Prevalence and Predictors of Smoking by Inpatients During a Hospital Stay

Susan Regan, PhD; Joseph C. Viana, BA; Michele Reyen, MPH; Nancy A. Rigotti, MD

Background: Accredited US hospitals prohibit smoking inside hospital buildings. Patients are expected to abstain from smoking throughout their hospitalization, but how many do so is unclear. Smoking by inpatients may compromise patient safety, clinical outcomes, and hospital efficiency.

Methods: We conducted an observational study of adult cigarette smokers visited by a tobacco counselor while hospitalized and reached for telephone follow-up in the 2 weeks after discharge. We assessed smoking during the hospital stay at the time of counseling for all patients and at follow-up for those reached. We used generalized linear models to estimate adjusted relative risk (ARR) for smoking while hospitalized, adjusted by patient and admission characteristics.

Results: From May 1, 2007, through April 31, 2010, counselors visited 5399 smokers, of whom 14.9% had smoked between admission and the visit. Of 3555 eligible smokers who consented to follow-up, 2185 were reached. Smoking at any time during the hospitalization was reported by 18.4%, less often during winter months than the rest of the year (14.4% vs 19.7%, P=.007). Smoking at any time while hospitalized was less common among those 50 years or older (ARR, 0.74; 95% CI, 0.62-0.88), those admitted to a cardiac unit (0.64; 0.51-0.81), and those intending to quit after discharge (0.46; 0.34-0.63) and more common among those with longer stays (1.36; 1.14-1.62) and those experiencing cigarette cravings (moderate: 1.23; 1.14-1.33; severe: 1.25; 1.18-1.34). Nicotine replacement therapy ordered the day of admission was associated with less smoking before the counselor’s visit (ARR, 0.83; 95% CI, 0.72-0.96) but not for the entire hospital stay.

Conclusions: Nearly one-fifth of smokers admitted to a smoke-free hospital smoked during their hospital stay. Ordering nicotine replacement therapy routinely at admission and ongoing monitoring of patients’ cigarette cravings might reduce smoking among admitted patients.
tion of smokers who continue to smoke during their admission and to identify patient and admission characteristics, including NRT use, associated with smoking while hospitalized (SWH).

METHODS

STUDY SETTING AND PARTICIPANTS

The study was conducted at Massachusetts General Hospital (MGH), a 900-bed, urban teaching hospital affiliated with Harvard Medical School and was approved by the Institutional Review Board of Partners Healthcare System, of which MGH is a member. Smoking is banned in all indoor areas and on the outdoor campus at MGH except in 2 outdoor shelters, which patients can use. Patients’ smoking status is routinely recorded at admission electronically or by telephone. The TTS counselors attempt to visit all referred smokers at the bedside to assist in managing nicotine withdrawal. Pharmacotherapy, typically NRT, is available to admitted smokers to manage cravings. All patients receive brief advice to quit (≤5 minutes). Those considering quitting receive cessation counseling (averaging 20 minutes) using motivational interviewing and covering behavioral strategies and use of medication to remain abstinent. Counselors may recommend varenicline, bupropion hydrochloride, or NRT to patients who are committed to remaining abstinent after discharge. Use of the prescription medications may be initiated during the admission, but, unlike NRT, their effect on cravings is typically delayed and unlikely to reduce the urge to smoke during the stay.

Patients were enrolled in the study during the 3-year period from May 1, 2007, through April 31, 2010. Enrolled patients were contacted by telephone in the 2 weeks after discharge to determine whether they had smoked during their admission. Patients were eligible for the study if they received counseling from a TTS counselor during their stay, reported having smoked cigarettes during their hospital stay, and had no communication barriers (eg, deafness or non–English-speaking) or health issues precluding participation (eg, cancer or palliative care). Counselors asked eligible patients to consent to participation at the end of the counseling session.

OUTCOME MEASURES

The TTS counselors recorded patients’ mean daily cigarette consumption (cigarettes per day) in the month before admission when smoking normally (ie, not too ill to smoke or cutting down temporarily for a planned admission), elapsed time since last cigarette smoked, cigarette craving (categorized as none, slight, mild, moderate, or severe), and intention to smoke after discharge (“I will quit,” “I will try to quit,” “I do not know,” or “I do not plan to quit”) at the time of their inpatient visit. At the postdischarge call, patients were asked if they had smoked any cigarettes during their hospital stay. Patients’ age, sex, date of admission, admitting service, length of stay (LOS), and pharmacy orders for NRT were obtained from hospital records.

The outcome of interest, SWH, was determined from data collected at the TTS counselor visit and during the postdischarge telephone call. Smoking early in the hospitalization (early SWH) was assessed at the TTS visit by comparing the patient’s report of the time elapsed since their last cigarette to the time elapsed between the visit and hospital admission. Patients who last smoked on the day of admission were not considered to have smoked while hospitalized because it could not be determined whether smoking occurred after the admission began. Smoking at any time during hospitalization was assessed in a follow-up telephone survey 2 weeks after discharge. Patients were defined as having smoked at any time during the admission if (1) they reported during their inpatient assessment that their last cigarette was smoked on day 2 or later of their hospital stay or (2) they reported SWH at the follow-up assessment.

STATISTICAL ANALYSIS

We calculated the prevalence and 95% CIs of early SWH for all patients counseled by the TTS and smoking at any time during the admission for those reached for follow-up. Logistic regression was used to test for linear trends in prevalence by study year. Characteristics of patients who did and did not smoke in the hospital were compared in bivariate analyses using t tests and Wilcoxon rank sum tests for continuous variables and χ² tests for categorical variables. We used generalized linear models to explore associations between patient and admission characteristics and early SWH and smoking at any time during the admission. The models used a Poisson distribution, log link function, and robust SEs and included age (<50 years vs ≥50 years), sex, baseline smoking level (<10 vs ≥10 cigarettes per day), cigarette craving (categorized as slight, mild, moderate, or severe, with none as the reference group), admission service (cardiac vs noncardiac), intention to quit after discharge (“I will quit,” “I will try to quit,” or “I don’t know,” with “I do not plan to quit” as the reference group), and NRT ordered on admission. We included a term for the winter months (December, January, and February) to assess whether colder outdoor temperatures might discourage patients from venturing outside to smoke. The models also included terms for duration of hospitalization at the time of assessing SWH, dichotomized at the median. In the model predicting smoking at any time during the stay, this term was based on total LOS (<5 vs ≥5 days). The model predicting early SWH included a term for days between admission and the visit (<3 vs ≥3 days). We present relative risks adjusted for all terms in the models (ARR) and 95% CIs. Results were evaluated using a criterion of P <.05 for statistical significance. All analyses were conducted using Stata statistical software (Stata Corp).

RESULTS

During the study period, 171,879 patients were admitted for an overnight stay, of whom 63,899 were admitted using a template that prompted smoking status identification. Smoking status was identified for 54,166 (84.8%), of whom 11,439 (21.1%) were smokers and were automatically referred to the TTS. A total of 12,771 referrals were received by the TTS, including 1,332 additional consult requests. Counselors were able to see 83,589 patients (65.4%): 2,361 received withdrawal assistance and brief advice only, 598 were not current cigarette smokers, and 5,399 received cessation counseling. Figure 1 displays the process of the study. Of the patients counseled by the TTS, 4,295 of 5,399 (79.6%) were eligible for follow-up and 3,555 of 4,295 (82.8%) consented. The follow-up response rate was 2,185 of 3,555 (61.5%) of those consenting to follow-up and 2,185 of 4,295 (50.9%) of those eligible. Patients had a mean age of 53 years, and most (58.2%) were male. The median LOS was 5 days, and the me-
who reported smoking early in the admission were younger, not smoke at any time during the hospitalization. Those patients who were reached for follow-up who did and did the year (14.4% vs 19.7%, \( P = .007 \)). All characteristics associated with having smoked at the time of the TTS visit were similarly associated with smoking at any time during the stay.

The generalized linear models are presented in Figure 2. A total of 207 patients (3.8%) were missing a data element and were excluded from these analyses. Early SWH (Figure 2A) was more common among heavier smokers (ARR, 1.43; 95% CI, 1.17-1.73) and those with stronger cravings (moderate: 1.22; 1.15-1.29; severe: 1.15; 1.09-1.21) and less common among those 50 years or older (0.68; 0.60-0.78), intending to quit (will try to quit: 0.85; 0.78-0.92; will quit: 0.46; 0.37-0.58), admitted to the cardiac service (0.80; 0.67-0.96), and receiving NRT the day of admission (0.83; 0.72-0.96). Patients who had reached day 3 or later of their stay before being seen by the TTS (longer stay) were more than twice as likely to report having smoked than those seen earlier in the stay (ARR, 2.39; 95% CI, 2.06-2.78).

At any point during hospitalization (Figure 2B), SWH was more frequent in those with stronger cravings (moderate: ARR, 1.23; 95% CI, 1.14-1.33; severe: 1.25; 1.18-1.34) and longer stays (1.36; 1.14-1.62) and less frequent in older patients (0.74; 0.62-0.88), those who intend to quit (will try to quit: 0.81; 0.71-0.91; will quit: 0.46; 0.34-0.63), and those admitted to the cardiac service (0.64; 0.51-0.81). In contrast to early SWH, SWH at any point was less frequent during the winter months (ARR, 0.76; 95% CI, 0.61-0.96) but was not associated with receiving NRT on admission or heavy smoking.

In a large sample of smokers admitted to a smoke-free hospital from 2007 to 2010, 18.4% reported having smoked during their hospital stay. Most smokers received NRT. In multivariate models, patients were more likely to report having smoked while hospitalized if they were younger, had more severe cigarette cravings, did not report planning to quit, had longer hospital stays, and were not admitted to a cardiac unit. Smoking during the first few days of the stay was more common among heavy smokers in both unadjusted and adjusted analyses. Receipt of NRT on admission was associated with a lower rate of smoking early in the stay; however, this effect was not significant for smoking at any point during the hospitalization.

Our results indicate a decrease in the rate of SWH when compared with a previous study\(^3\) of inpatient smokers at the same hospital, which found that 25% smoked during their stay in 1995. The difference may be partially explained by study design: the earlier study included all smokers admitted during the study period, whereas the current study is limited to patients receiving cessation counsel-

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**Figure 1.** Study flow diagram. TTS indicates Tobacco Treatment Service.

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**Table**

<table>
<thead>
<tr>
<th>Data Element</th>
<th>Count (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoked before the TTS visit</td>
<td>1104 (20.4%)</td>
</tr>
<tr>
<td>Excluded</td>
<td>278 No telephone</td>
</tr>
<tr>
<td>227 Mental status</td>
<td></td>
</tr>
<tr>
<td>206 Transferred to another facility</td>
<td></td>
</tr>
<tr>
<td>144 Language barrier</td>
<td></td>
</tr>
<tr>
<td>32 Other</td>
<td></td>
</tr>
<tr>
<td>Received NRT on admission or heavy smoking</td>
<td>953 (64.6%)</td>
</tr>
<tr>
<td>Counseled by TTS</td>
<td>3555 (82.8%)</td>
</tr>
<tr>
<td>Consented to follow-up</td>
<td>4295 (79.6%)</td>
</tr>
<tr>
<td>Reached after discharge</td>
<td>2185 (51.5%)</td>
</tr>
<tr>
<td>Eligible for follow-up</td>
<td>4925 (64.6%)</td>
</tr>
<tr>
<td>Refused follow-up</td>
<td>740 (17.2%)</td>
</tr>
<tr>
<td>771 Referred to TTS</td>
<td></td>
</tr>
</tbody>
</table>

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**COMMENT**

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45% of hospitals nationwide reported implementing campus-wide smoke-free policies. However, several studies have found campus-wide bans not sufficient to prevent smoking by inpatients. Staff reluctance to confront patients and visitors has been cited as an obstacle to enforcement. A clear policy prohibiting patients from venturing into hospital areas may discourage inpatients from smoking, and such bans are increasingly common. As of February 2008, 45% of hospitals nationwide reported implementing campus-wide smoke-free policies. However, several studies have found campus-wide bans not sufficient to prevent smoking by inpatients. Staff reluctance to confront patients and visitors has been cited as an obstacle to enforcement. A clear policy prohibiting patients from venturing into hospital areas may discourage inpatients from smoking, and such bans are increasingly common. As of February 2008, 45% of hospitals nationwide reported implementing campus-wide smoke-free policies.
sachusetts. The results may be influenced by the state's low prevalence of smoking or its weather patterns or the physical setting of the hospital and its outdoor smoking shelters. Because discharge diagnoses were not available, we were not able to account for seasonal changes in case mix that might explain the observed reduction in smoking during the winter. Our data on NRT orders after admission do not allow us to determine reliably whether NRT was first offered before or after the patient left to smoke. The estimated rates of SWH may be biased downward for 2 reasons. First, we based our estimate on patient self-report, which is subject to patient reluctance to disclose or failure to recall smoking as an inpatient. Second, our estimate of SWH relied in part on telephone follow-up. The follow-up reached less than half of those counseled (40% were eligible, consented, and responded) and may have been subject to nonresponse bias: respondents differed from nonrespondents in that they were less likely to have reported smoking by the time of the TTS counseling visit. Because our multivariate analysis was exploratory and well powered by our large sample size, the results should be interpreted with caution.

The 1992 Joint Commission regulations requiring hospitals to prohibit smoking in indoor areas led to the adoption of smoke-free policies in hospitals nationwide. These policies in turn encouraged temporary abstinence among a large number of smokers. Nonetheless, in 2007-2010, nearly 1 in 5 smokers admitted to one smoke-free hospital smoked during their hospital stay. This proportion is not much lower than that reported a decade ago, despite a hospital policy that now limits smoking to 2 outdoor shelters and the substantial use of NRT to treat nicotine withdrawal symptoms in hospitalized smokers. Assessment of cigarette cravings, especially among younger smokers and those who do not plan to quit after discharge, could identify high-risk patients. The routine order of NRT on admission and the expansion of smoke-free policies to cover the entire hospital campus are 2 strategies that might decrease the proportion of smokers who smoke while hospitalized. This could improve patient safety, hospital efficiency, and clinical outcomes for hospitalized smokers.

Accepted for Publication: July 24, 2012.
Published Online: November 5, 2012. doi:10.1001/2013.jama internmed.300

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Author Contributions: All authors had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Regan. Acquisition of data: Reyen. Analysis and interpretation of data: Regan, Viana, and Rigotti. Drafting of the manuscript: Regan and Viana. Critical revision of the manuscript for important intellectual content: Regan, Reyen, and Rigotti. Statistical analysis: Regan. Obtained funding: Rigotti. Administrative, technical, and material support: Reyen. Study supervision: Rigotti.

Conflict of Interest Disclosures: Dr Rigotti reported having received a research grant from Nabi Biopharmaceuticals, having been an unpaid consultant for Pfizer Inc and Alere Wellbeing Inc, and having received royalties for UpToDate Inc for smoking cessation activities.

Funding/Support: This project was supported by grants RC1-HL099668-01 and K24-HL08880-10 from the National Heart Lung and Blood Institute.

Previous Presentation: The data were presented in part in abstract form at the 2011 New England Regional Meeting of the Society of General Internal Medicine; March 4, 2011; Boston, Massachusetts.

REFERENCES