RESEARCH ARTICLE

Effects of Smoking on Cost of Hospitalization and Length of Stay among Patients with Lung Cancer in Iran: a Hospital-Based Study

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Abstract

Background: Smoking is recognized as a main leading preventable cause of mortality and morbidity worldwide. It is responsible for a considerable financial burden both on the health system and in society. This study aimed to examine the effect of smoking on cost of hospitalization and length of stay (LoS) among patients with lung cancer in Iran in 2014. Materials and Methods: A total of 415 patients were included in the study. Data on age, sex, insurance status, type of hospitals, type of insurance, geographic local, length of stay and cost of hospitalization was extracted by medical records and smoking status was obtained from a telephone survey. To compare cost of hospitalization and LoS for different smoking groups, current smokers, former smokers, and never smokers, a gamma regression model and zero-truncated poisson regression were used, respectively. Results: Compared with never smokers, current and former smokers showed a 48% and 35% increase in hospitalization costs, respectively. Also, hospital LoS for current and former smokers was 72% and 31% higher than for never smokers, respectively. Conclusions: Our study indicated that cigarette smoking imposes a significant financial burden on hospitals in Iran. It is, however, recommended that more research should be done to implement and evaluate hospital based smoking cessation interventions to better increase cessation rates in these settings.

Keywords: Smoking - cost of hospitalization - length of stay - Iran

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Introduction

Smoking is seen as one of the most important preventable cause of morbidity and mortality throughout the world. It is responsible for more than 10% of deaths over the world and it has been predicted that it will account for more than eight million deaths in 2030, which 83% of them will occur in low-middle income countries (LMICs) (Mathers and Loncar 2006; Pinto and Ugá 2011; Arrieta et al., 2015; Jalilian et al., 2015). The negative economic impact of smoking on the health system and society as a whole is substantial (Jha and Chaloupka, 2000, Rezaei et al., 2015). It was reported that the smoking was responsible for 6 to 15% of national health care expenditure in high-income countries, 2.1%-3.4% of gross domestic product (GDP) in Australia, 1.3%-2.2% of GDP in Canada and 1.4%-1.6% of GDP in the United States (Jha and Chaloupka 2000, Allender, Balakrishnan et al., 2009). However, the evidences concerning this issue are rarely documented in developing countries like Iran. The epidemiological evidence indicated that the smoking is closely associated with around 50 diseases prominent among these are cardiovascular diseases, cancers and respiratory diseases (Mathers and Loncar, 2006; Pinto and Ugá, 2011). One of the main cancers related to the cigarette smoking is lung cancer (LC). LC is one of the five leading tumors in Iran, and the rate has been increasing steadily in both men and women (Hosseini et al., 2009, Khorasani et al., 2015). Based on GLOBOCAN database, a total of 4341 deaths due to LC (2950 in men and 1411 in women) in the Iran in 2012 (Ferlay et al., 2014). Considering that more than 54% and 20.3% of these deaths are associated with smoking among men and women, respectively, in Iran (Rezaei et al., 2015). To our knowledge and based on literature review, sufficient information about effect of smoking on healthcare utilization and cost of hospitalization is not available for any diseases in Iran. The evidence concerning this issue is useful for health policy-decision making in Iran and other low-middle income countries (LMICs) in order to

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reducing the smoking prevalence and implementation of successful smoking cessation interventions. This study aimed to address this gap in the literature and examine the affect smoking status on cost of hospitalization and hospital length of stay among patients with lung cancer in Iran in 2014.

Materials and Methods

Study Setting

Tehran is the capital of Iran and Tehran province, based on census 2011, with a population of around 9 million in the city and 16 million in the wider metropolitan area. Tehran is the largest city and urban area of Iran, the second largest city in Western Asia, and the 3rd largest in the Middle East.

Study Sampling and Data Collection

In Iran's health system network, inpatients care delivered through hospitals owned by different providers. Governmental hospitals trough the Ministry of Health and Medical Education (MOHME) is the main providers of inpatients services in Iran (68% of total hospital beds), followed by Private hospitals (12% of total hospital beds), Social Security Organization (SSO) of hospitals (9% of total hospital beds), Armed Forces hospital (4% of total hospitals beds). The rest of hospital beds was related to the Oil Company and NGOs (Hajizadeh and Nghiem 2013). In the study, the beds in these hospitals was considered to be governmental hospitals. All patients aged 34+ years discharged from these hospitals between 21 March 2014 and 22 March 2015 who were diagnosed with lung cancer (ICD-10: C33-C34) were chosen as the study population. Because it is believed that the latent period between initial exposure smoking and occurrence cancer are about 20 years and more (Kang et al., 2003, Rezaei et al., 2015).

In this study, samples were selected in two stage. First; 501 patients who were admitted between 21 March 2014 and 22 March 2015 were selected based on hospitals beds in different providers (373 of patients in four governmental hospitals, 62 of patients from the two private hospitals, 45 of patients from the one Social security hospital and 22 of patients from the one Armed forces hospital). Data on sex, age, insurances status, type of diseases, local geographic, hospital length of stay and cost of hospitalization were retrieved from the patient's medical records by self-constructed check list. In the next stage, the information about smoking status of the selected patients were obtained by telephone survey. Finally, based on response rate in telephone survey, 415 patients (307 of patients in four governmental hospitals, 54 of patients from the two private hospitals, 36 of patients from the one Social security hospital and 18 of patients from the one Armed forces hospital) were included in the analysis.

Statistical Analysis

Patients were classified as current smokers if they smoked at least one cigarette per day at the time of the hospitalized, as never smokers if they had never smoked or less than 100 cigarettes in their lifetime, as former smokers if they had smoked regularly or occasionally in the past and before hospitalized.

Cost of hospitalization

To account for non -normality of cost data (Shapiro Wilk test ($p<0.001$). Kruskal-Wallis test was used to explore the existence of any significant difference in hospitalization cost among different groups. To consider the skewed distribution of costs, a generalised linear models with gamma and log-link was used to examine the association between cost of hospitalization and smoking status while controlling for age, sex, geographic local, type of hospital, hospital LoS and type of insurance. In the previous studies, this model has been used to be a good methods for healthcare costs (Diehr et al., 1999; Barber and Thompson, 2004; Wacker et al., 2013). Modified Park Test confirmed gamma distribution ($p=0.33$), as well as Pregibon Link-Test ($p=0.63$) and Pearson Correlation Test ($p=0.29$) confirmed the choice of the log link function. Because of age of population study was more than 35, the variable age minus 35 years were used as the offset variables. Cost data is presented in the original currency, Iranian Rial. (34500 IRR equals approximately US $1 in 2014-2015).

Hospital length of stay

The length of stay of hospital was defined from the date of admission and the date of discharge and was considered as dependent variable. The Chi-square test was used to explore the univariate association between LoS and explanatory variable included in the study. A zero-truncated poisson regression was used to examine the association between hospital LOS and smoking status while controlling for age, sex, geographic local, types of hospital and type of insurance. A p-value less than 0.05 was considered to be statistically significant and all data analysis was done by Stata software version 12.

Ethics

This study was approved by the ethics committee of the Deputy of Research, Tehran University of Medical Sciences (Code: IR.TUMS.REC.1394.659)

Results

A total of 415 patients with a mean age of 61.2 ± 9.8 years (ranged from 35 to 93) were included in the study. Men comprised 70.8% (n=294) of the all patients. The mean of LoS for all of the patients was 10.5 ± 7.9 days, for male and female was 10.7 ± 8.3 days and 10.01 ± 6.6 days, respectively. 42.9% of all of the patients was current smokers, while 43.4% and 13.7% were never and former smokers, respectively. The mean cost of hospitalization for all of the patients was 39333700 ± 34692030 IRR, for male and female was 40686100 ± 38035930 and 36047700 ± 24584440 IRR, respectively.

Cost of hospitalization and smoking status

The average cost of hospitalization was 52470550 ± 43329550 for current smokers, 38761850 ± 25870360 IRR for former smoker and 26523890 ± 19519710 IRR for never smokers. Univariate analysis based on

Kruskal-Wallis test indicate that there were a significant association between age, LoS, smoking status and type of hospitals with cost of hospitalization. The descriptive characteristics of patients included in the study based on cost of hospitalization are presented in Table 1.

Compared with never smokers, current and former smokers showed a 48% and 35% increase in hospitalization costs ($p<0.0001$), respectively. The results of glm with gamma distribution and log link function for hospitalization costs are presented in Table 2.

Hospital length of stay was associated with higher hospitalization costs. The hospitalization cost for patients with hospital LoS between 5 and 8 days had 81% higher hospitalization costs than patients with hospital LoS less than 5 days. The average cost of hospitalization for private hospitals was 1.37 times higher than compared with governmental hospitals.

Hospital length of stay and smoking status

The average hospital LoS was 13.17 ± 9.46 days for current smokers, 10.15 ± 6.21 days for former smoker and 7.96 ± 5.44 days for never smokers. Univariate analysis based on chi-square test indicate that there were a significant association between age, smoking status, type of insurance and type of hospitals with hospital LoS. The descriptive characteristics of patients included in the study

Table 1. Descriptive Characteristics of Patients Included in the Study Based on Cost of Hospitalization

Variable		Total	Hospitalization Cost (%)			P-value*
		n (%)	low	middle	high	
Sex	Male	294 (70.8)	97 (33)	100 (34)	97 (33)	
	Female	121 (29.2)	40 (33.1)	40 (33.1)	41 (33.8)	0.92
Age (year)	35-64	247 (59.5)	64 (25.9)	96 (38.9)	87 (35.2)	
	65	168 (40.5)	73 (43.4)	44 (26.2)	51 (30.4)	0.006
	Less than 5 days	98 (23.6)	78 (79.6)	14 (14.3)	6 (6.1)	
Hospital length of stay	5-8 days	102 (24.6)	45 (44.1)	52 (50.1)	5 (4.9)	
	9-13 days	103 (24.8)	14 (13.6)	53 (51.5)	36 (35)	
	More than 14 days	112 (27)	0 (0)	21 (18.7)	91 (81.3)	0.0001
	Never	180 (43.4)	30 (16.9)	67 (37.6)	81 (45.5)	
Smoking Status	Former	57 (13.7)	24 (42.1)	6 (10.5)	27 (47.4)	
	Current	178 (42.9)	83 (46.1)	67 (37.2)	30 (16.7)	0.0001
	Governmenta[1]	307 (74)	111 (36.2)	90 (29.3)	106 (34.5)	
Type of Hospital	Armed Forces	18 (4.3)	12 (66.7)	2 (11.1)	4 (22.2)	
	Private	54 (13)	3 (5.6)	32 (59.3)	19 (35.2)	
	Social Security	36 (8.7)	11 (30.6)	16 (44.4)	9 (25)	0.005
	MSIO[1]	150 (36.2)	51 (33)	50 (33.3)	49 (32.7)	
Type of insurance	SSIO[2]	167 (40.2)	61 (36.6)	50 (29.9)	56 (33.5)	
	AMIO[3]	24 (5.8)	10 (41.6)	7 (29.2)	7 (29.2)	
	Other	37 (8.9)	8 (21.7)	14 (37.8)	15 (40.5)	0.48
Geographic Local	Noninsurance	37 (8.9)	7 (19)	19 (51.3)	11 (29.7)	
	Tehran	274 (66)	86 (31.4)	103 (37.6)	85 (31)	
	Other provinces	141 (34)	51 (36.2)	37 (26.2)	53 (37.6)	0.83

[1]Medical Services Insurance organization; [2]Social Security Insurance organization; [3]Armed Forces Insurance organization.

Table 2. Results of GLM with Gamma Distribution and Log Link Function for Hospitalization Cost

Variable		Cost Ratio (95% Conf. Interval)	P-value
Sex	Male	1	
	Female	1.11 (0.94-1.30)	0.189
Age groups	65	1	
	35-64	1.09 (0.94-1.25)	0.224
	Less than 5 days	1	
Hospital length stay	5-8 days	1.84 (1.51- 2.24)	<0.0001
	9-13 days	2.96 (2.41-3.65)	<0.0001
	More than 14 days	4.70 (3.86- 5.73)	<0.0001
	Never	1	
Smoking Status	Former	1.35 (1.09- 1.66)	0.004
	Current	1.48 (1.26- 1.74)	<0.0001
Geographic Local	Tehran	1	
	Other provinces	1.05 (0.90 – 1.23)	0.48
	Governmental	1	
Type of Hospital	Armed Forces	1.22 (0.73- 2.05)	0.436
	Private	1.37 (1.06 - 1.77)	0.016
	Social Security	1.01 (0.79 – 1.30)	0.89
	AMIO3	1	
Type of insurance	Noninsurance	0.99 (0.59 – 1.67)	0.996
	SSIO2	1.20 (0.76 – 1.89)	0.427
	MSIO1	1.25 (0.79 – 1.98)	0.795
	Other	0.80 (0.47 – 1.33)	0.395

Table 3. Descriptive Characteristics of Patients Included in the Study Based on Hospital LoS

Variable		Total (%)	Hospital Length of Stay (%)				P –value*
			<5	8-May	13-Sep	>14	
Sex	Male	294 (70.8)	68 (23.1)	75 (25.5)	77 (26.2)	74 (25.2)	0.942
	Female	121 (29.2)	30 (24.8)	27 (22.3)	26 (21.5)	38 (31.4)	
Age group	35-64	247 (59.5)	50 (20.2)	54 (21.70	77 (31.2)	66 (26.7)	0.002
	65+	168 (40.5)	48 (28.6)	48 (28.6)	26 (15.5)	46 (27.4)	
Smoking Status	Never	180 (43.4)	57 (31.7)	56 (31.1)	36 (20)	31 (17.2)	0.0001
	Former	57 (13.7)	11 (19.3)	16 (28)	12 (21)	18 (31.6)	
	Current	178 (42.9)	30 (16.8)	30 (16.8)	55 30.9)	63 (35.5)	
	Governmental	307 (74)	83 (27)	74 (24.1)	62 (20.2)	88 (28.7)	
Type of Hospital	Armed Forces	18 (4.3)	10 (55.6)	5 (27.8)	0 (0)	3 (16.7)	0.001
	Private	54 (13)	0 (0)	10 (18.5)	31 (57.4)	13 (24)	
	Social Security	36 (8.7)	5 (13.9)	13 (36.1)	10 (27.8)	8 (22.2)	
	MSIO1	150 (36.2)	34 (22.7)	48 (32)	29 (19.3)	39 (26)	
Type of insurance	SSIO2	167 (40.2)	46 (27.5)	37 (22.2)	38 (22.7)	46 (27.5)	0.009
	AMIO3	24 (5.8)	9 (37.5)	4 (16.7)	5 (20.8)	6 (25)	
	Other	37 (8.9)	5 (13.5)	9 (24.3)	14 (37.8)	9 (24.3)	
Local Geographic	Noninsurance	37 (8.9)	4 (10.8)	4 (10.8)	17 (45.9)	12 (32.4)	0.19
	Tehran	274 (66)	64 (23.4)	67 (24.4)	76 (27.8)	67 (24.4)	
	Other	141 (34)	34 (24.1)	35 (24.8)	27 (19.1)	45 (31.9)	

Table 4. Results of Zero-Truncated Poisson Regression for Patients Included in the Study

Variable		Adjusted IRR(95% Conf. Interval)	P-value
Sex	Male	1	
	Female	1.13 (1.05 – 1.22)	<0.0001
Age groups	65	1	
	35-64	1.004 (0.94 – 1.07)	0.894
	Never	1	
Smoking Status	Former	1.31 (1.19 – 1.44)	<0.0001
	Current	1.72 (1.60 – 1.85)	<0.0001
Local Geographic	Tehran	1	
	Other provinces	1.21 (1.13 – 1.29)	<0.0001
	Armed Forces	1	
Type of Hospital	Governmental	1.75 (1.37 – 2.25)	<0.0001
	Private	1.94 (1.49 – 2.53)	<0.0001
	Social Security	1.53 (1.18 – 1.99)	0.001
	AMIO1	1	
Type of insurance	Noninsurance	0.80 (0.64 – 1.00)	0.056
	SSIO2	0.89 (0.73 – 1.08)	0.262
	MSIO3	0.96 (0.79 – 1.16)	0.698
	Other	0.95 (0.76 – 1.17)	0.645

based on hospital LoS are presented in Table 3.

The results of zero-truncated poisson regression about impact smoking status and others explanatory variables included in the study with hospital length of stay are shown in Table 4. The results indicated that the LoS for current and former smokers were 72% and 31% higher than compared to never smokers. Also, based on adjusted model, the LoS for patients who hospitalized in the governmental, social security and private hospitals were 76, 94 and 53% higher than compared with patients who were admitted in armed forces hospitals. There was no significant association between sex and type of insurance with LoS.

Discussion

The main objective of the present study was to examine the effect of smoking status both on cost of hospitalization and hospital LoS among patients with lung cancer in a hospital-based study in Iran. Cost of hospitalization for current and former smokers were 48% and 35% higher, respectively, than compared with never smokers. Also, compared with never smokers, hospital LoS for current and former smokers were 72% and 31% higher, respectively. To our knowledge, little information on the effects of smoking on cost of healthcare, deaths from diseases and medical care utilization are rarely documented in Iran. However, this was the first study to analyse affect smoking status on cost of hospitalization and hospital LoS among patients with LC in Iran. These findings add to our existing knowledge of the detrimental effects of cigarette smoking and are relevant specifically to patients with lung cancer.

Based on our empirical analysis indicated that cost of hospitalization and hospital LoS for current and former smokers were higher than compared with never smokers. These finding are in line with finding from studied conducted in Germany(Wacker, Holle et al., 2013), United Stated (Kahende et al., 2009), Canada (Azagba et al., 2013) and in Japan (Izumi et al., 2001). A study conducted by Kahende et al. concluded that the current smokers were more likely to be hospitalized

than compared with never smokers. Their analysis also indicated that among those who had an outpatient visit in the past year, current smokers had 4 times outpatient visits than to never smokers (Kahende et al., 2009). Wacker et al. have examined that the effect of smoking status on total cost (direct and indirect) from 2006 and 2008 in Germany. Their study have shown that there is a positive impact of current and former smoking on the healthcare utilization and total costs. They also concluded that total annual costs for current and former smokers were more than 20% and 35%, respectively, higher compared with never smokers (Wacker et al., 2013).

Also, a Study conducted by Bertakis et al. have showed that smoking has a positive significant impact on use of healthcare services, while health status, depression, and key socio-demographic variables were controlled (Bertakis and Azari 2006). Warner et al. also found that costs for current and former smokers were significantly higher compared to never smokers. They also concluded that the predicted monthly difference between current and never smokers was $ 400 whereas it was $ 273 for former smokers compared to never smokers (Warner et al., 2014). In our study, the difference between current and never smokers was 25946660 IR in cost of hospitalization, whereas it was 12237960 IR for former smokers compared to never smokers.

The differences hospital LoS was 5.21 days between current and never smokers, while it was 2.19 days former smokers compared to never smokers. This results are consistence with finding from studies conducted by Izumi et al. in Japan (Izumi et al., 2001) and Robbins et al. in USA (Robbins et al., 2000). Izumi et al have found that hospitalization rate for smokers (current plus former) was 26% in males and 22% in females higher than compared with never smokers. Robbins et al. concluded that hospitalization rate for current and former smokers were 30% and 20% higher, respectively, than compared to never smokers.

The results of the current study should be interpreted in light of some limitations. Firstly, the finding from the study based on hospitals from Tehran city, so the other studies must be conducted in other part of the country to increase the generalizability of results of this study. Second, we were unable to adjust for the effect of severity of illness among patients on cost of hospitalization and hospital LoS because of data for these factors were not available from the medical records patients. Thirds, total hospital costs do not reflect actual hospital cost of smoking due to not including governmental subsidies to hospital services and all out of pocket payments by the patients. Moreover, non-direct medical costs such as transportation and food costs and indirect costs associated with lost productivity due to disability and mortality are not included in the study. However, measuring these costs was beyond the scope of this study. Fourth, to obtain the smoking status of patients, the telephone survey was used and self-reported smoking status might be lead to under estimation of prevalence of current and former smoking.

In conclusion, the present study emphasizes the negative effect of smoking on cost of hospitalization and hospital LoS among patients with lung cancer. Based on our study, the current and former smokers were higher than cost of hospitalization and LoS compared to never smoker; indicating it is imposes a considerable burden on hospital, health system and society as a whole. It is, however, recommended that more research should be done to implement and evaluate hospital based smoking cessation interventions to better increase cessation rates in these settings.

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