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Cancer Awareness in Saudi Arabia: A Cross-Sectional Population-Based Observational Study

Nagwa Ibrahim[1], Asma Almuhsin[2], Awatif Alshaibani[2], Raghad Alkhattabi[2], Maryam Almulaifi[2], Ashraf Alalwan[1], Ahmed Aleid[1]*

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***Abstract*-- Introduction:** Cancer is the second leading cause of death globally. Lack of awareness about cancer could negatively impact its prevention and management. Published research for myths and misconception about cancer indicated the poor public knowledge and the essential need for education and awareness. The aim of this study is to assess the level of knowledge about cancer among the public in Saudi Arabia. **Materials & Methods:** This is a cross-sectional study. We designed a survey that contains 11 sections with a total of 64 questions. Sixty-one questions were closed ended and 3 open ended questions. Surveys were distributed electronically as well as a hard copy to reach the highest number of participants. The target participants were the general population in Saudi Arabia. **Results:** We received a total of 11,186 responses. We excluded data of 663 participants as they did not meet the inclusion criteria. The highest percentage of participants were Saudi Arabian citizens (95%), females (77%), between 20-29 years old (47.2%), from the central region (60.6%), out of which 60.2% had an education level above high school. The mean age was 28.74 (± 10.75) years. The maximum total knowledge score was 31, while the mean score was 18.66 (± 5.1). The acceptable knowledge level was considered to be 60%. However, only 54.7% of the participants reached the acceptable knowledge level. There was a significant correlation between the total knowledge across participants with age group of 20-29 ($p<0.01$), above high school level of education ($p<0.01$), female gender ($p<0.01$), and having family member or friend diagnosed with cancer ($p<0.01$). Two thirds of the female participants were familiar with self-breast examination, while only 40.2% were aware of the mammogram. About one third of the females above 40 years had a mammography performed. Most of the participants (81.1%) get information about cancer from the internet. **Conclusions:** Cancer awareness levels and knowledge remain relatively low in the evaluated study population. Therefore, conducting public awareness programs are very essential.

Keywords: Cancer awareness, Saudi Arabia, population-based, oncology.

[1]Department of Pharmaceutical Services, Prince Sultan Military Medical City (PSMMC), Riyadh, Saudi Arabia
[2]College of Pharmacy, Princess Nora University, Riyadh, Saudi Arabia
***Corresponding Author:** Ahmed Aleid, B.Sc. Pharm, PhD.
Email address: aaleid@psmmc.med.sa
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1. Introduction

Cancer is the second leading cause of death. In 2018, the number of new cases of cancer was 18.1 million worldwide and 24,485 thousand in Saudi Arabia, while the estimated mortality was 9.6 million globally and 10,518 in Saudi Arabia [1-3]. Cancer burden continues to grow internationally, exerting a tremendous physical, emotional and financial strain on individuals, families, society and healthcare systems. Differences in the incidence of cancer between countries might reflect the demographic risk factors.

Some of these risk factors can be modifiable and sometimes preventable such as smoking which induces lung cancer, as well as obesity and infections. On the other hand, other risk factors are not modifiable including race, familial genetic background and reproductive and hormonal history. In countries with strong health systems, survival rate of many types of cancers are improving due to early detection accessibility, quality treatment and survivorship care.

Lack of awareness is a major cause for misconception. The public's understanding about the disease is imperative to its prevention and management. Perceptive improvement about cancer could be through public awareness and educational programs about effective prevention and screening of different types of cancer. These tools are essential to improve the quality of cancer care [4].

Published articles nationally and internationally indicated the high percentage of myths and misconception about cancer among public. Most of the published studies were limited either to measure awareness in a specific type of cancer such as breast cancer or limited to some extent to certain knowledge such as risk factors. Reports from published studies indicated that knowledge about cancer is still poor among the public and greater attempts should be made to improve public awareness. In Saudi Arabia, the last research published about the same issue was in 2010 by Ravichandran and colleagues. They recommended the same results about the essential need for public awareness about cancer [5-11].

The objective of this study is to assess the current level of awareness about cancer myths and misconceptions in Saudi

Arabia, as well as to correlate the demographic data with the different knowledge levels.

2. Materials and Methods

2.1 Study Design

This is an observational, cross-sectional study carried out in the form of a survey. Participants were public citizens and residents aged ≥ 16 years in Saudi Arabia. Patients diagnosed with cancer were excluded from the study. Surveys with less than 75% of total answers were exclude from analysis.

2.2 Sample Size

The calculated sample size with 95% confidence limit and a precision level of ± 1% was 9,601 individuals.

2.3 Survey Sections

The survey consisted of 11 sections including 61 close-ended questions and 3 open-ended questions. The sections are: 1) demographic data: that included gender, age, nationality, place of residency, current marital status, level of education, and employment status, as well as if the participant is a healthcare provider, has a family member diagnosed with cancer and if the participant was self-diagnosed with cancer; 2) General information about cancer; 3) Cancer risk factors; 4) Cancer warning signs; 5) Treatment modalities; 6) Possible side effects of cancer treatment; 7) Cancer treatment route of administration; 8) Self-related health; 9) Breast self-examination (for women); 10) National Cancer Screening Programs in Saudi Arabia; and 11) Information resources about cancer. Most of the sections dealt with participants perception about cancer and other related issues. Therefore, the responses were designed as yes, no, don't know.

2.4 Validation

We conducted two methods of validity, the first being content validity in which we asked five experts, consultant clinical pharmacists, to evaluate our survey. All questions were clear and satisfactory for them. Then, we did a pilot face validity which included seventy participants. Again, they did not have major comments to change or add to the survey.

2.5 Data Collection

To ensure public participation from all five regions in Saudi Arabia (Central, North, South, East, West), we assigned pharmacists in each region to be responsible for the survey distribution. Non-probability convenience sampling was used. The surveys were distributed as hard copy as well as electronically. It was uploaded online as google forms format for easier distribution through social media and WhatsApp groups. The hard copies were distributed by the assigned pharmacists in malls, hospitals, universities, friends and family members. The survey did not include any personal identifiable data about the participant. Participation was completely voluntary and individuals were identified randomly. Completing the survey was considered as a consent to participate in the study. No incentive was given to the participants. Duration of the survey distribution was 3 months, that started from the 1st of September 2018 and ended on the 30th of November 2018. The study was approved by the Ethical and Research Committee at Prince Sultan Military Medical City. Completed surveys were coded and entered into database using IBM SPSS Statistics for Windows, V22.0.

2.6 Statistical Analysis

All the knowledge questions were then scored. Incorrect or uncertain (don't know) responses were given a zero score, while 1 point was given to each correct answer. We considered the answer to be correct based on the published literature. The knowledge score was computed by totaling the number of correct answers. The total scores presented for each section were as follows: general information about cancer (8 points), risk factors for cancer (4 points), warning signs for cancer (5 points), possible side effects of cancer treatment (6 points) and treatment modalities of cancer (8 points). The maximum knowledge scores were 31 and the minimum score was zero. The cut off value to evaluate different variables associated with the knowledge levels was 60% and more, which equals to 19 points out of 31.

Sociodemographic variables examined include age (<20, 20-29, 30-39, >40 years) and education (less than high school, high school, above high school). Characteristics of the study population were summarized as frequencies, mean and standard deviation (SD). The association between demographic parameters and respondent's correct knowledge was evaluated by Chi square test. Moreover, the association between the mean knowledge score and gender was evaluated by the independent samples t-test. The association between the mean knowledge score, age groups and educational level was evaluated by one-way ANOVA. All of the tests were considered as significant with $p<0.05$, confidence interval level 95%. All analyses were done using (SPSS) version 22.

3. Results

3.1 Patients Characteristics

The total study population was 11,186 individuals. We excluded 663 surveys that included cancer patients, participants < 16 years old and surveys with less than 75% complete answers **(Figure 1)**.

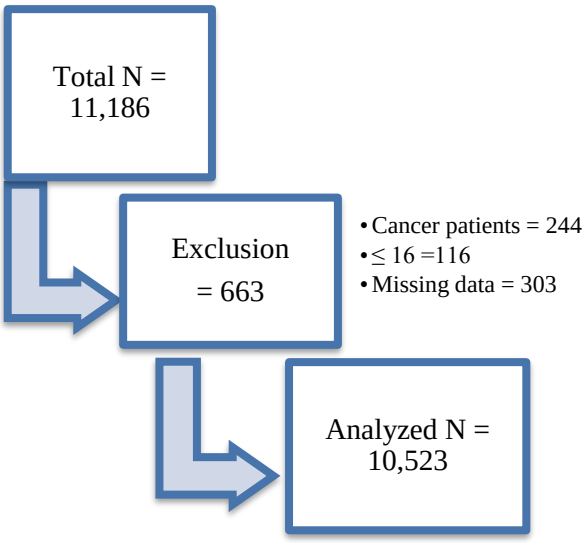

Figure 1. Study population and recruitment description.

The mean age (± SD) of respondents was 28.74 years (± 10.75) with a range of 16 to 65 years. The majority of participants were females (77%). Out of the total 10,523 individuals, 10,019 (95.2%) were Saudi nationals. The highest percentage were living in the central region (60.6%). Around two thirds (61.2%) were above high school education level, while 34.1% had high school education level. A fair proportion (52.7%) knew someone diagnosed with cancer, being either a family member or a friend **(Table 1)**.

Table 1. Demographic Characteristics

Variable	**N=10,523**	Percentage (%)
Gender		
Male	2430	23.1
Female	8093	76.9
Age group (years)		
16-19	1725	16.4
20-29	4970	47.2
30-39	1895	18.9
>40	1843	17.5
Nationality		
Saudi	10019	95.2
Non-Saudi	504	4.8
Place of residence		
Central region	6379	60.6
Northern region	1442	13.7
Southern region	721	6.9
Eastern region	810	7.7
Western region	1171	11.2
Education level		
Less than high school	487	4.6
High school	3592	34.1
Above high school	6444	61.2
Healthcare		
Yes	1771	16.8
No	8738	83
Family or friend diagnosed with cancer		
Yes	5541	52.7
No	4982	47.3

3.2 Cancer Knowledge

The maximum total knowledge score was 31, mean score was 18.66 ± 5.1, and the minimum score was zero. We considered an acceptable knowledge level to be 60% and above. Only 54.7% reached the acceptable knowledge level. **Table 2** describes the variables that were demonstrated to be associated with total knowledge.

There was a statistically significant difference in the total knowledge level across age groups, gender, and level of education. The age group of 20-29 had more knowledge ($p<0.01$). Mean score was 19.09 ± 5.05, mean 95% CI (18.4-18.8). Females had more knowledge than males ($p<0.01$). The mean score for female participants was 19.06 ± 4.87. Participants with above high school level of education had more knowledge ($p<0.01$). The mean score was 18.98 ± 5.14, mean 95% CI (18.85-19.10).

3.3 General Information About Cancer

Participants who believed that cancer is not a contagious disease that cannot spread from one person to another were 87%. About 88.3% noted that cancer could be cured if diagnosed early. Most responders thought cancer is fatal. Only 18.3% believed cancer is not fatal which is a very low percentage. More than half (65.4%) were aware that having a family member diagnosed with cancer does not mean definitely they will have cancer too. Around one third (37.8%) answered that cancer might be inherited. Half of the responders (54.1%) agreed that it is not difficult to detect cancer early. Around 76.1% were aware that breast cancer could be detected early through self-breast examination, while 87.6% believed that regular health check-up could help in detecting cancer early. The total mean score for general information was 5.15 ± 1.73. There was a statistically significant difference in the total general information about cancer knowledge across age groups, gender, and level of education as follows: females more than males ($p<0.01$). The mean score was 5.31 ± 1.59. Participants with age above 40 had better information compared to other age groups ($p<0.01$). The mean score was 5.35 ± 1.49. The level of education was higher in population above high school ($p<0.01$). The mean score was 5.23 ± 1.69.

3.4 Risk Factors for Cancer

A high percentage of participants (90.7%) were aware that smoking is a risk factor for cancer. Only 17.6% answered that a high-fat and sugar diet is not a risk factor for cancer. About 70.1% agreed that radiation is a risk factor for cancer. Around 55% knew pollution including environmental, water, and air pollution is a risk factor for cancer. The total mean score for this section was 2.33 ± 0.96. There was a statistically significant difference among age groups, gender, and level of education as follows: males more than females ($p<0.01$). The mean score was 2.45 ± 0.95. The level of information was higher in participants with age above 40 ($p<0.01$). The mean score was 2.38 ± 0.96. The knowledge level was higher in that population with education above high school ($p<0.01$). The mean score was 2.38 ± 0.96.

Table 2. Variables associated with total knowledge.

Variable	Total score out of 31		GI score out of 8		RF score out of 4		WS score out of 5		TM score out of 8		SE score out of 6	
	Mean (SD)	P	Mean (SD)	P	Mean (SD)	P	Mean (SD)	P	Mean (SD)	P	Mean (SD)	P
Total	18.66 (5.12)		5.15 (1.73)		2.33 (0.96)		2.00 (1.72)		4.91 (1.81)		4.26 (1.67)	
Gender*												
Male	17.34 (5.69)	<0.01	4.6 (2.04)	<0.01	2.45 (0.95)	<0.01	1.97 (1.83)	0.18	4.56 (1.93)	<0.01	3.77 (1.85)	<0.01
Female	19.06 (4.87)		5.31 (1.59)		2.3 (0.96)		2.02 (1.69)		5.01 (1.75)		4.41 (1.59)	
Age**												
I	18.6 (4.57)	<0.01	5.12 (1.63)	<0.01	2.32 (0.93)	<0.01	2.01 (1.56)	<0.01	4.85 (1.58)	<0.01	4.3 (1.62)	<0.01
II	19.09 (5.05)		5.11 (1.81)		2.36 (0.94)		2.13 (1.75)		5.11 (1.78)		4.38 (1.65)	
III	17.93 (5.41)		5.07 (1.8)		2.24 (1.00)		1.81 (1.75)		4.72 (1.92)		4.08 (1.76)	
IIII	18.36 (5.36)		5.35 (1.49)		2.38 (0.96)		1.89 (1.74)		4.62 (1.9)		4.11 (1.67)	
Education**												
I	16.78 (5.69)	<0.01	4.9 (1.66)	<0.01	2.03 (0.99)	<0.01	1.76 (1.64)	0.003	4.28 (1.96)	<0.01	3.81 (1.84)	<0.01
II	18.34 (4.94)		5.03 (1.79)		2.3 (0.95)		2.00 (1.68)		4.78 (1.76)		4.23 (1.64)	
III	18.98 (5.14)		5.23 (1.69)		2.38 (0.96)		2.03 (1.75)		5.02 (1.81)		4.32 (1.68)	

3.5 Warning Signs for Cancer

The awareness about the warning signs for cancer was as follows: loss of appetite (36.9%), unexplained weight loss (48.9%), persistent cough (25.3%), new lumps on the skin (49.3%), and change in bowel habit (40.6%). The total knowledge mean score was 2 ± 1.72. There was a statistically significant difference across age groups and level of education as follows: participants with age less than 20 had more information (p<0.01). The mean score was 2.01 ± 1.56. Population with education level above high school had more information (p<0.003). The mean score was 2.03 ± 1.75. There was no statistically significant difference based on gender (p<0.18).

3.6 Treatment Modalities of Cancer

Participants' awareness about cancer treatment modalities was as follows: surgery (77.9%), chemotherapy (94.1%), radiotherapy (64.5%), immunotherapy (38.9%), and hormonal therapy (24.4%). Less than half of the responders (40.5%) believed that herbals and alternative medicine are not an option of cancer treatment. Around 73% agreed that the treatment of cancer differs from patient to another. The total mean knowledge score for this section was 4.91 ± 1.81. There was a statistically significant difference among age groups, gender, and level of education as follows: females more than males (p<0.01), mean score 5.01 (1.75), age between 20-29 years participants' information was better than other age groups (p<0.01), mean score 5.11 ± 1.78, level of education above high school had more information (p<0.01), and mean score 5.02 ± 1.81.

3.7 Possible Side Effects of Cancer Treatment

The awareness about cancer treatment side effects were as follows: hair loss (89.9%), nausea and vomiting (74%), fatigue (68.3%), immunosuppression (75.3%). About 47.7% agreed that not all cancer treatments have the same side effects and 71.3% believed that cancer treatments have different side effects. The total mean score knowledge was 4.26 ± 1.67. There was a statistically significant difference in the level of information about side effects across age groups, gender, and level of education as follows: females more than males (p<0.01), mean score 4.41 ± 1.59, age group 20-29 years participants' knowledge was more than other age groups (p<0.01), mean score 4.38 ± 1.65, individuals with above high school level of education had more information (p<0.01), mean score was 4.32 ± 1.68.

3.8 Impact of Having a Family Member or a Friend Diagnosed with Cancer on Participants Knowledge

The level of information was higher in participants who had a family member or friend diagnosed with cancer in all the sections about cancer information except the warning signs section. The information level was as follows: the total knowledge mean score was 19.35 ± 4.49 (p<0.01), while the mean score for each section was as follows: general information 5.46 ± 1.36 (p<0.01), risk factors 2.38 ± 0.95 (p<0.01), treatment modalities 5.09 ± 1.76 (p<0.01), side effects 4.44 ± 1.58 (p<0.01), while mean score for warning signs was 1.99 ± 1.69 (p<0.17). **Table 3** describes the impact of having a family member or friend diagnosed with cancer on the level of knowledge.

Table 3. Impact of having family member or friend diagnosed with cancer on knowledge level

Variable	Total score out of 31		GI score out of 8		RF score out of 4		WS score out of 5		TM score out of 8		SE score out of 6	
	Mean (SD)	P	Mean (SD)	P	Mean (SD)	P	Mean (SD)	P	Mean (SD)	P	Mean (SD)	P
Yes *	19.35 (4.94)	<0.01	5.46 (1.36)	<0.01	2.38 (0.95)	<0.01	1.99 (1.69)	0.17	5.09 (1.76)	<0.01	4.44 (1.58)	<0.01
No	17.93 (5.19)		4..80 (2.00)		2.29 (0.96)		2.04 (1.76)		4.71 (1.83)		4.09 (1.75)	

*Population who had family member or friend diagnosed with cancer

Table 4. Percentages of participants with maximum and minimum scores.

Percentage (%)	Total	GI	RF	WS	TM	SE
Maximum (31)	2 (0.01)	303 (2.9)	680 (6.5)	1265 (12)	630 (6)	2891 (27.5)
Minimum (0)	9 (0.1)	360 (3.4)	379 (3.6)	2952 (28.1)	171 (1.6)	415 (3.9)

3.9 Percentage of Maximum and Minimum Scores About Cancer Knowledge

The highest percentage of maximum score (31) was in the cancer treatment side effects section 27.5% (2891 individuals), while the highest percentage of minimum score (0) was in the cancer warning signs section 28.1% (2952 participants). **Table 4** demonstrates the percentages of participants with minimum and maximum scores.

3.10 Knowledge on Medication Administration

Awareness about the different routes of cancer treatment administration was as follows: oral administration (34.2%), intrathecal delivery (36.8%) and intravenous injection (66.1%) as described in **Figure 2**.

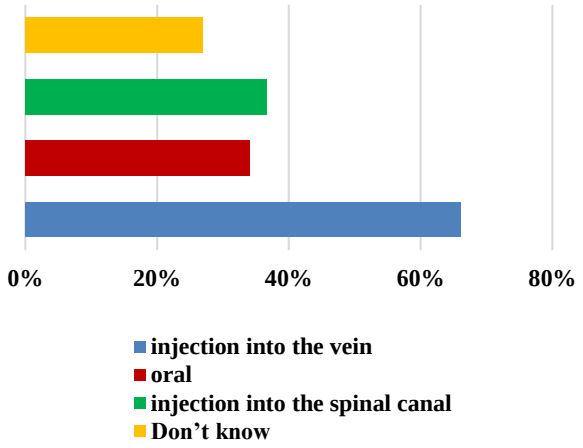

Figure 2. Knowledge on medication route of administration

3.11 Knowledge on Self-related Health

Only 19.6% of participants performed routine check-ups during the last year. The number of routine check-up done within one year or more was as follows: once (13.1%), twice (5.7%), and three times (1.9%). By asking the last time they had a check-up 10.6% out of 19.6% said they had the check-up more than one year ago.

3.12 Knowledge on Self-breast Examination

Around 67% of participating female subjects were familiar with self-breast examination, out of which, about 82.6% performed the examination 1-3 times last year. Only 40.2% were aware of mammography. About one third (33.3%) of females who were 40 years old had a mammography performed.

3.13 Knowledge About National Cancer Screening Programs in Saudi Arabia

By asking the participants about the national screening program, only 45.8% had heard about the program. Out of this 45.8%, a small percentage knew more details, such as 40% were aware that the program is free of charge, while 26.2% of the participants knew the program locations as demonstrated in **Figure 3**.

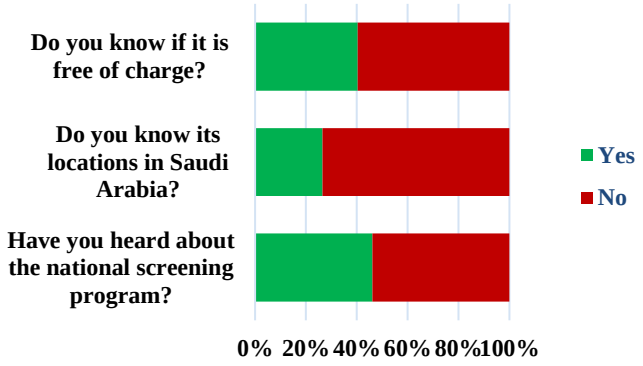

Figure 3. Awareness about the National Cancer Screening Programs

3.14 Knowledge About Cancer Information Resources

The awareness about cancer information resources was as follows: TV (30.8%), friends (36.3%), books (30.8%), internet (81.1%), and other resources such as doctor's advice and educational courses (13.8%) as reported in **Figure 4**.

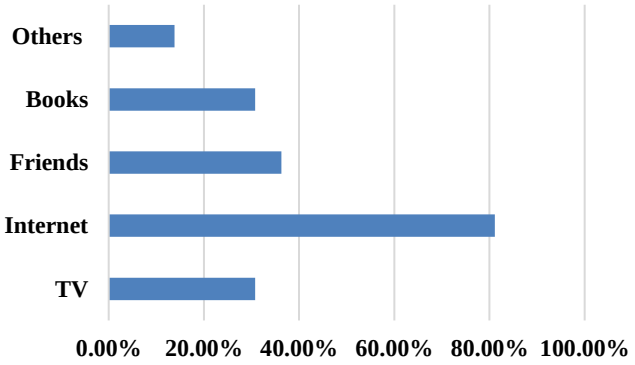

Figure 4. What were the resources used to get your cancer information?

4. Discussion

Cancer is still a dreadful challenge for oncologists. Cancer diagnosis does not indicate that this patient has an incurable disease where death is inevitable. Cancer care includes risk

assessment, primary prevention, screening, detection, diagnosis, treatment, recurrence surveillance and end of life care. Focusing on the steps and transitions in care where failure can occur can facilitate more organized systems and medical practices that improve care and establish meaningful measures of quality that promote improved outcomes. Myths and misconceptions about cancer have an impact on society that might negatively affect cancer prevention, management, and treatment outcomes [4,5]. Understanding the level of knowledge about cancer among Saudi Arabian citizen and residents will help decision makers to implement/improve cancer control programs. The rationale behind this study was the lack of public knowledge about cancer among the public in Saudi Arabia.

Our study provided the most detailed assessment to date about knowledge level related to cancer among Saudi Arabian citizens and residents. We included the most relevant information for assessment and were able to involve the largest number of participants compared to other published articles till present on the same topic and population. Our sample size was 10,523 compared to 1407 and less in other published local studies [8-12]. The total mean knowledge score was 18.66 (60%) out of 31which indicates a reasonable general knowledge level.

Ravichandran and colleagues [8] conducted a national study published in 2010 and addressed some of the information we assessed. As a general comparison our results were similar to their findings as total knowledge about cancer was low among the Saudi populations. The following are more detailed comparisons with Ravichandran study results. Our sample size was 10,523 versus 1,407 participants and more female participants (76.9% versus 51.1%). The acceptable level for knowledge was 60% in both studies. Around 54.7% of the participants reached the acceptable level versus 65.1 %. Moreover, 52.7% of individuals involved in our study knew someone diagnosed with cancer versus 42.5%, most of the individuals (81.1%) received cancer information from the internet versus 65.1% received cancer information from television. About 88.3% agreed that cancer could be cured if diagnosed early versus 69.4% agreed that cancer can be detected early. We were similar in the number of participants who agreed that smoking is a risk factor for cancer and the age group who had high level of knowledge about cancer those younger than 29 years.

Another study conducted in Saudi Arabia and published in 2015 reported the high awareness among medical students about the link between tobacco and high risk of cancer [13]. Our results were similar to them. There are more studies conducted in Saudi Arabia but published before 2010 that concluded the poor level of knowledge about cancer among adolescent [9], women [10], and public [12]. Our study results were similar to them having poor total level of information about cancer. In international studies, they reported the poor awareness about risk factors of cancer among Irish [6], modest level of knowledge about cancer and its screening among community pharmacists in Jordan [7]. So, our study had the same results that indicate the lack of awareness about cancer. We were not able to make further comparisons due to the different objectives and populations in each study. At the same time, we can notice the similarity as a general finding which is lack of knowledge.

Some limitations of this study should be highlighted. Till present, there is no international standardized questionnaire available to evaluate cancer knowledge, which might be considered a limitation in comparing our results directly with other published studies. Despite these limitations, our study has several strengths. We conducted the largest sample population till present compared to previously published studies evaluating cancer awareness in Saudi Arabia. We covered most of the related questions which helped us to comprehensively assess cancer related knowledge among Saudi Arabian citizens and residents. Our sample represented different public levels and different regions. We evaluated factors associated with knowledge on cancer from the general public.

5. Conclusions and Future Directions

This study provided information about level of knowledge regarding cancer among the public in Saudi Arabia. Our study revealed the low level of information among the studied population regarding cancer such as risk factors, warning signs and symptoms, the screening programs importance and locations. Further studies are recommended to better assess the improvement in cancer awareness among the public in Saudi Arabia. Finding of the current study could be considered a useful database for policy makers and health educators while developing and improving national cancer awareness programs.

Enhancing public awareness may lead to reduced numbers of cancer cases through implementing/improving public information about national screening programs, warning signs for cancer, risk factors and importance of exposure reduction. Education can be through social media, television, cancer information leaflets and increasing access to trustable evidence-based websites. Increased public awareness will decrease fear about cancer. Participation of all sectors as governmental, non-governmental and charitable organizations in improving awareness about cancer will be helpful to improve public level of knowledge about cancer among the public.

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be constructed as a potential conflict of interest.

Author Contributions: NI had the idea of the study, suggested methodology, reviewed the survey, performed the statistical analysis, and wrote the manuscript. AM, AS, RK, MM, collected the data, drafted the tables, performed the statistical analysis and contributed in writing the manuscript. AA, AE contributed in writing the manuscript. All authors revised the final manuscript and approved the final version.

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