ICASH-A02

BURDEN OF CANCER ATTRIBUTABLE TO SMOKING IN GULF COOPERATION COUNCIL (GCC) COUNTRIES, 2015

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ABSTRACT

***Background**: Smoking is a major cause of premature mortality worldwide. Smoking is recognized as the leading preventable cause of cancer and mortality from cancer. This study aims at estimating the number of cancer mortality and years of potential life lost (YPLL) attributable to smoking in GCC countries in 2015.*
***Methods**: Smoking prevalence was combined with Relative Risks (RRs) of cancer to obtain smoking attributable fractions (SAFs). Mortality data of people older than 15 years were derived from WHO deaths estimates while life expectation was obtained from WHO life tables 2015. Sixteen types of cancer were included in the analysis.*
***Results**: Smoking is responsible for 2,141 cancer deaths among people aged 15 years and above in GCC countries (1,895 deaths among men, 246 deaths among women). This represents 15% of cancer deaths in GCC (26.43% in male, 3.5% in female). Additionally, cancer deaths attributable to smoking were responsible for 40,485 YPLL (35,361 years among men, 5,124 years among women).*
***Conclusion**: Smoking causes a considerable burden in GCC countries in term of mortality and years of potential life lost. Effective smoking control initiatives and sustained efforts are needed to minimize cancer burden in the future.*

***Keywords**: Cancer, GCC, Premature mortality, Smoking, YPLL*

INTRODUCTION

Cancer is a major public health problem. Globally, cancer is recognized as the second leading cause of premature mortality [1]. Smoking is a well-established risk factor for many types of cancer [2]. Globally, smoking is estimated to cause 30% of cancer deaths in 2004 [3].

The Gulf Cooperation Council [GCC]'s health council consists of seven countries, Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates, and Yemen [4]. The aggregated population of GCC is estimated to be 82 million people [5, 6]. Currently, cancer has become a major public health problem and extensively impacts healthcare system [7]. Now cancer ranks among top four leading causes of death in this region. During the period from 1998 to 2009, 119,288 newly diagnosed cancer cases among the population of GCC countries except Yemen [8]. Moreover, these numbers were expected to increase in GCC due to several limitations in healthcare facilities, and rapid socioeconomic shifts that have led to unfavorable changes in lifestyle like physical inactivity, non-adherence to healthy foods, and on top of that high smoking rates [9]. By 2020, the new cancer cases would be expected to double, which equals a growth rate of almost 3 times greater than the international rate [10].

According to the World Health Organization, prevalence of smoking among male and female were 36.1%, and 6.8%, respectively. Although prevalence of smoking is declined in many countries, the prevalence of smoking appears to be increasing among GCC countries [11]. GCC countries witnesses an increase in smoking rates and

re-emergence of water pipe smoking as a popular tobacco use method [12]. In GCC countries the average number of smoked cigarette is 23.4 cigarettes per smoker per day in 2102 greater than the global average of 18 cigarettes [13]. Unprecedentedly, in some GCC countries the smoking rate increased by nearly 500% since 1990 to 2012 [10]. Hence, the objective of this study is to estimate the number of cancer mortality and YPLL attributable to smoking in GCC countries in 2015.

METHODS

Smoking Attributable Fraction (SAF)

Smoking attributable fraction (SAF) is a highly useful tool to estimate the death ratio, which can be attributed by smoking. To estimate SAF, the following formula [14] will be used:

SAFi (%) = 100* [P (RRi-1)/1+P (RRi-1)]

Where P is the prevalence of smoking and RRi is the relative risk of smoking for each type of cancer (i) included in the analysis.

Prevalence of smoking

Prevalence of smoking is the percentage of smokers in a given population [14]. For each country, the prevalence of smoking among individuals aged 15 years or above was obtained from WHO global health observatory date repository [11], and WHO report on the global tobacco epidemic 2017 [15] as shown in table 1. The effect of smoking on cancer risk is understood to be the result of past exposure. The time between initiation of exposure to smoking and cancer diagnosis is known as the latency period and start 2 to 33 years of the beginning of exposure to smoking [16]. Owing to data availability, the prevalence of 2009 was used for UAE, 2010 for Bahrain, Oman, and KSA, 2013 for Qatar and Yemen, and 2014 for Kuwait.

Table 1. Prevalence of smoking among GCC countries

Country/ year	Prevalence of current smoking of any tobacco product		Population as of July 2017 (Millions)	Reference
	Male	Female		
Bahrain/ 2010	34.8	6.5	1.4	[11]
Kuwait/ 2014	39.2	3.3	4.4	[15]
Oman/ 2010	18	1	4.6	[11]
Qatar/ 2013	21.3	0.6	2.6	[15]
KSA/ 2010	26	2.8	32.3	[11]
UAE/ 2009	28	0.9	9.3	[15]
Yemen 2013	21	6	28.3	[15]

KSA= Kingdom of Saudi Arabia, UAE= United Arab Emirates

Relative Risk

RR shows the extent to which the disease i is associated with exposure to smoking in comparison to non-exposed group. RRs of smoking-related cancers have been obtained from most recent, well-designed meta-analysis [3, 17, 18] and were summarized in table 2. Owing to lack of meta-analysis from GCC region, global meta-analyses which are comprehensive and most updated were used instead. The cancers included in this study are breast, bronchus, lung and trachea, cervix uteri, colorectal, esophagus, kidney, larynx, leukemia, lip and oral cavity, liver [excluding cancers secondary to hepatitis B, hepatitis C, and alcohol drinking], nasopharynx, other pharynx, ovary, pancreas, stomach, and urinary bladder [2, 3].

Table 2. Relative risks for smoking-related cancers

Type of cancer	Relative Risks (RR)		Reference
	Male	Female	
Lip, Oral Cavity cancer	3.43	3.43	[17]
Nasal, sinus cancer	1.95	1.95	[17]
Pharynx cancer	6.76	6.76	[17]
Esophagus cancer	2.50	2.50	[17]
Stomach cancer	1.74	1.45	[17]
Colon and rectum cancers	1.13	1.40	[17]
Liver cancer	1.56	1.56	[17]
Pancreas cancer	1.70	1.70	[17]
Trachea, bronchus, and lung cancers	10.92	10.92	[18]
Breast cancer	NA	1.06	[3]
Cervix uteri cancer	NA	1.83	[17]
Ovary cancer	NA	2.07	[17]
Leukemia	1.09	1.09	[17]
Kidney cancer	1.52	1.52	[17]
Bladder cancer	2.77	2.77	[17]
Larynx cancer	6.98	6.98	[17]

NA = not applicable

Estimation of smoking attributable deaths (SAD)

For each type of cancer (i), the number of premature mortality attributable to smoking in 2015 was estimated by multiplying the corresponding SAFi with the total number of death (aged 15 years or over) in 2015. The Number of deaths by age and gender for cancers in all GCC countries were derived from WHO estimated deaths, which published in March 2017, where the number of death by cause, gender, country, and age (15-29, 30-49, 50-59, 69-69, 70-79) were reported [19].

Estimation of years of potential life lost (YPLL)

YPLL is determined as the remaining years of life expectancy at the time of death. The remaining life expectancy at the time of death was determined using life-tables published by WHO for 2015 [20].

RESULTS

Based on our estimates of smoking prevalence rates and the RRs of included cancers, SAFs were calculated. The SAFs were substantially higher for males than females, resulting from higher prevalence of smoking among males. Table 3 shows the SAFi for each cancer type in all GCC countries.

Table 3. Smoking Attributable Fractions (SAFi)

Cancer type	SAF %													
	Bah		Kuw		Oma		Qat		KSA		UAE		Yem	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Lip, Oral Cavity	46	14	49	7	30	2	34	1	39	6	40	2	34	13
Nasal, sinus	25	6	27	3	15	1	17	1	20	3	21	1	17	5
Pharynx	67	27	69	16	51	5	55	3	60	14	62	5	55	26
Esophagus	34	9	37	5	21	1	24	1	28	4	30	1	24	8
Stomach	20	3	22	1	12	0	14	0	16	1	17	0	13	3
Colon and rectum	4	3	5	1	2	0	3	0	3	1	4	0	3	2
Liver	16	4	18	2	9	1	11	0	13	2	14	1	11	3
Pancreas	20	4	22	2	11	1	13	0	15	2	16	1	13	4
Lung	78	39	80	25	64	9	68	6	72	22	74	8	68	37
Breast	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0
Cervix uteri	NA	5	NA	3	NA	1	NA	0	NA	2	NA	1	NA	5
Ovary	NA	7	NA	3	NA	1	NA	1	NA	3	NA	1	NA	6

Cancer type	SAF %													
	Bah		Kuw		Oma		Qat		KSA		UAE		Yem	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Leukemia	3	1	3	0	2	0	2	0	2	0	2	0	2	1
Kidney	15	3	17	2	9	1	10	0	12	1	13	0	10	3
Bladder	38	10	41	6	24	2	27	1	32	5	33	2	27	10
Larynx	68	28	70	16	52	6	56	3	61	14	63	5	56	26

M= male, F= female, Bah= Bahrain, Kuw= Kuwait, Oma= Oman, Qat= Qatar, KSA= Kingdom of Saudi Arabia, UAE= United Arab Emirates, Yem= Yemen. NA = not applicable

Table 4. Number of cancer mortality attributable to smoking, 2015

Cancer site	Cancer mortality attributable to smoking															
	Bah		Kuw		Oma		Qat		KSA		UAE		Yem		Total	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Lip, Oral Cavity	1	0	3	0	3	0	2	0	25	3	7	0	31	13	73	17
Nasal, sinus	0	0	1	0	1	0	1	0	22	1	3	0	16	4	43	5
Pharynx	1	0	0	0	4	0	1	0	18	3	10	0	7	11	41	15
Esophagus	2	0	4	0	4	0	3	0	39	4	9	0	52	22	114	27
Stomach	3	0	4	0	7	0	4	0	52	2	13	0	39	4	122	7
Colon and rectum	1	0	3	1	2	0	1	0	25	6	4	0	8	4	43	12
Liver	0	0	1	0	0	0	0	0	9	1	1	0	1	0	12	1
Pancreas	3	0	7	0	4	0	2	0	40	3	7	0	14	5	76	10
Lung	38	8	61	5	48	2	49	1	497	47	121	3	207	38	1,021	104
Breast	NA	0	NA	0	NA	0	NA	0	NA	2	NA	0	NA	4	NA	6
Cervix uteri	NA	0	NA	0	NA	0	NA	0	NA	2	NA	0	NA	6	NA	9
Ovary	NA	1	NA	1	NA	0	NA	0	NA	6	NA	1	NA	14	NA	23
Leukemia	0	0	1	0	1	0	1	0	6	0	1	0	10	2	21	2
Kidney	1	0	2	0	1	0	1	0	21	1	3	0	5	0	35	2
Bladder	3	0	9	0	9	0	3	0	69	2	7	0	32	1	132	4
Larynx	4	-	4	0	4	0	3	0	35	1	11	-	101	2	162	2
Total	58	11	100	9	87	3	70	1	859	85	196	6	525	132	1,895	246
Total cancer death	138	122	293	310	400	277	245	120	3,193	2,899	576	472	2,325	2,915	7,170	7,115

M= male, F= female, Bah= Bahrain, Kuw= Kuwait, Oma= Oman, Qat= Qatar, KSA= Kingdom of Saudi Arabia, UAE= United Arab Emirates, Yem= Yemen. Roundup in calculations, NA = not applicable

Table 4 shows the number of cancer deaths attributable to smoking in GCC countries by gender. It was estimated that in 2015, there were 2,141cancer deaths attributable to smoking in GCC. Of this 1,895 deaths 88.5% occurred among men and 246 deaths 11.5% among women. The total number of cancer death attributable to smoking among men were 8 times higher than those of women. The number of premature mortality was the highest in Saudi Arabia, followed by Yemen. Lung cancer represents 53% of all premature mortality from cancer attributable to smoking. In both gender, 15% of cancer deaths in GCC was attributable to smoking (26.4% in male and 3.4% in female) in 2015.

Table 5 shows YPLLs attributed to smoking by type of cancer, country, and gender. As shown in the table, 40,485 YPLL (35,361 years among men, 5,124 years among women) were attributable to smoking.

Table 5. YPLL attributable to smoking in GCC 2015

Type of cancer		Bah	Kuw	Oma	Qat	KSA	UAE	YEM	Total
M	Lip, Oral Cavity	37	80	101	61	515	213	765	1,772
	Nasal, sinus	8	21	20	18	557	80	395	1,099
	Pharynx	16	0	112	13	347	228	40	756
	Esophagus	37	70	75	60	665	241	647	1,795
	Stomach	64	79	145	101	912	305	543	2,149
	Colorectal	19	57	40	33	485	96	171	901
	Liver	1	14	7	11	139	18	22	212
	Pancreas	69	126	84	52	720	162	272	1,485
	Lung	621	989	1,009	1,218	9,105	2,722	2,987	18,651
	Breast	NA	NA	NA	NA	NA	NA	NA	NA
	Cervix uteri	NA	NA	NA	NA	NA	NA	NA	NA
	Ovary	NA	NA	NA	NA	NA	NA	NA	NA
	Leukemia	10	44	29	23	173	41	334	654
	Kidney	17	52	25	33	418	63	155	763
	Bladder	42	121	155	42	1,135	133	342	1970
	Larynx	54	77	93	51	675	281	1,923	3154
	Total	995	1,730	1,895	1,716	15,846	4,584	8,596	35,361
F	Lip, Oral Cavity	5	10	0	0	72	5	272	364
	Nasal, sinus	0	0	0	0	30	1	105	136
	Pharynx	0	1	1	0	83	4	135	224
	Esophagus	3	3	2	1	85	9	420	523
	Stomach	3	5	3	1	50	3	68	133
	Colorectal	9	13	4	2	145	5	112	290
	Liver	1	1	1	0	12	0	9	24
	Pancreas	5	9	2	0	72	5	86	179
	Lung	118	88	37	25	1,066	99	710	2,143
	Breast	5	7	1	0	44	3	98	158
	Cervix uteri	5	9	4	1	57	8	114	198
	Ovary	20	19	6	2	149	17	284	497
	Leukemia	1	2	1	0	15	1	56	76
	Kidney	2	2	1	0	27	1	3	36
	Bladder	2	4	2	0	34	1	15	58
	Larynx	0	6	0	0	12	0	67	85
	Total	179	179	65	32	1,953	162	2,554	5,124
All		1,174	1,909	1,960	1,748	17,799	4,746	11,150	40,485

M= male, F= female, Bah= Bahrain, Kuw= Kuwait, Oma= Oman, Qat= Qatar, KSA= Kingdom of Saudi Arabia, UAE= United Arab Emirates, Yem= Yemen. Roundup in calculations, NA = not applicable

DISCUSSION

This analysis found that smoking is responsible for 2,141 cancer death and 40,485 YPLL due premature mortality in GCC 2015. This figures are slightly lower than studies from other parts of the world owing partly to the small number of population in this region. Our findings show that 15% of cancer deaths in GCC was attributable to smoking (26.43 in male, 3.5% in female) which is much lesser than ASEAN countries 44.2% in male, 94% in female [19], France 33.4% in male, 6.1% in female [20], Indonesia 30.6% [21], Japan 35% [22], and UK 23% in male, 16% in female [23]. That is possibly due to the region remains in the initial stage of tobacco epidemic, which means that it will experience an increase in smoking-related morbidity and mortality in the future [12].

Similar to other previous studies, the greatest association was seen between smoking and lung cancer 53% (71% in male, 24% in female) followed by laryngeal cancer 56% (58% in male, 21% in female) and pharyngeal cancers 39% (58% in male and 21% in female). Limitations of this study include:

underestimation of cancer mortality due to exclusion of smokeless types of tobacco and secondhand smoking. In addition, due to the unavailability, RRs were based on data from studies carried out outside GCC in regions. Lastly, it should be noted that the WHO mortality data used in this analysis were conservative and were estimated using modelling technic due to lack of national data for some countries.

CONCLUSION

Smoking causes a considerable burden in GCC countries in terms of mortality and potential life lost. Due to the escalating smoking epidemic in the region, and the fact that smoking is one of the most important preventable cause of cancer, more effort on smoking control should be a policy priority.

CONFLICT OF INTEREST

There is no conflict of interest to declare.

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