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Cigarette smoking in a Middle Eastern country and its association with hospitalisation use: a nationwide cross-sectional study

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ABSTRACT

Objectives: Little is known about the distribution of cigarette smoking by place and persons at the national level or its burden on healthcare expenditure in countries of the Middle East. We examine in this study the pattern of cigarette smoking by age, gender and geography and assess its association with hospitalisation use in Lebanon, a small middle-income country in the Middle East.

Design: Population-based cross-sectional study.

Setting: The study draws on data collected as part of the nationwide multistage cluster sample Nutrition and Non-Communicable Disease Risk Factor survey conducted in Lebanon in 2009.

Participants: A total of 2836 Lebanese adults 18 years and over.

Measures: Hospitalisation, the outcome variable, was measured using one item and recoded as a dichotomous variable. Cigarette smoking, the main exposure variable, was assessed by examining smoking status and pack-years, capturing intensity, frequency and duration of exposure.

Results: The overall prevalence rate of current smoking in this study was 34.7%, with significantly higher rates in males than females (42.9% and 27.5%, respectively). Close to two-thirds of the study population reported ever being hospitalised (62.8%). Compared to non-smokers, past and current smokers were significantly more likely to be hospitalised, after controlling for sociodemographic and health-related characteristics (OR=2.9, 95% CI 1.26 to 3.34, and OR=1.35, 95% CI 1.12 to 1.63, respectively). Hospitalisation use increased significantly in a dose–response manner with increasing pack-years.

Conclusions: When compared to regional and international estimates, the prevalence rates of smoking in Lebanon are considerably high, with percentages among women being among the highest in the region. Our findings of increased odds of hospitalisation among ever smokers, net of the effect of comorbidity, underscore the additional burden of smoking on the healthcare bill cost. Continued monitoring of smoking rates and disease surveillance frameworks are warranted in developing countries for policy development and evaluation.

Strengths and limitations of this study

- The study data are unique, being the first to be collected at the national level in the country, with good external validity.
- Associations between smoking and hospitalisation were evaluated net of the effect of comorbidity and other classical risk factors, suggesting additional pathways for the relationship between smoking and health outcomes.
- The study relied on secondary data analyses; causes of hospitalisation were not available to the authors.
- Reverse causality may pose a potential limitation for some of the observed associations.

INTRODUCTION

Tobacco smoking has been established as an important risk factor for cardiovascular diseases, cancer, respiratory illnesses and a wide range of other harmful health outcomes. The WHO estimates the mortality rate associated with tobacco smoking at close to six million people per annum with a projected increase to eight million by the year 2030.[1] Also, smoking accounts for six of eight leading causes of death worldwide and is associated with a large percentage of healthcare costs.[2]

The burden of smoking on healthcare expenditure is notably reflected in the increased rates of hospitalisation as well as longer hospital stays for current and past smokers compared to non-smokers. This has been established in both genders, different age groups and across various settings.[3–5] Further support for the link between smoking and hospitalisation is evident in studies that examine the impact of public smoking bans on subsequent rates of hospitalisation. For example, Vander Weg *et al*[6] in a study in the USA showed that risk-adjusted

hospital admission rates for myocardial infarction and chronic obstructive pulmonary disease had dropped by 20–21% 3 years after implementation of smoke-free legislations. Similar results have been established in studies assessing tobacco control policies and public smoking bans in Switzerland.[7] Recent data indicate that about 70% of current smokers' excess medical care costs are preventable by quitting.[8]

Research addressing the prevalence of smoking and its related health risks has received increasing attention over the past years across the globe and more recently in the developing world. Eighty per cent of the world's one billion smokers reside in low and middle-income countries. These countries carry the higher burden of smoking-related mortality, morbidity and healthcare cost. Among its neighbouring Arab countries, Lebanon, a middle-income country of the Mediterranean region (around 4 million population and a GDP of US$9284 per capita), has been witnessing alarming rates of smoking among men and women. For example, close to 33% of adults aged 18 years and over in Beirut, the capital city, report current cigarette use, with a higher percentage among men than women (44% and 23%, respectively).[9] Cigarette smoking is also prevalent in significant proportions among physicians (30.7%), pregnant women (20%) and university students (19.2%), with recent data indicating that younger women are increasingly adopting smoking behaviour that parallels those of men.[10–12] Yet these studies are limited by being small scaled, focusing on only one segment of the population. Also, evidence linking tobacco consumption with healthcare utilisation remains largely lacking in Lebanon and the Mediterranean region. Drawing on recent data collected at the national level, this study examines the prevalence of cigarette smoking in Lebanon, its pattern of use by age, gender and locality (governorates), and assesses the association of cigarette smoking and other sociodemographic and health-related characteristics with hospital use. The paper provides detailed information on differentials in hospitalisation use between smokers and non-smokers and among various intensities of life-time cigarette consumption levels. It aims to better inform decision-makers and public health campaigns of the impact of cigarette smoking on medical expenditure, focusing on hospital use. The findings also serve as a benchmark for future assessments of the burden of smoking in the country and evaluations of policy interventions.

METHODS

Study design and sampling

This study relied on secondary analyses of data drawn from the Nutrition and Non-communicable Disease Risk Factor (NNCD-RF) survey. The NNCD-RF survey was a population-based cross-sectional study conducted on a nationally representative Lebanese sample between the years 2008 and 2009. A stratified, multistage cluster household sampling design was used with Lebanese Governorates constituting the strata from which clusters at the district level, both urban and rural, were selected. The primary sampling units were households, with one adult aged 18 years and over randomly selected from within each household to participate in the survey, using the Kish method.[13] Refusals did not exceed 10.7%, yielding a final sample of 2836 participants (1332 males and 1504 females). Further details of the study conduct and methods are presented elsewhere.[14]

Measures

The study followed the WHO STEPwise approach and guidelines in the data collection process and interview schedule for surveillance of NCD risk factors.[15] In the first step, participants responded to a comprehensive questionnaire using face-to-face interviews by well-trained research assistants with a public health or nutrition background. The questionnaire targeted information on demographic and socioeconomic characteristics, smoking and alcohol consumption, health conditions and comorbidity, and healthcare seeking behaviour.[16] Smoking is referred to hereafter in this paper to indicate 'cigarette smoking'. In the second step, anthropometric and blood pressure measurements were obtained using standardised methods and calibrated equipment. The Institutional Review Board of the American University of Beirut approved the original study design and conduct, and informed consent was obtained from all participants.

Information on cigarette smoking, the main exposure variable, was elicited in terms of status (never, past and current), duration (age at initiation and age at stopping for past smokers), frequency (number of days of smoking per week) and intensity (average number of packs consumed per day). Consequently, 'pack-years' was estimated for ever smokers by multiplying the average number of packs smoked per day by the number of years of exposure. This yielded a continuous score ranging from 0 (for never smokers) to a maximum of 184 pack-years (for ever smokers). The measure pack-years, capturing life-time cigarettes smoking exposure, was then grouped into four categories (0, 1–19, 20–39, 40–59 and ≥60 pack-years).

The main outcome variable, hospitalisation, was measured using one item 'Have you ever been hospitalized for at least one night, other than those for delivery?' and was recoded as a dichotomous variable (yes/no). The study also examined several covariates which were assessed alongside two broad categories, namely sociodemographic and health-related variables. Sociodemographic information included age (grouped into four categories: 18–34, 35–49, 50–64, ≥65 years), gender, marital status (single, married, divorced/widowed), governorate (Beirut, Mount Lebanon, North, South, Bekaa), educational level (elementary or less, secondary or technical, and university), working status (yes, no), insurance coverage and type (none, private, and

public including the National Social Security Fund (NSSF) and the Civil Servant Cooperative (COOP) and military). The NSSF covers employees in the private sector, while the COOP/military covers the civil servants in the public and governmental sector. Health-related characteristics included self-rated health (excellent, good, weak), behaviours (physical activity using the short version of the International Physical Activity Questionnaire[17] and alcohol intake coded as a 4-category variable: none or occasional, <1–2 times/week, 3–6 times/week, and daily), body mass index (BMI) and self-reported medical conditions (hypertension, hyperlipidaemia, diabetes and heart disease, and other comorbid conditions, all considered as dichotomous variables).

Statistical analysis

Prevalence estimates, expressed as numbers, percentages and means, for smoking status and intensity were calculated for the total study population and stratified by age, gender and governorate. Similarly, frequencies and descriptive statistics were estimated for sociodemographic, behavioural and health-related factors for the total sample population, as well as by hospitalisation status. Associations between the various covariates and hospital use were measured using prevalence ORs (POR) and their 95% CIs, adjusted for age. The percentage of missing data was minimal, with less than 4% of the data being missing for any single variable. Cases with missing information were excluded from the analyses. Logistic regression analyses were then conducted to estimate the prevalence odds of hospitalisation, first by smoking status and second by pack-years, adjusted for all potential confounders (age, gender, governorate, education, working status, insurance type, self-rated health, hypertension, hyperlipidaemia, diabetes heart disease and other comorbid conditions). In this analysis, and with smoking being the main exposure, the study sample was considered to be adequately powered to detect an OR of 2.0 in a logistic regression analysis that adjusts for all the covariates included in the model.[18] All statistical analyses were performed using the Statistical Software Package for Social Sciences (SPSS V.20), and a p value <0.05 was considered significant.

RESULTS

Table 1 shows the distribution of smoking status and lifetime smoking consumption (pack-year) by age and gender. One-third of the study participants were current smokers (34.7%), with higher rates in males than in females (42.9% and 27.5%, respectively). Prevalence rates of current smoking increased with increasing age, reaching its maximum value in the age group 35–49 in males (52.1%), and in the older age group 50–64 in females (45.1%), declining thereafter. A higher proportion of males than females were quitters (15.8% and 11.9% among ever smokers, respectively); this disparity was most noted in the 50–64 age group. Among ever-smokers, mean pack-year was significantly higher for males than for females (36.9±1.6 and 22.9±1.0, respectively; p value<0.05) and increased consistently with increasing age, notably among males.

The distributions of the sociodemographic and health characteristics are shown in tables 2 and 3, respectively,

Table 1 Per cent distribution of smoking (status and pack-years) by age and gender among Lebanese adults, 2009

	Smoking status				Pack-years					
	Never (%)	Past (%)	Current (%)	Quitters* (%)	0 (%)	1–19 (%)	20–39 (%)	40–59 (%)	≥60 (%)	Mean±SE*
Total	**59.5**	**5.8**	**34.7**	**14.3**	**59.8**	**19.2**	**9.4**	**6.2**	**5.3**	**31.2±1.1**
Males	49.0	8.1	42.9	15.9	49.1	21.5	11.8	8.3	9.2	36.9±1.6
Age (years)										
18–34	60.4	2.2	37.4	5.5	60.7	31.8	5.8	1.3	0.3	13.6±2.0
35–49	41.0	6.9	52.1	11.7	41.1	18.1	21.8	10.6	8.3	34.6±1.8
50–64	39.4	12.8	47.8	21.1	39.7	6.7	12.5	17.9	23.2	58.8±3.2
≥65	36.6	27.5	35.9	43.4	36.6	10.5	11.1	16.3	25.5	68.0±5.8
Females	68.8	3.7	27.5	11.9	69.0	17.3	8.1	3.7	1.9	22.9±1.0
Age (years)										
18–34	84.8	0.9	14.3	5.9	85.1	14.2	0.6	0.0	0.2	7.8±1.7
35–49	60.0	3.4	36.6	8.5	60.1	21.2	14.2	3.4	1.1	20.6±1.1
50–64	48.5	6.4	45.1	12.4	48.5	19.2	14.0	12.3	6	33.3±2.3
≥65	57.0	13.4	29.6	31.2	57.4	16.3	12.8	7.1	6.4	33.8±3.7
Governorate										
Beirut	59.2	5.5	35.3	13.5	59.2	19.4	12.0	5.2	4.2	29.1±2.5
Mount	59.1	6.5	34.4	15.9	59.5	19.7	8.8	6.2	5.9	32.9±1.8
North	59.6	6.4	34.0	15.8	60.2	20.2	9.6	5.8	4.2	27.4±1.9
South	59.2	2.8	38.0	6.9	59.7	17.8	11.2	5.8	5.6	32.4±2.7
Bekaa	61.0	6.6	32.4	16.9	61.0	18.2	9.8	5.2	5.8	30.6±2.8

*Among ever smokers.

Table 2 Distribution of the sociodemographic characteristics in the total sample and their association with hospitalisation rate, 2009

	Total sample		Hospitalisation				Age-adjusted	
			No		Yes			
	N		n	Per cent	n	Per cent		
Total	2836	Per cent	1053	37.2	1781	62.8	POR	95% CI
Age								
18–34	1264	44.6	624	49.4	639	50.6	1.00	
35–49	816	28.8	301	36.9	515	63.1	1.67	1.39 to 2.00
50–64	461	16.3	101	22.0	359	78.0	3.47	2.77 to 4.44
≥65	295	10.3	27	9.2	268	90.8	9.69	6.43 to 14.01
Gender								
Female	1504	53.0	618	41.1	884	58.9	1.00	
Male	1332	47.0	435	32.7	897	67.3	1.45	1.23 to 1.70
Marital status								
Single	995	35.1	475	47.8	519	52.2	1.00	
Married	1621	57.2	537	33.1	1083	66.9	1.15	0.94 to 1.40
Divorced/widowed	218	7.7	39	17.9	179	82.1	1.33	0.87 to 2.03
Governorate								
Beirut	309	10.9	137	44.3	172	55.7	1.00	
Mount	1213	42.8	453	37.3	760	62.7	1.19	0.91 to 1.55
North	500	17.6	194	39.0	304	61.0	1.30	0.96 to 1.75
South	466	16.4	150	32.2	316	67.8	1.60	1.17 to 2.17
Bekaa	346	12.2	119	34.4	227	65.6	1.40	1.01 to 1.95
Education								
Elementary or less	1260	44.4	372	29.5	887	70.5	1.00	
Secondary or technical	736	26.0	297	40.4	438	59.6	0.87	0.71 to 1.07
University	840	29.6	384	45.7	456	54.3	0.80	0.66 to 0.98
Working status								
No	1457	51.4	531	36.5	924	63.5	1.00	
Yes	1378	48.6	521	37.8	857	62.2	1.18	1.01 to 1.39
Insurance type								
None	1139	40.2	458	40.3	619	59.7	1.00	
Private	499	17.6	200	40.1	299	59.9	1.09	0.87 to 1.37
Public NSSF	804	28.3	286	35.6	518	64.4	1.26	1.04 to 1.54
Governmental COOP/Military	394	13.9	109	27.7	285	72.3	1.59	1.23 to 2.07

COOP, the Cooperative of Civil Servants; NSSF, the National Social Security Fund; POR, prevalence OR adjusted for age.

in the total sample and stratified by hospitalisation status. The sample consisted in the majority of younger adults (44.6%) in the age 18–34 years, with a slightly larger percentage of females (53%) than males (47.0%). Ever been hospitalised increased significantly with increasing age, and was higher in males than in females (age adjusted POR=1.45, 95% CI 1.23 to 1.70) (table 2). Also, hospitalisation declined with increasing levels of education, and was significantly higher in the South and Bekaa in comparison to other governorates. Participants covered by public and governmental insurance schemes (NSSF and the COOP/Military) were also significantly more likely to be hospitalised than those covered by the private insurance or the uninsured (p value <0.001).

The proportion of ever smokers in the total sample approached 40% with close to half of these (19.3%) having accumulated over a lifetime between 1 and 19 pack-years (table 3). The majority perceived their health status as good (58.7%) and excellent (33.2%). Close to half of the sample was involved in moderate or high physical activity levels (31.9% and 21.8%, respectively). Only 2.6% reported daily alcohol consumption. Obesity was identified in one of four study participants. Hypertension was the most prevalent comorbid condition (27.2%), followed by hyperlipidaemia (15.2%), diabetes (7.1%) and heart disease (6.3%). Compared to the never smokers (56.9%), the odds of hospitalisation were noted to be highest among past smokers (POR: 2.68, 95% CI 1.66 to 9.33) followed by current smokers (POR: 1.46, 95% CI 1.22 to 1.74) (table 3). Hospitalisation increased consistently with increasing pack-years in a dose–response fashion, yielding a rate of 86% among smokers of ≥60 pack-years. Also, hospitalisation use was significantly higher among those perceiving their health as weak, and those reporting hyperlipidaemia, diabetes, heart disease and other comorbid conditions compared to their counterparts.

Table 4 presents the results of the multivariate logistic regression with smoking status and pack-years as the main exposure variables, and hospitalisation as the

Table 3 Distribution of the health-related characteristics in the total sample and their association with hospitalisation rate, 2009

	Total sample		Hospitalisation					
			No		Yes		Age-adjusted	
	N	Per cent	n	Per cent	n	Per cent	POR	95% CI
Cigarette smoking status								
Never	1686	59.5	726	43.1	959	56.9	1.00	
Ex-smoker	164	5.8	22	13.4	142	86.6	2.68	1.66 to 4.33
Current	984	34.7	303	30.8	680	69.2	1.46	1.22 to 1.74
Pack-year								
0	1686	59.7	726	43.0	959	57.0	1.00	
1–19	545	19.3	190	34.9	355	65.1	1.44	1.18 to 1.77
20–39	267	9.5	79	29.6	188	70.4	1.34	1.00 to 1.79
40–59	175	6.2	33	18.9	142	81.1	2.06	1.34 to 3.18
>60	151	5.3	21	14.0	129	86.0	2.25	1.37 to 3.70
Self−rated health								
Excellent	937	33.2	440	47.0	497	53.0	1.00	
Good	1659	58.7	571	34.4	1087	65.6	1.43	1.02 to 1.70
Weak	230	8.1	40	17.4	190	82.6	3.00	2.07 to 4.40
Physical activity								
Low	1319	46.5	479	36.3	840	63.7	1.00	
Moderate	882	31.1	320	36.3	562	63.7	0.89	0.75 to 1.08
High	618	21.8	246	39.9	370	60.1	0.85	0.69 to 1.04
Alcohol in past year								
None/occasional	2241	79.0	847	37.8	1392	62.2	1.00	
<1–2 times/week	437	15.4	162	37.1	275	62.9	1.06	0.85 to 1.32
3–6 times/week	83	2.9	26	31.3	57	68.7	1.44	0.89 to 2.35
≥7 times/week	75	2.6	18	24.0	57	76.0	1.61	0.92 to 2.82
BMI								
Normal	1104	39.5	475	43.1	628	56.9	1.00	
Overweight	987	35.3	348	35.3	639	64.7	1.06	0.88 to 1.28
Obese	704	25.2	218	31.0	486	69.0	1.04	0.84 to 1.30
Hypertension								
No	2038	72.8	854	41.9	1183	58.1	1.00	
Yes	763	27.2	186	24.4	577	75.6	1.20	0.97 to 1.49
Hyperlipidaemia								
No	2406	84.8	974	40.5	1430	59.5	1.00	
Yes	430	15.2	79	18.4	351	81.6	1.87	1.42 to 2.46
Diabetes								
No	2540	92.9	1026	38.9	1614	61.1	1.00	
Yes	194	7.1	27	13.9	167	86.1	1.87	1.20 to 2.89
Heart disease								
No	2657	93.7	1047	39.4	1609	60.6	1.00	
Yes	178	6.3	6.0	3.4	172	96.6	8.12	3.53 to18.67
Other comorbid conditions								
No	1999	70.7	871	43.6	1127	56.4	1.00	
Yes	830	29.3	180	21.7	650	78.3	2.05	1.69 to 2.50

BMI, body mass index; POR, prevalence OR adjusted for age.

outcome. In the fully adjusted model, ever smokers were significantly at higher odds of hospitalisation than non-smokers, with the magnitude of the association being larger for the past smokers than the current smokers (OR=2.09, 95% CI 1.26 to 3.44; and OR=1.35, 95% CI 1.12 to 1.63, respectively). Hospitalisation rates increased with increasing life-time exposure to smoking (p for trend <0.01). Life-time consumption of 40–59 pack-years and ≥60 pack years showed significant associations with hospitalisation use with an adjusted POR=1.68 (95% CI 1.06 to 2.67) and POR=2.01(95% CI 1.15 to 3.49), respectively. When compared to the non-insured, the COOP/military public insurance schemes had higher odds of hospitalisation than their counterparts (POR=1.80), for both regression models of smoking status and pack-years.

DISCUSSION

This study adds to the growing body of knowledge in the developing world showing evidence of the hazards of tobacco use, with a focus on the association of cigarette

Table 4 Multivariate analysis: smoking and hospitalisation use

	Model with smoking status as main exposure		Model with pack-years as main exposure	
	Fully-adjusted POR	95% CI	Fully-adjusted POR	95% CI
Exposure variable				
Smoking status (never)	1.00			
Ex-smoker	2.09	1.26 to 3.44		
Current	1.35	1.12 to 1.63		
Pack –year (0)			1.00	
1–19			1.38	1.11 to 1.71
20–39			1.17	0.86 to 1.59
40–59			1.68	1.06 to 2.67
≥60			2.01	1.15 to 3.49
p Value for trend			<0.01	
Sociodemographic characteristics				
Gender (female)	1.00			
Male	1.61	1.32 to 2.00	1.60	1.32 to 1.96
Age (18–34)	1.00		1.00	
35–49	1.25	1.02 to 1.53	1.26	1.03 to 1.55
50–64	1.97	1.47 to 2.66	1.91	1.41 to 2.60
≥65	4.40	2.71 to 7.15	4.46	2.74 to 7.26
Governorate (Beirut)	1.00		1.00	
Mount	1.24	0.94 to 1.64	1.24	0.94 to 1.63
North	1.31	0.95 to 1.81	1.32	0.96 to 1.82
South	1.67	1.20 to 2.32	1.65	1.19 to 2.30
Bekaa	1.44	1.01 to 2.06	1.44	1.01 to 2.04
Education (elementary or below)	1.00		1.00	
Secondary or technical	0.93	0.75 to 1.16	0.95	0.76 to 1.17
University	0.85	0.68 to 1.07	0.86	0.68 to 1.08
Working status (not working)	1.00			
Working	1.11	0.91 to 1.34	1.10	0.91 to 1.34
Insurance type (none)	1.00			
Private insurance	1.37	1.06 to 1.78	1.40	1.08 to 1.81
Public NSSF	1.44	1.16 to 1.79	1.45	1.17 to 1.80
Governmental COOP/military	1.80	1.36 to 2.37	1.80	1.37 to 2.38

POR adjusted for gender, age, governorate, Education, working status, Insurance type, self-rated health, hypertension, diabetes, heart disease and other comorbid conditions.
COOP, the Cooperative of Civil Servants; NSSF, the National Social Security Fund; POR, prevalence OR.

smoking with hospitalisation use. Ever smokers, current and past smokers, were significantly more likely to have been hospitalised in comparison to those who had never smoked, net of the effect of established cardiovascular risk factors and comorbidity. The intensity and duration of smoking, measured in terms of life-time consumption of pack-years, showed a significant dose–response relationship with hospital use.

Current prevalence rates of smoking in Lebanon from this study are estimated at 35%. This figure is among the highest in the region and exceeds estimates obtained from the USA (23%) and Europe (26% in Great Britain, 27% in Germany and 30% in France).[2] In the Arab region, smoking prevalence rates vary, ranging from as low as 20% in Bahrain and Egypt to high rates in Tunisia (31%) and Kuwait (34.4%).[1 19] Also, national estimates for ex-smoking rates from this study (5.8%) appear to be one of the lowest compared to countries worldwide and in the region. For example, ex-smoking rates approach 32% in the USA and 10.2% in Saudi Arabia.[20 21]

As elsewhere, men in Lebanon were more likely to be smokers than women (1.6 times). Historically, men exhibited much greater prevalence rates than women, with the ratio reaching as high as 5–1 in certain regions.[22] While the lower smoking rates in women are likely to be attributed to under-reporting and social desirability biases, this gender differential has been declining worldwide, as women are increasingly adopting smoking behaviour that parallels those of men, to the extent that sex ratios are approaching 1 in France and reaching below 1 in Norway.[2 23] In Lebanon, the gap in smoking between men and women has been relatively narrow as early as the 1960s (male to female ratio not exceeding two),[24] and appears to be among the lowest when compared to estimates from neighbouring countries. For example, the male-to-female smoking ratio is 5.33 in Syria, 9.53 in Jordan and 27 in Saudi Arabia.[21 25 26] Lebanon has long been characterised as more liberal than other Arab societies, with westernisation and diminishing cultural constraints on women's

behaviour contributing to the consistently high prevalence rates among women in the country. In contrast, sociocultural traditions in most countries of the Arab region, including male dominance and the limited opportunity for the majority of women for work and risk exposures, may have influenced the overall low female smoking rates.[23]

Our study showed a direct and significant relationship between smoking and hospitalisation. Past and current smokers were significantly more likely to have been hospitalised than those who had never smoked, net of the effect of comorbidity. Similarly, percentages of hospitalisation use increased significantly with increasing pack-years. The higher odds of hospitalisation in past smokers in comparison to current smokers corroborate findings from other studies elsewhere.[5 27 28] This is likely to be due to reverse causality, with smokers who have developed a serious chronic illness resulting in hospitalisation being more likely to quit smoking. Indeed, post hoc analysis of our data revealed that 65% of past smokers reported deteriorating health as the main reason for quitting smoking. Hence, declining health and incident diseases requiring hospitalisation become the cause for quitting rather than the consequence, a phenomenon described as the 'ill quitter' effect.[29]

The observed differentials in the proportions of hospitalisation by the various insurance coverage schemes in our study merit some consideration. Our analyses revealed that those covered by governmental and military schemes were particularly at higher odds of hospitalisation than their counterpart, net of the effect of sociodemographic characteristics and comorbidity. A number of explanations are offered here. First, this may partly be due to the self-selection of the 'older and sicker' population into such public insurance modalities,[30] thus potentiating a greater use of hospital services. Alternatively, it may be attributed to the specific nature of services offered across the different insurance schemes in Lebanon. In comparison to the private sector and the NSSF, the schemes covering the civil servants (both COOP and military) present themselves with a less rigid gatekeeping rein and less complex bureaucratic admission processes, which may increase the likelihood of health-seeking behaviour and act as push factors towards enhanced utilisation of hospital care.

The findings of this study need to be considered in the light of the following limitations. Given the inherent limitation of cross-sectional study designs, one can only draw an association but not solid causal inferences from our study. As mentioned earlier, reverse causality is a likely explanation for the relatively large magnitude of the association between past smoking and hospitalisation. Also, the outcome 'ever been hospitalized' is a crude measure and does not detail the reasons for hospitalisation, or whether admissions were due to smoking-related diseases. Yet, with smoking being a lifetime exposure and hospital use being a recurrent event, the relationship between smoking and hospital use is better captured using hospital use over time, rather than within a certain limited recall period. Additionally, including hospitalisations which are not necessarily due to smoking-related diseases is likely to have attenuated associations, with the current findings being considered underestimates of the magnitude of the association between cigarette smoking and hospital use. Furthermore, the observed regression estimates of smoking effect may have been affected by residual or unmeasured confounding bias, owing to the use of crude measures of certain variables that have been only partially controlled for (eg, the use of dichotomous measures of comorbidity) or the omission of others from the regression model (eg, marital status or indicators of income). Finally, early life exposure to high intensity smoking doses may have resulted in a differential competing risk of earlier mortality, leading to survivor bias, and hence attenuation of associations among survivors at older ages.

In conclusion, our findings of increased odds of hospitalisation among ever smokers, net of the effect of comorbidity, underscore the additional burden of smoking on healthcare. The high rate of smoking behaviour in Lebanon, coupled with increasing costs of medical care and an ageing population, is likely to adversely impact on the healthcare bill in the country. Smoking-related health costs in Lebanon are estimated at around 146 million dollars.[31] Furthermore, public resources and the governmental budget will bear the greatest burden as citizens continue to rely on services provided by the public insurance schemes. Lebanon ratified the WHO Framework Convention for Tobacco Control in December 2005, and passed the law in 2011 banning smoking in public places, restaurants, cafes and bars among others. While great strides have been achieved so far (eg, health warning labels on cigarette packages), smoking remains until today a socially accepted behaviour, with strategies for implementation of current policies being slow and not without obstacles. One major problem lies in the lack of dedicated funds for the enforcement of the tobacco control law, particularly for restriction of smoking behaviour in governmental public buildings and in restaurants and closed areas. Furthermore, the country lacks an effective national surveillance scheme of tobacco use and there is no proper planning of tobacco control initiatives. Our study calls for the need for serious efforts for closing the loopholes in the tobacco law and for proactive policies for an effective tobacco control policy in the country. This study is the first national survey to be conducted in Lebanon with results generalisable to the total population; it serves as a benchmark for future studies to assess whether the 2011 legislation has had an effect on the prevalence of smoking. Disease surveillance frameworks and continuous monitoring of NCD risk factors are increasingly warranted in Lebanon and other developing countries to provide stakeholders with timely information needed for development and assessment of policies and programmes.

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