

## Pattern of Malignant Tumors in Najran, Saudi Arabia: A 5-year Retrospective Study

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### Abstract

**Background:** The relative frequency of malignant tumors has been reported to have an association with age, gender, and location. The current study is a retrospective study to assess the pattern and relative frequency of different malignant tumors in Najran, Saudi Arabia.

**Methods and Results:** All patients from both genders were included in the study from June 2014 to May 2019, and data were retrieved from the records of confirmed cancer cases at the departments of pathology. For 5 years, a total of 763 cases [325(42.6%) men and 438(57.4%) women] and 37 types of malignant tumors were diagnosed in Najran. According to the histopathological diagnosis, carcinomas were the most frequent tumors (n=564, 73.9%). According to the affected organ/body system, tumors of the gastrointestinal system were the commonest malignancy, observed in 156(20.4%) of the patients (91 men and 65 women). Finally, the chi-square test revealed that the frequency of malignant tumors climbed as age increased ( $P=0.0005$ ).

**Conclusion:** The relative frequency of several cancers in Najran showed that the most common cancers in both genders are in the following order: gastrointestinal, thyroid, breast, skin and soft tissue cancers, and lymphoma. In addition, women are more affected than men, and increasing age is a risk factor to develop a malignancy. (*International Journal of Biomedicine*, 2021;11(4):498-504.)

**Key Words:** tumor • gender • risk factor • Najran

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### Introduction

Malignant tumors are considered a leading cause of death globally and second to cardiovascular diseases in developing countries. The GLOBOCAN-database report showed that 9.6 million deaths were due to malignancy in 2018, and an estimated 18.1 million people acquired diseases caused by

malignancy—cancers. The most commonly reported cancers worldwide are lung, prostate, colorectal, stomach, and liver in men; and breast, colorectal, lung, cervical, and thyroid cancers in women.<sup>(1)</sup> Global Cancer Statistics 2020 shows that an estimated 19.3 million new cancer cases and almost 10 million cancer deaths occurred in 2020. Female breast cancer was the most commonly diagnosed cancer, with an estimated 2.3 million new cases (11.7%), followed by lung (11.4%), colorectal (10.0%), prostate (7.3%), and stomach (5.6%) cancers.<sup>(2)</sup>

Both developed and developing countries have a high burden of cancer in their healthcare systems; however,

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differences exist regarding the types of cancers in several regions of the world.<sup>(3)</sup> Several factors are responsible for increasing the burden of cancer, such as population growth and aging, in parallel with other environmental, socio-economic, and cultural factors. These factors are more common in rapidly growing economies, where the cause of cancer shifted from cancers related to poverty and infections to cancers associated with lifestyle modifications.<sup>(1,4)</sup> Saudi Arabia has been undergoing extraordinary economic development since the early 1970s, which has had a deep impact on environmental factors such as quality of air, water, food consumption styles, overall lifestyle, and industrial conditions. Thus, modernization has modified the patterns of genetic and environmental risk factors responsible for cancer development.<sup>(5)</sup> The epidemiological pattern of cancer in Saudi Arabia is unique to that of Western countries. According to the Saudi Cancer Registry and GLOBCAN-2020, colorectal cancer, non-Hodgkin lymphoma, and leukemia were the most common types in males,<sup>(2,6)</sup> which is in contrast to the European and North American regions, where the solid cancers are more frequent.<sup>(7,8)</sup>

In the modern era, it is becoming possible to detect cancer and perform reliable diagnosis. This is due to the availability of modern medical facilities and research, and people are getting more conscious and aware of their health. Additionally, one of the important fields for researchers to study is the different types and frequencies of each type of cancer, which may help in taking proper public health measures for the prevention, diagnosis, and treatment of cancer. Saudi Arabia is a vast country with many regions of variable climatic and cultural backgrounds. Therefore, the frequency of several cancer types differs from one place to another,<sup>(7)</sup> and the actual incidence rate can only be assessed from population-based registries of the country.

Najran is a populous city of Saudi Arabia with more than 500 new cancer cases reported in the last 5 years. It was also reported that among cancer cases in Najran, breast cancer was the most common (42%), second - liver cancer (22%), and third - leukemia (17%).<sup>(9)</sup> The present paper is a retrospective study based on the records of pathology departments at all hospitals in Najran. This study was conducted to investigate the relative frequency of different malignant tumors in the region, which may provide a balanced estimate of the incidence of different cancers and give a solid background for further studies for the sake of improving and developing the diagnostic and therapeutic tools.

## Methods

A retrospective study was conducted after getting approval from the ethical committee at the College of Medicine, Najran University. All patients from both genders were included in the study from June 2014 to May 2019, and data were retrieved from the records of confirmed cancer cases by histopathology and cytopathology at the departments of pathology in King Khalid Hospital, Najran General Hospital, Maternity & Child Hospital, and Najran University Hospital. King Khalid Hospital is a reference hospital and the

main hospital in the region to date. It is well equipped and provides all major medical and surgical facilities. The clinical laboratory has facilities for all routine and specialized tests. Its radiology department is the best in the region and equipped with modern machinery for ultrasonography, mammography, and CT scanning. Similarly, the pathology laboratory is modern and operational to perform frozen sections, routine stains, and sophisticated immunoperoxidase studies.

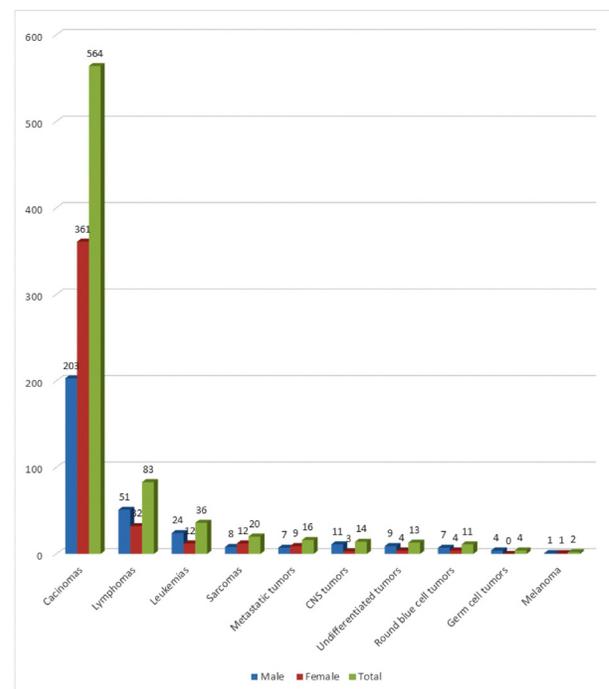
The information collected on a data sheet included file number, age, gender, type of tissue, malignancy, and histology. Data were carefully entered in an excel file and analyzed, and statistics were performed using GraphPad Prism 6. Baseline characteristics were summarized as frequencies and percentages for categorical variables. Group comparisons with respect to categorical variables are performed using chi-square tests. We used the Chi-square test to compare observed data. A probability value of  $P < 0.05$  was considered statistically significant.

This study was approved by the Ethical Committee at the College of Medicine, Najran University.

## Results

For 5 years, a total of 763 cases [325(42.6%) men and 438(57.4%) women] and 37 types of malignant tumors were diagnosed in Najran. The mean age of all patients was 52.6 years; the mean age of men and women was 53.5 and 51.7 years, respectively.

According to the histopathological diagnosis (Figure 1), carcinomas were the most frequent tumors ( $n=564$ , 73.9%) – 203(36%) cases in men and 361(64%) cases in women. Lymphomas were the second most frequent tumor ( $n=83$ , 10.9%) – 51(61.4%) cases in men and 32(38.6%) in women.



**Fig. 1.** Most frequent tumors in men and in women according to the histopathological diagnosis.

Leukemia ranked third (n=36, 4.7%), and men [24(66.7%)] were affected more than women [12(33.3%)]. These diseases were followed by sarcomas [20(2.6%)], metastatic tumors [16(2.1%)], CNS tumors [14(1.8%)], undifferentiated tumors [13(1.7%)], and round blue cell tumors [11(1.4%)]. Germ cell tumors were exclusively in men [4(0.5%)], and the least common tumor was melanoma [2(0.3%)], which was diagnosed in one man and one woman.

According to the affected organ/body system (Table 1), tumors of the gastrointestinal system were the commonest malignancy, observed in 156(20.4%) of the patients (91 men and 65 women). The thyroid gland was the second most affected organ – in 130(17%) patients (35 men and 95 women). The breast tumors were at the third position (16.3%) and exclusively in women (n=124). Skin and soft tissue tumors accounted for 8.5% (29 men and 36 women). Tumors of lymphoid tissues were at the fifth position at 7.7% (34 men and 25 women). The genital tract tumors were at the sixth position (41 women and 14 men). This was followed by bone marrow tumors [42(5.5%)], tumors of the urinary system [40(5.2%)], oral cavity [25(3.3%)], respiratory system [22(2.9%)], hepatobiliary system and pancreas [22(2.9%)], CNS [15(2%)], and bone [8(1%)]. Noteworthy, all the last observations were more common in men than women (Table 1).

**Table 1.**

**Distribution of different malignant tumors according to the affected organ/body system**

Type of tumor	Total	%	Male	%	Female	%
Tumors of gastrointestinal tract	156.0	20.4	91.0	58.3	65.0	41.7
Thyroid tumors	130.0	17.0	35.0	26.9	95.0	73.1
Breast tumors	124.0	16.3	0.0	0.0	124.0	100.0
Skin and soft tissue tumors	65.0	8.5	29.0	44.6	36.0	55.4
Lymphoid tumors	59.0	7.7	34.0	57.6	25.0	42.4
Tumors of genital tract	55.0	7.2	14.0	25.5	41.0	74.5
Bone marrow tumors	42.0	5.5	27.0	64.3	15.0	35.7
Urinary system	40.0	5.2	32.0	80.0	8.0	20.0
Tumors of oral cavity	25.0	3.3	20.0	80.0	5.0	20.0
Tumors of respiratory system	22.0	2.9	13.0	59.1	9.0	40.9
Tumors of hepatobiliary system and pancreas	22.0	2.9	14.0	63.6	8.0	36.4
CNS tumors	15.0	2.0	12.0	80.0	3.0	20.0
Bone tumors	8.0	1.0	4.0	50.0	4.0	50.0
Total	763.0		325.0		438.0	

According to gender (Table 2), the most frequent tumors in men were found in the following order: tumors of gastrointestinal tract [91(28%)], thyroid tumors [35(10.8%)], lymphoid tumors [34(10.5%)], tumors of the urinary system [32(9.8%)], skin and soft tissue tumors [29(8.9%)], bone marrow tumors [27(8.3%)], tumors of the oral cavity

[20(6.2%)], tumors of the genital tract [14(4.3%)], tumors of hepatobiliary system and pancreas [14(4.3%)], tumors of the respiratory system [13(4%)], CNS tumors [12(3.7%)], and finally bone tumors [4(1.2%)].

The most frequent tumors in women (Table 2) were found in the following order: breast tumors [124(28.3%)], thyroid tumors [95(21.7%)], tumors of gastrointestinal tract (GIT) [65(14.8%)], tumors of genital tract [41(9.4%)], tumors of skin and soft tissues [36(8.2%)], lymphoid tumors [25(5.7%)], bone marrow tumors [15(3.4%)]; tumors of the respiratory system [9(2.1%)], tumors of the urinary system [8(1.8%)], tumors of hepatobiliary system and pancreas [8(1.8%)], tumors of the oral cavity [5(1.1%)], tumors of the CNS [4(0.9%)], and bone tumors [3(0.7%)].

**Table 2.**

**Common malignant tumors according to gender**

Type of tumor	Total	Male	%	Type of tumor	Total	Female	%
Tumors of GIT	156.0	91.0	28.0	Breast tumors	124.0	124.0	28.3
Thyroid tumors	130.0	35.0	10.8	Thyroid tumors	130.0	95.0	21.7
Lymphoid tumors	59.0	34.0	10.5	Tumors of GIT	156.0	65.0	14.8
Urinary system tumors	40.0	32.0	9.8	Tumors of genital tract	55.0	41.0	9.4
Skin and soft tissue tumors	65.0	29.0	8.9	Skin and soft tissue tumors	65.0	36.0	8.2
Bone marrow tumors	42.0	27.0	8.3	Lymphoid tumors	59.0	25.0	5.7
Tumors of oral cavity	25.0	20.0	6.2	Bone marrow tumors	42.0	15.0	3.4
Tumors of genital tract	55.0	14.0	4.3	Tumors of respiratory system	22.0	9.0	2.1
Tumors of hepatobiliary system and pancreas	22.0	14.0	4.3	Urinary system tumors	40.0	8.0	1.8
Tumors of respiratory system	22.0	13.0	4.0	Tumors of hepatobiliary system and pancreas	22.0	8.0	1.8
CNS tumors	15.0	12.0	3.7	Tumors of oral cavity	25.0	5.0	1.1
Bone tumors	8.0	4.0	1.2	Bone tumors	8.0	4.0	0.9
Breast tumors	124.0	0.0	0.0	CNS tumors	15.0	3.0	0.7

According to the subtype of tumors (Table 3), the most common carcinomas were adenocarcinoma [30.7% (n=173: M=86, F=87)], representing 42.2% of carcinomas in men (the most common carcinoma subtype in men), and 24.2% in women. Papillary thyroid carcinoma was the second most common carcinoma [22.2% (n=125: M=33, F=92)], with 25.6% of carcinomas in women and 16.2% in men. In-situ and invasive ductal carcinoma of the breast were the third most common carcinomas (21.1%, n=119) with no registered cases in men and the most common carcinomas in women (33.1%).

Table 3.

Distribution of different malignant tumors in males and females according to the subtypes of tumors

Type of tumor							
<b>Carcinomas</b>		N	%	Male	%	Female	%
	Adenocarcinoma	173	30.7	86	42.2	87	24.2
	Thyroid papillary carcinoma	125	22.2	33	16.2	92	25.6
	In-situ and invasive ductal carcinoma of breast	119	21.1	0	0	119	33.1
	Squamous cell carcinoma	63	11.2	34	16.7	29	8.1
	Basal cell carcinoma	25	4.4	10	4.9	15	4.2
	Transitional cell carcinoma	25	4.4	22	10.8	3	0.8
	Renal cell carcinoma	14	2.5	9	4.4	5	1.4
	Hepatocellular carcinoma	6	1.1	5	2.5	1	0.3
	Thyroid follicular carcinoma	5	0.9	2	1	3	0.8
	In-situ and invasive lobular carcinoma of breast	4	0.7	0	0	4	1.1
	Carcinosarcoma	3	0.5	0	0	3	0.8
	Small cell carcinoma	2	0.4	2	1	0	0
Total		564		203		361	
<b>Sarcoma</b>		N	%	Male	%	Female	%
	Leiomyosarcoma	6	30	1	12.5	5	41.7
	Osteosarcoma	4	20	2	25	2	16.7
	Dermatofibrosarcoma	3	15	1	12.5	2	16.7
	Ewing sarcoma	2	10	1	12.5	1	8.3
	Rhabdomyosarcoma	2	10	1	12.5	1	8.3
	Kaposi Sarcoma	1	5	1	12.5	0	0
	Angiosarcoma	1	5	1	12.5	0	0
	Liposarcoma	1	5	0	0	1	8.3
Total		20		8		12	
<b>Leukemias</b>		N	%	Male	%	Female	%
	Acute myelogenous leukemia	12	33.3	9	37.5	3	25
	Multiple myeloma	12	33.3	7	29.2	5	41.7
	Myeloproliferative neoplasm	7	19.4	4	16.7	3	25
	Chronic myelogenous leukemia	3	8.3	3	12.5	0	0
	Myelodysplastic syndrome	2	5.6	1	4.2	1	8.3
Total		36		24		12	
<b>Lymphomas</b>		N	%	Male	%	Female	%
	Non-Hodgkin's lymphoma	48	57.8	34	66.7	14	43.8
	Hodgkin's lymphoma	35	42.2	17	33.3	18	56.3
Total		83		51		32	
<b>Round blue cell tumors</b>		N	%	Male	%	Female	%
	Neuroendocrine tumor	8	72.7	7	100	1	25
	Small round blue cell tumor	3	27.3	0	0	3	75
Total		11		7		4	
<b>Germ cell tumors</b>		N	%	Male	%	Female	%
	Germ cell tumor	3	75	3	75	0	0
	Seminoma	1	25	1	25	0	0
Total		4		4		0	
<b>CNS tumors</b>		N	%	Male	%	Female	%
	Glioblastoma multiforme NOS	6	42.9	5	45.5	1	33.3
	Malignant meningioma	4	28.6	2	18.2	2	66.7
	Oligodendroglioma NOS	2	14.3	2	18.2	0	0
	Glioma NOS	1	7.1	1	9.1	0	0
	Astrocytoma NOS	1	7.1	1	9.1	0	0
Total		14		11		3	

Squamous cell carcinoma was at the fourth position [11.2% (n=63: M=34, F=29)], accounting for 16.7% of carcinomas in men and 8.1% in women. Basal cell carcinoma and transitional cell carcinoma were the fifth most common carcinoma subtypes – 4.4% (n=25) for each subtype. Other subtypes of carcinoma were found in the following order: renal cell carcinoma (2.5%), hepatocellular carcinoma (1.1%), thyroid follicular carcinoma (0.9%), in-situ and invasive lobular carcinoma of the breast (0.7%), carcinosarcoma (0.5%), and small cell carcinoma (0.4%).

Regarding sarcoma subtypes (Table 3), leiomyosarcoma was the most common [30% (n=6: M=1, F=5)], constituting 41.7% of sarcomas in women and 12.5% in men. After that, the following sarcoma subtypes were in the following order: osteosarcoma [20% (n=4: M=2, F=2)], dermatofibrosarcoma [15% (n=3: M=1, F=2)], Ewing sarcoma [10% (n=2: M=1, F=1)], rhabdomyosarcoma [10% (n=2: M=1, F=1)], Kaposi sarcoma 95% [n=1: (M=1, F=0)], angiosarcoma [5% (n=1: M=1, F=0)], and liposarcoma [5%: (n=1: M=0, F=1)]. When it comes to leukemia subtypes, acute myelogenous leukemia [33% (n=12: M=9, F=3)] and multiple myeloma [33% (n=12: M=7, F=5)] were the most common ones. Myeloproliferative neoplasm was the second most common leukemia subtype [19.4% (n=7: M=4, F=3)]. The last two leukemia subtypes were chronic myelogenous leukemia [8.3% (n=3: M=3, F=0)] and myelodysplastic syndrome [5.6% (n=2: M=1, F=1)].

The most common lymphoma subtype (Table 3) was non-Hodgkin's lymphoma [57.8% (n=48: M=34, F=14)] and the second most common lymphoma subtype was Hodgkin's lymphoma [42.2% (n=35: M=17, F=18)]. Regarding the round blue cell tumors, neuroendocrine tumor was the most common [72.7% (n=8: M=7, F=1)], followed by the small round blue cell tumors [26.3% (n=3: M=0, F=3)]. Germ cell tumors were reported only in men [3(75%)], and there was only one case of seminoma, comprising 25% of the germ cell tumor subtypes.

Of the CNS tumor subtypes (Table 3), glioblastoma multiforme was the most common [42.9% (n=6: M=5, F=1)] and malignant meningioma was the second most common [28.6% (n=4: M=2, F=2)]. Oligodendroglioma not otherwise specified (NOS) was diagnosed in 2(14.3%) men while glioma NOS (7.1%) and astrocytoma NOS (7.1%) were found in one case each.

According to age, the patients were categorized into five groups (Table 4): Group 1 (1-15 years), Group 2 (16-30 years), Group 3 (31-45 years), Group 4 (46-60 years), and Group 5 (over 60 years). The most affected age group was Group 5, representing 31.8% of cases (n=243); Group 4 formed 30.1% of the cases (n=230). Group 3 was the third (25.4%) most affected age group (n=194), then the Group 2, which constituted 11.5% of all cases (n=88). The least affected age group was Group 1, which made up only 1.0% of cases (n=8). Most of the carcinomas(n=183), sarcomas(n=7), metastatic tumors(n=6), and round blue cell tumors (n=5) were diagnosed in Group 4. Meanwhile, most of lymphomas(n=27), leukemias(n=18), undifferentiated tumors(n=5), and the only two cases of melanoma, were in Group 5. The majority of the CNS tumors were diagnosed in Groups 4 (n=6) and 5 (n=6). There were only four cases of germ cell tumors, diagnosed in

Group 2 and 3, equally. Finally, only eight cases (1.0%) were discovered in Group 1; those cases were carcinomas (n=4), lymphomas (n=3), and only one case of sarcomas. Finally, the chi-square test revealed that the frequency of malignant tumors climbed as age increased ( $P=0.0005$ ).

**Table 4.**

**Distribution of different malignant tumors according to age groups**

Type of tumor	Age group (year)					Total
	Group 1	Group 2	Group 3	Group 4	Group 5	
	1-15	16-30	31-45	46-60	Over 60	
Carcinomas	4	49	150	183	178	564
Lymphomas	3	19	21	13	27	83
Leukemias	0	4	8	6	18	36
Sarcomas	1	6	5	7	1	20
Metastatic tumors	0	3	2	6	5	16
CNS tumors	0	2	0	6	6	14
Undifferentiated tumors	0	2	2	4	5	13
Round blue cell tumors	0	1	4	5	1	11
Germ cell tumors	0	2	2	0	0	4
Melanoma	0	0	0	0	2	2
Total	8	88	194	230	243	763
%	1.0	11.5	25.4	30.1	31.8	

## Discussion

A few previous studies were conducted in Saudi Arabia to report the relative frequency of different cancers. However, some of these studies are old now, and others were conducted in a single referral hospital or institution, which may have several limitations. Accordingly, this study was planned to include all patients from different hospitals in Najran. Another important aspect is the referral bias<sup>(10)</sup> since patients with cancers are usually referred to specialized and tertiary centers due to the unavailability of certain services such as radiotherapy for a certain type of cancer and sometimes for the sake of advanced surgical intervention. Hence, true figures might be underrepresented sometimes at the general hospitals or overestimated at the specialized-tertiary centers. For the same reason, it was speculated that the actual figures might be higher than what the current study reported. However, since the incidence rate of cancer in the whole population is not available, the current study has revealed important conclusions about malignancies in Najran. Another advantage of the current study is the involvement of all cases in different age groups and in both males and females.

In this study, there were a total of 763 confirmed cases of malignant tumors. According to the histopathological diagnosis, carcinomas were the most frequent tumors, and they affected females more than males. The common subtype of

carcinomas was adenocarcinoma (30.7%), representing 42.2% of carcinomas in men (the most common carcinoma subtype in men), and 24.2% in women. Moreover, most of the diagnosed adenocarcinomas in men (28%) affected the gastrointestinal system. These observations are consistent with the Saudi Cancer Registry report and GLOBCAN-2020 report, which revealed that gastrointestinal cancer was the most common one, and Najran was at the top of the list of regions that have the highest rate of gastrointestinal cancer.<sup>(2,11)</sup> However, in a study conducted in the North of Saudi Arabia, stomach cancer and gastrointestinal tumors were among the common cancers, with 9.6% frequency, but not the most common compared to breast cancer (24.7%) and leukemia (18.7%).<sup>(12)</sup>

Although papillary thyroid carcinoma was the second common subtype of carcinomas (22.2%) in both men and women; in-situ and invasive ductal carcinoma of the breast were the most common carcinomas in females (33.1%). The last observation is in agreement with different studies during the last three decades that showed breast cancer is the most common cancer type and accounted for 24%-29% of all female cancers.<sup>(2,6,13,14)</sup> In the same context, a review article that considered all cities of Saudi Arabia stated that the crude frequency of breast cancer was 15.9% from 2001 to 2014. Furthermore, the highly frequent morphology for this cancer was infiltrating duct carcinoma (78.7%), and then lobular carcinoma.<sup>(7)</sup> These results regarding breast cancer are found not only in Saudi Arabia since it has been reported as the most common type of women's cancer in 140 of 184 countries.<sup>(15)</sup>

The frequency of papillary thyroid carcinoma indicated that women are affected with a higher frequency than men with an approximate ratio of 3:1. A previous study from all regions of Saudi Arabia showed that the relative frequency of thyroid cancer was 3.7% for both genders and 5.6% for women.<sup>(16)</sup> Another study was conducted in Riyadh Armed Forces Hospital in 1994, and the results were similar to the present study; thyroid cancer was quite high in Riyadh with a case fatality rate of 5.0%, and the female to male ratio was 2.4:1.<sup>(14)</sup> Furthermore, the percentage of thyroid cancer among total cancer cases has increased by 1.7% from 2001 to 2014, making thyroid cancer the second most common cancer in women in Saudi Arabia.<sup>(7)</sup> Thyroid cancer is a rare tumor worldwide, but thyroid cancer frequency in Saudi Arabia has always been surprisingly high.<sup>(17)</sup> The associated risk factor may include industrialization and deficiency of iodine in vast desert regions of Saudi Arabia. In the GLOBCAN-2020 report, thyroid malignancies were the second most common in women, accounting for 14.3%, but in men – the fourth most common cancer, representing 6.2%.<sup>(13)</sup>

Oral cancer is the 10th most common cancer in the world and the third most common cancer in Saudi Arabia.<sup>(18)</sup> In the present study, the relative frequency of oral cavity cancer, mainly squamous cell carcinoma, was 3.3% in Najran. The main cause of this cancer may be regarded as chewing smokeless tobacco-like substances called Shamma and Quat in Najran. Another study from Saudi Arabia also showed a high relative frequency of oral cavity cancer for the same reason, and the majority of the patients presented with lesions in the tongue.<sup>(14)</sup>

According to GLOBOCAN-2020, lung cancer has a worldwide prevalence of 11.4%, making it the second most

commonly diagnosed cancer in the world among all other types.<sup>(2)</sup> In the present study, the frequency of malignant tumors of the respiratory system is extremely lower (2.9%) than that of the other countries, which may be due to the use of smokeless tobacco. Interestingly, although the Saudi Cancer Registry in 2014 reported a low incidence rate of lung cancer in Saudi Arabia, as compared to other countries, still it was high and ranked fourth.<sup>(19)</sup> Moreover, the same conclusion was reported in the GLOBCAN-2020 report.<sup>(2,13)</sup>

Lymphomas (10.9%) were the second common frequent tumor after carcinomas, and leukemia was in the third place (4.7%). Both lymphomas and leukemia were more frequent in males than in females. Our results are in agreement with studies that used data from the Saudi Cancer Registry up to 2014 and reported that the incidence of lymphoma was 8.4%.<sup>(6,7)</sup> However, the most common lymphoma subtype in the current study was non-Hodgkin's lymphoma, which is in agreement with GLOBCAN-2020 report,<sup>(2)</sup> while it was reported that Hodgkin lymphoma is relatively more frequent in Saudi Arabia than in countries in the West, and it might be due to the high consanguineous marriage rate (38.9%) in the population.<sup>(7)</sup>

Leukemia was also found to be among the frequent cancers in Najran (4.7%), and 33% of leukemias were acute myelogenous leukemia as the most common subtype. Saudi Cancer Registry ranked leukemia as the fifth most common cancer among both genders during 1999-2013, and the Precursor B-cell lymphoblastic leukemia was highly frequent, then precursor cell lymphoblastic leukemia with almost the same male to female ratio.<sup>(20)</sup>

Next to carcinomas, lymphomas, and leukemia, the following tumors came in order: sarcomas (2.6%), metastatic tumors (2.1%), CNS tumors (1.8%), undifferentiated tumors (1.7%), and round blue cell tumors (1.4%). Finally, germ cell tumors were exclusively in men, and the least common tumor was melanoma (0.3%), which was diagnosed in one man and one woman. The latter observation is supported by previous reports.<sup>(21-23)</sup>

It is noteworthy that the number of diagnosed tumors in the pediatric group (Group 1) was only eight cases (1%). The most affected age groups were Groups 5 and 4. The chi-square test revealed that the frequency of malignant tumors climbed as age increased, indicating age as a risk factor for developing cancer ( $P=0.0005$ ). This supports the previously reported data that the incidence of cancer in adolescents and young adults is lower than that of the elderly in Saudi Arabia.<sup>(24)</sup>

**In conclusion**, the relative frequency of several cancers in Najran showed that the most common cancers in both genders are in the following order: gastrointestinal, thyroid, breast, skin and soft tissue cancers, and lymphoma. In addition, women are more affected than men, and increasing age is a risk factor to develop a malignancy.

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## Competing Interests

The authors declare that they have no competing interests.

## Disclaimers

The views expressed in this article are the *author's* own and do not reflect the official position of the institutions.

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