study.

On another front, the inclusion of recent ex-smokers via the eligibility criterion “tobacco use within the past year” may have had an impact on our ability to detect an intervention effect. These subjects were recruited because of concern over their risk for relapse. Since all ex-smokers remained abstinent throughout the trial, we conclude that strong initial advice from a physician is likely to be sufficient to keep them from relapsing. Recent quitters may also sustain abstinence without any advice,
Predicting Smoking Cessation in Head and Neck Cancer Patients

A hypothesis this study design could not address. Therefore, future research of this type should consider recruiting only current smokers at diagnosis (or those who had quit within the preceding month, which comprised our definition). Patients who are still smoking at diagnosis represent a population at great risk for continuing their behavior, since only about 60% should be expected to continuously abstain over 12 months. These patients should constitute the focus of future research with additional, or refined, intervention techniques.

Another possible statistical issue is that the rate of abstinence by control subjects in our study may have been unusually high. However, a recent study emanating from the University of Texas M. D. Anderson Cancer Center reported a 67.3% cessation rate among current smokers and recent ex-smokers (up to 1 year) (18), which is consistent with our findings. The subjects were the survivors of a series of patients with squamous cell carcinomas of the head and neck, whose smoking status was assessed at initial registration and then at an average of 42 months later. The cessation rate may be high because patients at this major tertiary care center routinely receive brief physician advice to stop, as in our study. Limitations include self-report only of smoking status and loss from the original cohort by death and nonresponse (18). As in the present study, current smokers reported reduced consumption (18). Thus, there appears to be supportive evidence for high quit rates at institutions where physician smoking cessation advice is a component of medical care.

A final potential reason for the lack of a significant intervention effect is that the most important elements of advice were incorporated into the control protocol and were delivered at a time when advice could make a difference. Since almost all cessation occurred around the time of disease diagnosis and treatment, the common components of initial advice in both conditions (strong, direct advice to stop smoking combined with personalized risk factor information) may have fostered decisions and actions on the part of patients to abstain. The additional elements of the experimental advice (booklets, a contract, reminder postcards, and standardized booster sessions) were not critical. The impact of disease severity, surgery, and hospitalization discouraged smoking in many instances, easing subjects past the acute withdrawal period (26). Extended treatment and/or recovery resulted in a low overall relapse rate (19.8%), thus minimizing the need for systematic booster sessions and written reminders.

A slight majority of subjects in the intervention condition reported that they utilized the special materials and benefited from them. Further research might focus on how to communicate more effectively with older and more entrenched patients (i.e., nicotine dependent, precontemplators) since they were observed to quit at lower rates than others. Three-fourths (76.3%) of intervention subjects had positive attitudes about the provider advice, remembering statements of confidence in their ability to stop smoking and to remain abstinent.

The logistic regression models provide theoretical insight into which patient characteristics and disease and treatment factors predicted successful long-term cessation. For example, the two surgical treatment groups had approximately double the CA rate of the radiation-only patients in our sample. Surgical treatment necessitated extirpation of portions of the upper aerodigestive tract, which can make smoking physically more difficult or uncomfortable. Surgical patients also experienced hospitalization and an enforced nonsmoking period up to 1 month or longer. Primary radiation, on the other hand, is delivered as an outpatient procedure and so does not involve extended environmental barriers to smoking. While radiated patients may endure substantial morbidity, and smokers may suffer differentially more so (11), radiated patients do not experience anatomical barriers to smoking. Consistent with this view, it was reported recently that patients undergoing coronary artery bypass graft surgery were more likely to stop smoking than those undergoing other less invasive cardiac procedures, e.g., angioplasty or angiography (26). In Crouse and Hageman’s study, the difference in quit rates persisted after controlling for severity of disease, thus supporting an effect of invasiveness of treatment on the likelihood of smoking cessation.

The predictive value of the Stage of Change model (22) was again demonstrated in the present study; readiness to quit at baseline was associated with 12-month CA status. Almost one-half of precontemplators became continuous abstainers, a rate far exceeding that in healthy populations (27, 28) or even in patients with coronary artery disease (14). Thus, we observed a “readiness” phenomenon which led to a dramatic boost in quit rates and impelled patients who otherwise might not have considered stopping smoking into immediate and sustained action (14, 29).

Not surprisingly, nicotine dependence also emerged as a significant predictor of long-term abstinence as reflected in the “time to first cigarette” variable. The long, intense smoking histories and self-perceived addiction of head and neck cancer patients are well known (18, 20). The addiction component of smoking as measured by the Fagerstrom Tolerance Questionnaire has been negatively related to success in cessation across disparate populations (28, 30–34). Future intervention in this patient population must address the most heavily addicted subjects, potentially with pharmacological adjuncts, such as the transdermal nicotine patch (35, 36).

The smoking cessation rates in this trial are at the high end of those reported for cardiac or oncologic populations, in which quit rates at 12 months or longer range from approximately 25% to 70% (12–15, 17, 18, 37–39). In addition to finding a high quit rate, the timing of cessation by these subjects was quite interesting. Cessation occurred early (within the first month) and was largely sustained. Similar patterns have been observed for patients with heart disease (14, 40). It would thus appear that subjects were influenced in their decisions to stop smoking by some combination of factors, including severity of illness, invasiveness of treatment, enforced hospitalization, readiness to change, and the initial physician- or dentist-delivered cessation advice that all received (12, 14, 40, 41).

To conclude, how should the practitioner apply our findings? First, patients appear to benefit from systematic, brief advice to stop smoking. Since advice to quit smoking can be delivered at essentially no cost, we recom-
mend that physicians incorporate such advice into the usual care of their head and neck cancer patients. Second, a "stepped care" approach (42) may be necessary for that 30–40% of smokers for whom advice, plus their disease/treatment situation, is not sufficient to promote continuous abstinence. In this case, stepped care might well include pharmacological adjunctive treatment, materials aimed at those scoring as precontemplators on the Stage of Change scale, and special attention to primary radiotherapy patients. The latter might include advice delivered repeatedly by radiation oncologists during the 6 weeks of radiation therapy. The findings from this study should encourage clinicians working with head and neck cancer patients as well as other life-threatening smoking-related diseases to intervene early and decisively in their patients' smoking behavior.

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