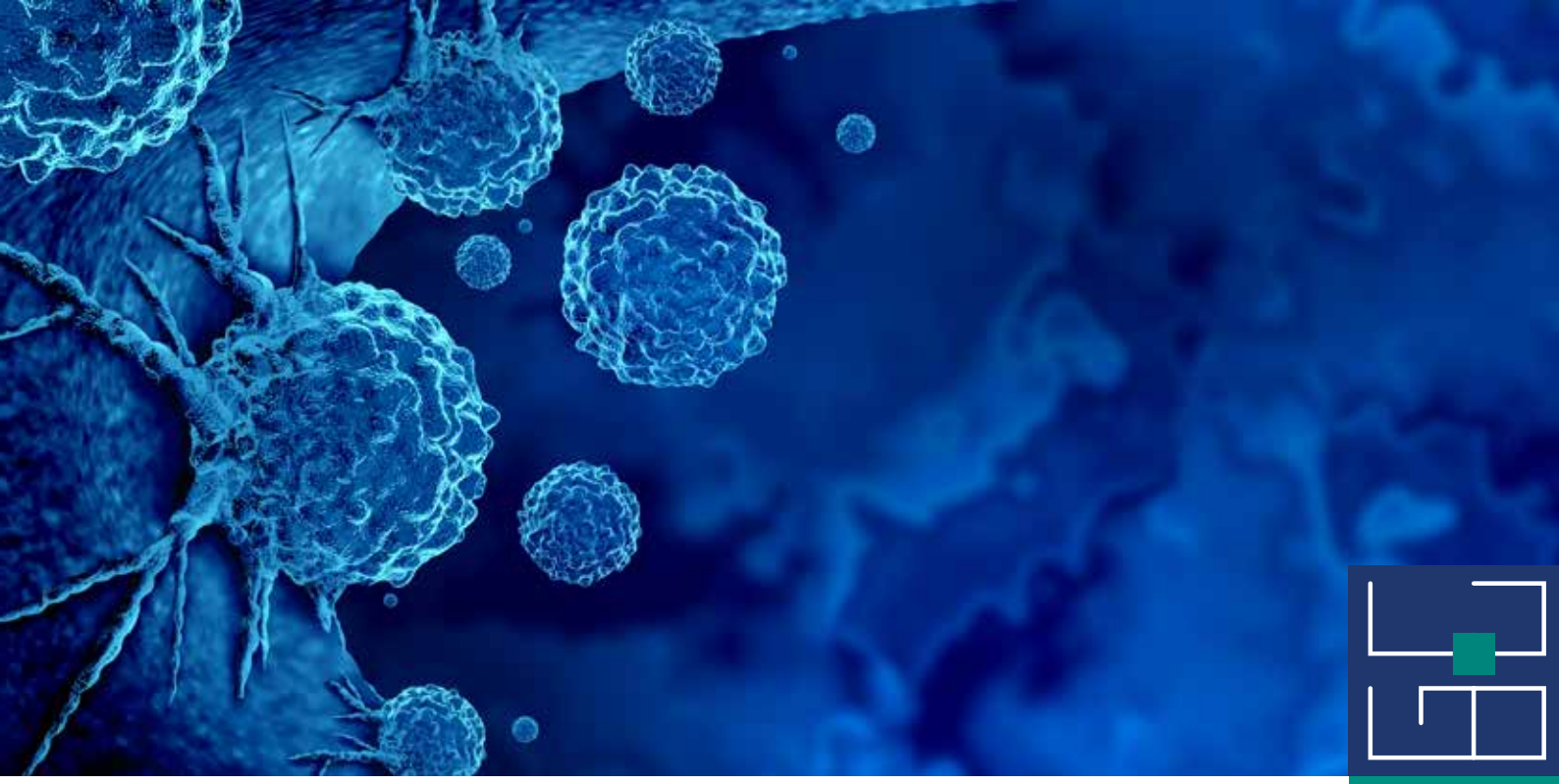

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Oncology Division Tumor Registry

Review 2020-2022

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Introduction

Cancer is one of the leading causes of death in the world, particularly in developing countries. Many of these deaths can be avoided, and others can be detected early, treated and cured. Even with late-stage cancer, the suffering of patients can be relieved with good palliative care. This is why it is important to have accurate cancer data so we can allocate the proper resources for treatment and prevention of cancer. The Oncology Division at Johns Hopkins Aramco Healthcare (JHAH) is delighted to present the 2020-2022 JHAH Tumor Registry Review.

JHAH is a leading cancer center in the Eastern Province of Saudi Arabia that provides state-of-the-art cancer treatment to all Saudi Aramco and JHAH employees and their dependents. JHAH is the first cancer center in the Kingdom and in the Gulf Cooperation Council countries (GCC) to establish a tumor registry. The specialized services at the Oncology Center include, but are not limited to, chemotherapy, immunotherapy, radiotherapy, surgery, autologous stem cell transplantation and palliative care.

The tumor registry is a vital component of the Oncology Center and is used to report trends in cancer occurrence that is used for quality control analysis and for research. The hospital administration uses information from the registry for planning, allocation and utilization of health resources. The JHAH tumor registry works in collaboration with the Saudi Cancer Registry (SCR) to collect and maintain cancer incidence, mortality and survival data. We acknowledge the work and support of the dedicated physicians, nurses and hospital staff, and express gratitude to the tumor registry staff for their tremendous effort and commitment.

Dr. Nafisah Al Faris

Oncology Division
Johns Hopkins Aramco Healthcare

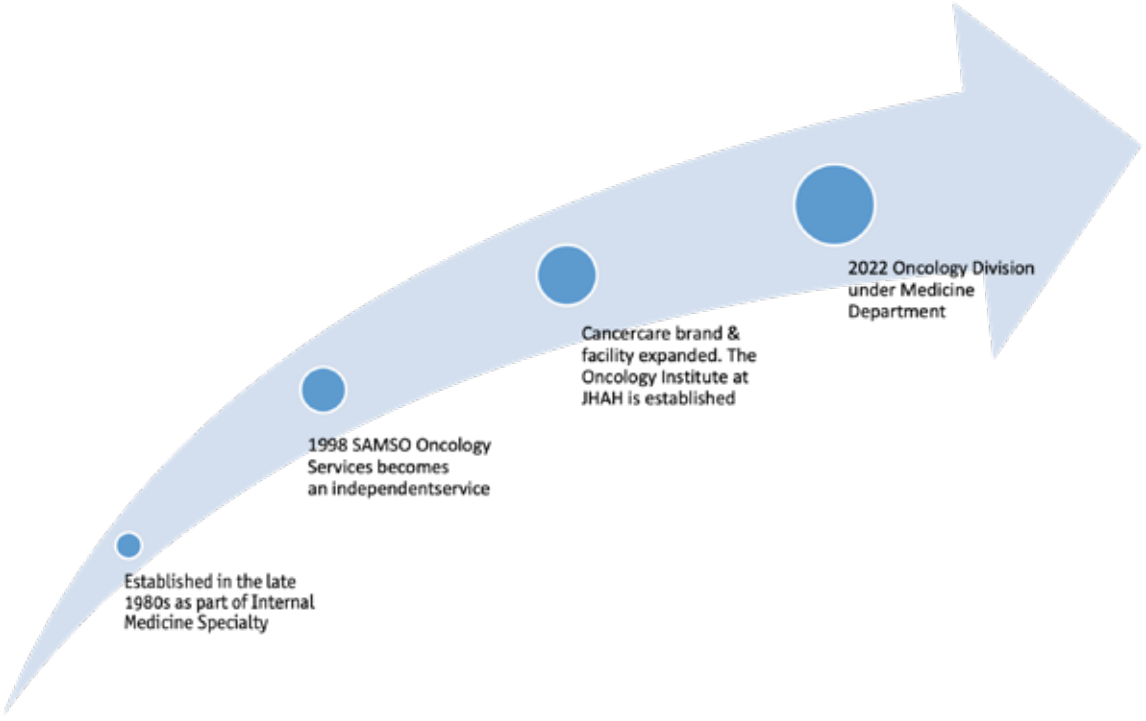
The Oncology Division is driven by three key pillars: delivering quality clinical outcomes, upholding academic excellence and fostering oncology education. Notably it has been designated as a training site for the Ministry of Health Oncology and Hematology Fellowship Program.

Mission
To improve the community's health by providing high-quality, multidisciplinary, comprehensive clinical care for oncology diseases and blood disorders in a comprehensive Blood and Cancer Center.

Vision
To lead in clinical excellence and education within the Kingdom of Saudi Arabia.

The Oncology Division is a comprehensive cancer center offering diverse cancer care that spans medical, surgical and radiation oncology services. This includes cancer care, autologous bone marrow transplant, blood disorder management, palliative care and a dedicated tumor registry. Delivering both inpatient and outpatient services, the division integrates cutting-edge chemotherapy, immune therapy, biologic therapy, hormone therapy, diagnostic and therapeutic procedures and state-of-the-art radiotherapy. Oncology services in the institution originated in the 1980s, gaining independent status in 1998 within the Saudi Aramco Medical Services Organization, which has evolved into the present-day Oncology Division at JHAH. Widely recognized, it has earned local, regional and international acclaim and recognition.

Chart 1: Oncology Division Map



Tumor Registry Unit

The JHAH Tumor Registry uses an information system designed to collect, manage and analyze patient data of those diagnosed with cancer.

The unit began collecting this information in 1987. It is a hospital-based registry that collects data from all medical organizations within the JHAH system, including its network of providers. The registry reports its data to the Saudi Cancer Registry in the Saudi Arabian Ministry of Health. The registry's database currently holds about 16,500 cases.

For quality improvement purposes, the Tumor Registry has been applying internal audits (Peer Reviews), which help standardize and reduce variations among the abstractors. External Audits also are done by Oncology, Hematology and Radiation Oncology physicians, which leads to high accuracy in registry data.

The registry contains a wide range of information, including the following:

- Patient demographics, age, gender and nationality
- Medical history, physical findings and screening information
- Diagnostic information including relevant dates and diagnostic procedure(s)
- Tumor information including primary site (Topography), cell type (Histology), behavior and extent of disease
- Type of therapies, i.e., surgery, chemotherapy, radiotherapy and hormone and immunotherapy
- Follow-up information including patient status, cancer status, last date of contact and death when appropriate

JHAH Cancer Population

In this review, a 3-year period of data (2020-2022) is covered. The total number of cases reported is 2,070 patients, with an annual incidence rate of about 700 patients per year. There was a dip to 600+ in 2020, which is likely due to the impact of the COVID-19 lockdown and restrictions. The overall number of cancer cases has steadily increased over the last 10 years for both genders. There is a slight predominance of cancer cases in females (52%) compared to males (48%) in the current review. As expected, nearly 90% of the population are Saudi nationals, and the remaining 10% are expatriates.

The median age at cancer diagnosis is 60, with an overwhelming majority being in their mid-40s to mid-70s. The peak age for males occurs a decade earlier (in the mid-50s) than females (in their mid-60s). Pediatric patients (14 years-old or younger) constitute a very small number of cases at 1%, and adolescents and young adults (15 to 29 years-old) comprise 3%.

The predominant presentation of solid tumors is loco-regional disease, comprising about two-thirds of all cases (66%), while one-fifth are metastatic at diagnosis (21%). The 3-year relative survival rate is more than 80%. As expected, the more advanced the disease stage, the lower the survival rate as is the likelihood of remaining disease-free.

The overall top three cancers are breast (21.5%), colorectal (11.1%) and prostate (7.5%). While the 2020 national registry in Saudi Arabia shares the top two cancers, breast followed by colorectal, it differs in that the third most common cancer nation-wide is thyroid cancer with prostate cancer not being among the top 10 cancers. The 2022 United States (US) registry shows that breast cancer is the most common with prostate cancer being second. Thus, JHAH data appear to be closer to the pattern in the US.

In women, the most common cancer is breast cancer (40.7%). Gynecologic is second at 11.8%, and colorectal cancers are third at 8.8%. In the Saudi registry, the top cancers in females are breast, followed by thyroid, and colorectal is third. The US registry shows the top cancers to be breast followed by lung and then colorectal cancers. So apart from the second most common cancer in women being thyroid cancer in KSA and lung in USA, the distribution is quite similar to both registries.

In men, the number one cancer is prostate (15.7%) followed by colorectal (13.6%) and then lung (9.5%). In the Saudi registry, the top cancer in males is colorectal followed by leukemia then non-Hodgkin lymphoma, with prostate cancer coming a distant fourth. The US registry shows the top cancers to be prostate followed by lung and then colorectal cancer, which is quite similar to JHAH data except for the second and third places.

In summary, at JHAH, despite a continuous increase in cancer cases over the years, a remarkable 3-year patient survival rate of more than 80% is achieved, likely due to early cancer detection and high standard of care. This is quite encouraging and reassuring about the ongoing strategies followed at the JHAH Oncology Division.

Interestingly, the cancer primary site distribution in JHAH seems to bear more resemblance to that in the US than in KSA despite 90% of all cancer cases being Saudi nationals. This could be due to lifestyle or environmental factors. Further research is warranted.

Chart 2: Distribution of Cancer Cases, 2020-2022

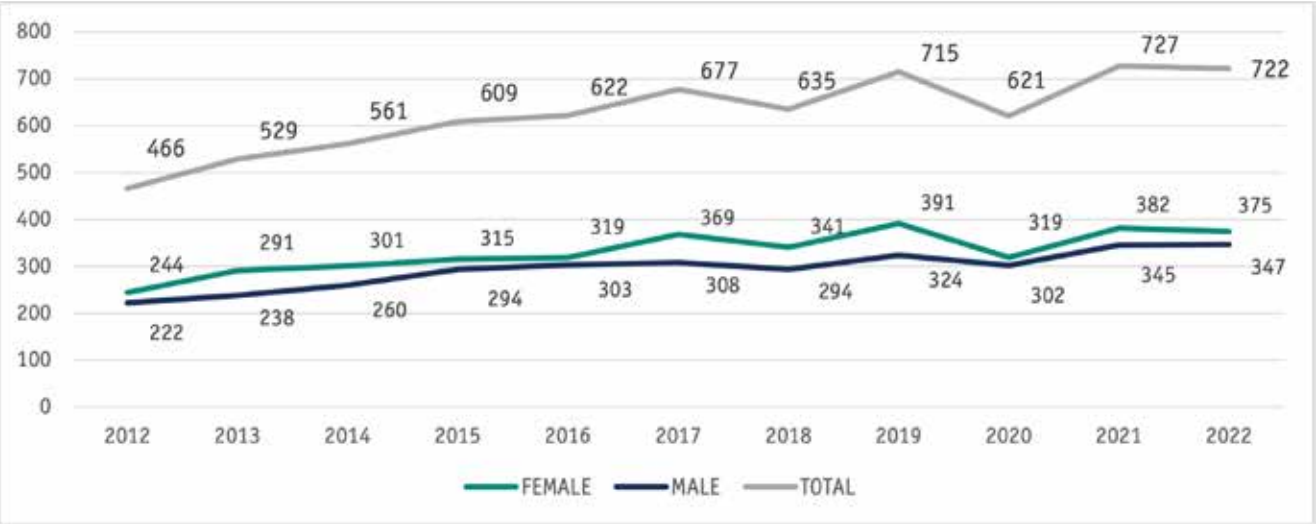


Table 1: Gender Distribution of Cancer Cases by Nationality, 2020-2022

SAUDI			NON SAUDI			GRAND TOTAL
FEMALE	MALE	TOTAL	FEMALE	MALE	TOTAL	
956	901	1857	120	93	213	2070
51.5%	48.5%	89.7%	56.3%	43.7%	10.3%	

Chart 3: Gender Distribution of Cancer Cases, 2020-2022

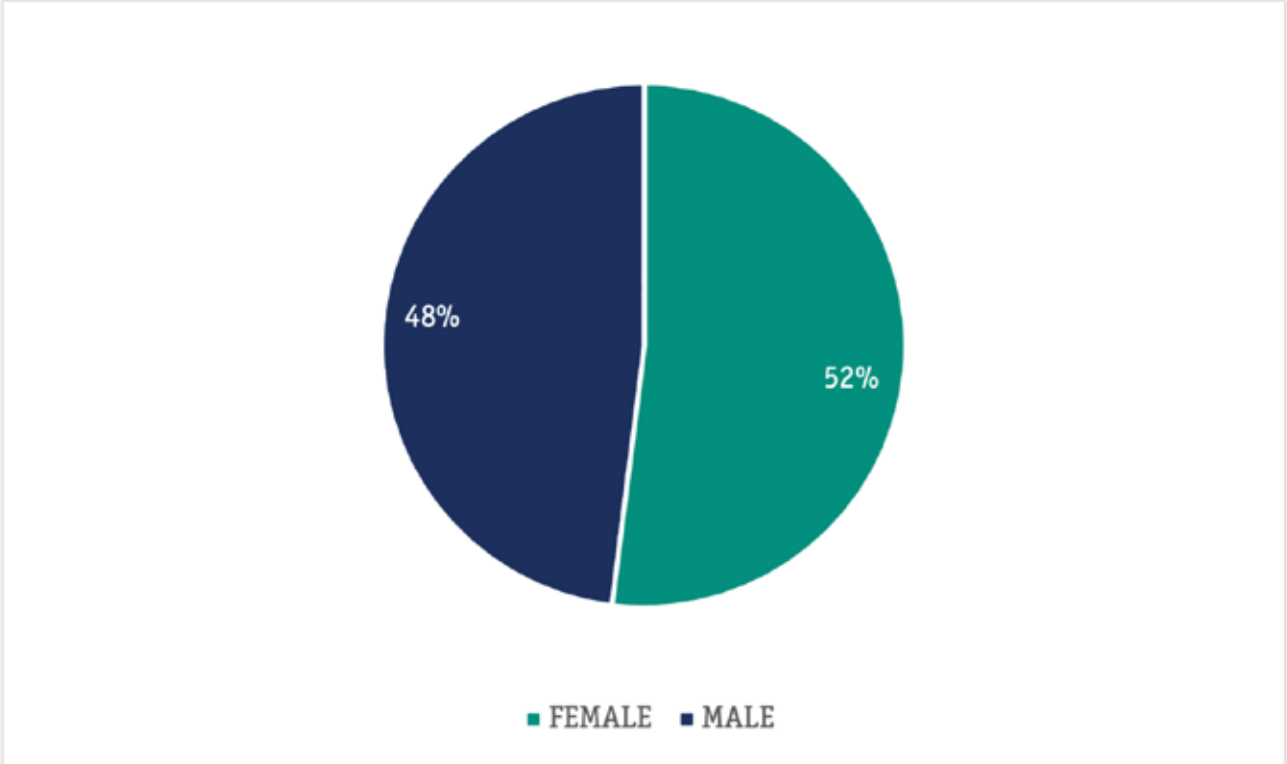


Chart 4: Age Distribution of Cancer Cases by Gender, 2020-2022

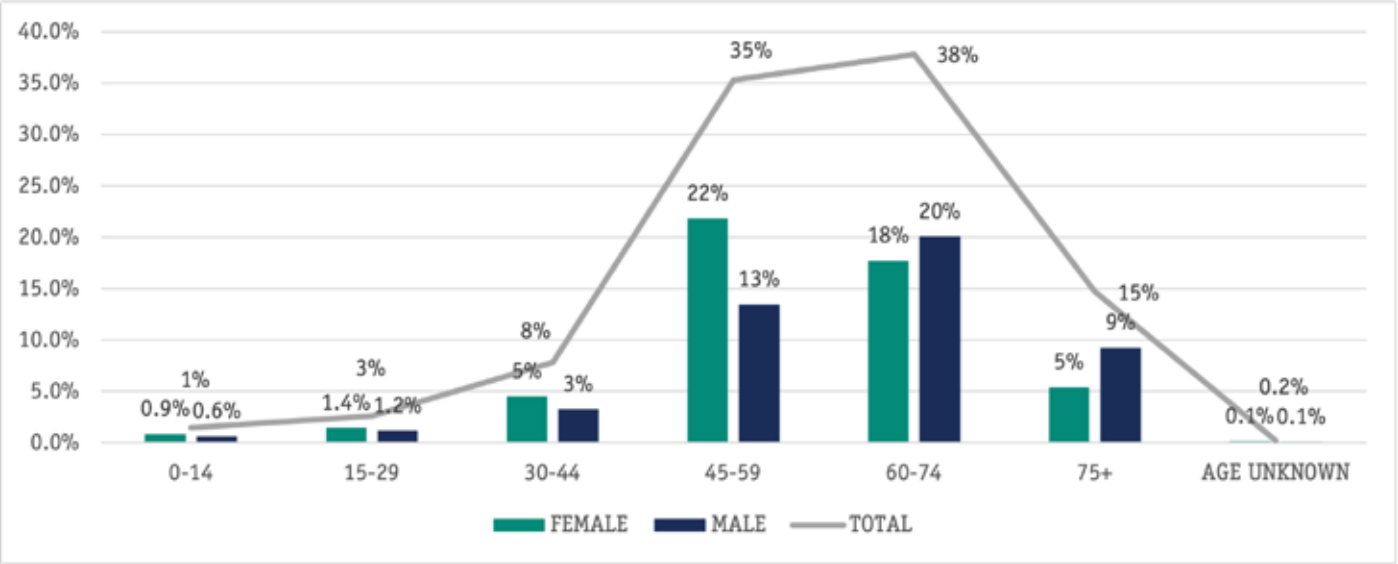
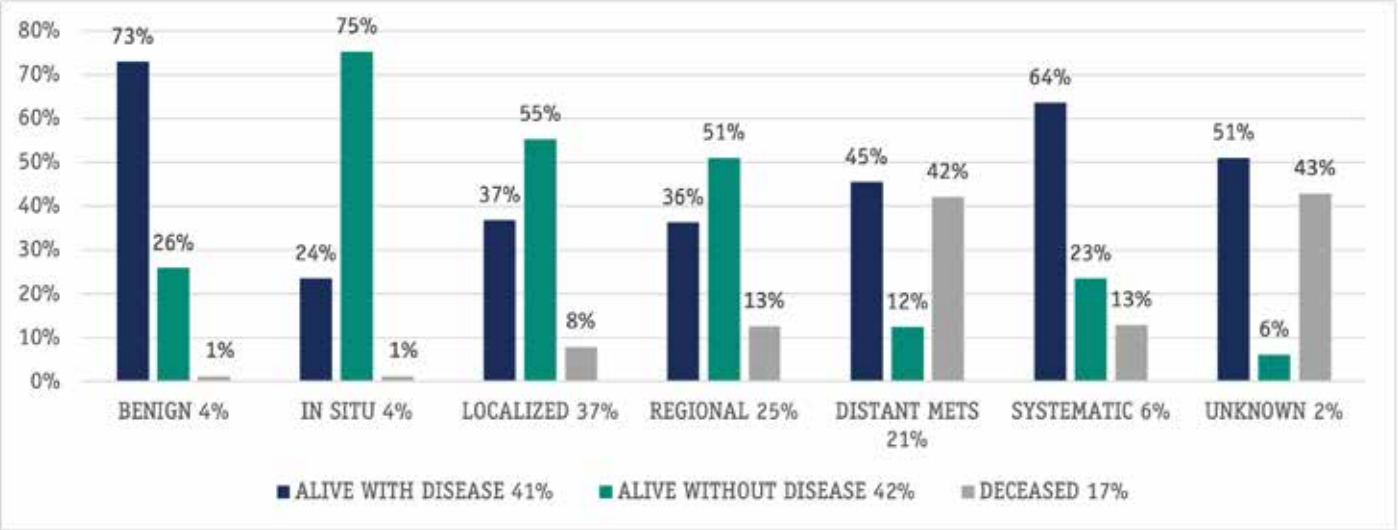


Chart 5: Survival Distribution of Cancer Cases by Stage, 2020-2022



Note: Systematic cases are those with systematic disease in hematology cases.

Cancer Rates 2020-2022

Median Age At Diagnosis	3-Year Survival	Median follow up
60	**83%**	**11 months**
2020-2022	2020-2022	2020-2022

Table 2: Distribution of the Most Frequent Types of Cancers by Gender and Age Group, 2020-2022

PRIMARY SITE	FEMALE	0-14 %	PRIMARY SITE	MALE	%
LEUKEMIA	5	27.8%	LEUKEMIA	3	23.1%
CNS MALIGNANT	4	22.2%	CNS BENIGN	2	15.4%
EYE	2	11.1%	CNS MALIGNANT	2	15.4%
PERITONEUM AND RETROPERITONEUM	2	11.1%	CONNECTIVE SOFT TISSUE	1	7.7%
BONE	1	5.6%	NON-HODGKIN LYMPHOMA	1	7.7%
CONNECTIVE SOFT TISSUE	1	5.6%	OTHER HEMATOPOIETIC	1	7.7%
GI NON COLORECTAL	1	5.6%	SKIN NON MELANOMA	1	7.7%
NON-HODGKIN LYMPHOMA	1	5.6%	TESTIS	1	7.7%
URINARY NON PROSTATE	1	5.6%	THORACIC NOS	1	7.7%
Total	18		Total	13	

PRIMARY SITE	FEMALE	15-29 %	PRIMARY SITE	MALE	%
THYROID GLAND	15	50.0%	CNS BENIGN	3	12.5%
HODGKIN LYMPHOMA	4	13.3%	LEUKEMIA	3	12.5%
BREAST	3	10.0%	CNS MALIGNANT	2	8.3%
COLON AND RECTUM	3	10.0%	HODGKIN LYMPHOMA	2	8.3%
BENIGN PITUITARY GLAND	1	3.3%	LUNG AND BRONCHUS	2	8.3%
CNS BENIGN	1	3.3%	OTHER HEMATOPOIETIC	2	4.2%
CNS MALIGNANT	1	3.3%	BONE	1	4.2%
GI NON COLORECTAL	1	3.3%	COLON AND RECTUM	1	4.2%
NON-HODGKIN LYMPHOMA	1	3.3%	CONNECTIVE SOFT TISSUE	1	4.2%
Total	30		HEAD AND NECK	1	4.2%
			OTHER SITE	6	25.0%
			Total	24	

PRIMARY SITE	FEMALE	30-44 %	PRIMARY SITE	MALE	%
BREAST	37	39.4%	THYROID GLAND	10	14.7%
THYROID GLAND	18	19.1%	COLON AND RECTUM	8	11.8%
FEMALE GENITAL	8	8.5%	URINARY NON PROSTATE	8	11.8%
COLON AND RECTUM	6	6.4%	SKIN NON MELANOMA	7	10.3%
OTHER HEMATOPOIETIC	5	5.3%	HODGKIN LYMPHOMA	5	7.4%
CNS BENIGN	4	4.3%	NON-HODGKIN LYMPHOMA	5	7.4%
HEAD AND NECK	2	2.1%	TESTIS	5	7.4%
HODGKIN LYMPHOMA	2	2.1%	LEUKEMIA	4	5.9%
SKIN MELANOMA	2	2.1%	BENIGN PITUITARY GLAND	3	4.4%
URINARY NON PROSTATE	2	2.1%	CNS BENIGN	2	2.9%
OTHER SITE	8	8.5%	OTHER SITE	11	16.2%
Total	94		Total	68	

PRIMARY SITE	FEMALE	45-59 %	PRIMARY SITE	MALE	%
BREAST	205	45.4%	COLON AND RECTUM	41	14.7%
FEMALE GENITAL	47	10.4%	PROSTATE GLAND	33	11.8%
COLON AND RECTUM	44	9.7%	SKIN NON MELANOMA	30	10.8%
THYROID GLAND	31	6.9%	NON-HODGKIN LYMPHOMA	23	8.2%
CNS BENIGN	24	5.3%	LUNG AND BRONCHUS	22	7.9%
NON-HODGKIN LYMPHOMA	20	4.4%	URINARY NON PROSTATE	22	7.9%
GI NON COLORECTAL	11	2.4%	LEUKEMIA	15	5.4%
LEUKEMIA	11	2.4%	GI NON COLORECTAL	14	5.0%
SKIN NON MELANOMA	10	2.2%	LIVER	10	3.6%
PANCREAS	9	2.0%	CNS MALIGNANT	9	3.2%
OTHER SITE	40	8.8%	OTHER SITE	60	21.5%
Total	452		Total		

PRIMARY SITE	FEMALE	60-74 %	PRIMARY SITE	MALE	%
BREAST	159	43.3%	PROSTATE GLAND	81	19.5%
FEMALE GENITAL	57	15.5%	COLON AND RECTUM	61	14.7%
COLON AND RECTUM	30	8.2%	LUNG AND BRONCHUS	43	10.3%
CNS BENIGN	15	4.1%	URINARY NON PROSTATE	36	8.7%
THYROID GLAND	12	3.3%	PANCREAS	25	6.0%
NON-HODGKIN LYMPHOMA	10	2.7%	GI NON COLORECTAL	24	5.8%
URINARY NON PROSTATE	9	2.5%	NON-HODGKIN LYMPHOMA	18	4.3%
LUNG AND BRONCHUS	8	2.2%	LEUKEMIA	13	3.1%
PANCREAS	8	2.2%	SKIN NON MELANOMA	13	3.1%
HEAD AND NECK	7	1.9%	HEAD AND NECK	12	2.9%
OTHER SITE	52	14.2%	OTHER SITE	90	21.6%
Total	367		Total	416	

PRIMARY SITE	FEMALE	75+ %	PRIMARY SITE	MALE	%
BREAST	33	29.5%	PROSTATE GLAND	42	21.9%
FEMALE GENITAL	14	12.5%	URINARY NON PROSTATE	26	13.5%
COLON AND RECTUM	12	10.7%	COLON AND RECTUM	24	12.5%
NON-HODGKIN LYMPHOMA	9	8.0%	LUNG AND BRONCHUS	24	12.5%
LIVER	6	5.4%	GI NON COLORECTAL	9	4.7%
CNS BENIGN	5	4.5%	LIVER	8	4.2%
PANCREAS	5	4.5%	NON-HODGKIN LYMPHOMA	8	4.2%
GALLBLADDER	3	2.7%	PLASMA CELL TUMORS	7	3.6%
GI NON COLORECTAL	3	2.7%	SKIN NON MELANOMA	7	3.6%
LUNG AND BRONCHUS	3	2.7%	PANCREAS	6	3.1%
OTHER SITE	19	17.0%	OTHER SITE	31	16.1%
Total	112		Total	192	

PRIMARY SITE	FEMALE	ALL AGES %	PRIMARY SITE	MALE	%
BREAST	438	40.7%	PROSTATE GLAND	156	15.7%
FEMALE GENITAL	127	11.8%	COLON AND RECTUM	135	13.6%
COLON AND RECTUM	95	8.8%	LUNG AND BRONCHUS	94	9.5%
THYROID GLAND	77	7.2%	URINARY NON PROSTATE	93	9.4%
CNS BENIGN	49	4.6%	SKIN NON MELANOMA	59	5.9%
NON-HODGKIN LYMPHOMA	42	3.9%	NON-HODGKIN LYMPHOMA	55	5.5%
LEUKEMIA	26	2.4%	GI NON COLORECTAL	47	4.7%
URINARY NON PROSTATE	24	2.2%	LEUKEMIA	42	4.2%
PANCREAS	23	2.1%	PANCREAS	36	3.6%
GI NON COLORECTAL	22	2.0%	LIVER	27	2.7%
OTHER SITE	153	14.2%	OTHER SITE	250	25.2%
Total	1076		Total	994	

Table 3: Most Common Cancers, 2020-2022

PRIMARY SITE	2020	2021	2022	Total	%
BREAST	132	149	164	445	21.5%
COLON AND RECTUM	76	67	87	230	11.1%
PROSTATE GLAND	33	63	60	156	7.5%
FEMALE GENITAL	31	49	47	127	6.1%
URINARY NON PROSTATE	37	41	39	117	5.7%
LUNG AND BRONCHUS	40	38	34	112	5.4%
THYROID GLAND	30	40	34	104	5.0%
NON-HODGKIN LYMPHOMA	32	39	26	97	4.7%
SKIN NON MELANOMA	21	22	35	78	3.8%
CNS BENIGN	14	35	21	70	3.4%

Most Common Cancers 2020-2022

Breast Cancer

Breast cancer was the most common cancer in the 2020-2022 period with 445 cases. Gender distribution is consistent with historical and international data. The age distribution is also consistent with institutional historic data and national data, with the most affected age group being 50-59.

Stage distribution between 2020 and 2022 remained consistent with the previous 2017-2019 data, with the majority of patients being diagnosed with a localized disease. This is followed by regional disease with a minority of patients diagnosed with de Novo stage IV at around 14%, which is comparable to previous data.

The three (3) year survival was newly included in this report. For breast cancer, the rate was around 93%, with a median age at diagnosis of 58, which is most likely attributed to early diagnosis and localized disease that promotes cure and prolonged survival.

Mammogram is the primary test used to detect breast cancer in asymptomatic patients. Mammograms are used to detect at least 33% of our breast cancer patients. Breast self-exam was used to detect 59% of the cases. This data highlights the importance of mammograms in early detection.

Histologically, the subtypes of breast cancer are consistent with national and international data, with the most breast cancer subtypes being invasive ductal carcinoma followed by lobular carcinoma. Various rare subtypes registered in at less than 5% of the total patient population.

Table 4: Gender Distribution of Breast Cancer by Nationality, 2020-2022

SAUDI			NON SAUDI			GRAND TOTAL
FEMALE	MALE	TOTAL	FEMALE	MALE	TOTAL	
385	7	392	53	0	53	445
98.2%	1.8%	88.1%	100.0%	0.0%	11.9%	

Chart 6: Gender Distribution of Breast Cancer, 2020-2022

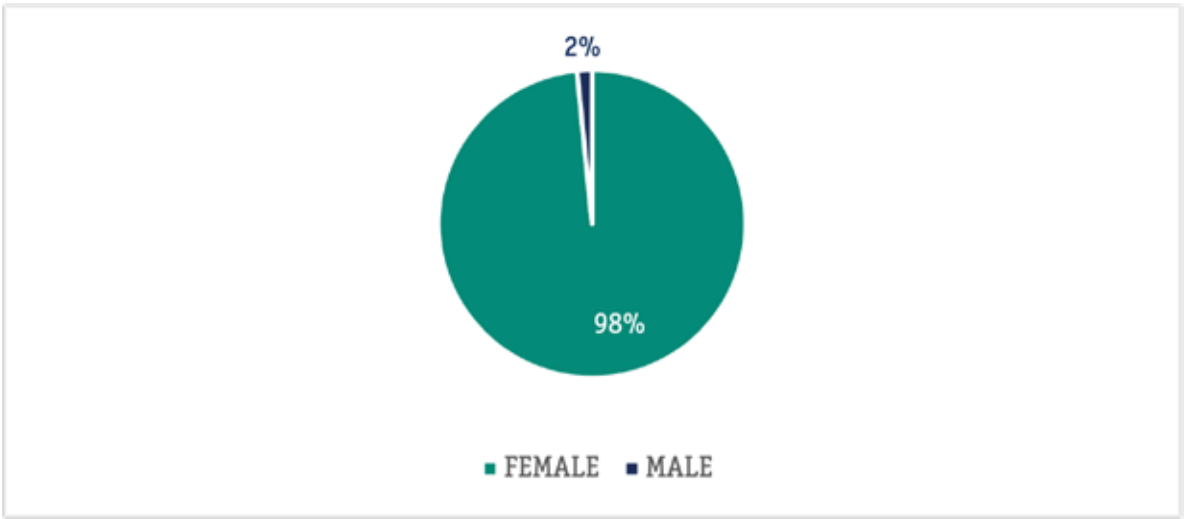


Chart 7: Age Distribution of Breast Cancer by Gender, 2020-2022

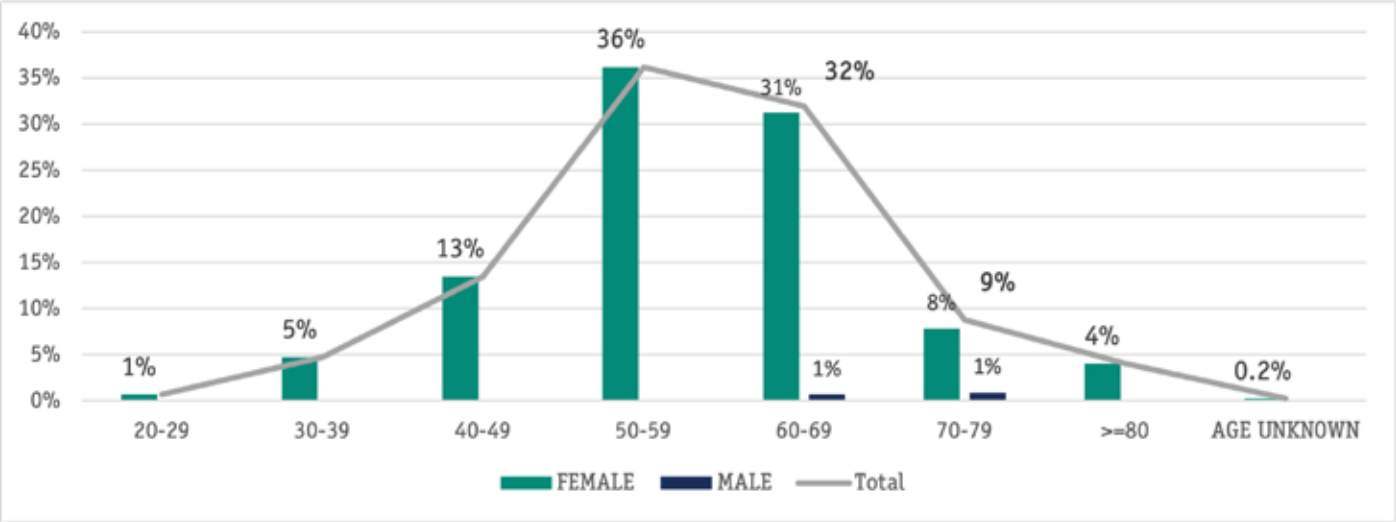
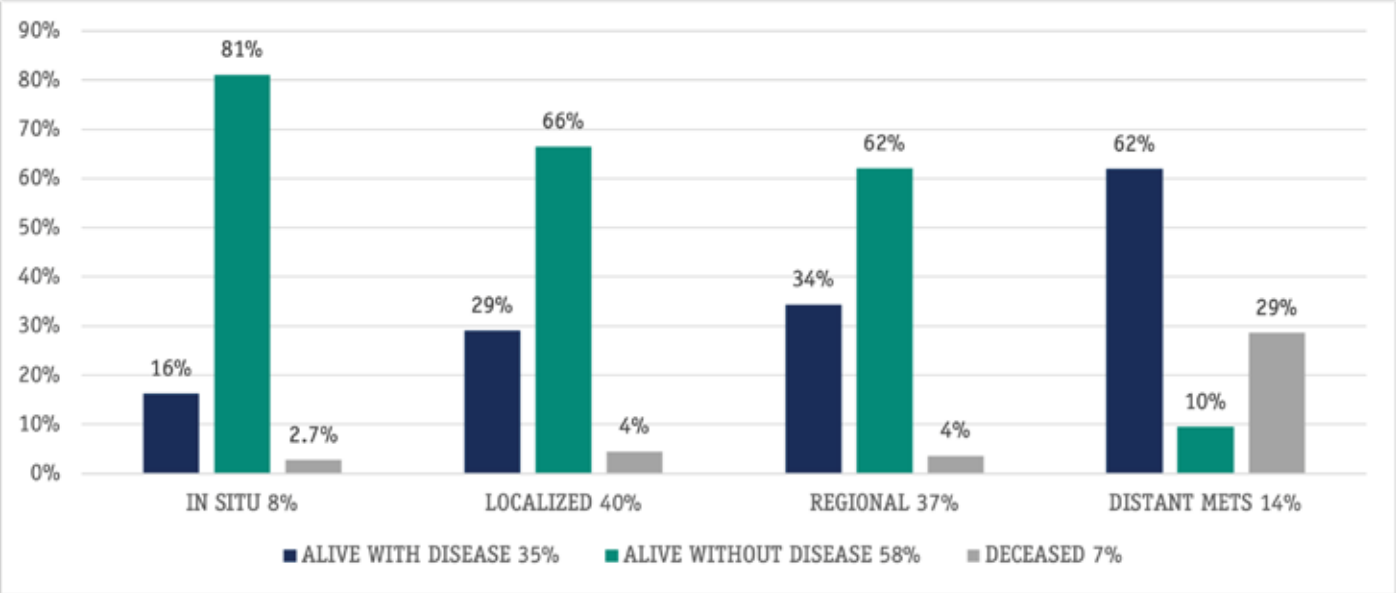


Chart 8: Survival Distribution of Breast Cancer by Stage, 2020-2022



Breast Cancer Rates 2020-2022

Median Age At Diagnosis	3-Year Survival	Median follow up
58	**93%**	**18 months**
2020-2022	**2020-2022**	**2020-2022**

Chart 9: First Detection Distribution of Breast Cancer, 2020-2022

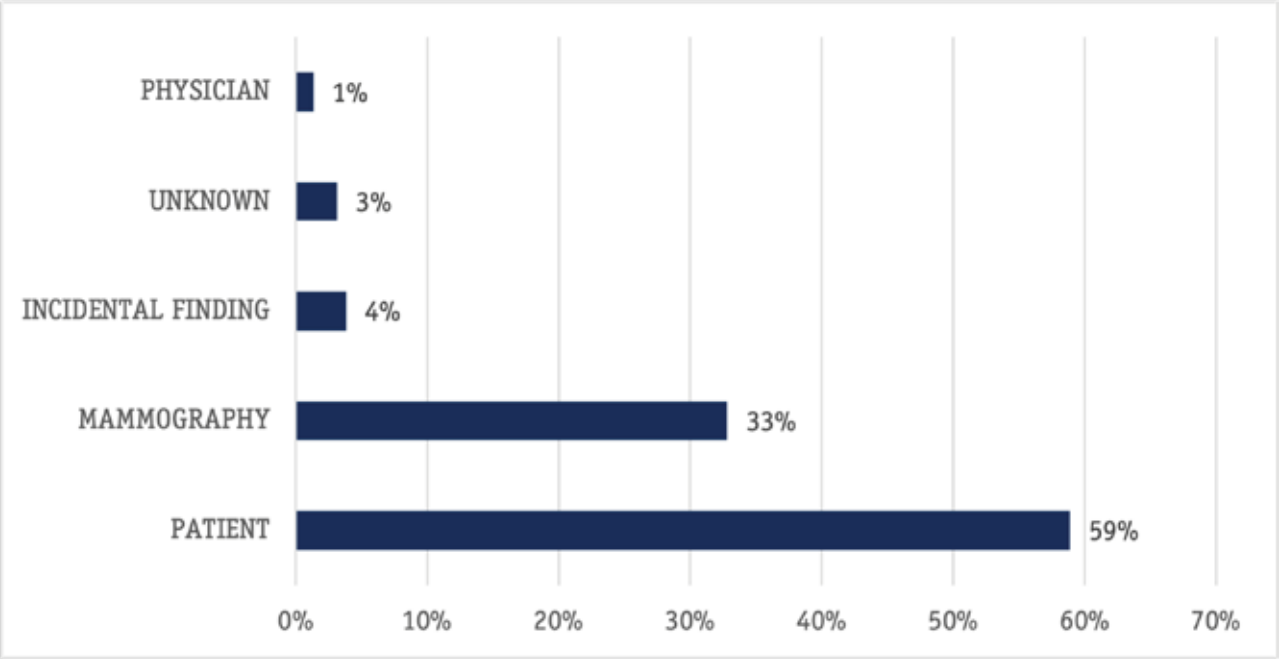


Table 5: Morphological Distribution of Breast Cancer, 2020-2022

Morphological type	2020	2021	2022	TOTAL	%
INVASIVE DUCTAL CARCINOMA	106	135	143	384	86.3%
LOBULAR CARCINOMA	19	12	11	42	9.4%
DUCT AND LOBULAR CARCINOMA	5	2	5	12	2.7%
NEOPLASM MALIGNANT NOS	1		2	3	0.7%
ADENOCARCINOMA NOS	1		2	3	0.7%
NEUROENDOCRINE CARCINOMA			1	1	0.2%
Total	132	149	164	445	

Colorectal Cancer

At JHAH, colorectal cancer was the second most common cancer in the 2020-2022 period. There were 230 colorectal cancer cases, with no significant increase from previous years. There has been a gradual increase in the percentage of male to female, which is a further change from the previous three years. As far as age distribution goes, there has been no significant change over the last three years. Most of the patients diagnosed were between the ages of 50-69. Median age at diagnosis was 61 years, which highlights the importance of regular colonoscopy screenings starting at 45-50 years of age.

Most patients who were diagnosed with metastatic disease in 2020 are deceased. The percentage of deceased patients went down gradually between 2021 and 2022. As for patients with localized and regional disease, the majority are alive without disease, which reflects effective treatment for patients with early diagnosis.

The three-year survival rate for all patients with colorectal cancer is 87%, and as expected, is highest in the localized group and lowest for the distant disease group. Almost 75% of patients presented with regional or distant metastatic. It is thought that this can be significantly improved with a more robust screening program. Finally, there have been no change in morphological subtypes from previous years.

Table 6: Gender Distribution of Colorectal Cancer by Nationality, 2020-2022

SAUDI			NON SAUDI			GRAND TOTAL
FEMALE	MALE	TOTAL	FEMALE	MALE	TOTAL	
90	132	222	5	3	8	230
40.5%	59.5%	96.5%	62.5%	37.5%	3.5%	

Chart 10: Gender Distribution of Colorectal Cancer, 2020-2022

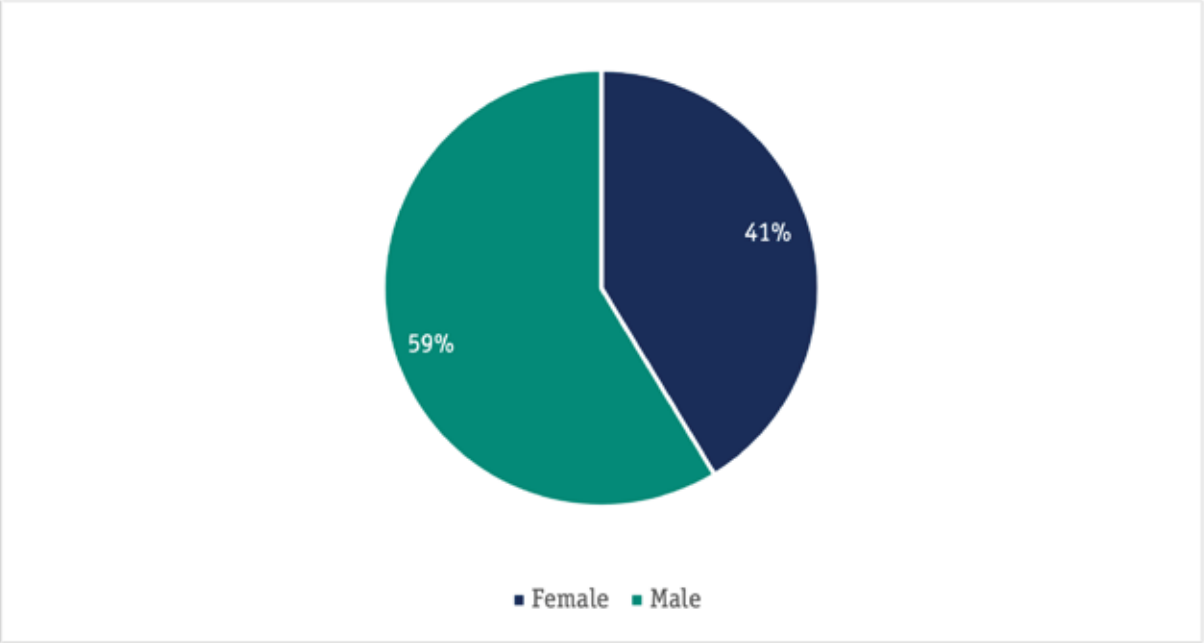


Chart 11: Age Distribution of Colorectal Cancer by Gender, 2020-2022

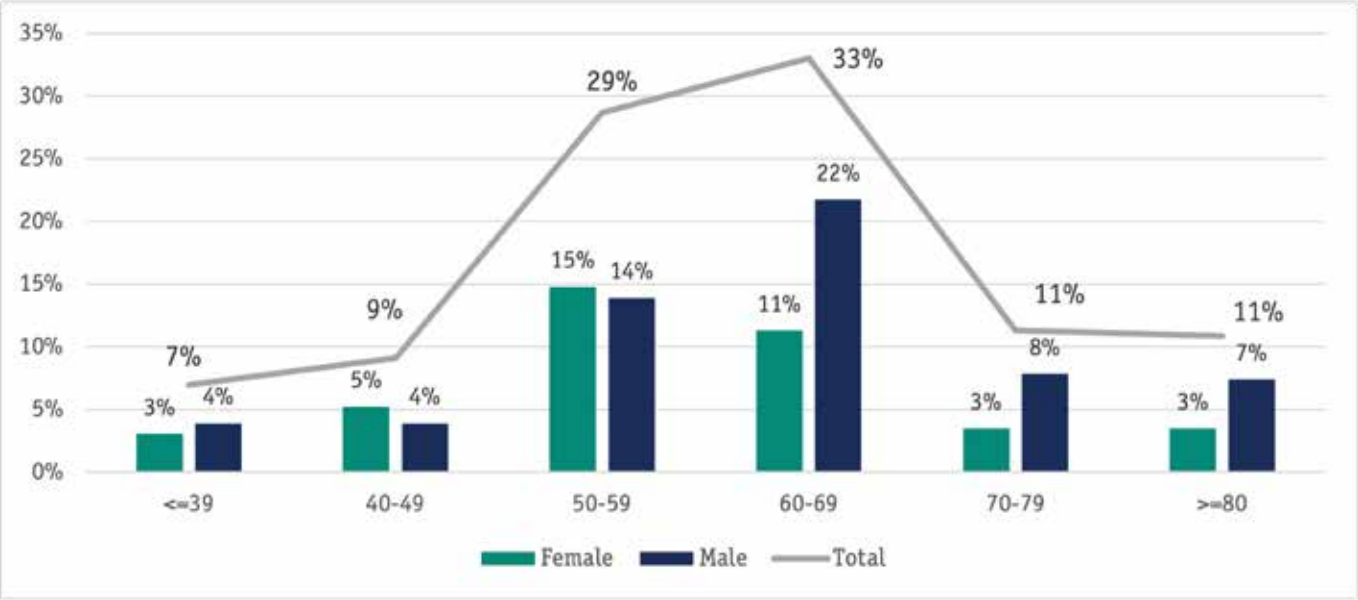
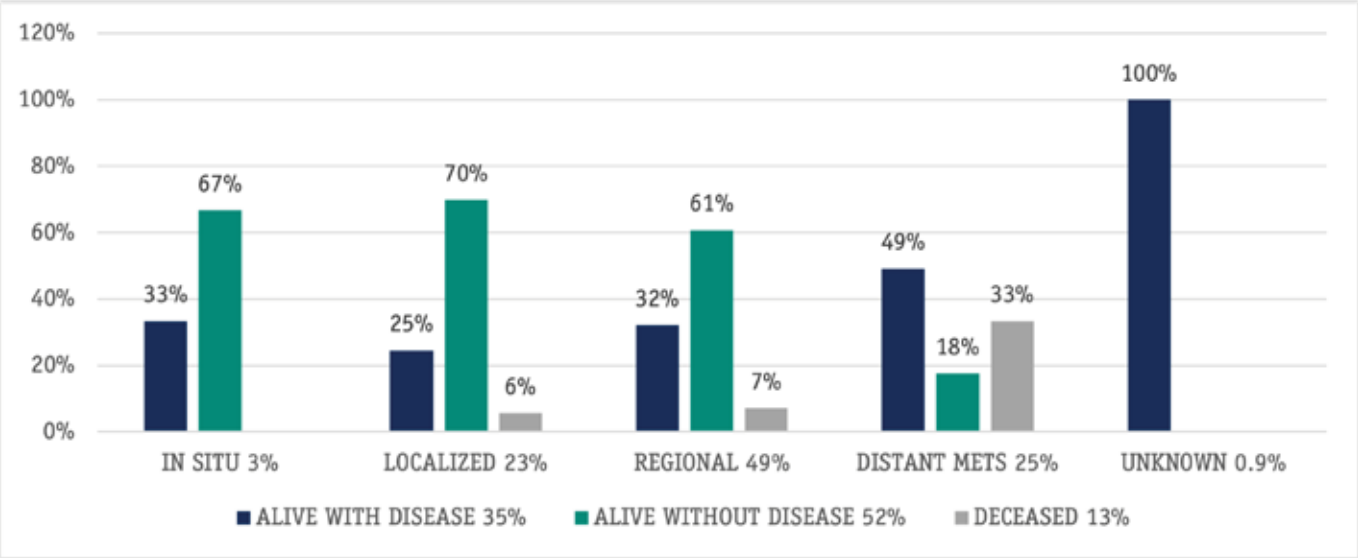


Chart 12: Survival Distribution of Colorectal Cancer by Stage, 2020-2022



Colorectal Cancer Rates 2020-2022

Median Age At Diagnosis	3-Year Survival	Median follow up
61	87%	9 months
2020-2022	2020-2022	2020-2022

Table 7: Morphological Distribution of Colorectal Cancer, 2020-2022

Morphological type	2020	2021	2022	Total	%
ADENOCARCINOMA	74	64	82	220	95.7%
CARCINOID TUMOR	2	2	5	9	3.9%
SQUAMOUS CELL CARCINOMA	0	1	0	1	0.4%
Total	76	67	87	230	

Prostate Cancer

Prostate cancer is the most common cancer in males. One-hundred and fifty (150) cases of prostate cancer were diagnosed in the 2020-2022 period.

As shown in the age group distribution, prostate cancer remains a disease found in older men, with a median age at diagnosis of 67 years. Survival is better in the earlier diagnosis stage as demonstrated in the graph, with a 3-year survival rate of 88%. While screening for prostate cancer is still considered controversial, it should be individualized according to each patient's personal and family history.

Table 8: Distribution of Prostate Cancer by Nationality, 2020-2022

SAUDI	NON SAUDI	TOTAL
150	6	156
96.2%	3.8%	

Chart 13: Age Distribution of Prostate Cancer, 2020-2022

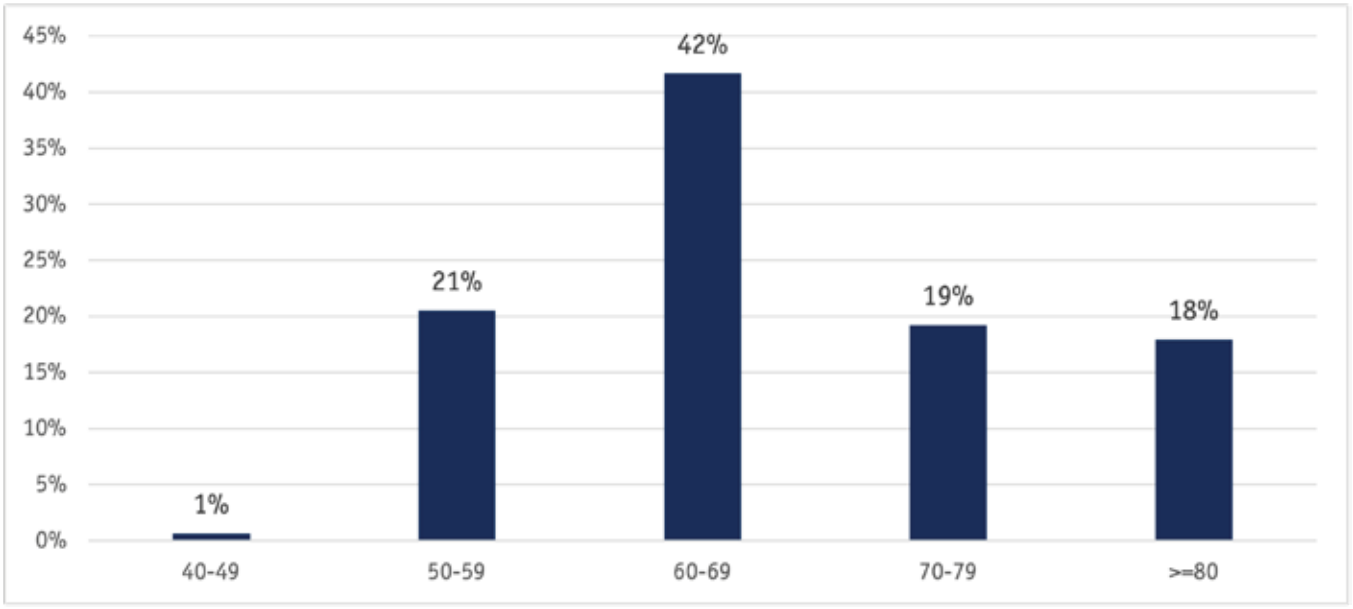
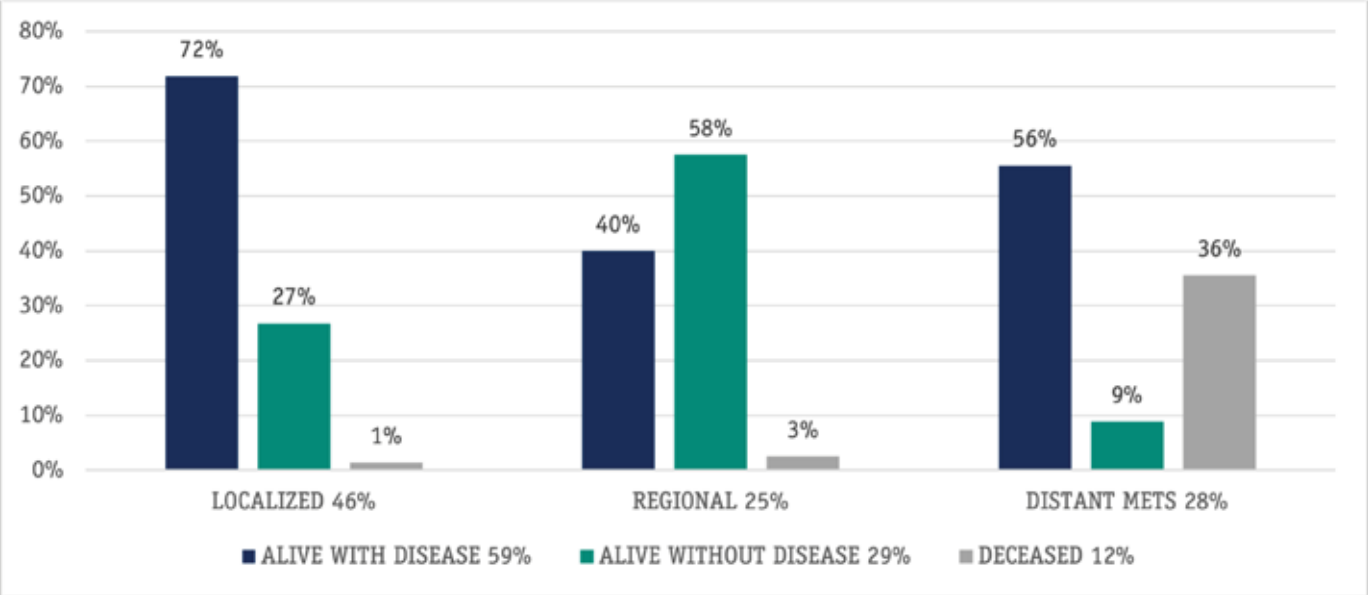


Chart 14: Survival Distribution of Prostate Cancer by Stage, 2020-2022



Prostate Cancer Rates 2020-2022

Median Age At Diagnosis	3-Year Survival	Median follow up
67	88%	15 months
2020-2022	2020-2022	2020-2022

Thyroid Cancer

During the 2020-2022 period, thyroid cancer was reported as the 7th most common cancer at JHAH. It has been consistently found more in females than males and is the 4th most common cancer in females.

Thyroid cancer in adults was reported in all age groups; however, the highest incidence was in the 40-59 age group, with a median age at diagnosis of 48 years. Ninety-seven percent (97%) of thyroid cancer cases were either localized or regional with a 3-year survival rate of 99%, which is similar to other registries. Papillary thyroid cancer was a major type of thyroid cancer at JHAH, with very good prognosis and survival.

Table 9: Gender Distribution of Thyroid Cancer by Nationality, 2020-2022

SAUDI			NON SAUDI			GRAND TOTAL
FEMALE	MALE	TOTAL	FEMALE	MALE	TOTAL	
66	24	90	11	3	14	104
73%	26.7%	86.5%	78.6%	21.4%	13.5%	

Chart 15: Gender Distribution of Thyroid Cancer, 2020-2022

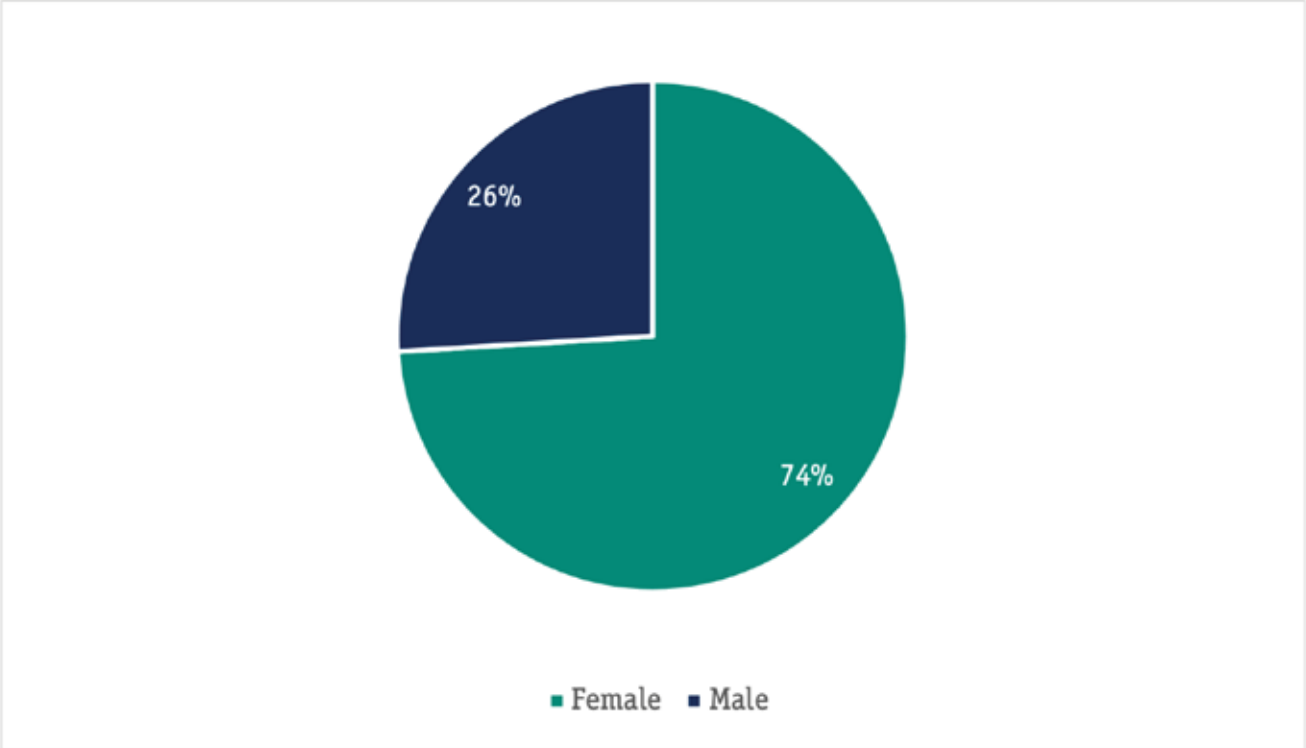


Chart 16: Age Distribution of Thyroid Cancer by Gender, 2020-2022

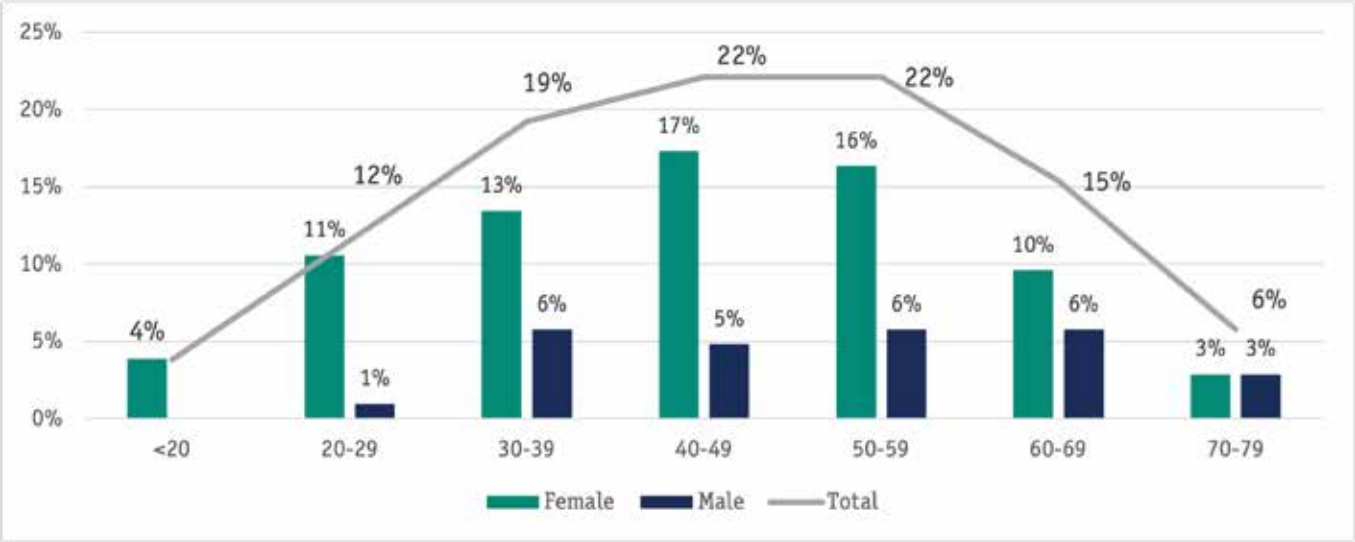
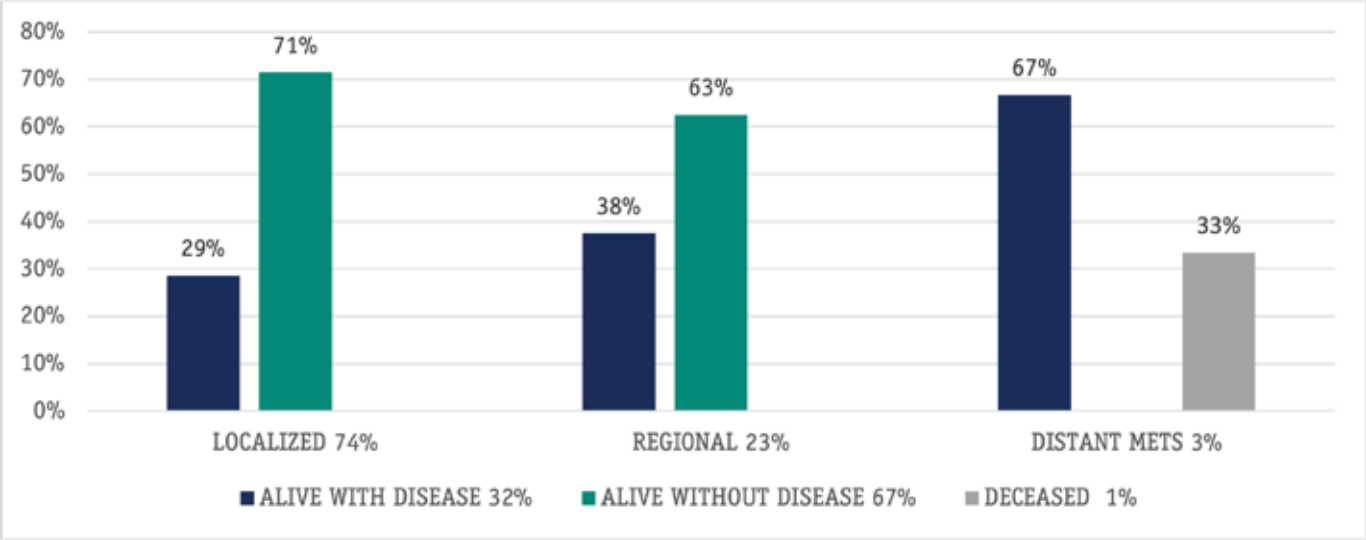


Chart 17: Survival Distribution of Thyroid Cancer by Stage, 2020-2022



Thyroid Cancer Rates 2020-2022

Median Age At Diagnosis	3-Year Survival	Median follow up
48	99%	10 months
2020-2022	2020-2022	2020-2022

Chart 18: Focality Distribution of Thyroid Cancer, 2020-2022

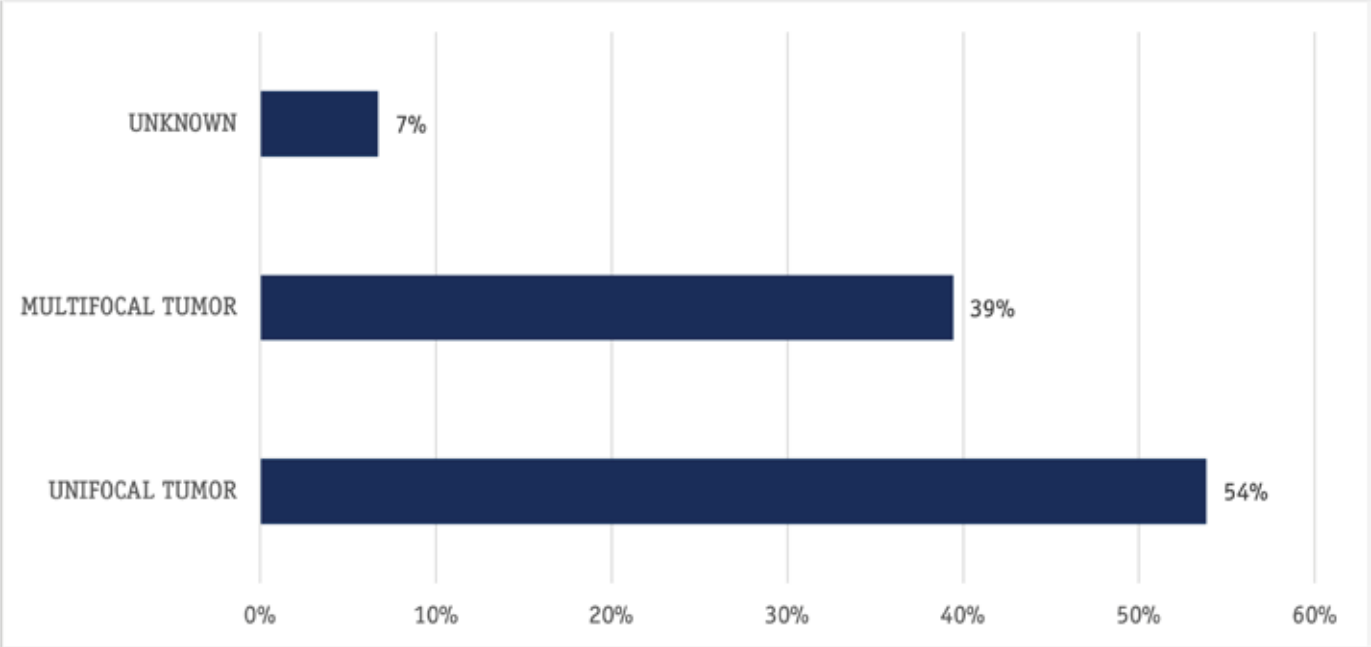


Table 10: Morphological Distribution of Thyroid Cancer, 2020-2022

Morphological type	2020	2021	2022	Total	%
PAPILLARY ADENOCARCINOMA	19	16	17	52	50%
PAPILLARY AND FOLLICULAR ADENOCARCINOMA	7	21	12	40	38%
FOLLICULAR ADENOCARCINOMA	4	1	4	9	9%
CARCINOMA NOS		1		1	1%
INSULAR CARCINOMA			1	1	1%
MEDULLARY CARCINOMA		1		1	1%
Total	30	40	34	104	

Lung Cancer

This is the first time we included lung cancer in our Tumor Registry Review as it is becoming a more common cancer with a total number of 112 cases in the 2020-2022 period.

Gender distribution in lung cancer is consistent with historical and international data. Our data show that most lung cancer patients are male, around 84%.

The age distribution is also consistent with international historical data and national data, with the most affected age group, around 36%, being the 60-69 age group.

Stage distribution between 2020 and 2022 shows the majority of patients diagnosed with distant metastases at around 53%, followed by regional 26%, and the remainder as localized at around 21%.

The three-year survival rate for lung cancer at JHAH was around 44% for the 2020-2022 period, with a median age at diagnosis of 66. A lung cancer screening program at JHAH requiring annual low-dose CT scan screening for high-risk individuals (age 50 years or older with a ≥20 pack per year history of smoking) per National Comprehensive Cancer Network (NCCN) guidelines should be considered. Screening is not recommended for individuals with functional status or comorbidity that would prohibit curative-intent therapy.

An active smoking-cessation program is one of the best ways to prevent lung cancer; however, it is important to bear in mind that biomarker-driven, non-small cell lung cancer (NSCLC) occurs predominantly in those who have never smoked.

Most histological subtype cases are non-small-cell lung cancer with adenocarcinoma cases at 35% and squamous carcinoma cases at 16%. Small-cell lung cancer only contributes around 7% of the cases.

Table 11: Gender Distribution of Lung Cancer by Nationality, 2020-2022

SAUDI			NON SAUDI			GRAND TOTAL
FEMALE	MALE	TOTAL	FEMALE	MALE	TOTAL	
17	91	108	1	3	4	112
15.7%	84.3%	96.4%	25.0%	75.0%	3.6%	

Chart 19: Gender Distribution of Lung Cancer, 2020-2022

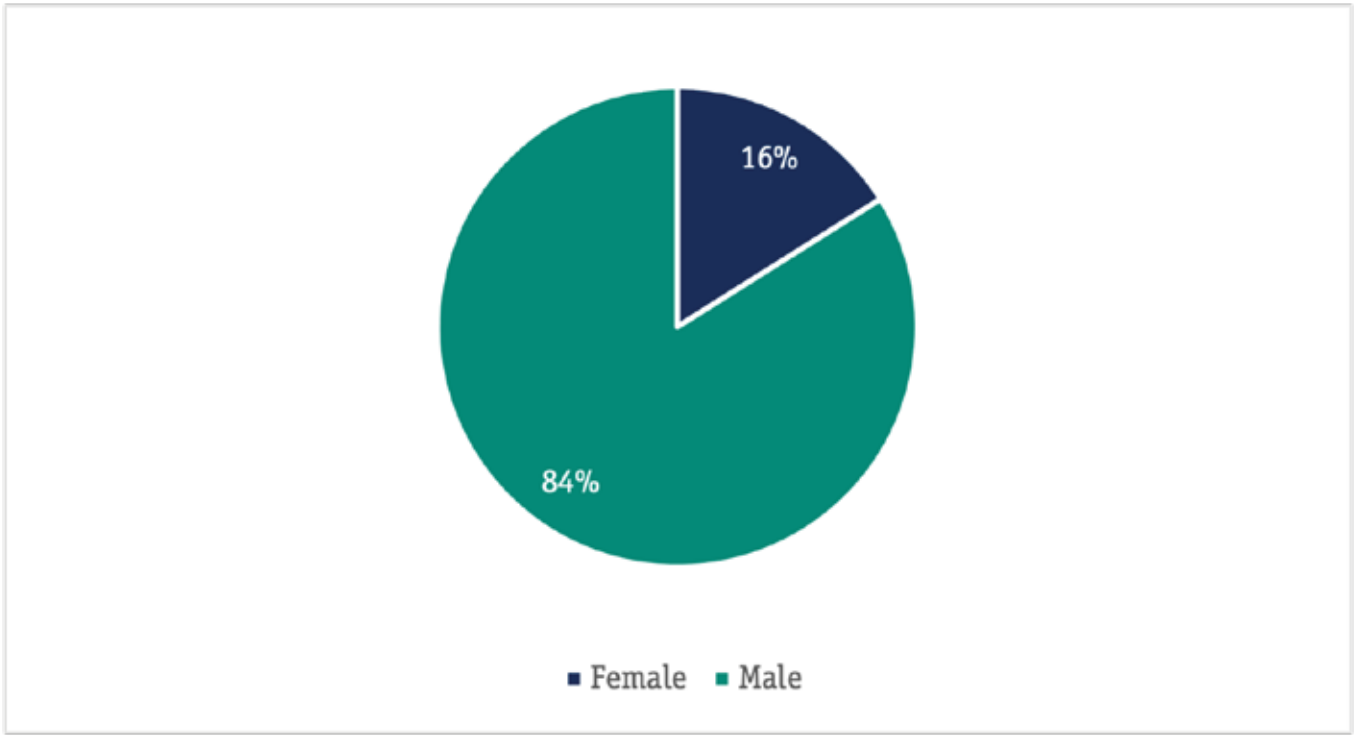


Chart 20: Age Distribution of Lung Cancer by Gender, 2020-2022

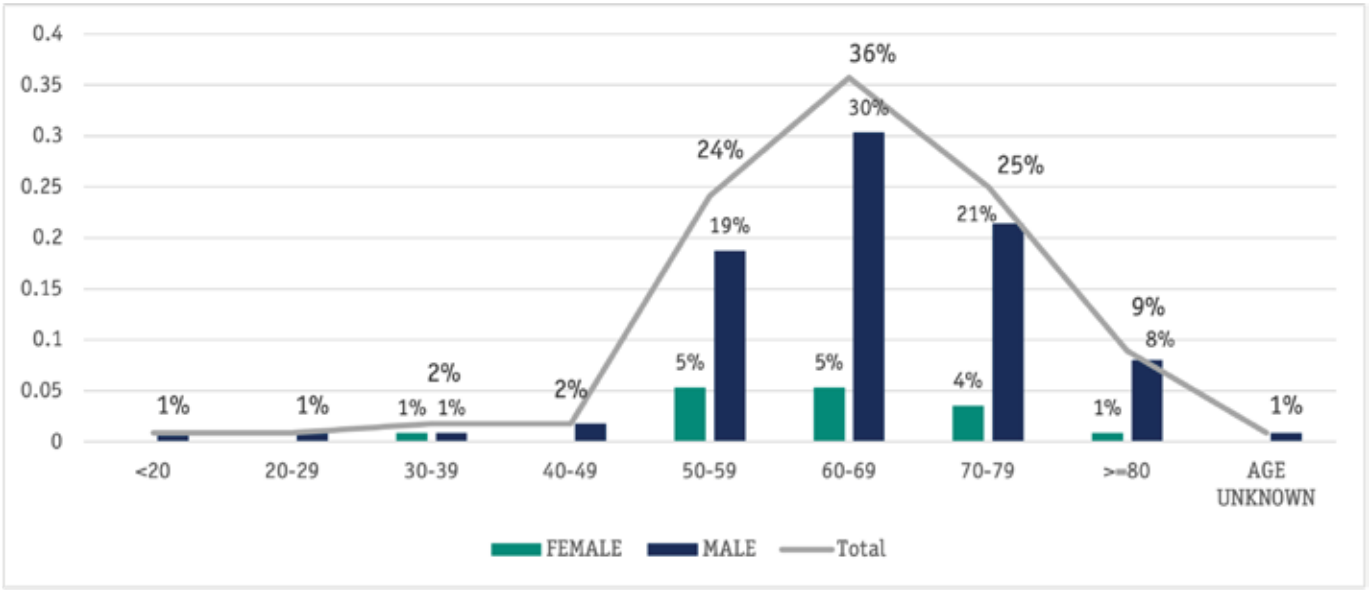
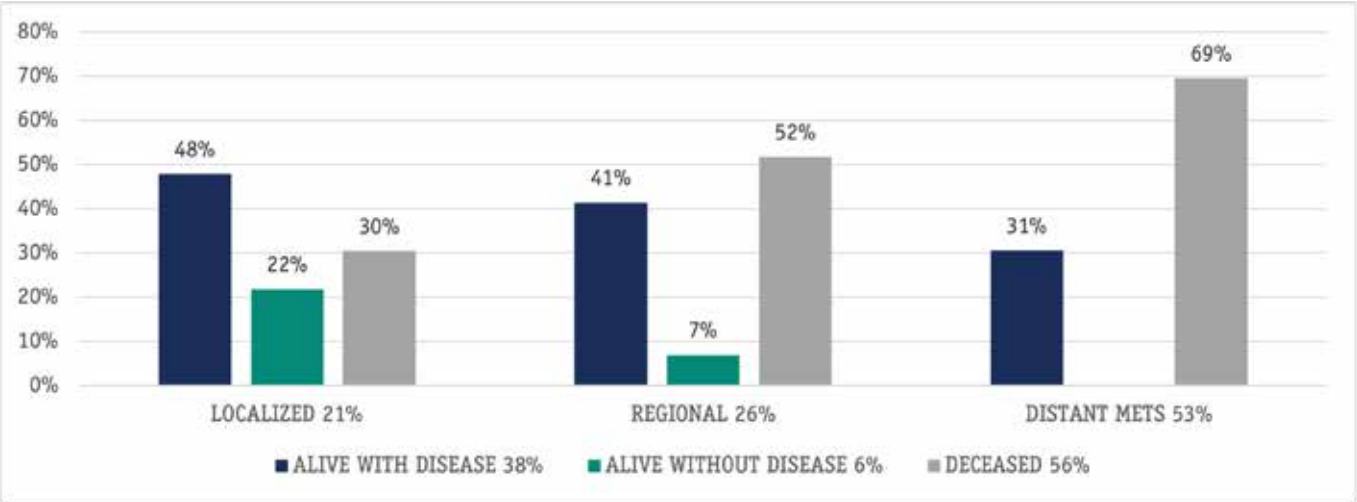


Chart 21: Survival Distribution of Lung Cancer by Stage, 2020-2022



Lung Cancer Rates 2020-2022

Median Age At Diagnosis	3-Year Survival	Median follow up
66	44%	9 months
2020-2022	2020-2022	2020-2022

Table 12: Morphological Distribution of Lung Cancer, 2020-2022

Morphological type	2020	2021	2022	TOTAL	%
ADENOCARCINOMA	24	18	17	59	52.7%
SQUAMOUS CELL CARCINOMA	5	8	9	22	19.6%
NEUROENDOCRINE CARCINOMA	4	2	1	7	6.3%
SMALL CELL CARCINOMA	1	6		7	6.3%
NEOPLASM MALIGNANT NOS	3		2	5	4.5%
LARGE CELL CARCINOMA	1	1		2	1.8%
NON-SMALL CELL CARCINOMA NOS	1		1	2	1.8%
NEUROENDOCRINE TUMORS		1	1	2	1.8%
SALIVARY GLAND-TYPE TUMORS		1	1	2	1.8%
CARCINOMA NOS	1		1	2	1.8%
ADENOSQUAMOUS CARCINOMA			1	1	0.9%
SARCOMATOID CARCINOMA		1		1	0.9%
Total	40	38	34	112	

Hematologic Malignancies

Leukemia

There were 68 adult and pediatric leukemia cases from 2020 to 2022. Males were diagnosed with leukemia more than females with percentages of 62% and 38% respectively. The majority of cases were Saudi at 94.1%. The peak age was 45-75 with a median age of 58, which is consistent with international data.

Almost two thirds of the cases were chronic leukemia; one third were acute leukemia. The JHAH Oncology Division treated 25 new acute leukemia cases, half were myeloid in origin and the other half were lymphoid. There were 43 chronic leukemia cases, with the majority being chronic lymphocytic leukemia. There was one case of hairy cell leukemia and one case of T-prolymphocytic leukemia.

The therapy outcome for acute leukemia is hard to sum in one group, and the numbers are too small to draw a solid conclusion.

Table 13: Gender Distribution of Leukemia Cases by Nationality, 2020-2022

SAUDI			NON SAUDI			GRAND TOTAL
FEMALE	MALE	TOTAL	FEMALE	MALE	TOTAL	
25	39	64	1	3	4	68
39.1%	60.9%	94.1%	25.0%	75.0%	5.9%	

Chart 22: Gender Distribution of Leukemia Cases, 2020-2022

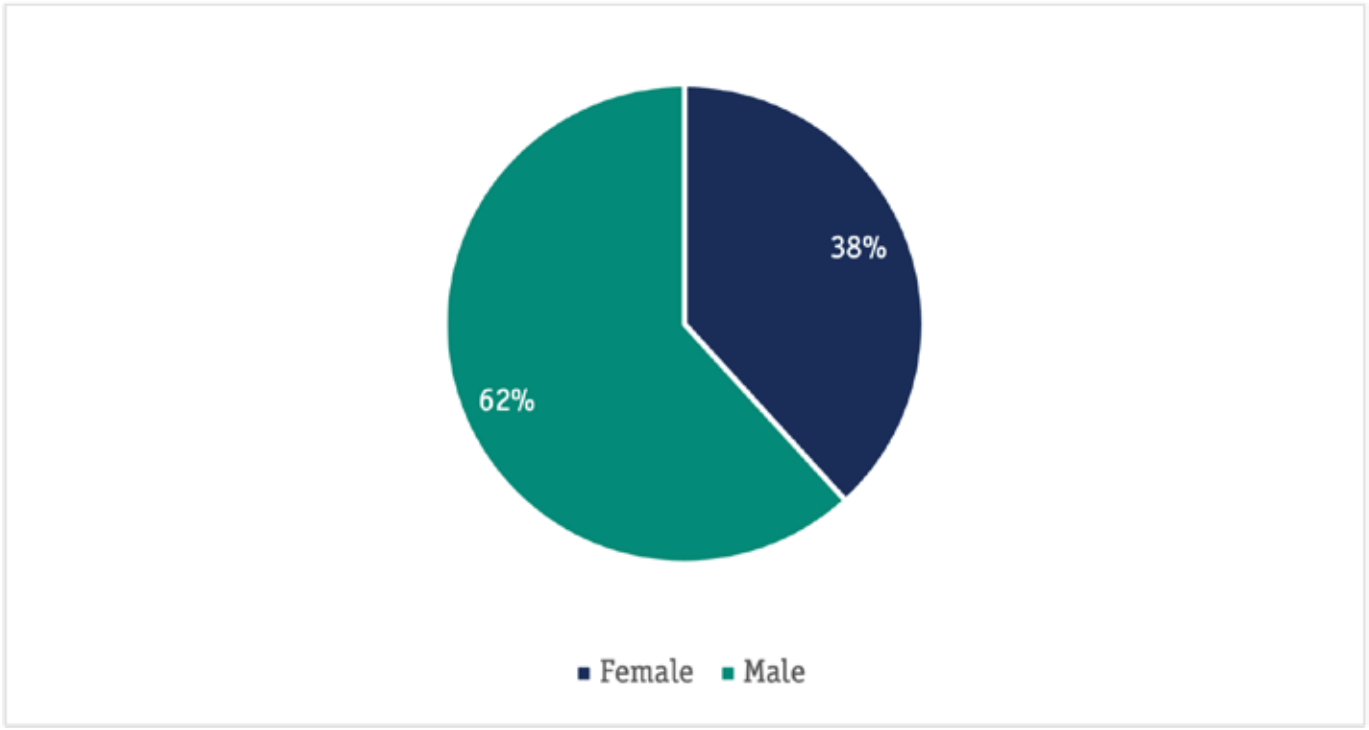


Chart 23: Age Distribution of Leukemia Cases by Gender, 2020-2022

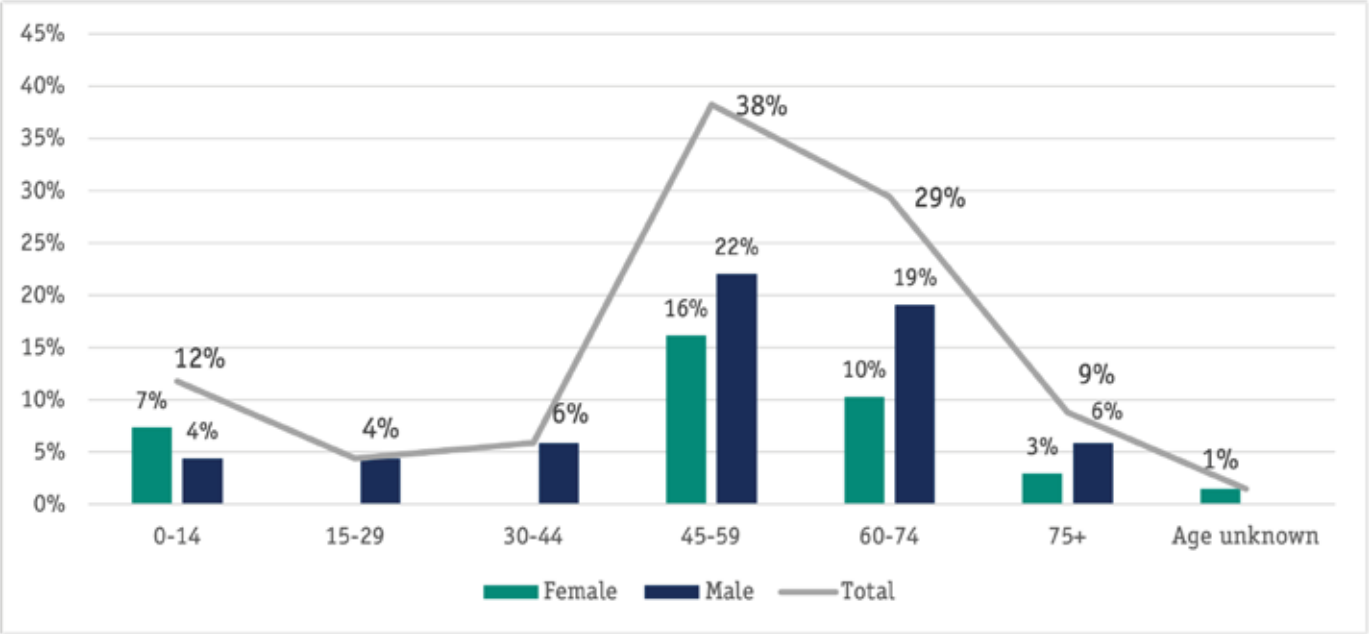


Chart 24: Subtype Distribution of Leukemia, 2020-2022

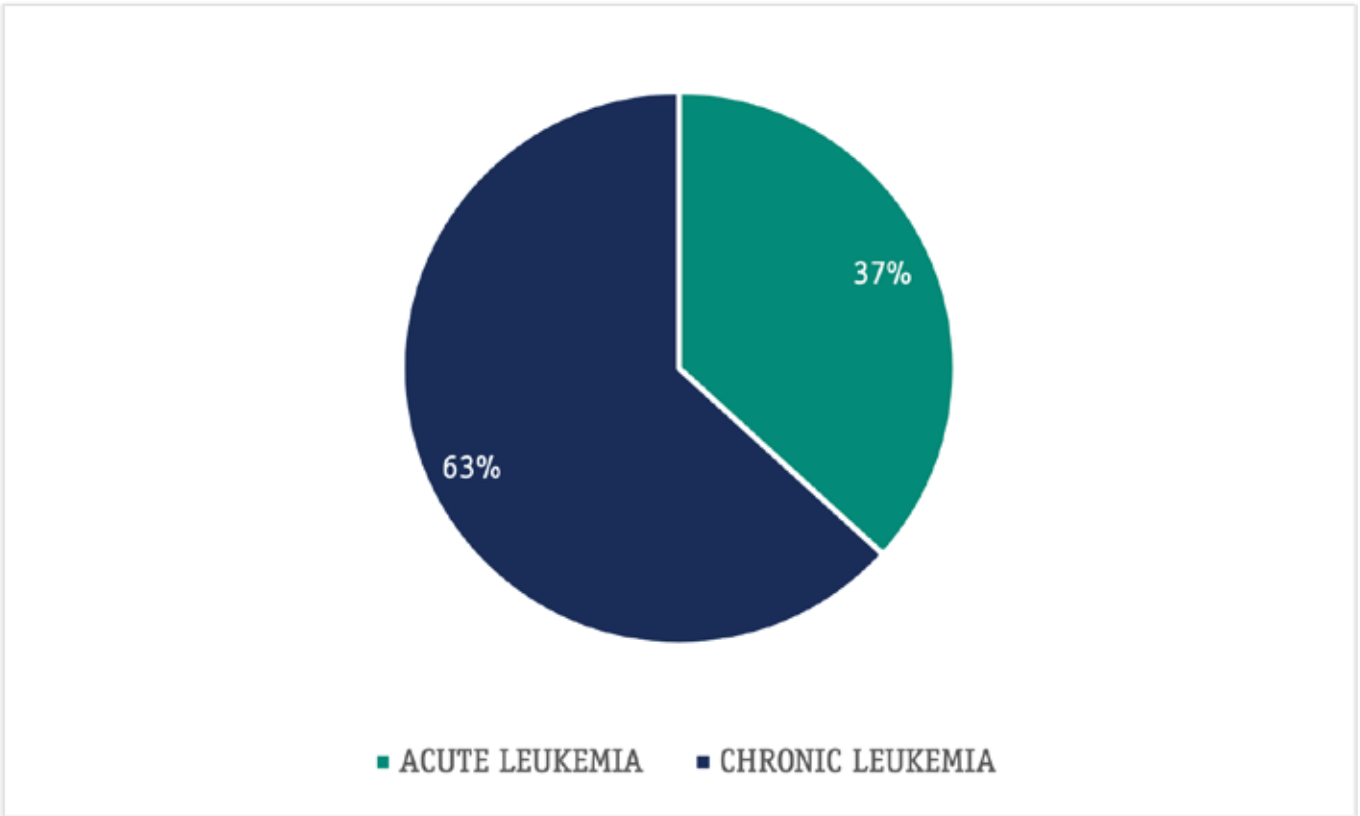
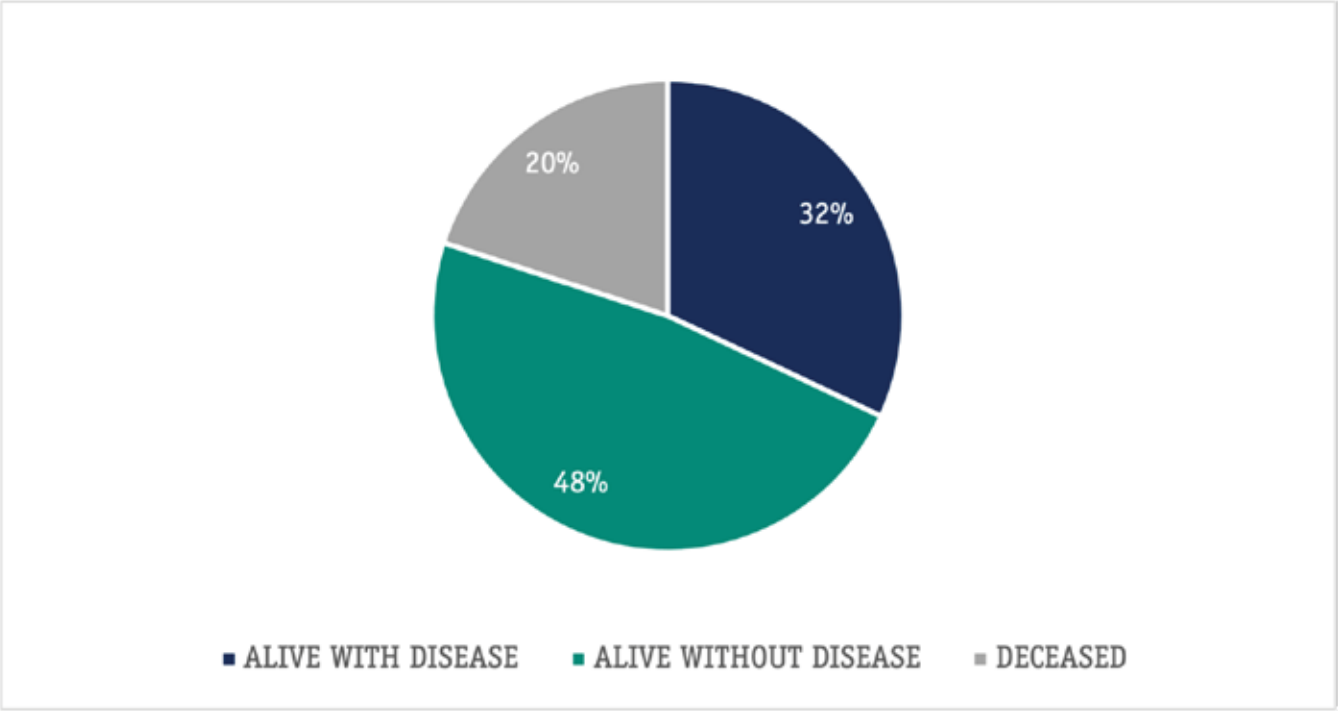


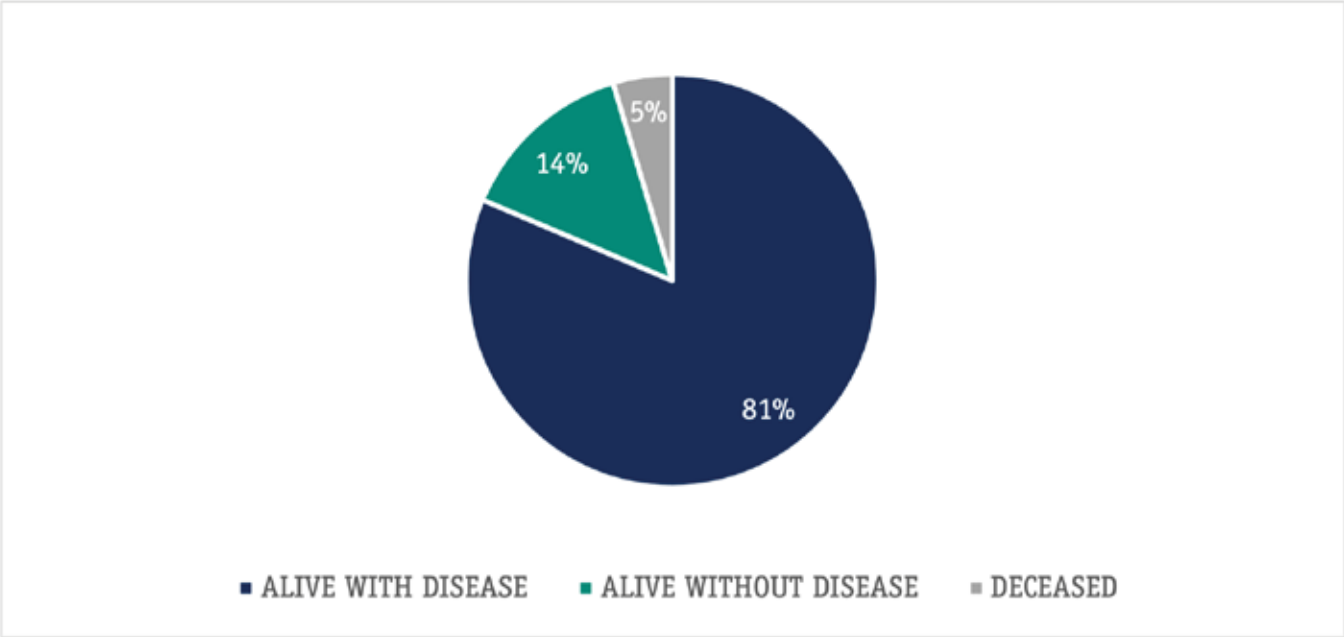
Chart 25: Survival Distribution of Acute Leukemia, 2020-2022



Acute Leukemia Rates 2020-2022

Median Age At Diagnosis	3-Year Survival	Median follow up
53	80%	6 months
2020-2022	2020-2022	2020-2022

Chart 26: Survival Distribution of Chronic Leukemia, 2020-2022



Chronic Leukemia Survival Rate 2020-2022

Median Age At Diagnosis	3-Year Survival	Median follow up
58	95%	17 months
2020-2022	2020-2022	2020-2022

Table 14: Morphological Distribution of Leukemia Cases, 2022-2020

(ICD-O-3)	Morphological type	2020	2021	2022	Total	%
CHRONIC						
98233	B-CELL CHRONIC LYMPHOCYTIC LEUKEMIA	9	8	7	24	35%
98633	CHRONIC MYELOID LEUKEMIA NOS	2	3	7	12	18%
98753	CHRONIC MYELOGENOUS LEUKEMIA BCR/ABL POSITIVE	2	2	1	5	7%
98343	PROLYMPHOCYTIC LEUKEMIA T-CELL TYPE	0	0	1	1	1%
99403	HAIRY CELL LEUKEMIA	0	1	0	1	1%
ACUTE						
98113	B LYMPHOBLASTIC LEUKEMIA	1	6	2	9	13%
98613	ACUTE MYELOID LEUKEMIA NOS	1	5	3	9	13%
98013	ACUTE LEUKEMIA NOS	0	1	0	1	1%
98263	ACUTE LEUKEMIA BURKITT TYPE DX 2020- DX 2021+ USE 96873	1	0	0	1	1%
98273	ADULT T-CELL LEUKEMIA	1	0	0	1	1%
98373	CORTICAL T ALL DX 2021+ DX 2020- USE 97293	0	1	0	1	1%
98663	ACUTE PROMYELOCYTIC LEUKEMIA T(15;17)(Q22;Q11-12)	1	0	0	1	1%
98913	ACUTE MONOCYTIC LEUKEMIA	0	1	0	1	1%
99313	ACUTE PANMYELOSIS WITH MYELOFIBROSIS	0	0	1	1	1%
Total		18	28	22	68	

Lymphoma

Chart 27: Subtype Distribution of Lymphoma, 2020-2022

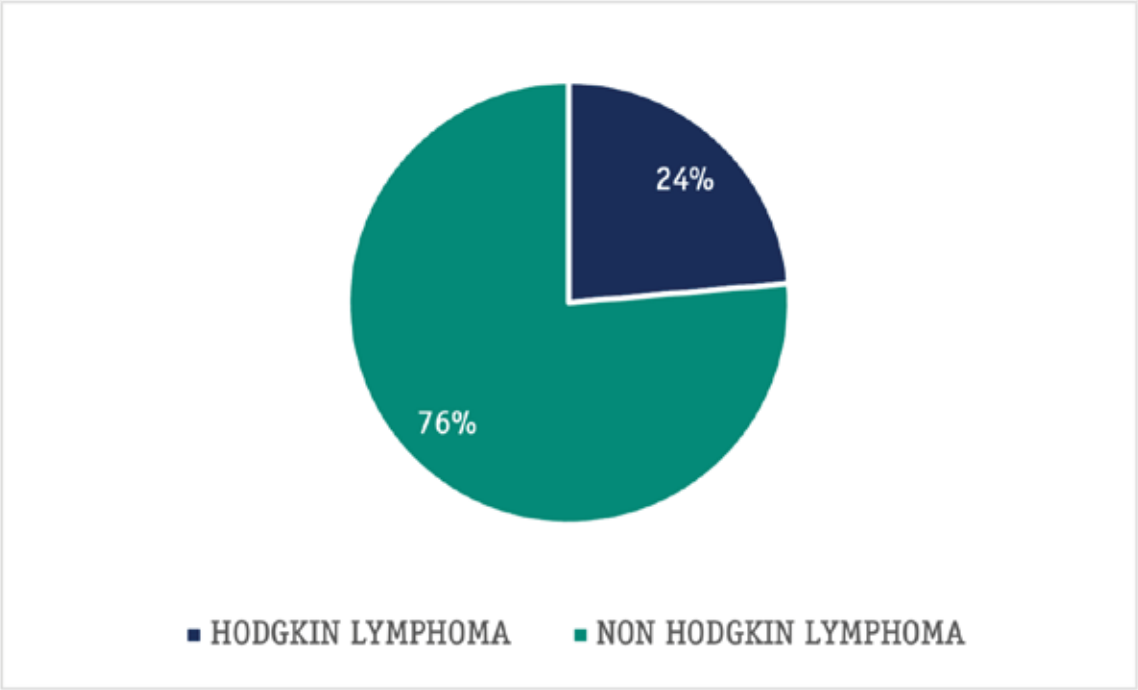
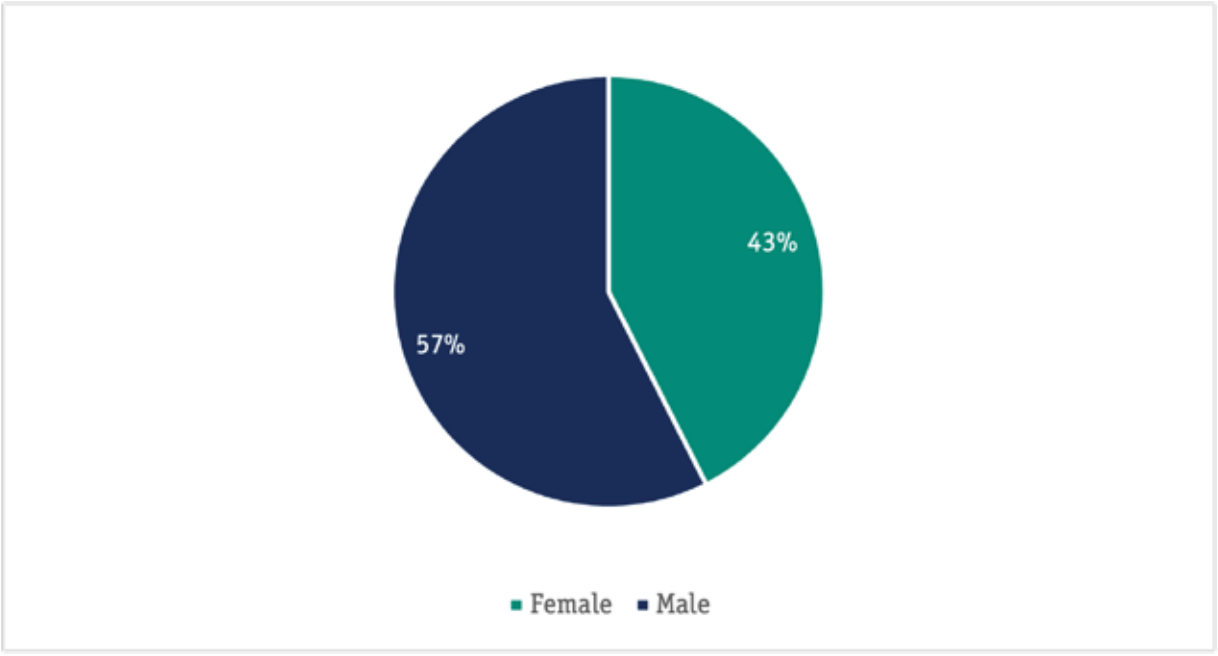


Table 15: Gender Distribution of Lymphoma by Nationality, 2020-2022

SAUDI			NON SAUDI			GRAND TOTAL
FEMALE	MALE	TOTAL	FEMALE	MALE	TOTAL	
51	68	119	3	5	8	127
42.9%	57.1%	93.7%	37.5%	62.5%	6.3%	

Chart 28: Gender Distribution of Lymphoma Cases, 2020-2022



Non-Hodgkin Lymphoma (NHL)

Close to 100 NHL cases were treated in the JHAH Oncology Division between 2020 and 2022. About two thirds of the cases were diffuse large B cell lymphoma (DLBCL) and follicular lymphoma (FL). The median age at diagnosis was 59. Half of the patients with DLBCL and FL had advanced stage with 47% alive without the disease. The three-year relative survival rate was 81%.

Of the rare subtypes, one case was treated for highly aggressive Burkitt's lymphoma; two cases had mantle cell lymphoma; and two cases had T cell-anaplastic large cell lymphoma.

Chart 29: Age Distribution of Non-Hodgkin Lymphoma by Gender, 2020-2022

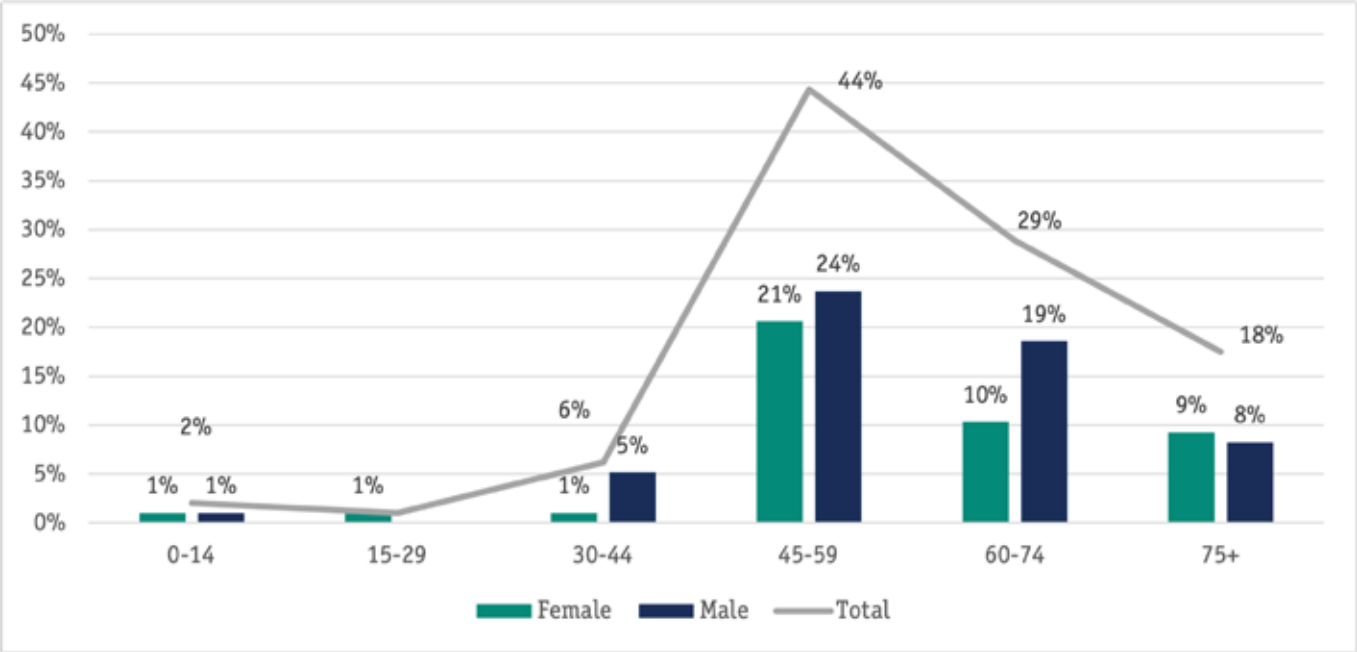
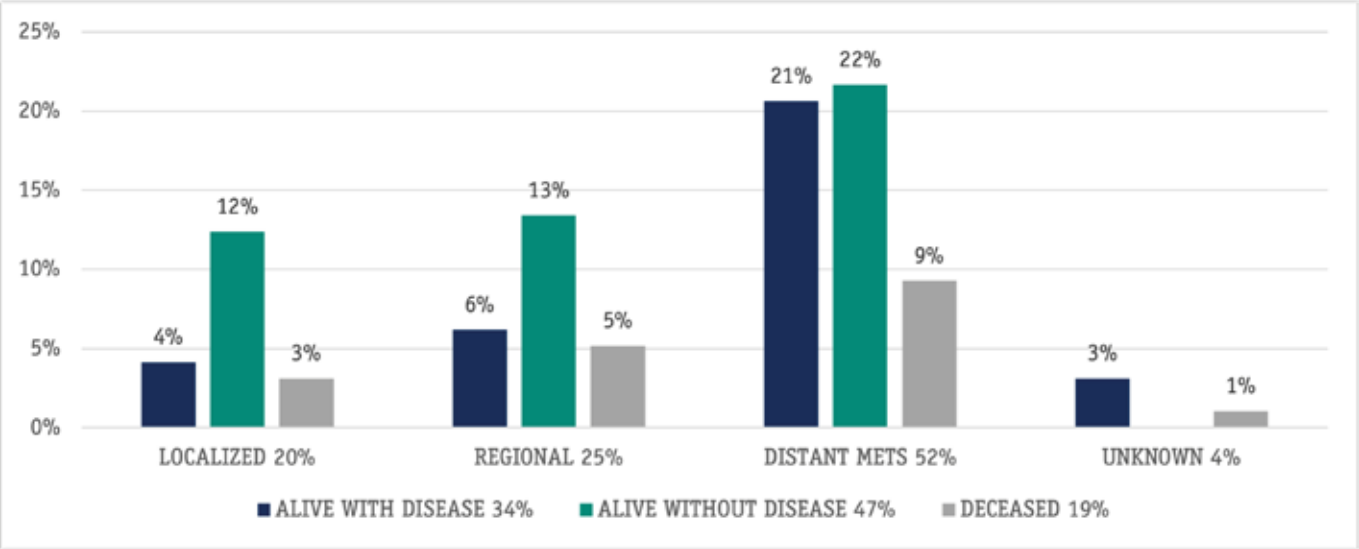


Chart 30: Survival Distribution of Non-Hodgkin Lymphoma by Stage, 2020-2022



Hodgkin lymphoma Rates 2020-2022

Median Age At Diagnosis	3-Year Survival	Median follow up
59	**81%**	**17 months**
2020-2022	**2020-2022**	**2020-2022**

Table 16: Morphological Distribution of Non-Hodgkin Lymphoma Cases, 2020-2022

(ICD-O-3)	Morphological type	2020	2021	2022	Total	%
96803	DIFFUSE LARGE B-CELL LYMPHOMA	15	19	18	52	54%
96903	FOLLICULAR LYMPHOMA	8	10	3	21	22%
96993	MARGINAL ZONE B-CELL LYMPHOMA	3	4	2	9	9%
97003	MYCOSIS FUNGOIDES	1	2	1	4	4%
98233	SMALL LYMPHOCYTIC LYMPHOMA	2	0	1	3	3%
95913	NON-HODGKIN LYMPHOMA NOS	0	1	1	2	2%
96733	MANTLE CELL LYMPHOMA	1	1	0	2	2%
97143	ANAPLASTIC LARGE CELL LYMPHOMA	1	1	0	2	2%
96873	BURKITT LYMPHOMA	1	0	0	1	1%
97023	MATURE T-CELL LYMPHOMA	0	1	0	1	1%
Total		32	39	26	97	

Hodgkin Lymphoma (HL)

In the 2020-2022 period, HL constituted 24% of all lymphomas, which is more than double the international data; however, the annual growth rate in incidences is similar to the literature at 1% per year. The majority of cases were classical HL; nevertheless, the percentage of nodular lymphocyte predominance Hodgkin lymphoma was higher than expected at 17% (10% in international registries).

The literature describes a bimodal distribution of Hodgkin lymphoma. This was not clearly demonstrated in our registry as our database numbers are relatively small in number and many retirees leave the JHAH system to other institutions, which may explain the lack of a late-age peak. The median age at diagnosis was 49 years with males dominating at 60%.

The outcome of Hodgkin lymphoma is good throughout the three years from 2020 to 2022, with a relative survival rate of 90%.

Chart 31: Age Distribution of Hodgkin Lymphoma by Gender, 2020-2022

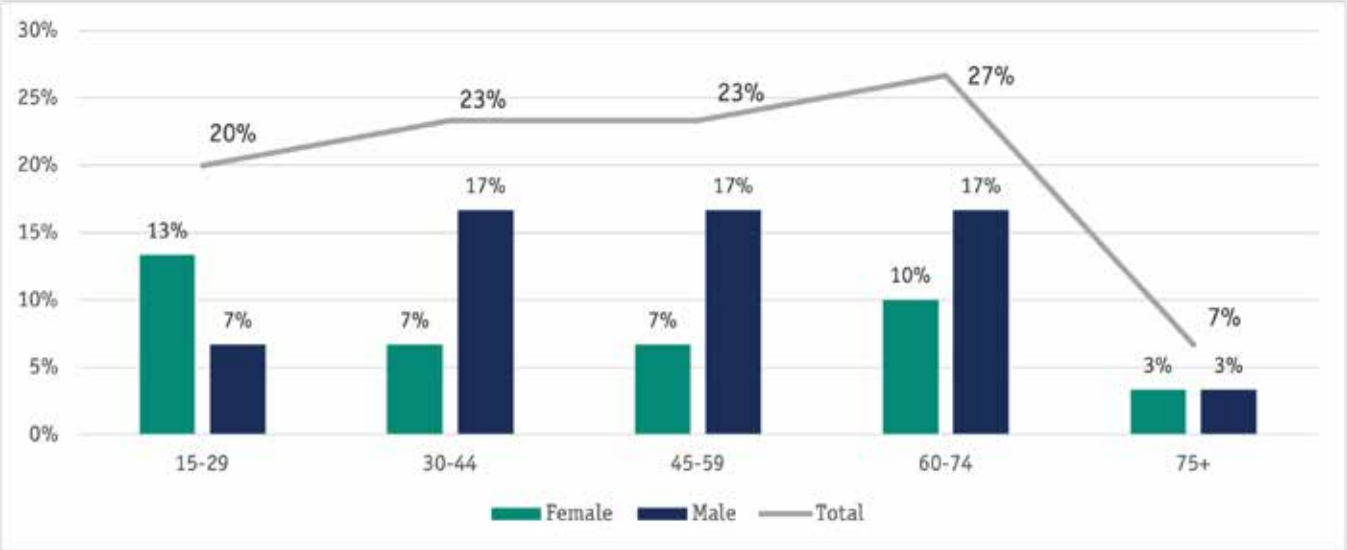
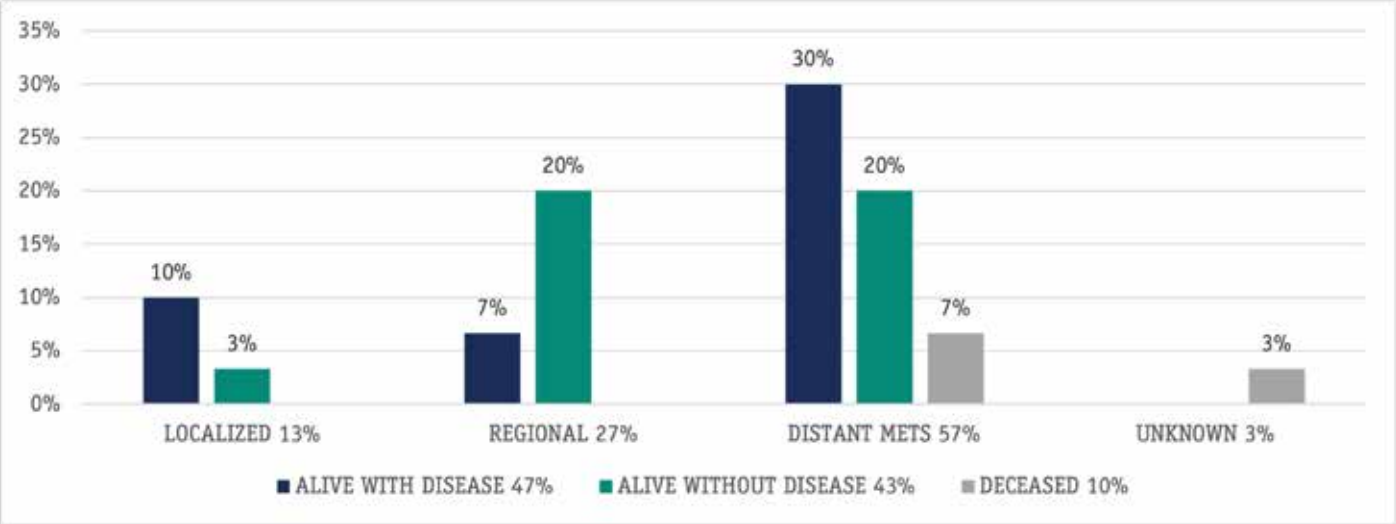


Chart 32: Survival Distribution of Hodgkin Lymphoma by Stage, 2020-2022



Hodgkin lymphoma Rates 2020-2022

Median Age At Diagnosis	3-Year Survival	Median follow up
49	**90%**	**7 months**
2020-2022	**2020-2022**	**2020-2022**

Table 17: Morphological Distribution of Hodgkin Lymphoma Cases, 2020-2022

(ICD-O-3)	Morphological type	2020	2021	2022	Total	%
96633	HODGKIN LYMPHOMA NODULAR SCLEROSIS	3	5	3	11	37%
96503	HODGKIN LYMPHOMA NOS	0	1	7	8	27%
96593	HODGKIN LYMPHOMA NODULAR LYMPHOCYTE PREDOMINANCE	2	2	1	5	17%
96523	HODGKIN LYMPHOMA MIXED CELLULARITY	1	1	2	4	13%
96513	HODGKIN LYMPHOMA LYMPHOCYTE-RICH	0	1	0	1	3%
96533	HODGKIN LYMPHOMA LYMPHOCYTE DEPLETION	0	0	1	1	3%
Total		6	10	14	30	

Pediatrics

Childhood cancer is extremely distressing and causes severe disturbance in family life. Despite excellent international survival rates that reach 85%, it is still the most common cause of death in children in developed countries. Modern medicine has made great advances in finding cures and enhancing survival for children with cancer. Access to medical facilities that provide state-of-the-art treatment is key to such excellent survival rates. JHAH was a pioneering institution in the Kingdom in providing state-of-the-art treatment for our patients. This has led to excellent survival results of 97%, which is comparable to the survival rates at the best institutions in developed countries. Excellent support services and direct access to care for patients and families throughout their treatment journey are also key.

From 2020 to 2022, 31 cases of childhood cancer were reported at JHAH, which compares to 41 cases between 2017 and 2019. Of these, 42% were male and 58% were female, which is slightly different than international data (58% male and 42% female). This is likely due to small numbers. The overall survival rate was around 97% compared to 85% in the previous review. This is possibly related to improved treatment versus small number variation, but it could be both. As expected, similar to international data, acute lymphocytic leukemia is the most common childhood cancer in our patients at 25.8% of cases. Next is CNS tumors at 19.4%.

Table 18: Gender Distribution of Pediatric Cancers by Nationality, 2020-2022

SAUDI			NON SAUDI			GRAND TOTAL
FEMALE	MALE	TOTAL	FEMALE	MALE	TOTAL	
14	10	24	4	3	7	31
58.3%	41.7%	77.4%	57.1%	42.9%	22.6%	

Chart 33: Gender Distribution of Pediatric Cancers, 2020-2022

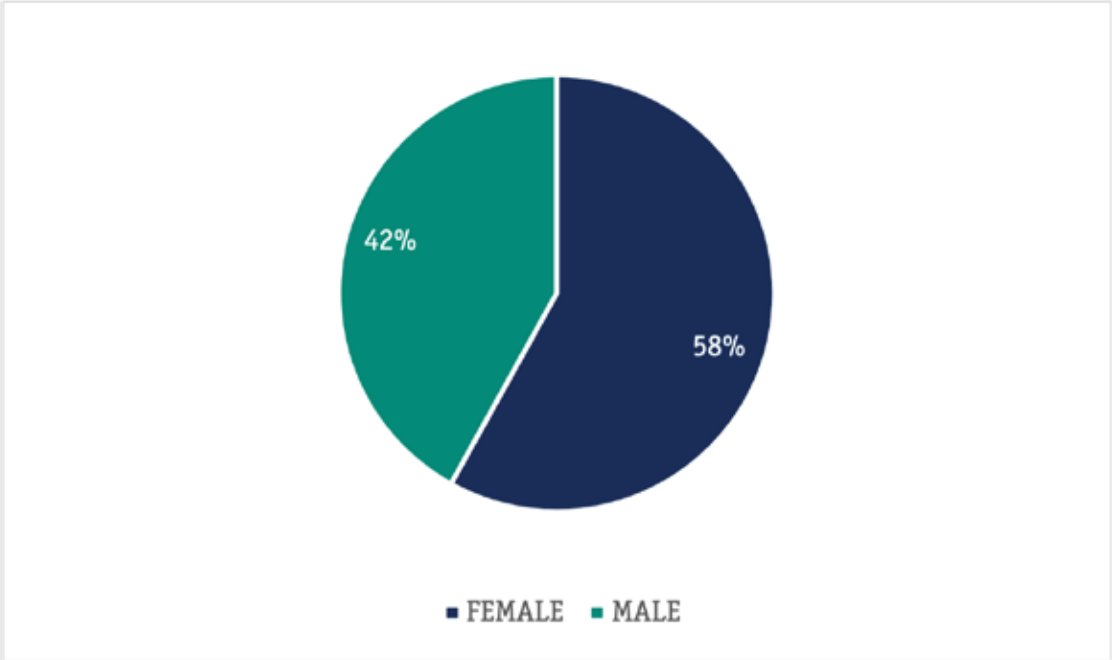
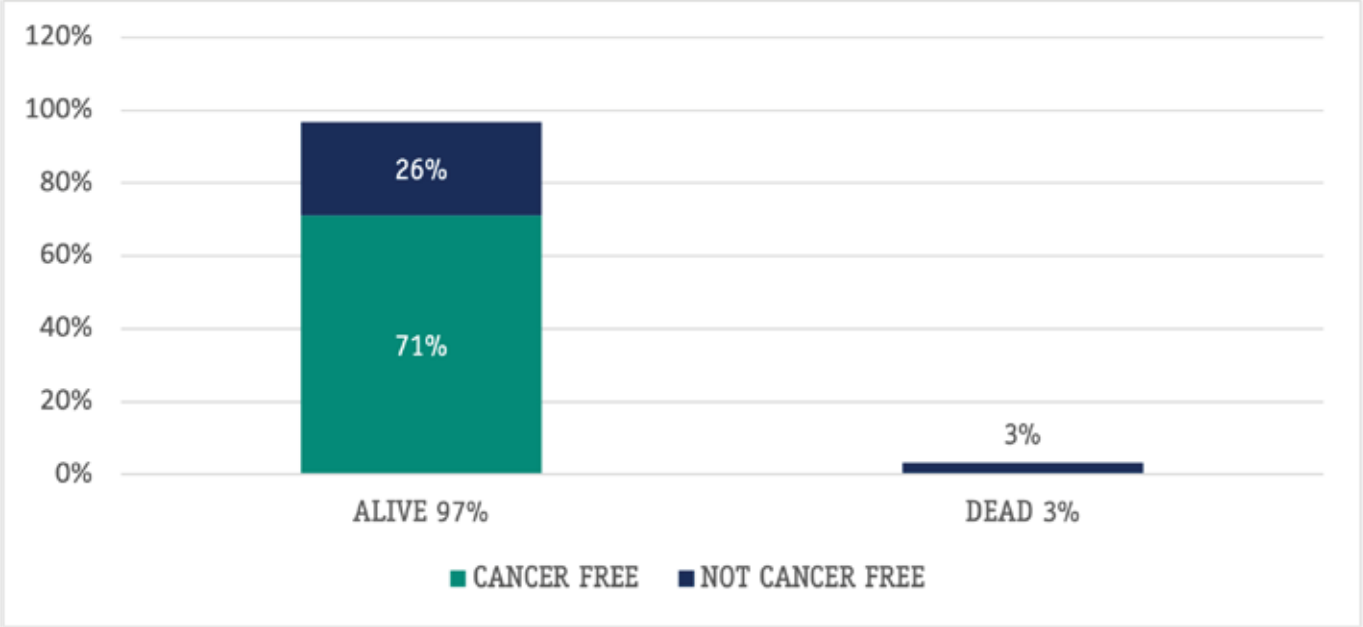


Chart 34: Survival Distribution of Pediatric Cancers, 2020-2022



Pediatric Cancers Rates 2020-2022

Median Age At Diagnosis	3-Year Survival	Median follow up
3	**97%**	**11 months**
2020-2022	**2020-2022**	**2020-2022**

Table 19: Morphological Distribution of Pediatric Cancer Cases, 2020-2022

ICD-O-3	Morphological type	2020	2021	2022	TOTAL	%
LEUKEMIA					8	25.8%
98113	B LYMPHOBLASTIC LEUKEMIA	1	4	2		
98273	T-CELL LEUKEMIA	1				
CNS MALIGNANT					6	19.4%
93923	EPENDYMOMA ANAPLASTIC		1			
94213	PILOCYTIC ASTROCYTOMA	2	1			
95083	ATYPICAL TERATOID/RHABDOID TUMOR			1		
95303	MENINGIOMA MALIGNANT	1				
CONNECTIVE SOFT TISSUE					2	6.5%
88013	SPINDLE CELL SARCOMA	1				
94733	PRIMITIVE NEUROECTODERMAL TUMOR		1			
CNS BENIGN					2	6.5%
93511	CRANIOPHARYNGIOMA ADAMANTINOMATOUS		1			
93800	GLIOMA BENIGN			1		
RETROPERITONEUM					2	6.5%
95003	NEUROBLASTOMA		2			
EYE					2	6.5%
95103	RETINOBLASTOMA	1	1			
NON-HODGKIN LYMPHOMA					2	6.5%
96873	BURKITT LYMPHOMA	1				
97003	MYCOSIS FUNGOIDES		1			
BONE					1	3.2%
88113	FIBROMYXOSARCOMA		1			
SKIN NON MELANOMA					1	3.2%
88323	DERMATOFIBROSARCOMA			1		
URINARY NON PROSTATE					1	3.2%
89603	NEPHROBLASTOMA			1		
TESTIS					1	3.2%
90713	YOLK SAC TUMOR	1				
THORACIC					1	3.2%
94903	GANGLIONEUROBLASTOMA			1		
OTHER HEMATOPOIETIC					1	3.2%
97513	LANGERHANS CELL HISTIOCYTOSIS		1			
GI NON COLORECTAL					1	3.2%
80703	SQUAMOUS CELL CARCINOMA NOS	1				
Total					31	

Conclusion

The JHAH Oncology Division prioritizes patients and their families, emphasizing their central role from the first meeting through survivorship and palliative care. Our dedicated team employs the Partners in Care model, which ensures both quality and continuity of care. Every staff member, from physicians, experienced oncology nurses certified in chemotherapy, to the biotherapy administration and technicians, remain at the forefront of their respective fields through continuous training and education and by using the latest equipment and technologies to deliver the highest standard of compassionate care.

Table 20: Incidence Table all Cancer Cases, 2020-2022

ALL CANCER CASES						
ICD 10	PRIMARY SITE	2020	2021	2022	TOTAL	%
C00	LIP		1		1	0.0%
C01-C02	TONGUE	3	6	3	12	0.6%
C03-C06	MOUTH	2	5	2	9	0.4%
C07-C08	SALIVARY GLANDS	2			2	0.1%
C09	TONSIL		1	1	2	0.1%
C11	NASOPHARYNX	4	3	3	10	0.5%
C14	PHARYNX NOS		1		1	0.0%
C15	ESOPHAGUS	3	1	9	13	0.6%
C16	STOMACH	15	15	10	40	1.9%
C17	SMALL INTESTINE	8	5	3	16	0.8%
C18	COLON	43	40	58	141	6.8%
C19-C20	RECTUM	33	27	29	89	4.3%
C21	ANUS	1	1	1	3	0.1%
C22	LIVER	24	12	4	40	1.9%
C23-C24	GALLBLADDER	4	2	10	16	0.8%
C25	PANCREAS	17	19	23	59	2.9%
C30-C31	NOSE AND SINUSES	2			2	0.1%
C32	LARYNX	6	4	5	15	0.7%
C34	LUNG AND BRONCHUS	40	38	34	112	5.4%
C38	THORACIC			1	1	0.0%
C41	BONE	1	1	2	4	0.2%
C43	SKIN MELANOMA	7	9	2	18	0.9%
C44	SKIN NON MELANOMA	21	22	35	78	3.8%
C45	MESOTHELIOMA		1	2	3	0.1%
C46	KAPOSI SARCOMA		1	1	2	0.1%
C47;C49	CONNECTIVE SOFT TISSUE	4	2	7	13	0.6%
C48	PERITONEUM AND RETROPERITONEUM	1	5	2	8	0.4%
C50	BREAST	132	149	164	445	21.5%
C51	VULVA		1	2	3	0.1%
C52	VAGINA		1		1	0.0%
C53	CERVIX UTERI	3	8	3	14	0.7%
C54	CORPUS UTERI	25	27	34	86	4.2%
C55	UTERUS NOS		3	5	8	0.4%
C56	OVARY	3	9	2	14	0.7%
C57	FEMALE UNSPECIFIED			1	1	0.0%
C61	PROSTATE GLAND	33	63	60	156	7.5%
C62	TESTIS	2	4	4	10	0.5%
C64	KIDNEY	18	18	16	52	2.5%
C65	RENAL PELVIS	1			1	0.0%
C66	URETER			1	1	0.0%
C67	BLADDER	18	23	22	63	3.0%
C69	EYE	1	1		2	0.1%
C71	CNS MALIGNANT	13	10	9	32	1.5%
C73	THYROID GLAND	30	40	34	104	5.0%
C75	OTHER ENDOCRINE	1			1	0.0%
C80	UNSPECIFIED SITE	8	6	5	19	0.9%
C81	HODGKIN LYMPHOMA	6	10	14	30	1.4%
C82-C86;C96	NON-HODGKIN LYMPHOMA	32	39	26	97	4.7%
C90	MULTIPLE MYELOMA	7	10	11	28	1.4%
C91-C95	LEUKEMIA	18	28	22	68	3.3%
D32-D33	CNS BENIGN	14	35	21	70	3.4%
D35	PITUITARY GLAND BENIGN	3	7	5	15	0.7%
D47	OTHER HEMATOPOIETIC	12	13	14	39	1.9%
Total		621	727	722	2070	

Note: There were 57 cases of basal cell carcinoma diagnosed and treated between 2020 and 2022. This relatively high number is because of the Saudi Aramco community's multinational population.

Table 21: Incidence Table Female Cancer Cases, 2020-2022

FEMALE						
ICD 10	PRIMARY SITE	2020	2021	2022	TOTAL	%
C00	LIP		1		1	0.1%
C01-C02	TONGUE		4		4	0.4%
C03-C06	MOUTH	1	3	1	5	0.5%
C07-C08	SALIVARY GLANDS	2			2	0.2%
C09	TONSIL				0	0.0%
C11	NASOPHARYNX		1	1	2	0.2%
C14	PHARYNX NOS				0	0.0%
C15	ESOPHAGUS	1		2	3	0.3%
C16	STOMACH	4	7	3	14	1.3%
C17	SMALL INTESTINE	2	1	2	5	0.5%
C18	COLON	23	14	21	58	5.4%
C19-C20	RECTUM	9	11	17	37	3.4%
C21	ANUS	1			1	0.1%
C22	LIVER	5	8		13	1.2%
C23-C24	GALLBLADDER	1	1	5	7	0.7%
C25	PANCREAS	5	7	11	23	2.1%
C30-C31	NOSE AND SINUSES				0	0.0%
C32	LARYNX				0	0.0%
C34	LUNG AND BRONCHUS	8	6	4	18	1.7%
C38	THORACIC				0	0.0%
C41	BONE		1	1	2	0.2%
C43	SKIN MELANOMA	3	5		8	0.7%
C44	SKIN NON MELANOMA	4	10	5	19	1.8%
C45	MESOTHELIOMA				0	0.0%
C46	KAPOSI SARCOMA			1	1	0.1%
C47;C49	CONNECTIVE SOFT TISSUE	2		2	4	0.4%
C48	PERITONEUM AND RETROPERITONEUM		4	2	6	0.6%
C50	BREAST	132	147	159	438	40.7%
C51	VULVA		1	2	3	0.3%
C52	VAGINA		1		1	0.1%
C53	CERVIX UTERI	3	8	3	14	1.3%
C54	CORPUS UTERI	25	27	34	86	8.0%
C55	UTERUS NOS		3	5	8	0.7%
C56	OVARY	3	9	2	14	1.3%
C57	FEMALE UNSPECIFIED			1	1	0.1%
C61	PROSTATE GLAND				0	0.0%
C62	TESTIS				0	0.0%
C64	KIDNEY	10	5	5	20	1.9%
C65	RENAL PELVIS				0	0.0%
C66	URETER				0	0.0%
C67	BLADDER	1	1	2	4	0.4%
C69	EYE	1	1		2	0.2%
C71	CNS MALIGNANT	6	2	3	11	1.0%
C73	THYROID GLAND	25	27	25	77	7.2%
C75	OTHER ENDOCRINE				0	0.0%
C80	UNSPECIFIED SITE	2	4	1	7	0.7%
C81	HODGKIN LYMPHOMA	3	3	6	12	1.1%
C82-C86;C96	NON-HODGKIN LYMPHOMA	18	11	13	42	3.9%
C90	MULTIPLE MYELOMA	1	2	4	7	0.7%
C91-C95	LEUKEMIA	5	10	11	26	2.4%
D32-D33	CNS BENIGN	9	27	13	49	4.6%
D35	PITUITARY GLAND BENIGN	1	2	2	5	0.5%
D47	OTHER HEMATOPOIETIC	3	7	6	16	1.5%
Total		319	382	375	1076	

Table 22: Incidence Table Male Cancer Cases, 2020-2022

ICD 10	PRIMARY SITE	2020	2021	2022	TOTAL	%
C00	LIP				0	0.0%
C01-C02	TONGUE	3	2	3	8	0.8%
C03-C06	MOUTH	1	2	1	4	0.4%
C07-C08	SALIVARY GLANDS				0	0.0%
C09	TONSIL		1	1	2	0.2%
C11	NASOPHARYNX	4	2	2	8	0.8%
C14	PHARYNX NOS		1		1	0.1%
C15	ESOPHAGUS	2	1	7	10	1.0%
C16	STOMACH	11	8	7	26	2.6%
C17	SMALL INTESTINE	6	4	1	11	1.1%
C18	COLON	20	26	37	83	8.4%
C19-C20	RECTUM	24	16	12	52	5.2%
C21	ANUS		1	1	2	0.2%
C22	LIVER	19	4	4	27	2.7%
C23-C24	GALLBLADDER	3	1	5	9	0.9%
C25	PANCREAS	12	12	12	36	3.6%
C30-C31	NOSE AND SINUSES	2			2	0.2%
C32	LARYNX	6	4	5	15	1.5%
C34	LUNG AND BRONCHUS	32	32	30	94	9.5%
C38	THORACIC			1	1	0.1%
C41	BONE	1		1	2	0.2%
C43	SKIN MELANOMA	4	4	2	10	1.0%
C44	SKIN NON MELANOMA	17	12	30	59	5.9%
C45	MESOTHELIOMA		1	2	3	0.3%
C46	KAPOSI SARCOMA		1		1	0.1%
C47;C49	CONNECTIVE SOFT TISSUE	2	2	5	9	0.9%
C48	PERITONEUM AND RETROPERITONEUM	1	1		2	0.2%
C50	BREAST		2	5	7	0.7%
C51	VULVA				0	0.0%
C52	VAGINA				0	0.0%
C53	CERVIX UTERI				0	0.0%
C54	CORPUS UTERI				0	0.0%
C55	UTERUS NOS				0	0.0%
C56	OVARY				0	0.0%
C57	FEMALE UNSPECIFIED				0	0.0%
C61	PROSTATE GLAND	33	63	60	156	15.7%
C62	TESTIS	2	4	4	10	1.0%
C64	KIDNEY	8	13	11	32	3.2%
C65	RENAL PELVIS	1			1	0.1%
C66	URETER			1	1	0.1%
C67	BLADDER	17	22	20	59	5.9%
C69	EYE				0	0.0%
C71	CNS MALIGNANT	7	8	6	21	2.1%
C73	THYROID GLAND	5	13	9	27	2.7%
C75	OTHER ENDOCRINE	1			1	0.1%
C80	UNSPECIFIED SITE	6	2	4	12	1.2%
C81	HODGKIN LYMPHOMA	3	7	8	18	1.8%
C82-C86;C96	NON-HODGKIN LYMPHOMA	14	28	13	55	5.5%
C90	MULTIPLE MYELOMA	6	8	7	21	2.1%
C91-C95	LEUKEMIA	13	18	11	42	4.2%
D32-D33	CNS BENIGN	5	8	8	21	2.1%
D35	PITUITARY GLAND BENIGN	2	5	3	10	1.0%
D47	OTHER HEMATOPOIETIC	9	6	8	23	2.3%
Total		302	345	347	994	

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