

## RESEARCH PAPER

# Public awareness of environmental risk factors of cancer and attitude towards its prevention among the Lebanese general population

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## Keywords

Awareness • Cancer • Risk factors • Lebanese • Prevention

## Summary

**Introduction.** Since the majority of cancers occur as a result of modifiable risk factors, cancer is being seen more as a preventable disease. The primary objective of our study was to assess the level of awareness of environmental risk factors of cancer among the Lebanese general population. The secondary objective focused on identifying the predictors of the preventability of the disease.

**Methods.** We conducted a cross-sectional study between June and July 2020. An online questionnaire was used to collect data pertaining to the knowledge of environmental risk factors of cancer, source of information and personal practice of the participants. Bivariate and multivariate analyzes were performed.

**Results.** About 387 respondents agreed to participate in the study.

The study showed low awareness regarding infectious agents, lifestyle, diet and many work exposures. The predictors of the attitude of respondents regarding the preventability of cancer were: believing that cancer has an environmental cause ( $p=0.014$ ), not having a healthy lifestyle ( $p = 0.004$ ), not smoking waterpipe ( $p = 0.023$ ), being single ( $p = 0.013$ ), and having a university degree ( $p = 0.049$ ).

**Conclusions.** Efforts should be made to improve awareness of the cancer risk factors regarding infectious agents, lifestyle, diet and many work exposures. This can also be followed by further studies assessing the impact of these community and governmental cancer prevention initiatives on cancer risk factors level of awareness.

## Introduction

Cancer is the second leading cause of death globally, accounting for an estimated 9.6 million deaths, or one in six deaths in 2018 [1]. In Lebanon, the risk of being diagnosed with cancer before the age of 75 is estimated to be 17.5% and 7,100 new cases of cancer are diagnosed each year [2].

According to the World Health Organization research, 35% of deaths caused by cancer worldwide are due to potentially preventable or modifiable risk factors. These risk factors are related to lifestyle, including smoking and alcohol consumption, infections, parasites, exposure to ultraviolet (UV) light and tanning using devices that emit UV radiation, environmental exposures, dietary factors, hormone replacement therapy, as well as exposure to ionizing radiation [3-6]. Worldwide, tobacco use causes the death of around 6 million people every year [7]. Cigarette smoking is the most harmful form of tobacco use, causing the largest cancer burden. Passive smoking, like actual smoking is also carcinogenic. Substances contained in tobacco smoke sediments remains chemically active and are harmful to health [7-9]. Moreover, the international agency for research on cancer (IARC) has classified alcohol as a Class I carcinogen for liver cancer [10, 11]. It also increases the risk of cancer of the mouth, throat,

larynx, esophagus, liver and breast [10-12]. Diet also plays an important role in contributing to cancer development. Indeed, the World Cancer Research Fund Report 2007 estimates that 35% of the incidences of cancer worldwide can be linked to nutrition and lack of physical activity [13]. Epidemiological studies have also shown that obese patients with oncological treatment have worse prognoses and greater morbidity and mortality than those with normal Body Mass Index (BMI) [14, 15]. According to a synthetic analysis, infections are linked to about 15.4% of cancers worldwide [16], this percentage is variable between countries and was found to be approximately equal to half of the worldwide burden in Italy [17]. Another cancer risk factor is certain workplace exposures. The Centers for Disease Control and Prevention (CDC), estimates 3 to 6% of all cancers worldwide to be caused by exposures to carcinogens in the workplace [18]. Additionally, over 120 chemical or biological agents are classified as carcinogens by the IARC [19]. The main agents found to be contributing to the workplace cancer are asbestos, shift-work involving night work, mineral oils, solar radiation, silica, Diesel Engine Exhaust (DEE), coal tars and pitches, occupation as a painter or welder, dioxins, environmental tobacco smoke, radon, tetrachloroethylene, arsenic and strong inorganic acid mists [20]. Indoor radon could explain 10% of all

lung cancer deaths each year in France [21]. To add, according to a recent study done in South-Eastern Italy, areas at higher radon concentrations seem to overlap with those characterized by the highest pulmonary cancer mortality and incidence rates, thus indicating that human exposure to radon could possibly enhance other individual or environmental pro-carcinogenic risk factors (i.e. cigarette smoking, air pollution and other exposures) [22]. Other important carcinogens that are found to be linked to cancer include bisphenol A, phthalates and naphthalene [23, 24], household cleaning products, plastic containers, indoor combustion, soot and wood dust [25].

Cancer prevention is a crucial step and the most cost-effective long-term strategy for the control of cancer specially in middle and low-income countries [26]. Prevention programs are an important weapon to fight against cancer, because they can contribute to reducing both the incidence of cancer and mortality [27]. The risk of getting cancer can be also reduced by making healthy choices. Keeping a healthy weight, avoiding tobacco, limiting the amount of alcohol you drink, eating a healthy diet with plenty of fruit and vegetables, exercising regularly, limiting alcohol use, practicing safe sex, reducing exposure to UV and ionizing radiations (occupational or medical diagnostic imaging), avoiding urban air pollution and indoor smoke from household use of solid fuels can all contribute to decreasing the risk of cancer [1].

Awareness of evidence-based risk factors is considered an important part of cancer prevention. Many studies were done in the US [28], UK [29] causing an estimated 9.6 million deaths in 2018. Low cancer symptom awareness has been associated with poor cancer survival for all cancers combined. The Cancer Awareness Measure (CAM, Japan [30], Tanzania [31], Nepal [32], Iran [33], UAE [34], Oman [35], Saudi Arabia [36], India [37]) to estimate the knowledge of people about cancer and its risk factors and to implement many public health interventions to increase awareness. The knowledge level differed between these countries. Other studies suggest that awareness of specific risk factors vary for different cancer types [38].

In Lebanon, several studies estimated the knowledge of risk factors of specific types of cancer like colorectal cancer [39], breast cancer [40] and cervical cancer. However, no studies were done to assess the level of public awareness concerning the evidence-based risk factors of cancer in general among the Lebanese general population. There is a need for such studies in Lebanon in order to know how to intervene and implement a prevention strategy specially that the cancer incidence in Lebanon is among the highest in the region and is expected to remain as such over the coming decade [41, 42]. Thus, the primary objective of this study was to assess the public awareness of environmental risk factors for cancer among the Lebanese general population. The secondary objective focused on identifying the predictors of the attitude of respondents regarding the preventability of the disease.

## Materials and methods

### STUDY DESIGN AND PARTICIPANTS

A descriptive cross-sectional study was conducted over a period of two months from June until July 2020 to estimate the awareness about the environmental risk factors of cancer among the Lebanese general population. The inclusion criteria included: being Lebanese aged 18 or more, residing in Lebanon, and speaking Arabic or English.

### SAMPLE SIZE CALCULATION

To calculate the minimum sample size needed, Epi info was used. The expected frequency was set 50% because no similar study was conducted in the region and a margin error of 5% was also considered. Accordingly, 384 participants were required and targeted.

### DATA COLLECTION TOOL

The tool used in this study was an online standardized questionnaire developed using google form. The questionnaire was based on literature review [19, 28-30, 34-36]. It consisted mainly of closed-ended, dichotomous (yes/no), multiple choice questions or a 5-point Likert type scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree).

The questionnaire encompasses 3 main parts. The first part is entitled “demographic and general information” and was mainly to collect sociodemographic and background information about the participants. The second part is entitled “General knowledge about cancer and its environmental risk factors” and contained questions regarding 43 environmental cancer risk factors where the answer would be in the form of 5-point Likert scale. This part also included a question about if the participant thinks cancer is preventable or not and 3 questions regarding the participant source of information. The third part is entitled “personal practice” and was mainly designed to collect some information about the participant lifestyle. This section included questions about lifestyle habits and behaviors that can somehow reflect if the participant is trying to have a healthy lifestyle or not specially that these behaviors are self-controlled like smoking, waterpipe, alcohol consumption, red meat consumption, fruits and vegetables consumption, physical activity, high sugar food consumption and excessive exposure to sunlight. The questionnaire was first written in English, translated to Arabic and then back translated to English by another person. The objective of the questionnaire was provided at the beginning of the survey in the cover letter which included the purpose of the survey and the time needed to fill the questionnaire which is 5 to 10 minutes. To ensure face and content validity, the questionnaire was pilot tested and reviewed by three experts in the field of cancer.

## RECRUITMENT OF PARTICIPANTS

Questionnaires were first sent electronically as a link using Google forms through social media applications. The response rate was estimated based on the percentage of people responding by Yes to the question asking them if they accept to participate in the study that was mainly considered as a consent. Although we couldn't track the non-responders, reminder messages were sent again. A pilot study of 14 respondents was conducted to assess the clarity of the questionnaire in both languages and the validity and reliability of the Arabic version. Even though, this study doesn't require any definite ethical approval but a verbal consent was obtained from all participants before filling the questionnaires by asking them if they want to participate in the study. All data were collected in a manner that respects participant's anonymity and confidentiality.

## STATISTICAL ANALYSIS

Analysis of data was carried out using the Statistical Program for Social Sciences (SPSS) version 21. Descriptive analysis was first performed to evaluate the distribution of the socio-demographic characteristics of the participants, their lifestyle behaviors, their knowledge about cancer and its environmental risk factors, and their source of information. The dependent variable is a dichotomous variable: cancer preventable or not. Bivariate analysis was done for all variables related to sociodemographic, cancer history, cancer cause and practice. Since all of our variables are categorical variables, the Chi square and Fisher exact tests were used when applicable. The Cochran Armitage trend test was performed for categorical variables following a specific order such as age, BMI, income, education and variables related to practice. Differences with a two-tailed p-value < 0.05 were considered as statistically significant. Multivariate analysis using logistic regression was also performed. Since the number of participants is less than 500 the forward LR method was used. The entered variables are the variables having a p-value < 0.2 in the bivariate analysis. The adjusted odds ratio (OR) and 95% confidence intervals generated by the multiple logistic regression models were used to describe the relationship of the entered variables with the attitude of the participants toward the preventability of cancer. To test the reliability between the questions related to the same risk factor in the questionnaire, we used Cronbach alpha. To ensure construct validity of our questionnaire, a factor analysis was performed considering all the environmental risk factors. Our items were all in the form of Likert scale. Then, to ensure the reliability of the questionnaire, Cronbach alpha of the whole list of environmental risk factors was calculated.

## Results

### PARTICIPANTS BASELINE CHARACTERISTICS

Only 387 individuals accepted to participate in our study with 99.5% participation rate. In total, 207 participants

were women (53.5%) while 180 were men (46.5%). Most of our participants were young where 52.7% of them were aged between 18 and 24 and only 3.1% were 65 years or above. Most of the participants were single (63.8%) and were from different regions in Lebanon. To note here, 56.3% of the participants were living in urban places while 43.7% lived in rural places. The majority of the participants (84.0%) completed one or more university degree. It should be noted that 80.1% of the participants didn't work in the medical field. The majority of the participants (95.1%) didn't undergo any cancer screening, and didn't have cancer (97.2%) (Tab. I).

### KNOWLEDGE ABOUT RISK FACTORS OF CANCER AND ATTITUDE REGARDING THE PREVENTION OF THIS DISEASE

The majority of our participants have heard information about cancer (89.9%). Internet (74.2%) was the most common source of information about cancer in general. The most preferred sources identified by the participants to receive information concerning environmental risk factors of cancer were healthcare professionals (51.9%) and internet sources (43.7%).

Approximately 86 % of the respondents agreed that the cause of cancer is both genetic and environmental and 56 % agreed that cancer could be preventable (Fig. 1).

The environmental risk factors of cancer positively identified by the participants were environmental pollution (91.5%), smoking (90.4%), industrial pollution (88.3%), nuclear rays (85.5%), UV radiation (83.5%), X rays (72.6%), tobacco exposure (72.4%), processed food (72.1%), long term use of preservatives (68.8%), excessive sunlight exposure (65.9%), artificial sweeteners (65.3%), pesticides (65.4%), genetically modified food (65.2%), uranium (64.9%), high sugar diet (63.4%), living close to high voltage transmission lines (62.0%), alcohol (61.8%), stress (58.7%), plastic bottles (58.4%), hormone in beef (51.9%), red meat (50.9%), diesel exhaust (49.9%), unbalanced diet (49.8%), mobile phones (48.3%), paints (48.3%), obesity (45.5%), and hormonal treatment after menopause (45.0%).

Low awareness was found among the following factors: benzene (43.1%), low fiber diet (40.1%), low physical activity (38.2%), infections (36.6%), naphthalene (36.4%), many sexual partners (36.4%), radon (32.3%), asbestos (31.8%), arsenic (31.5%), vitamin D deficiency (31.5%), phthalates (27.6%), bisphenol A (27.1%), breastfeeding for less than 6 months (23.5%) and wood dusts (19.4%). To note, only a small percentage of participants disagreed with the fact of considering coffee and Mediterranean diet as risk factors of cancer (33.3% and 15.8% respectively) (Fig. 2).

### THE PARTICIPANT'S LIFESTYLE CHARACTERISTICS

Half of the participants (51.7%) considered themselves living an unhealthy lifestyle and 82.4% considered

Tab. I. The socio-demographic characteristics of the study population.

Variable	Categories	Frequency (n = 387)	Percentage (%)
Gender	Male	180	46.5
	Female	207	53.5
Age	18-24	204	52.7
	25-44	120	31
	45-64	51	13.2
	65 or above	12	3.1
Marital	Single	247	63.8
	Married	128	33.1
	Divorced	6	1.6
	Widowed	6	1.6
Education level	Elementary/intermediate/high school	62	16.1
	Bachelor's degree	215	55.6
	Master's or PhD degree	110	28.4
	PhD		
Income	< 675 000 LBP	49	12.7
	675 000-999 000	46	11.9
	1 000 000-1 999 000	110	28.4
	2 000 000-2 999 000	76	19.6
	3 000 000 or above	106	27.4
Working in the medical field	No	310	80.1
	Yes	77	19.9
Region	North	42	10.9
	South	65	16.8
	Beirut	96	24.8
	Beqaa	27	7.0
	Mount Lebanon	81	20.9
	Nabatiyeh	30	7.8
	Akkar	21	5.4
	Baalback/hermel	25	6.5
Living place	Urban	218	56.3
	Rural	169	43.7
Cancer screening	No	368	95.1
	Yes	19	4.9
Having cancer	No	376	97.2
	Yes, I had	2	.5
	Yes, I'm currently having	9	2.3
Know someone having cancer	No	100	25.8
	Yes	287	74.2
Occupation	Unemployed	179	46.3
	Agriculture	9	2.3
	Manufacturing	4	1.0
	Trade	42	10.9
	Transport, Post and telecom	11	2.8
	Services/Financial intermediation/insurance	119	30.7
	Retired	8	2.1
	Other/not specified	15	3.9

themselves living in an unhealthy environment. About 67.7% of the participants were non-smokers and 54.0% didn't smoke waterpipe. The majority of the participants didn't drink alcohol (83.2%) and most of the participants exercised for 30 minutes 3 times per week but with different frequencies (78.9%). About 30.2% of the participants eat five fruits and vegetables per day most of the time. Only 11.9% of the participants

consume red meat more than three times per week while 75.4% consume red meat less than 3 times and 12.7% don't consume red meat at all. In addition, 9.0% of the participants don't consume high sugar food and only 25.1% don't expose themselves excessively to sunlight. To note, almost half of the participants (48.3%) had a normal BMI, 35.4% were overweight, and 11.6% were obese (Tab. II).

Fig. 1. Descriptive analysis of cancer causes and preventability.

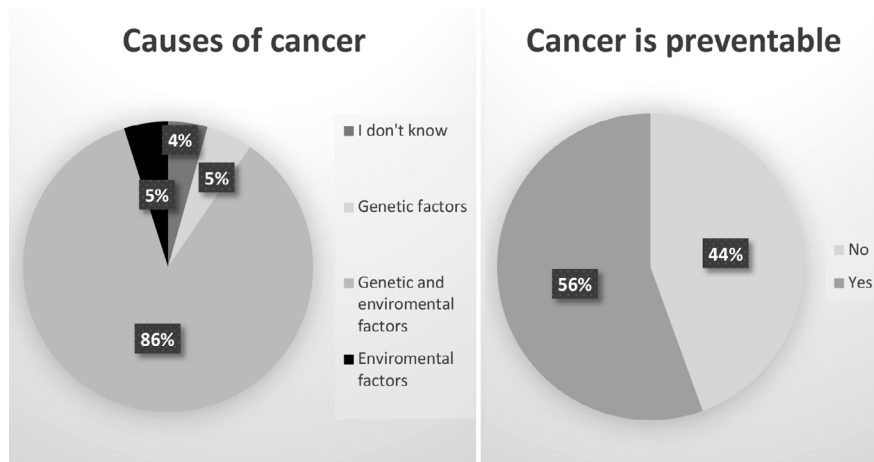
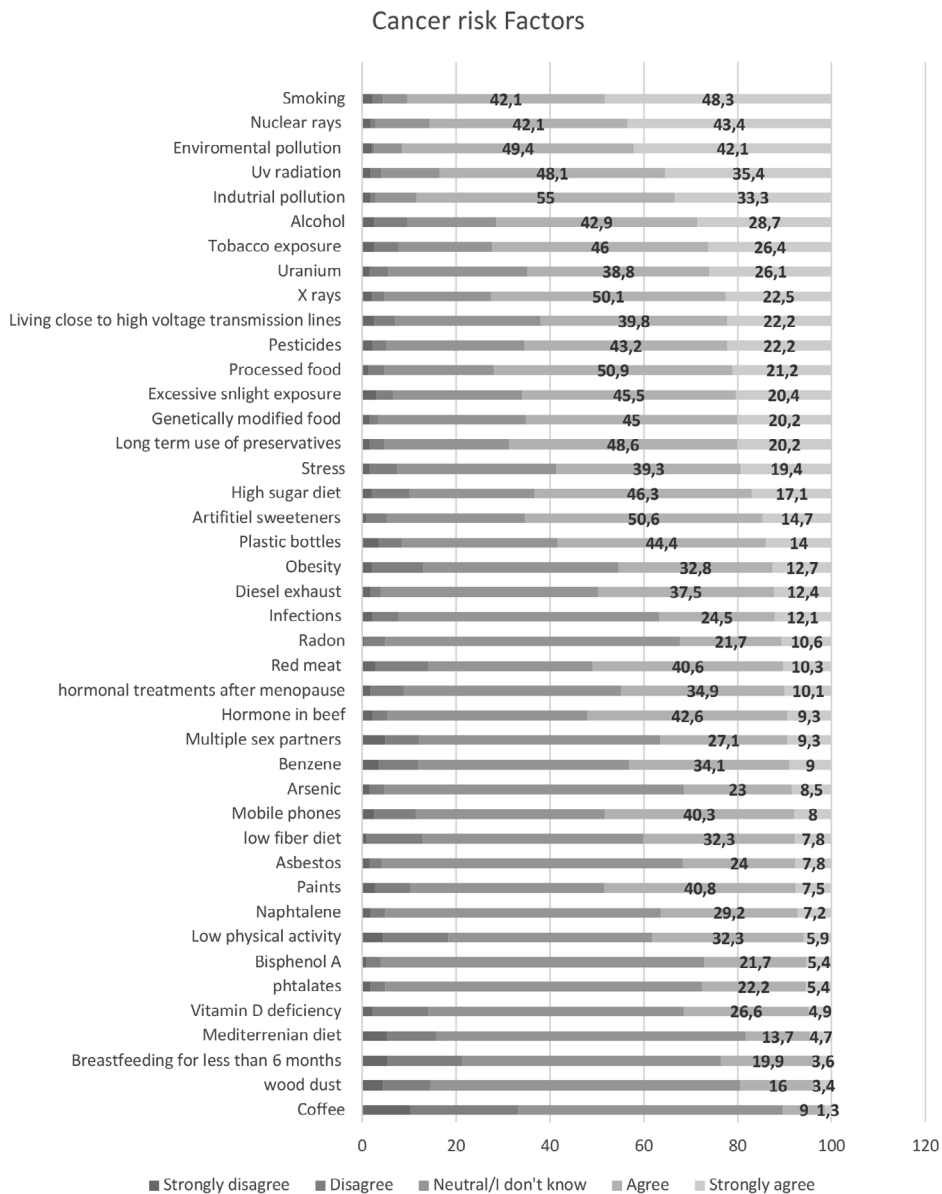


Fig. 2. Knowledge of the participants of the environmental cancer risk factors.



Tab. II. Table summarizing the lifestyle of the participants-

Variables	Categories	Frequency (n = 387)	Percentage (%)
Healthy lifestyle	No	200	51.7
	Yes	187	48.3
Healthy environment	No	319	82.4
	Yes	68	17.6
Cigarette smoking	No	262	67.7
	Yes, more than 20 cigarettes per day	28	7.2
	Yes, less than 20 cigarettes per day	48	12.4
	Sometimes	21	5.4
	Rarely	28	7.2
Water pipe smoking	No	209	54.0
	Yes, everyday	51	13.2
	Most of the times	29	7.5
	Sometimes	41	10.6
	Rarely	57	14.7
Alcohol intake	No	322	83.2
	Yes, not more than 1 drink per day	5	1.3
	Sometimes	24	6.2
	Rarely	36	9.3
Doing at least 30 mins of physical activity 3 times per week	No	82	21.2
	Yes, always	79	20.4
	Most of the times	68	17.6
	Sometimes	80	20.7
	Rarely	78	20.2
Eating at least 5 fruits and vegetables per day	No	55	14.2
	Yes, everyday	54	14.0
	Most of the times	117	30.2
	Sometimes	112	28.9
	Rarely	49	12.7
Consuming red meat	No	49	12.7
	Yes, more than 3 times weekly	46	11.9
	Yes, 3 times weekly	120	31.0
	Sometimes (up to 3 times/month)	83	21.4
	Rarely	89	23.0
Consuming high sugar food	No	35	9.0
	Yes, everyday	28	7.2
	Most of the times	73	18.9
	Sometimes	152	39.3
	Rarely	99	25.6
Being exposed excessively to sunlight	No	97	25.1
	Yes, everyday	12	3.1
	Most of the times	44	11.4
	Sometimes	104	26.9
	Rarely	130	33.6
BMI	Underweight (< 18.5)	18	4.7
	Normal (18.5 through 24.99)	187	48.3
	Overweight (25 through 29.99)	137	35.4
	Obese (30 or above)	45	11.6

BMI: Body Mass Index; Underweight < 18.5; Normal: Between 18.5 and 24.99; Overweight: Between 25 and 29.99; Obese > 30.

#### SOCIODEMOGRAPHIC CHARACTERISTICS AND ATTITUDE REGARDING THE PREVENTABILITY OF THE DISEASE

Regarding the sociodemographic characteristics of the participants, the variables that were found to be significantly associated with the attitude of patients regarding the preventability of cancer were: gender ( $p = 0.014$ ), age ( $p = 0.000$ ), education ( $p = 0.001$ ), occupation ( $p = 0.000$ ), region ( $p = 0.000$ ), medical

field ( $p = 0.064$ ), living place ( $p = 0.041$ ), having cancer ( $p = 0.003$ ), and knowing a family member or a friend having cancer ( $p = 0.015$ ) (Tab. III).

The variables found to be significantly associated with the attitude of patients regarding the preventability of cancer were: BMI ( $p = 0.000$ ), having a healthy life ( $p = 0.015$ ), smoking ( $p = 0.000$ ), waterpipe ( $p = 0.000$ ) and alcohol ( $p = 0.055$ ) (Tab. IV).

Tab. III. Sociodemographic characteristics and the attitude regarding preventability of cancer.

Variable	Cancer not preventable (N = 172)		Cancer preventable (N = 215)		P-value
	n	%	n	%	
<b>Gender</b>					
Male	92	53.5%	88	40.9%	0.014†
Female	80	46.5%	127	59.1%	
<b>Marital</b>					
Single	88	51.2%	159	74.0%	0.000†
Married/Divorced/Widowed	84	48.8%	56	26.0%	
<b>Age</b>					
18-24	76	44.2%	128	59.5%	0.000† 0.000‡
25-44	53	30.8%	67	31.2%	
45-64	33	19.2%	18	8.4%	
65 and above	10	5.8%	2	0.9%	
<b>Education</b>					
Elementary/intermediate/ high school	33	19.2%	29	13.5%	0.001†
Bachelor's degree	107	62.2%	108	50.2%	
Master's or PhD degree	32	18.6%	78	36.3%	
<b>Occupation</b>					
Unemployed	79	45.9%	100	46.5%	0.000¥
Agriculture	8	4.7%	1	0.5%	
Manufacturing	2	1.2%	2	0.9%	
Trade	23	13.4%	19	8.8%	
Transport	8	4.7%	3	1.4%	
Services	40	23.3%	79	36.7%	
Retired	7	4.1%	1	0.5%	
Not specified/other	5	2.9%	10	4.7%	
<b>Income</b>					
<675 000 LBP	19	11.0%	30	14.0%	0.303† 0.759‡
675 000 - 999 000	18	10.5%	28	13.0%	
1 000 000 - 1 999 000	53	30.8%	57	26.5%	
2 000 000 - 2 999 000	40	23.3%	36	16.7%	
3 000 000 or above	42	24.4%	64	29.8%	
<b>Region</b>					
North	19	11.0%	23	10.7%	0.000†
South	29	16.9%	36	16.7%	
Beirut	28	16.3%	68	31.6%	
Beqaa	20	11.6%	7	3.3%	
Mount Lebanon	30	17.4%	51	23.7%	
Nabatiyeh	20	11.6%	10	4.7%	
Akkar	7	4.1%	14	6.5%	
Baalbeck/Hermel	19	11.0%	6	2.8%	
<b>Working in the medical field</b>					
No	145	84.3%	65	76.7%	0.064†
Yes	27	15.7%	50	23.3%	
<b>Living place:</b>					
Urban	87	50.6%	131	60.9%	0.041†
Rural	85	49.4%	84	39.1%	
<b>Cancer screening</b>					
No	162	94.2%	206	95.8%	0.461†
Yes	10	5.8%	9	4.2%	
<b>Had cancer</b>					
No	162	94.2%	214	99.5%	0.003¥
Yes, had cancer or currently having	10	5.8%	1	0.5%	
<b>Know a friend or family member having cancer</b>					
No	34	19.8%	66	30.7%	0.015†
Yes	138	80.2%	149	69.3%	

†: chi square;‡: Cochran; ¥: fisher.

Tab. IV. Association between lifestyle and attitude regarding preventability of cancer.

	Cancer not preventable		Cancer preventable		P-value
	n	%	n	%	
<b>BMI</b>					
Underweight	3	1.7%	15	7.0%	Variable
Normal	67	39.0%	120	55.8%	
Overweight	74	43.0%	63	29.3%	
Obese	28	16.3%	17	7.9%	
<b>Healthy life</b>					
No	77	44.8%	123	57.2%	0.015†
Yes	95	55.2%	92	42.8%	
<b>Healthy environment</b>					
No	146	84.9%	173	80.5%	0.256†
Yes	26	15.1%	42	19.5%	
<b>Smoking</b>					
No	94	54.7%	168	78.1%	0.000† 0.000‡
Rarely	17	9.9%	11	5.1%	
Sometimes	15	8.7%	6	2.8%	
Yes less than 20 cigarettes per day	26	15.1%	22	10.2%	
Yes more than 20 cigarettes per day	20	11.6%	8	3.7%	
<b>Water pipe</b>					
No	66	38.4%	143	66.5%	0.000† 0.000‡
Rarely	32	18.6%	25	11.6%	
Sometimes	26	15.1%	15	7.0%	
Most of the times	22	12.8%	7	3.3%	
Yes everyday	26	15.1%	25	11.6%	
<b>Alcohol</b>					
No	137	79.7%	185	86.0%	0.055¥ 0.084‡
Rarely	4	2.3%	1	0.5%	
Sometimes	9	5.2%	15	7.0%	
Not more than 1 drink per day	22	12.8%	14	6.5%	
<b>Eating &gt; 5 fruits and vegetables per day</b>					
No	19	11.0%	36	16.7%	0.210† 0.023‡
Rarely	20	11.6%	29	13.5%	
Sometimes	46	26.7%	66	30.7%	
Most of the times	59	34.3%	58	27.0%	
Everyday	28	16.3%	26	12.1%	
<b>Exercising for 30 minutes 3 times per week</b>					
No	43	25.0%	39	18.1%	0.424† 0.479‡
Rarely	33	19.2%	45	20.9%	
Sometimes	30	17.4%	50	23.3%	
Most of the times	30	17.4%	38	17.7%	
Always	36	20.9%	43	20.0%	
<b>Eating red meat</b>					
No	22	12.8%	27	12.6%	0.104† 0.210‡
Rarely	50	29.1%	39	18.1%	
Sometimes (up to 3 times per month)	30	17.4%	53	24.7%	
Yes, equal or less than 3 times weekly	50	29.1%	70	32.6%	
Yes, more than 3 times weekly	20	11.6%	26	12.1%	
<b>Eating high sugar food</b>					
No	17	9.9%	18	8.4%	0.631† 0.195‡
Rarely	48	27.9%	51	23.7%	
Sometimes	68	39.5%	84	39.1%	
Most of the times	27	15.7%	46	21.4%	
Every day	12	7.0%	16	7.4%	
<b>Exposed excessively to sunlight</b>					
No	48	27.9%	49	22.8%	0.645† 0.617‡
Rarely	56	32.6%	74	34.4%	
Sometimes	41	23.8%	63	29.3%	
Most of the times	21	12.2%	23	10.7%	
Everyday	6	3.5%	6	2.8%	

BMI: Body Mass Index; Underweight < 18.5; Normal: between 18.5 and 24.99; Overweight: between 25 and 29.99; Obese > 30; †: chi square; ‡: Cochran; ¥: Fisher.



### THE PREDICTORS OF THE ATTITUDE OF RESPONDENTS REGARDING THE PREVENTABILITY OF CANCER

In the multivariate model, cancer was considered more as preventable when the participants considered the cause of cancer is environmental, OR=18.648 (95% CI: 1.81-191.65,  $p = 0.014$ ). People having a healthy life considered more than those who didn't that cancer is non-preventable, OR = 0.49 (95% CI: 0.3-0.8,  $p = 0.004$ ). Participants smoking waterpipe with different frequencies considered that cancer is not preventable. For rarely smokers, the OR was 0.46 (95% CI: 0.24-0.9,  $p = 0.023$ ). Married participants considered that cancer is non-preventable, OR = 0.52 (95% CI: 0.31-0.87,  $p = 0.013$ ). Participants having a high educational degree considered that cancer is preventable, OR = 2.18 (95% CI: 1.0-4.74,  $p = 0.049$ ). Participants having cancer considered more than people who didn't that cancer is non-preventable, OR = 0.14 (95% CI: 0.02-1.14,  $p = 0.066$ ) (Tab. V).

### RELIABILITY AND VALIDATION OF THE SCALE

The alpha coefficient of the three following risk factors: naphthalene, phthalates and paints, the two factors sunlight and UV radiation, multiple sex partners and infections, diesel and benzene were respectively 0.697, 0.619, 0.569, 0.583. Their alpha coefficients are above 0.5 suggesting that the items have good internal consistency. The alpha coefficient of the 2 items arsenic and pesticides 0.423, bisphenol A and plastic 0.423 were low suggesting low internal consistency between the items. The results of the exploratory factor analysis suggested that our items were able to explain 62.66% of the variability of our latent variable or awareness of environmental risk factors of cancer. In this study, the Kaiser-Meyer-Olkin statistic was 0.929. This means that the data are suitable for performing factor analysis. The result of the Bartlett test was also significant. This means that the opposite assumption was confirmed and there was a significant correlation between variables ( $p < 0.001$ ). Cronbach's alpha of all scale-items was equal to 0.95.

### Discussion

Cancer has a big impact on the patient's life, physically, emotionally and financially. Thus, the most important step is the prevention of cancer occurrence when it is possible. As cancer has been linked to many preventable environmental risk factors [1], having a good knowledge about these risk factors is an essential step to help prevent and reduce the burden of this disease [26].

Our study showed that more than half of our sample had recognized the following factors as risk factors of cancer: environmental pollution, smoking, industrial pollution, nuclear rays, UV radiation, X rays, tobacco exposure, processed food, long term use of preservatives, excessive sunlight exposure, artificial sweeteners, pesticides, genetically modified food, uranium, high

sugar diet, living close to high voltage transmission lines, alcohol, stress, plastic bottles, hormone in beef and red meat. On the other hand, less than 50% of the participants had recognized the following factors: diesel exhaust, unbalanced diet, mobile phones, paints, obesity, hormonal treatment after menopause, benzene, low fiber diet, low physical activity, infections, naphthalene, many sexual partners, radon, asbestos, arsenic, vitamin D deficiency, phthalates, bisphenol A, breastfeeding for less than 6 months and wood dusts.

In 2001, the American Institute for Cancer Research (AICR) commissioned its first Cancer Risk Awareness Survey to gauge Americans' awareness of various lifestyle-related cancer risk factors. In 2019, they reported that less than half of Americans recognize that alcohol, diets high in red meat, diets low in vegetables, fruits, and fiber and insufficient physical activity all have a clear link to cancer development [28]. Our results were similar to that of the AICR 2019 survey except for alcohol and red meat where more than half of the Lebanese population did identify them as risk factors of cancer. This survey also showed that the awareness of other established cancer risk factors like obesity and processed meat is above 50% among Americans. This wasn't the same in our study where less than half of the participants identified obesity as a risk factor for cancer. The majority of Americans correctly identified tobacco (89%) and excessive exposure to sunlight (82%) as cancer risks [28] and this was similar to our results.

Our results were not in line with a previous Japanese study that showed that the attributable fraction of cancer-causing viral and bacterial infection was considered the highest (51%), followed by that of tobacco smoking (43%), stress (39%), and endocrine-disrupting chemicals (37%) [30]. Thus, it is worth increasing awareness about infectious agents as a cause of cancer.

A study done in Iran in 2010 to assess the public awareness of cancer risk factors and its determinants showed that a small proportion of the respondents (12.2%) had high knowledge level and most of them had mixed (56.9%) and low level of awareness (30.9%). The most important determinants of knowledge level included level of education, gender, and family history [33].

Our results were also aligned with the results of a pilot study done in Emirates showing that many of the study participants were able to identify smoking, alcohol, and nuclear radiation as cancer-causing factors, but a large number of the respondents failed to identify infections, some food-related contaminants/components, and occupation-associated carcinogens as risk factor [34]. These results emphasize on the need of an awareness campaign concerning occupation-associated carcinogens.

Our results were very close to the results of a study done in Oman. Similarly to our results, the majority of respondents identified that smoking cigarettes (83.3%), passive smoking (72.7%) and excessive drinking of alcohol (69.0%) are risks factors for cancer while fewer respondents identified that eating less fruits and vegetables (21.6%), eating more red or processed meat

Tab. V. The predictors of the preventability of cancer.

Variables	ORa	95% CI	P-value
<b>Cancer cause</b>			
Don't Know	1	Ref	0.013
Genetic	0.351	0.071-1.720	0.197
Environmental	18.648	1.814-191.651	0.014
Both genetic and environmental	0.892	0.281-2.829	0.846
<b>Healthy life</b>			
No	1	Ref	0.004
Yes	0.485	0.297-0.790	
<b>Water pipe</b>			
No	1	Ref	0.000
Rarely	0.462	0.238-0.899	0.023
Sometimes	0.268	0.124-0.576	0.001
Most of the times	0.114	0.040-0.323	0.000
Everyday	0.362	0.178-0.738	0.005
<b>Marital status</b>			
Single	1	Ref	
Married	0.520	0.309-0.873	0.013
<b>Education</b>			
Elementary/intermediate/ high school	1	Ref	0.008
Bachelor degree	0.913	0.449-1.859	0.803
Masters or PhD	2.179	1.002-4.736	0.049
<b>Have cancer</b>			
No	1	Ref	
Yes	0.135	0.016-1.141	0.066

ORa: adjusted Odds Ratio; omnibus test: significant so at least the variable is associated with the dependent variable; model summary: Nagelnerke R square 0.299 so the model was able to explain 29.9% of the variability of the dependent variable; Hosmer Lemshow was not significant (0.153) so the model is adequate; classification table showed that 71.1% of the participants had good classification; correlation matrix: all R s were < 0.8 so no variables were over correlated.

(30.2%), being overweight (32.0%), doing less physical exercise (31.0%), having a close relative with cancer (34.9%) and getting frequent sunburn during childhood (38.8%) are risk factors contributing for the development of cancer [35].

The level of awareness is high in both western and Arab countries concerning smoking. It is important to highlight that the majority of the respondents are also aware that drinking alcohol is also a risk factor for cancer, which could be explained by the cultural stigma in these countries where smoking and alcohol are seen as unhealthy [43].

Concerning the western dietary pattern and lifestyle, the level of awareness was low in all countries and similar in Lebanon except for red meat and processed food where we had a better knowledge. Indeed, the western dietary pattern including red and processed meat and refined grains and sedentary lifestyles are associated with increase in the risk of cancer [44]. Low fruit and vegetable intake, smoking, drinking of alcohol and obesity were still the leading risk factors for death from cancer worldwide [45]. Giovannucci et al, found that a healthy lifestyle can prevent 40% of cancer cases and 50% of cancer deaths in the United States. Thus, it is important to raise awareness about the importance of adopting a healthy lifestyle [46].

Concerning the source of information of our participants, internet sources was the most common source of information followed by healthcare professionals and the most preferred sources identified were healthcare professionals (51.9%) and internet sources (43.7%).

While our study population favored being educated through healthcare professionals, in the pilot study done in Emirates, respondents favored being educated via the media [34].

Concerning the attitude towards the preventability of cancer, 56% of our participants perceived that cancer is preventable and 44% considered cancer as non-preventable. Our results were similar to a study done in Mumbai where 55% of the participants perceived that cancer could be preventable [47]. However, in a study done in India, the majority of the study population (42%), perceived cancer could not be preventable, and around 30% of them did not know what to perceive about the preventive methods for cancer [48].

Concerning the predictors of the attitude of our participants toward the preventability of cancer, it is important to highlight that the main predictor is believing that cancer has an environmental cause. This is a logical result, since the environmental risk factors are usually preventable unlike the genetic ones. Participants considering cancer is preventable considered at the same time that they are not living a healthy lifestyle, which showed that they underestimate the impact of taking health precautions in preventing cancer. This result can also reflect that these participants are feeling guilty and that's why they are considering themselves not living a healthy lifestyle. Another important result is that waterpipe remained in the multivariate model while smoking was removed, this reflects the Lebanese profile where waterpipe is a cultural habit and the prevalence of waterpipe smoking has increased extensively [49,50].

This result also shows that people smoking waterpipe are not aware that waterpipe can increase the risk of cancer. Married participants considered less that cancer is preventable this could be related to age and level of education. Participants having cancer considered more that cancer is not preventable, due to the fact that many of these patients take precautions but couldn't stop cancer from occurring.

To our knowledge, this is the first study assessing the knowledge of the Lebanese population toward the general environmental risk factors of cancer. Another strong point in this study is that it achieved the minimum sample size needed and this increase the power of study. Concerning the questionnaire, it was strongly built based on good literature review and covered a lot of risk factors and in some cases, the question was asked in different ways to ensure that the questionnaire truly reflects what the participant knows in order to decrease the classification bias. The Cronbach alpha reflecting the reliability of the knowledge questionnaire was high (0.95). However, the calculated alpha coefficient was low for the bisphenol A and plastic and for the arsenic and pesticides. This shows that the participants are not able to identify what is the scientific name of the substance causing cancer leading to a classification bias. The questionnaire included mainly closed ended questions which makes it easier for respondents and to have fewer missing answers. Only in questions where the respondents can be frustrated because their desired answer is not a choice (like when asked about the preferred information source etc.) an option where the respondent can write a short answer was added. In questions concerning the knowledge of the participants concerning the environmental risk factors a Likert scale was used to have more precise answers thus removing the classification bias.

On the other hand, this study has some limitations. This study was done during the COVID-19 pandemic so we couldn't fill the questionnaires face to face with the participants. First, we had difficulty reaching certain types of participants, such as those who do not have internet access and thus our sample had more young people which increase the selection bias. Second, there is no identification tool so it is impossible to know if the sample providing answers is the right person or if one person is submitting multiple responses. Third, since the questionnaire was distributed through the internet, we couldn't control effectively its spread and we couldn't know the exact response rate and the number of people ignoring our questionnaire. Finally, according to the Lebanese statistical Bulletin 2018 [51], 21.92% of the Lebanese population live in Akkar and the North, 14.46% in Beqaa and Baalbek, 7.81 in Nabatieh, 11.67% in the South, 34.85% in mount Lebanon and 9.3 % Beirut. While, in our study 24.8% of our participants were living in Beirut, 20.9% in Mount Lebanon, 16.8% in South, 16.3% in North and Akkar, 7.8% in Nabatieh, 13.5% in Beqaa and in Baalback/Hermel. Thus, our results may overestimate the results in Beirut and South and underestimate it in Mount Lebanon. To add, our sample

was selected using mostly the convenience sampling method, this can lead to selection bias and can affect the generalizability of the results.

## Conclusions

Cancer is a multi-factorial disease having both environmental and genetic risk factors. Our results increase the need for more health campaigns to increase awareness on these risk factors specially those related to toxic substances and infections and lifestyle habits. This can also be followed by further studies assessing the impact of these community and governmental cancer prevention initiatives on cancer risk factors level of awareness.

## Acknowledgements

Funding sources: this research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## Conflict of interest statement

The authors declare no conflict of interest.

## Authors' contributions

MK performed study, collected data, analyzed data and drafted the manuscript.

MEH, DK, SA, SR, AAH reviewed, edited the manuscript and approved the final version of the manuscript to be submitted.

RA designed study, analyzed data, reviewed and approved the final version of the manuscript to be submitted.

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Received on January 16, 2021. Accepted on April 12, 2021.

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**How to cite this article:** Kabalan M, El-Hajj M, Khachman D, Awada S, Rachidi S, Al-Hajje A, Ajrouche R. Public awareness of environmental risk factors of cancer and attitude towards its prevention among the Lebanese general population. *J Prev Med Hyg* 2021;62:E584-E478. <https://doi.org/10.15167/2421-4248/jpmh2021.62.2.1974>

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