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Routine screening of hospital patients for secondhand tobacco smoke exposure: A feasibility study

Gina Rae Kruse[a,b,c,*] and **Nancy A. Rigotti**[a,b]

[a]Division of General Internal Medicine Massachusetts General Hospital, Harvard Medical School, Boston, MA, USA

[b]Tobacco Research and Treatment Center, Massachusetts General Hospital, Harvard Medical School, Boston, MA, USA

[c]Department of Social and Behavioral Sciences, Harvard School of Public Health, Boston, MA, USA

Abstract

Objective—Secondhand tobacco smoke (SHS) exposure causes over 40,000 deaths per year, but healthcare systems rarely address this risk factor. In September 2012, Massachusetts General Hospital initiated routine inpatient screening for SHS exposure by adding a question to the nurses' computerized admission assessment form ("Is smoking allowed in your home or car?"). We measured the implementation of this screening question over 1 year.

Methods—Multivariable analysis of hospital records of adult and pediatric admissions (N = 35,701) from September 1, 2012 to August 31, 2013, to assess screening question completion and identify characteristics of nonsmokers who may be exposed to SHS.

Results—Nurses entered "Yes" or "No" to the screening question for 91% of 34,295 adult admissions and 86% of 1406 pediatric admissions. Among nonsmokers, smoking in the home or car was allowed for 3% of adult admissions and 4% of pediatric admissions. Adults admitted for psychiatric diagnoses, children admitted for asthma, and patients with Medicaid insurance had higher odds of exposure to SHS in their home or car.

Conclusion—Routine screening of SHS among hospitalized patients by nurses is feasible. Doing so offers hospitals an opportunity to intervene and to promote smoke-free policies in patients' homes and cars.

Keywords

Secondhand tobacco smoke exposure; Electronic health records; Smoke-free homes

[*]Corresponding author at: 50 Staniford Street, 9th Floor, Boston, MA02114, USA. gkruse@mgh.harvard.edu (G.R. Kruse).

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GRK declares no conflicts of interest.

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Introduction

Of the 20 million U.S. deaths attributed to tobacco in the last 50 years, nearly 2.5 million were due to cardiac disease and lung cancer caused by secondhand tobacco smoke (SHS) exposure (Office on Smoking and Health, 2006; Office on Smoking and Health, 2014). In 2008, an estimated 37% of adults and 50% of children had biochemical evidence of SHS exposure (Centers for Disease Control and Prevention, 2010). Because most U.S. states have adopted comprehensive smoke-free policies for indoor public places and worksites (Centers for Disease Control and Prevention, 2014), homes and cars are now the major sources of SHS exposure (Office on Smoking and Health, 2006). Among the U.S. adults, 10.9 million (6%) are exposed to SHS in their homes and 16.7 million (9%) are exposed in vehicles (Richter et al., 2013).

Healthcare professionals are well-positioned to educate nonsmokers to avoid SHS, and the Centers for Disease Control and Prevention recommend that healthcare providers do so (Centers for Disease Control and Prevention, 2010). Hospitalization provides an opportunity to screen for and intervene about SHS exposure, just as it provides an opportunity to promote smoking cessation among active smokers (Levy et al., 2011; Rigotti et al., 2012). However, there are few examples of routine inpatient screening for SHS (Blaine et al., 2014; Wilson et al., 2012).Whether a hospital can systematically screen inpatients for SHS exposure has not been demonstrated. In 2012, Massachusetts General Hospital (MGH), a 900-bed hospital in Boston, MA, adopted a system to screen all newly-admitted patients for SHS exposure. This study assesses the implementation of screening and identifies characteristics of hospitalized patients who are at risk for SHS exposure. This information could be used to target an intervention program to address SHS exposure and promote smoke-free homes and cars among all hospitalized patients as has been demonstrated among patients with cardiac disease (Rigotti et al., 2014).

Methods

MGH screens all new admissions for smoking status using a question in the nursing admission order set of a computerized order entry system. In September 2012, a question to screen for SHS (“Is smoking allowed in the patient's home or car?”) was added to this nursing order set. Response options were “Yes”, “No” or “Unknown” and a response was mandatory for admissions. This screening question was chosen because it assesses the most common sources of SHS exposure in a single question and is associated with a biochemical measure of SHS exposure among inpatients (Prochaska et al., 2013). Nurses were notified about the change to the order set through standard educational channels including email communications and education by clinical specialists but specific training was not provided regarding how to ask the screening question. We studied the implementation of the new field from September 1, 2012–August 31, 2013. The study was approved by the Partners HealthCare Institutional Review Board.

We merged data from the computerized order entry system with electronic health record and billing data. The admission was the unit of analysis. We examined two outcomes: (1) the success of implementation, defined as the proportion of all admissions with a “Yes” or “No”

answer to the SHS screening question, and (2) the proportion of nonsmokers' admissions with a “Yes” answer, indicating that smoking was allowed in the home or car. We used multivariable logistic regression models to identify patient and admission-level factors associated with collecting a “Yes” or “No” response compared to the “Unknown” response among all admissions and with reported SHS exposure among nonsmokers, while adjusting for potential confounding. We stratified analyses by age (adult [≥18 years] and pediatric [<18 years]). We accounted for clustering of admissions within patients by using generalized estimating equations (GEE) and also created separate models for first admissions and readmissions. We tested for changes in screening over time by comparing SHS screening rates by month using Cochran–Armitage trend tests. Analyses were conducted using SAS version 9.3 (Cary, NC).

Results

From September 1, 2012 to August 31, 2013, nurses completed 51,347 admission order sets for 38,050 unique patients. From this, we excluded 13,086 admissions of employees, short stay admissions, day surgeries, or hospice. Employees were excluded for confidentiality, short stay and day surgery admissions were in the hospital too briefly, and hospice admissions were deemed inappropriate for any potential intervention. Another 2560 admissions were missing smoking status, and 4 admissions were missing gender. Our final study sample included 34,295 adult and 1406 pediatric admissions.

Factors associated with SHS screening

Nurses completed the SHS screening question with a “Yes” or “No” response for 90.6% of adult admissions (Table 1). The proportion of patients with a “Yes” or “No” response increased in the year after implementation from 86% in September 2012 to 93% in August 2013 (trend test statistic 12.39, $p < 0.001$). Among adults, nonsmokers and Whites were more likely to have a “Yes” or “No” response, while adults who were single or had a psychiatric discharge diagnosis were more likely to have an “Unknown” response. Nursing unit was also associated with screening; adult admissions to psychiatry were more likely to have an “Unknown” response than admissions to surgery, neurology, obstetric, or pediatric units.

Nurses completed a “Yes” or “No” response to the SHS screening question for 85.6% of pediatric admissions. This did not change in the year after implementation (trend test statistic 1.23, $p = 0.22$). Among pediatric admissions, the “Unknown” response occurred more often for adults accompanying children under the age of five years, non-Whites, and those with Medicaid.

Factors associated with allowing smoking in the home and car

Overall, 2.5% of adult nonsmoker admissions and 3.8% of pediatric nonsmoker admissions allowed smoking in the home or car (Table 2). Among nonsmoking adults (n= 26,242), factors associated with allowing smoking in the home or car included younger age, being male, being single, having Medicaid or no insurance, and having a psychiatric primary diagnosis or being admitted to the psychiatric unit. Adults admitted to obstetric or oncology

units were less likely to allow smoking in the home or car. Among nonsmoking pediatric admissions (n = 1184), those with Medicaid insurance or admitted for asthma were more likely to allow smoking in the home or car.

Separate models for first admissions and readmissions for both outcomes showed no important differences from the GEE models presented.

Discussion

This study demonstrates that nurses in a large, busy hospital can routinely screen inpatients for SHS exposure. Nurses nearly always completed a field in the computerized admission form requiring them to ask patients about smoking in the home or car. Compliance remained high over one year, suggesting sustainability. While few nonsmokers allowed smoking in the home or car, asking the question serves to communicate to all patients that SHS is a risk factor important to their health. Hospitalization may increase perception of risk and outcome expectancies and serves as a ‘teachable moment’ for smoking cessation (McBride et al., 2003). It may also be a teachable moment for reducing SHS exposure. The effectiveness of interventions to reduce SHS exposure among inpatients has been demonstrated among patients with coronary disease (Rigotti et al., 2014) and parents of children with asthma (Blaine et al., 2014; Geller et al., 2011; Winickoff et al., 2003).

Universal screening allowed us to identify patients most at risk for SHS exposure. Among adults, patients admitted to the psychiatric unit or who had a psychiatric primary discharge diagnosis were at higher risk of SHS exposure, suggesting that interventions might initially target this group. The high rate of smoking among individuals with psychiatric diagnoses (Cook et al., 2014) may explain why nonsmokers with these diagnoses have a high rate of exposure to SHS. Among children, those admitted with asthma had higher odds of being exposed to SHS in the home or car. This is consistent with prior work finding an association between detectable cotinine levels and readmission among children with asthma (Howrylak et al., 2014).

The study is limited by the fact that smoking in patients' home and car was assessed by patients' self-report and recorded by nurses. Patients' self-report about smoking in their home or car may be underreported (Prochaska et al., 2013). Biochemical screening of inpatients for SHS exposure would be more accurate, but this is not technically feasible in the acute hospital setting. Self-report of allowing smoking in the home was 71% sensitive and 76% specific compared to measurement of cotinine, a biochemical measure of SHS exposure, in one study (Prochaska et al., 2013) and nurse administered screening may be less sensitive (Wilson et al., 2012). Nurses also may not have asked the question in the same way. We cannot determine whether “Unknown” responses represented incomplete screening by nurses or patients responding with “Unknown” and we were limited to a single screening question. While a more robust measure may be informative, it was not feasible for us to add additional mandatory fields to the order set.

Failing to assess SHS exposure among hospitalized patients is a missed opportunity to improve patients' health by promoting smoking bans in the home and car.

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Table 1

Characteristics associated with screening hospital patients for SHS exposure.

Characteristic	"Yes" or "No" response to SHS screening	"Unknown" response to SHS screening	Multivariable logistic regression[a]
Adult admissions	N (row %)	N (row %)	OR (95% CI)
Total	31,060 (90.6)	3235 (9.4)	
Smoking status			
Non-smoker	26,242 (92.2)	2225 (7.8)	REF
Smoker	4818 (82.7)	1010 (17.3)	0.48 (0.44–0.53)
Sociodemographic characteristics			
Gender			
Male	15,027 (89.6)	1737 (10.4)	REF
Female	16,033 (91.5)	1498 (8.5)	0.98 (0.90–1.06)
Age			
18–44 years	7950 (91.8)	706 (8.2)	REF
45–64 years	10,427 (89.2)	1263 (10.8)	0.90 (0.80–1.00)
65 and older	12,683 (90.9)	1266 (9.1)	1.02 (0.89–1.16)
Race/ethnicity			
Non-White	5889 (90.1)	651 (10.0)	REF
White	25,171 (90.7)	2584 (9.3)	1.17 (1.06–1.29)
Marital status			
Married	16,151 (91.8)	1438 (8.2)	REF
Divorced	5718 (89.7)	655 (10.3)	0.96 (0.86–1.06)
Single	8255 (88.9)	1027 (11.1)	0.88 (0.80–0.97)
Other marital	936 (89.1)	115 (10.9)	0.89 (0.73–1.10)
Insurance status			
Commercial	15,410 (91.5)	1433 (8.5)	REF
Medicare	12,523 (89.9)	1402 (10.1)	0.89 (0.80–0.98)
Medicaid	2437 (88.5)	316 (11.5)	0.95 (0.82–1.09)
Self-pay/uninsured	667 (89.5)	78 (10.5)	1.02 (0.81–1.30)
Missing insurance	23 (79.3)	6 (20.7)	0.53 (0.28–1.00)
Nursing unit			
Psychiatry	553 (81.0)	130 (19.0)	REF
Medicine	5090 (85.1)	889 (14.9)	0.78 (0.59–1.04)
Surgery	8994 (93.1)	665 (6.9)	1.65 (1.22–2.21)
Cardiology	3043 (89.0)	375 (11.0)	0.95 (0.70–1.30)
Neurology	2460 (94.8)	136 (5.2)	2.18 (1.56–3.05)
Oncology	1716 (87.2)	253 (12.9)	0.79 (0.57–1.09)
Obstetrics	1886 (97.8)	43 (2.2)	4.75 (3.11–7.25)
Pediatrics	934 (95.1)	48 (4.9)	2.15 (1.42–3.26)
Intensive Care	3314 (86.4)	522 (13.6)	0.83 (0.61–1.12)

Other floors	3070 (94.6)	174 (5.4)	2.22 (1.61–3.08)
Primary discharge diagnosis[b]			
Coronary heart disease	998 (88.2)	133 (11.8)	1.03 (0.84–1.26)
COPD	325 (87.1)	48 (12.9)	1.06 (0.75–1.49)
Asthma	111 (85.4)	19 (14.6)	0.91 (0.55–1.51)
Stroke	706 (92.5)	57 (7.5)	1.04 (0.79–1.38)
Cancer	3410 (91.2)	331 (8.9)	0.99 (0.87–1.12)
Psychiatric illness	902 (79.8)	228 (20.2)	0.70 (0.56–0.87)
Other diagnoses	27,608 (91.9)	2419 (8.1)	REF
Characteristic	"Yes" or "No" response to SHS screening	"Unknown" response to SHS screening	Multivariable logistic regression[a]
Pediatric admissions	N (row %)	N (row %)	OR (95% CI)
Total	1204 (85.6%)	202 (14.4%)	
Smoking status			
Non-smoker	1184 (85.5)	201 (14.5)	REF
Smoker	20 (95.2)	1 (4.8)	3.08 (0.39–24.34)
Sociodemographic characteristics			
Gender			
Male	645 (84.3)	120 (15.7)	REF
Female	559 (87.2)	82 (12.8)	1.22 (0.89–1.68)
Age			
5 years and older	891 (88.2)	119 (11.8)	REF
Under 5 years	313 (79.0)	83 (21.0)	0.56 (0.40–0.77)
Race/ethnicity			
Non-White	460 (81.3)	106 (18.7)	REF
White	744 (88.6)	96 (11.4)	1.56 (1.12–2.16)
Insurance status			
Commercial	938 (87.8)	131 (12.3)	REF
Medicaid	233 (77.9)	66 (22.1)	0.54 (0.37–0.78)
Self-pay/uninsured	32 (86.5)	5 (13.5)	0.86 (0.32–2.26)
Primary discharge diagnosis[b]			
Asthma	59 (88.1)	8 (11.9)	1.52 (0.68–3.37)

Abbreviations: OR — odds ratio, CI — confidence interval, REF — reference group, and COPD — chronic obstructive pulmonary disease.

[a] Adjusted for all covariates listed and using generalized estimating equations to account for clustering of patients with readmissions.

[b] Discharge ICD9: cancer (140–209.36, 209.70–209.75, 230–234); psychiatric diagnosis (290–319); coronary heart disease (410–414); stroke (431.14–431.19, 433, 434, 435, 436); COPD (490–492, 494, 496); and asthma (493).

Table 2

Characteristics associated with admissions of nonsmokers who allow smoking in their home or car as compared to those who do not.

Characteristic	No smoking in home/car	Smoking in home/car	Multivariable logistic regression[a]
Adult admissions	N (row %)	N (row %)	OR (95% CI)
Total	25,594 (97.5)	648 (2.5)	
Sociodemographic characteristics			
Gender			
Male	11,767 (97.1)	355 (2.9)	REF
Female	13,827 (97.9)	293 (2.1)	0.78 (0.66–0.93)
Age			
18–44 years	6261 (97.6)	155 (2.4)	REF
45–64 years	7916 (96.9)	251 (3.1)	1.08 (0.83–1.40)
65 and older	11,417 (97.9)	242 (2.1)	0.66 (0.48–0.92)
Race/ethnicity			
Non-White	4952 (97.7)	116 (2.3)	REF
White	20,642 (97.5)	532 (2.5)	1.23 (0.98–1.56)
Marital status			
Married	14,283 (97.8)	319 (2.2)	REF
Divorced	4608 (97.7)	108 (2.3)	1.04 (0.81–1.33)
Single	6000 (96.7)	203 (3.3)	1.28 (1.04–1.59)
Other marital	723 (97.1)	22 (2.9)	1.30 (0.83–2.05)
Insurance status			
Commercial	12,854 (97.7)	301 (2.3)	REF
Medicare	10,659 (97.6)	264 (2.4)	1.24 (0.97–1.58)
Medicaid	1603 (96.4)	60 (3.6)	1.62 (1.13–2.31)
Self-pay/uninsured	459 (95.2)	23 (4.8)	2.14 (1.36–3.37)
Nursing unit			
Psychiatry	291 (91.8)	26 (8.2)	REF
Medicine	3871 (96.8)	128 (3.2)	0.83 (0.44–1.58)
Surgery	7515 (97.6)	186 (2.4)	0.67 (0.35–1.29)
Cardiology	2607 (97.6)	63 (2.4)	0.63 (0.32–1.26)
Neurology	2080 (97.5)	54 (2.5)	0.65 (0.33–1.30)
Oncology	1520 (99.2)	12 (0.8)	0.21 (0.08–0.53)
Obstetrics	1791 (99.1)	16 (0.9)	0.25 (0.11–0.57)
Pediatrics	867 (98.0)	18 (2.0)	0.53 (0.23–1.18)
Intensive care	2547 (97.6)	83 (3.2)	0.84 (0.43–1.66)
Other floors	2618 (80.7)	174 (5.4)	0.64 (0.33–1.26)
Primary discharge diagnosis[b]			
Coronary heart disease	778 (97.0)	24 (3.0)	1.21 (0.78–1.86)

COPD	202 (95.7)	9 (4.3)	1.38 (0.66–2.87)
Asthma	68 (93.2)	5 (6.9)	2.29 (0.86–6.09)
Stroke	579 (96.8)	19 (3.2)	1.28 (0.74–2.22)
Cancer	2897 (97.9)	61 (2.1)	0.91 (0.69–1.20)
Psychiatric diagnoses	456 (92.3)	38 (7.7)	1.99 (1.15–3.42)
Other diagnoses	20,614 (97.7)	492 (2.3)	REF
Characteristic	No smoking in home/car	Smoking in home/car	Multivariable logistic regression[a]
Pediatric admissions	N (row %)	N (row %)	OR (95% CI)
Total	1139 (96.2)	45 (3.8)	
Sociodemographic characteristics			
Gender			
Male	619 (97.2)	18 (2.8)	REF
Female	520 (95.1)	27 (4.9)	1.85 (1.00–3.42)
Age			
5 years and older	838 (96.1)	34 (3.9)	REF
Under 5 years	301 (96.5)	11 (3.5)	0.88 (0.42–1.86)
Race/ethnicity			
Non-White	440 (96.7)	15 (3.3)	REF
White	699 (95.9)	30 (4.1)	1.73 (0.83–3.57)
Insurance status			
Commercial	903 (97.2)	26 (2.8)	REF
Medicaid	207 (92.4)	17 (7.6)	3.06 (1.57–5.95)
Self-pay/uninsured	29 (93.6)	2 (6.5)	2.35 (0.55–10.05)
Primary discharge diagnosis[b]			
Asthma	51 (87.9)	7 (12.1)	4.01 (1.62–9.92)

Abbreviations: OR — odds ratio, CI — confidence interval, REF — reference group, and COPD — chronic obstructive pulmonary disease.

[a] Adjusted for all covariates listed and using generalized estimating equations to account for clustering of patients with readmissions.

[b] Discharge ICD9: cancer (140–209.36, 209.70–209.75, 230–234); psychiatric diagnosis (290–319); coronary heart disease (410–414); stroke (431.14–431.19, 433, 434, 435, 436); COPD (490–492, 494, 496); and asthma (493).