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Post-discharge tobacco cessation rates among hospitalized US veterans with and without diabetes

S. A. Duffy[1,2], A. Munger[3], C. A. Karvonen-Gutierrez[1], J. D. Piette[1,3], T. A. Kao[2] and the Veterans Integrated Service Network (VISN) 11 Tobacco Tactics Team*

[1]VA Center for Clinical Management Research, VA Ann Arbor Healthcare System, [2]University of Michigan, School of Nursing and [3]University of Michigan Health System, Ann Arbor, MI, USA

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Abstract

Aims Smoking is a major risk factor for cardiovascular complications among patients with diabetes. Hospitalization has been shown to enhance cessation rates. The purpose of this study was to compare 6-month post-hospitalization tobacco cessation rates among US veterans with and without diabetes.

Methods This was a longitudinal study among inpatient veterans who used tobacco in the past month (n = 496). Patients were recruited and surveyed from three Midwestern Department of Veterans Affairs hospitals during an acute-care hospitalization. They were also asked to complete a follow-up survey 6 months post-discharge. Bivariate- and multivariable-adjusted analyses were conducted to determine differences in tobacco cessation rates between patients with and without a diagnosis of diabetes.

Results The mean age of patients was 55.2 years and 62% were white. Twenty-nine per cent had co-morbid diabetes. A total of 18.8% of patients with diabetes reported tobacco cessation at 6 months compared with 10.9% of those without diabetes (P = 0.02). Cotinine-verified cessation rates were 12.5 vs. 7.4% in the groups with and without diabetes, respectively (P = 0.07). Controlling for psychiatric co-morbidities, depressive symptoms, age, self-rated health and nicotine dependence, the multivariable-adjusted logistic regression showed that patients with diabetes had three times higher odds of 6-month cotinine-verified tobacco cessation as compared with those without diabetes (odds ratio 3.17, P = 0.005).

Conclusions Post-hospitalization rates of smoking cessation are high among those with diabetes. Intensive tobacco cessation programmes may increase these cessation rates further.

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Keywords diabetes, smoking

Introduction

Diabetes affects 20%, or 1 million, of US Department of Veterans Affairs users compared with 8% of the general population [1]. Diabetes accounts for 28% of Department of Veterans Affairs pharmacy costs and Department of Veterans Affairs patients with diabetes die at almost twice the rate as veterans without diabetes [1]. Overall, 24% of adults with diabetes smoke; this prevalence is similar to the rate among those without diabetes [2,3], and smoking among those serviced by the Department of Veterans Affairs is also approximately 20% [4].

Among people with diabetes, smoking is associated with poor glycaemic control [5] and exacerbates macro- and microvascular complications, including neuropathy, nephropathy, retinopathy, cardiovascular disease and stroke [6]. Moreover, compared with non-smokers with diabetes, smokers with diabetes were less likely to be active in diabetes care, including self-checking blood glucose levels, doing exercise and receiving medical services, and were more likely to feel depressed and lack of social support from their family and friends [7]. Thus, smokers with diabetes show increased

Correspondence to: Sonia A. Duffy PhD RN, VA Center for Clinical Management Research, VA Ann Arbor Healthcare System, 2215 Fuller Rd, Ann Arbor, MI 48105, USA. E-mail: bump@umich.edu

**The members of the VISN 11 Tobacco Tactics Team, in alphabetical order, are Timothy Carmody, Gregory Dalack, Lee Ewing, Petra Flanagan, Christopher Hermann, Thomas Hicks, Samantha Louzon, David Ronis, Patricia Smith and Richard White.*

morbidity and mortality rates. However, smoking cessation is the most important strategy to reduce the complications among patients with diabetes [7].

As rates of diabetes are particularly high in the Department of Veterans Affairs, and as smoking is particularly harmful among people with diabetes, having diabetes may serve as an additional motivation to stop smoking among hospitalized Department of Veterans Affairs patients. Hospitalization for a serious chronic illness such as diabetes may prompt an emotional reaction, increasing motivation to change behaviour [8], often called a 'teachable moment' [9]. Several studies have shown that hospitalization itself appears to enhance cessation [10], as many smokers have already achieved a period of abstinence as a result of indoor smoking bans. However, inpatient smoking cessation post-hospitalization has focused mainly on patients with cardiovascular and pulmonary disease and has not been extensively studied on inpatients with diabetes [11].

Prior to implementing a tobacco cessation programme for inpatients, the objective of this study was to determine post-hospitalization pre-intervention cessation rates among Department of Veterans Affairs smokers with and without diabetes. Given the well-known harmful effects of smoking on diabetes, it is hypothesized that having diabetes may serve as an additional motivation to stop smoking among hospitalized Department of Veterans Affairs patients. Given the high prevalence of diabetes and smoking in the Department of Veterans Affairs, information about differential cessation rates among smokers with and without diabetes may inform smoking cessation interventions and other policies designed to help patients stop smoking. In addition to informing Department of Veterans Affairs national policies regarding smoking cessation interventions for people with diabetes, the results of this study have broad implications for understanding how cessation programmes can take advantage of the teachable moments afforded by a diabetes-related hospitalization.

Research design and methods

Design

This was a longitudinal study among patients that used tobacco and were hospitalized at one of three Midwestern Department of Veterans Affairs hospitals. The independent variable was having a diagnosis of diabetes vs. not having a diagnosis of diabetes. The dependent variables included 6-month tobacco cessation rates. Multivariable analyses were adjusted for co-morbid psychiatric problems, age, nicotine dependence, depressive symptoms and self-rated health. Human studies approval was received from all of the sites included in the study and informed consent was obtained from all patients.

Setting and sample

Patients were recruited at the time of admission to Department of Veterans Affairs hospitals in Ann Arbor and Detroit, Michigan, and Indianapolis, Indiana. Patients were eligible if they: (1) were admitted as inpatients to intensive care units, general medical, surgical, extended care and psychiatric/substance abuse units; (2) reported using tobacco within 1 month prior to hospitalization; (3) had a projected hospital stay of at least 24 h; and (4) were willing to complete a written 15-min survey prior to discharge. Patients were excluded if they: (1) were considered by their inpatient team to be too ill to participate; (2) were terminally ill; (3) were involved in a concurrent trial that included intervention on smoking; or (4) were pregnant.

Of the 907 tobacco users approached to participate between 1 May 2006 and 18 September 2009, 73 were either ineligible, did not complete the baseline survey or died prior to the 6-month follow up date. In addition, 26 patients were sent a 6-month survey, but died before it could be returned. Of the 808 remaining, 312 did not complete the follow-up survey and were thus classified as non-responders. The remaining 496 were included in this sample. Patients that did not return a 6-month survey were more likely to have cancer, but less likely to have psychiatric problems, arthritis or alcohol problems ($P < 0.05$). The overall survey response rate was 61% (496/808) and was roughly equivalent among patients with and without diabetes.

Procedures

Tobacco users were identified soon after admission using the nursing assessment in the Department of Veterans Affairs electronic medical record, the Computerized Patient Record System. Identified patients were approached by a research assistant who obtained informed consent and completed the baseline survey with the patient. A second survey was mailed to participants 6 months post-discharge. At 6 months, participants also were asked to return a urine cotinine strip to confirm 6-month smoking status. Participants were given $5.00 for completing each survey and $15.00 for returning a cotinine test.

Measures

Co-morbidities

Co-morbidities were measured using both self-report and electronic medical record data. Using a validated instrument [12] patients were asked (yes/no) if they had ever been diagnosed with diabetes, psychiatric problems, cancer, lung disease, heart disease, high blood pressure, stroke or arthritis/orthopaedic problems. Patients who had diabetes or other chronic conditions of interest self-reported or were listed as an International Classification of Diseases-9 coded diagnosis in inpatient or outpatient encounters were considered to have that diagnosis. Patients could have more than one co-morbid condition. The correlation between self-reported and medical record-abstracted diabetes diagnosis was 0.86.

Problem drinking was assessed using the Alcohol Use Disorders Identification Test (AUDIT) [13]. An AUDIT score ≥ 8 was considered problem drinking. Depressive symptoms were measured using the Geriatric Depression Scale Short Form

(GDS) [14]. A GDS score ≥ 4 was considered as having depressive symptoms. Self-rated health was measured by the validated question 'In general, would you say your health is excellent/very good/good/fair/poor?' [15].

Tobacco use

The six-question Fagerstrom Test for Nicotine Dependence (FTND) was used to assess nicotine dependence at the time of hospitalization [16]. A FTND score ≥ 6 was considered nicotine dependent. Outcomes included self-reported 6-month cessation rates and 6-month cotinine-verified tobacco cessation. Patients were asked a validated question to measure self-reported 6-month tobacco cessation [17]: 'Have you used any tobacco products in the past 7 days (yes/no)?' This question was also confirmed with a urinary cotinine level screen. The 57 patients that did not return a cotinine test strip or that had an unreadable result were counted in the cotinine-verified patients who had not stopped smoking.

Demographics

Demographic factors that have been found to influence tobacco cessation were collected via baseline survey and electronic records, including age, sex, race/ethnicity, marital status, education and employment. For the bivariate- and multivariable-adjusted analyses, race was classified as white vs. non-white, marital status was classified as married vs. not married, education was classified as high school or less vs. some college or more, and employment was classified as employed vs. not employed.

Data analysis

Means and frequencies were calculated for all variables. The primary independent variable of interest was diagnosis with diabetes (yes/no). Dependent variables included measures of 6-month tobacco cessation rates (i.e. 6-month self-reported and cotinine-verified cessation rates). Bivariate analyses were conducted using χ^2-, Fisher's exact or Student's *t*-tests to test differences between patients with and without diabetes in 6-month tobacco cessation, nicotine dependence, problem drinking, depressive symptoms, co-morbid chronic illnesses and demographic characteristics. Covariates significantly associated with the 6-month cessation indicators or with co-morbid diabetes status in bivariate analyses were considered for inclusion as control variables in the multivariable-adjusted analysis.

Multivariable-adjusted logistic regression models were used to determine the independent association between diabetes diagnosis and the tobacco cessation variables. Variables with statistically significant bivariate relationships with the outcome measures and/or with the main predictor of interest were considered for inclusion in the final model. Final model selection was based on reported importance of variables in the literature, model fit and control of confounding.

Collinearity diagnostics, including variance inflation factors, were examined to ensure that there was not collinearity between predictor variables in the final models. Importantly, the variance inflation factor for co-morbid psychiatric problems and depression was only 1.084 and indicated low multicollinearity between these two variables.

Missing data were handled using case-wise deletion. Patients with missing data were not different in terms of key variables of interest, including cessation outcomes or co-morbid diabetes. Most variables did not have any missing data. Of the variables included in the multi-variable adjusted logistic regression models, 36 patients (7%) had depression data missing, 42 patients (8%) had nicotine-dependence data missing and 18 patients (4%) had self-rated health data missing. Values for $P < 0.05$ are reported.

Results

Patient baseline characteristics

The average age of patients was 55.2 years, most of the patients were male and the majority (62%) were white (Table 1). Approximately one quarter were married, just over half had some college education or more and only 15% were employed. Approximately one third of the patients had co-morbid diabetes (29.0%, $n = 144$). Of the other co-morbidities, the most common was high blood pressure, followed by psychiatric problems, arthritis, heart disease, lung disease, cancer and stroke (Table 1). The most common reasons for being admitted to the hospital were for psychiatric problems or surgery. Approximately one third (32%, $n = 152$) of patients screened positive for alcohol problems and over half (60%, $n = 276$) screened positive for depressive symptoms. Over half of patients (59%) self-reported their health status as fair or poor; only 13% of patients reported their health status as excellent or very good.

Compared with patients without diabetes, patients with diabetes were approximately 3.5 years older ($P = 0.0003$), were more likely to report poorer health ($P = 0.02$) and were less likely to have psychiatric co-morbidities ($P = 0.009$). Patients with diabetes also were more likely to have co-morbid lung disease, heart disease, high blood pressure and stroke ($P < 0.05$) and were more likely to be admitted to the hospital for heart disease, wound healing or vascular problems ($P < 0.05$). However, those with diabetes were less likely to be admitted to the hospital for cancer or psychiatric problems ($P < 0.05$) and were less likely to have depressive symptoms ($P = 0.004$) and problem alcohol use ($P = 0.0008$).

Baseline tobacco use

While most of the tobacco users were smokers, nine (2%) were smokeless tobacco users. Among the smokers, 43% were considered nicotine dependent, as defined by a Fagerstrom score ≥ 6 [16]. On average, patients smoked nearly one pack (equivalent to 20 cigarettes) per day in the month prior to their baseline admission. Nicotine dependence did not differ significantly at baseline between patients with and without diabetes.

Table 1 Demographic information, health history and smoking history among 496 inpatient tobacco users

	Overall		Diabetes $n = 144$		No diabetes $n = 352$		P-value for diabetes vs. no diabetes
	Mean	SD	Mean	SD	Mean	SD	
Age	55.2	9.2	57.5	7.6	54.2	9.6	< 0.0001
Number of cigarettes smoked per day in past month	18.4	12.9	18.0	14.1	18.6	12.4	0.63
	n	%	n	%	n	%	
Sex							
Male	470	94.8	135	93.8	335	95.2	0.52
Female	26	5.2	9	6.3	17	4.8	
Race/ethnicity							
White	307	62.2	87	60.4	220	62.9	0.61
Non-white	187	37.9	57	39.6	130	37.1	
Marital status							
Married	115	23.2	41	28.5	74	21.1	0.08
Not married	380	76.8	103	71.5	277	78.9	
Education status							
High school or less	209	42.6	58	40.3	151	43.5	0.51
Some college or more	282	57.4	86	59.7	196	56.5	
Employment status							
Employed	71	15.5	17	12.7	54	16.6	0.29
Not employed	388	84.5	117	87.3	271	83.4	
Co-morbidities							
High blood pressure	337	67.9	131	91.0	206	58.5	< 0.0001
Psychiatric problems	306	61.7	76	52.8	230	65.3	0.009
Arthritis	286	57.7	84	58.3	202	57.4	0.85
Heart disease	192	38.7	76	52.8	116	33.0	< 0.0001
Lung disease	176	35.5	61	42.4	115	32.7	0.04
Cancer	79	15.9	18	12.5	61	17.3	0.18
Stroke	62	12.5	26	18.1	36	10.2	0.02
2 or more co-morbidities	370	74.6	139	96.5	231	65.6	< 0.0001
Reasons admitted to hospital							
Cancer	36	7.3	5	3.5	31	8.8	0.04
Lung disease	47	9.5	17	11.8	30	8.5	0.26
Heart disease	86	17.3	36	25.0	50	14.2	0.004
Stroke	22	4.4	9	6.3	13	3.7	0.21
Psychiatric problems	140	28.2	28	19.4	112	31.8	0.006
Arthritis	39	7.9	11	7.6	28	8.0	0.91
Wound healing	30	6.1	15	10.4	15	4.3	0.009
Surgery	118	23.8	31	21.5	87	24.7	0.45
Vascular problems	44	8.9	19	13.2	25	7.1	0.03
Problem alcohol (AUDIT ≥ 8)	152	32.1	29	20.9	123	36.7	0.0008
Depressive symptoms (GDS ≥ 4)	276	60.0	66	48.5	210	64.8	0.001
Self-rated health status							
Excellent	10	2.1	3	2.1	7	2.1	0.02
Very good	53	11.1	9	6.4	44	13.1	
Good	135	28.2	31	22.0	104	30.9	
Fair	179	37.5	66	46.8	113	33.5	
Poor	101	21.1	32	22.7	69	20.5	
Nicotine dependent (FTND ≥ 6)	196	43.2	54	42.9	142	43.3	0.93
Self-reported 6-month cessation rate	65	13.2	27	18.8	38	10.9	0.02
Cotinine-verified 6-month cessation rate	44	8.9	18	12.5	26	7.4	0.07

AUDIT, Alcohol Use Disorders Identification Test; FTND, Fagerstrom Test for Nicotine Dependence; GDS, Geriatric Depression Scale Short Form.

Six-month cessation rates

The 6-month self-reported cessation rate was 13.2% ($n = 65$) and the cotinine-verified 6-month cessation rate was 8.9% ($n = 44$). In bivariate analyses, the 6-month self-reported cessation rates among patients with diabetes (18.8%) was significantly higher than among patients without diabetes (10.9%, $P = 0.02$). The cotinine-verified cessation rate was also was higher in the subgroup with diabetes compared with the

subgroup without diabetes (12.5 vs. 7.4%, respectively) and this was marginally statistically significant ($P = 0.07$). Six-month self-reported and cotinine-verified cessation rates were lower among patients with psychiatric co-morbidities (10.5 and 5.9%) as compared with those without psychiatric problems (17.6 and 13.7%; $P = 0.03$ and $P = 0.003$, respectively). Likewise, those with depressive symptoms had lower self-reported cessation rates (11.0%) as compared with those without depressive symptoms (16.4%, $P = 0.09$). Patients who were nicotine dependent at baseline had lower 6-month self-reported and cotinine-verified cessation as compared with those that were not nicotine dependent.

Multivariable-adjusted analyses

Diabetes status was statistically significantly associated with self-reported 6-month tobacco cessation in an unadjusted model, whereas the relationship between cotinine-verified 6-month tobacco cessation and diabetes status was marginally significant. However, as shown in Table 2, after adjustment for psychiatric co-morbidities, depressive symptoms, age, self-rated health and nicotine dependence, there was a statistically significant relationship between diabetes status and both outcome variables ($P < 0.01$). Specifically, patients with diabetes had more than two and a half times greater odds of self-reported cessation at 6 months compared with those without diabetes (odds ratio 2.65, $P = 0.003$). Moreover, those with diabetes had more than three times greater odds of cotinine-verified 6-month cessation compared with those without diabetes (odds ratio 3.17, $P = 0.005$). Psychiatric co-morbidities, depressive symptoms, age and nicotine dependence at baseline were not independently associated with any of the outcomes in the multivariable analysis.

Discussion

Despite similar levels of baseline nicotine dependence, patients with diabetes had substantially higher tobacco cessation rates 6 months after hospitalization compared with patients with other diagnoses. Given the serious consequences of tobacco use for the cardiovascular risk profile of patients with diabetes, these findings are encouraging. The reason for these higher cessation rates are unclear, but may be related to a variety of factors, such as multiple co-morbidities, higher motivation to stop because of diabetic complications caused by smoking and frequent hospitalizations among those with diabetes. In fact, 29% of the hospitalized tobacco users had diabetes compared with 20% of Department of Veterans Affairs users and 8% of the general population that have diabetes [1], suggesting high hospitalization rates among smokers with diabetes.

While these results indicate that hospitalized patients with diabetes have higher cessation rates than those without diabetes, the majority of hospitalized patients with diabetes still failed to achieve cessation 6 months post-discharge and therefore remain at substantially higher risk for myocardial infarctions, stroke, renal failure and cancer. A prior study conducted in these same hospitals by our group found that only 17% of inpatient smokers reported receiving smoking cessation interventions [18]. Introducing state-of-the-art inpatient smoking cessation interventions are likely to enhance the already elevated cessation rates among patients with diabetes who are frequently hospitalized. Smoking cessation interventions (both pharmacotherapy and behavioural intervention followed by supportive contacts after discharge) that begin during hospitalization increase the odds of smoking cessation by 65% at 6–12 months over what is achieved after usual hospital care [10], particularly among motivated smokers.

Limitations of the study

The study included only tobacco users hospitalized in the Department of Veterans Affairs and therefore may not generalize to other populations. The response rate was only 61%; not all of the patients returned cotinine urine strips and those patients' cessation rates may have been different. Six-month follow-up data was obtained by post, whereas face-to-face communication may have been more reliable. Although the concordance between self-report and urinary cotinine status has been shown to be high [19,20], use of nicotine replacement therapy was not assessed, which could affect urinary cotinine levels. The outcome measure was 7-day point prevalence abstinence at 6 months post-discharge and not continuous

Table 2 Multivariable-adjusted logistic regression: co-morbid diabetes status and self-reported or cotinine-verified 6-month cessation rates

	6-month self-report cessation ($n = 65$ stopped smoking)			Verified 6-month cessation ($n = 44$ stopped smoking)		
	Odds ratio	95% CI	*P*-value	Odds ratio	95% CI	*P*-value
Co-morbid diabetes	2.65	1.38–5.09	0.003	3.17	1.41–7.15	0.005
Co-morbid psychiatric problems	0.81	0.41–1.57	0.52	0.65	0.28–1.50	0.31
Depressive symptoms	0.82	0.42–1.60	0.55	1.26	0.54–2.98	0.59
Self-rated health	0.86	0.63–1.18	0.36	0.65	0.44–0.97	0.03
Nicotine dependence	0.58	0.30–1.14	0.11	0.54	0.23–1.30	0.17
Age	0.99	0.95–1.02	0.44	1.02	0.97–1.06	0.48

abstinence after hospitalization. While there were a large number of African Americans included in the study, similar to the Midwest region of the three study sites, Hispanics and other minorities were less represented.

Conclusions

Tobacco cessation rates 6 months after hospitalization were higher among hospitalized patients with diabetes than among those without diabetes. The results indicate that the event of hospitalization may present an opportunity for tobacco users with diabetes to stop smoking. Intensive tobacco cessation intervention strategies for inpatient smokers with diabetes are likely to further enhance cessation rates and decrease morbidity and mortality in this high-risk group.

Competing interests

Nothing to declare.

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