Prevalence and Predictors of Smoking by Inpatients During a Hospital Stay

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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.


The Joint Commission requires accredited US hospitals to have a policy that prohibits smoking in hospital buildings, and hospitals have nearly universally adopted smoke-free building policies. However, the requirement does not extend to the hospital campus, and in most hospitals where a campus-wide smoking ban is not in place, hospitalized smokers may travel outside the hospital if they wish to smoke. The fact that patients may go outdoors to smoke, especially without supervision or in inclement weather, raises safety concerns. Quality of care and hospital efficiency could be compromised if patients are not available for examinations or treatments. Patients who smoke during a hospitalization may experience direct negative consequences, such as delayed recovery from cardiopulmonary disease or impaired wound healing, and do not experience the immediate cardiovascular benefits of carbon monoxide elimination. Further, they deprive themselves of an opportunity to initiate a quit attempt in a supportive, smoke-free environment.

Few recent studies have evaluated patients’ behavior under smoke-free building policies except in hospitals outside the United States or among special populations. Two studies in US hospitals, both completed more than 10 years ago, reported that one-quarter of smokers admitted to a general hospital smoked during their stay. Since then, the proportion of smokers who smoke during a hospital stay may have decreased as a result of declining population smoking prevalence, clinical practice guidelines recommending the use of nicotine replacement therapy (NRT) to relieve nicotine withdrawal symptoms, and increasingly common hospital smoking bans.

We conducted an observational study of smokers admitted to a large urban teaching hospital with a smoke-free building policy. Our aim was to assess the propor-

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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 via admission and postoperative order templates in the computerized physician order entry system used by the medical, surgical, neurology, and gynecology services. The templates also facilitate the ordering of NRT. The system generates an automatic electronic referral to the MGH Tobacco Treatment Service (TTS). In addition, staff may make referrals at any time during an 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 receive cessation counseling (averaging 20 minutes) using motivational interviewing and covering behavioral strategies and use of medication to remain abstinence. 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, had a telephone where they could be reached, were discharged to home, and had no com- munication barriers (eg, deafness or non–English-speaking) or could be reached, were discharged to home, and had no com-

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 quit smoking at any time during the admission. Smoking 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 encourage 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).17

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 1332 additional consult requests. Counselors were able to see 8358 patients (65.4%): 2361 received withdrawal assistance and brief advice only, 598 were not current cigarette smokers, and 5399 received cessation counseling (Figure 1). Of the smokers counseled by the TTS, 4295 of 5399 (79.6%) were eligible for follow-up and 3535 of 4295 (82.8%) consented. The follow-up response rate was 2185 of 3535 (61.5%) of those consenting to follow-up and 2185 of 4295 (50.9%) of those eligible. Patients had a mean age of 53 years, and most (58.2%) were male (Table). 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 had not smoked by the time of the TTS visit and of their admission than those admitted during the rest of February) were less likely to smoke at any time during the hospitalization. During the 3-year study period, prevalence of smoking before the TTS visit decreased slightly from 16.0% (95% CI, 15.2%-20.6%) in year 1 to 19.3% (95% CI, 18.5%-22.2%) in year 2 and 18.1% (95% CI, 15.1%-21.1%) in year 3, but the trend did not reach statistical significance ($P = .08$), and no similar reduction was observed among the patients reached for follow-up (Figure 1). Patients admitted during the winter months (December, January, and February) were less likely to smoke at any time during their admission than those admitted during the rest of the year (14.4% vs 19.7%, $P = .007$).

The Table presents characteristics of patients who had and had not smoked by the time of the TTS visit and of patients who were reached for follow-up who did and did not smoke at any time during the hospitalization. Those who reported smoking early in the admission were younger, smoked more cigarettes per day, reported more severe cravings, were less likely to report they will quit or try to quit on discharge, had longer hospital stays, were less likely to be admitted to the cardiac service, and were more likely to receive NRT during the stay than those who had abstained up to the TTS visit. Among those eligible for follow-up, patients who were reached for follow-up were less likely to have reported smoking at the time of the counseling session than telephone nonrespondents (12.6% vs 16.3%, $P < .001$). 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 day (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$^{15}$ 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-
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 outside 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 outside 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. 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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.

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REFERENCES