

# Chapter 14

## General Oncology Care in the Kingdom of Saudi Arabia



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### 14.1 The Kingdom of Saudi Arabia Demographics

The Kingdom of Saudi Arabia (KSA) is in the southwest of Asia. It extends over four-fifths of the Arabian Peninsula, stretching over a land area of 2,149,700 square kilometers and it is divided into 13 administrative regions. Riyadh city is the capital of the KSA. The country has the two holy mosques of Islam in Makkah and Al-Madinah. The estimated population for Saudi Arabia in 2016 was 31,787,580. Saudi nationals were estimated to be 20,081,582 of these 10,231,364 (51%) were males and 9,850,218 (49%) were females. The Non-Saudi population was 11,705,998 of these 8,028,355 (69%) were males and 3,677,643 (31%) were females [1].

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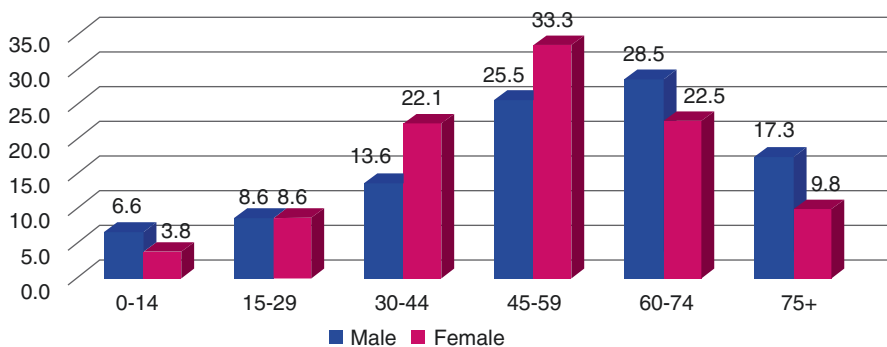
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## 14.2 Cancer Statistics in Saudi Arabia

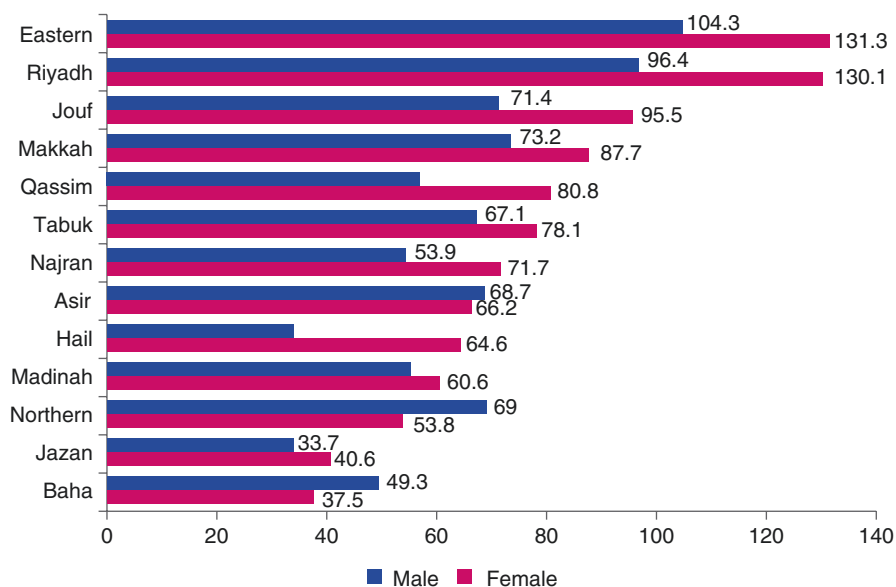
### 14.2.1 Cancer Incidence

In 1992, The Saudi Cancer Registry (SCR), a population-based registry, was established under the authority of the Ministry of Health (MOH). In 2014, SCR was moved to the Saudi Health Council under the Department of National Registries in the National Center for Health Information. According to the most recent cancer incidence report by SCR in 2016, the total number of newly diagnosed cancer cases reported to the Saudi Cancer Registry (SCR) was 17,602. Overall, cancer cases were more among women than men; it affected 8044 (45.7%) males and 9558 (54.3%) females (Fig. 14.1). A total of 13,562 cases were reported among Saudi nationals, 3834 among non-Saudi, and 206 of unknown nationality. The crude incidence rates (CIR) of all cancers were 56.6/100,000 in males and 74.5/100,000 in females. The overall age-standardized incidence rate (ASR) was 74.7/100,000 in males and 91.3/100,000 in females. Eastern region reported the highest ASR among males and females, whereas Jazan region reported the lowest ASR among males and females (Fig. 14.2). The median age at diagnosis was 57 years with a range of (0–116) for males and 51 years with a range of (0–116) for females (Table 14.1).

The most common malignancies among the overall population are breast cancer, colorectal, and thyroid cancer (Table 14.2). The top three reported cancers among Saudi females are breast, thyroid, and colorectal cancers in descending order. Cancers among Saudi males are topped with colorectal cancer, lymphoma (Non-Hodgkin's), and prostate cancer. Non-Saudi males manifested colorectal followed by prostate and skin cancers, while non-Saudi females showed similar distribution to the Saudi females. A detailed report of SCR can be found online.



**Fig. 14.1** Distribution of cancer cases among Saudi nationals by gender and age groups, 2016. *Source:* Cancer Incidence Report Saudi Arabia 2016 [1]



**Fig. 14.2** Age Standardized Rate (ASR)\* of all cancer sites among Saudi nationals, 2016. *Source:* Cancer Incidence Report Saudi Arabia 2016 [1]

### 14.2.2 Cancer Mortality

The percentage of deaths due to cancer increased steadily between 1990 and 2016. In 1990, the total percentage of deaths due to cancer was approximately 5% and increased to 12% in 2016 [2]. There were 36,951 deaths from Noncommunicable Diseases, and cancer accounted for 19.1% as per WHO cancer country profile 2020 [3, 4].

## 14.3 Oncology Care in Saudi Arabia

Oncology care across the Kingdom is provided through multiple public sectors, including the Ministry of Health, Ministry of Higher Education via university hospitals and specialized hospitals serving different governmental sectors (e.g., the Military, the National Guard Ministry, Arabian American Oil Company (ARAMCO), and the Ministry of Interior). Another providing partner is the Al-Faisal organization through the world-renowned King Faisal Specialist Hospitals and Research Centers (KFSH&RC) in Riyadh, Jeddah, and a recent branch in Al-Madinah cities. All cancer care facilities are freely accessible to citizens. Furthermore, private

**Table 14.1** Number, percentage, CIR, ASR, and Cumulative Rates (per 100,000) among Saudi Nationals by primary cancer site and gender, 2016. Source: Cancer Incidence Report Saudi Arabia 2016 [1]

ICD-10	Site	Male					Female						
		No.	%	Crude Rate	ASR World	Cumulative Rate		No.	%	Crude Rate	ASR World	Cumulative Rate	
						0-64	0-74					0-64	0-74
All	All sites Total	5803	100.00%	56.6	74.7	39.95	81.8	7358	100.00%	74.5	91.3	62.75	99.35
Not C44	All sites but C44	5596	96.40%	54.6	72	39.05	79.3	7192	97.70%	72.9	89.2	61.7	97.2
C00	Lip	16	0.30%	0.2	0.2	0.125	0.205	6	0.10%	0.1	0.1	0.025	0.055
C01-C02	Tongue	60	1.00%	0.6	0.8	0.34	1.045	47	0.60%	0.5	0.7	0.435	0.83
C03-C06	Mouth	59	1.00%	0.6	0.8	0.39	0.95	60	0.80%	0.6	0.8	0.46	0.925
C07-C08	Salivary glands	23	0.40%	0.2	0.3	0.135	0.28	30	0.40%	0.3	0.4	0.255	0.33
C09	Tonsil	3	0.10%	0	0	0.03	0.03	2	0.00%	0	0	0.005	0.05
C10	Other Oropharynx	4	0.10%	0	0.1	0.015	0.06	2	0.00%	0	0	0.015	0.015
C11	Nasopharynx	154	2.70%	1.5	1.8	1.425	1.895	59	0.80%	0.6	0.7	0.535	0.745
C12-C13	Hypopharynx	7	0.10%	0.1	0.1	0.035	0.125	14	0.20%	0.1	0.2	0.08	0.2
C14	Pharynx unspc.	2	0.00%	0	0	0.02	0.02	1	0.00%	0	0	0.01	0.01
C15	Esophagus	78	1.30%	0.8	1.1	0.53	1.055	50	0.70%	0.5	0.7	0.275	0.69
C16	Stomach	207	3.60%	2	2.9	1.26	3.32	111	1.50%	1.1	1.5	0.765	1.615
C17	Small intestine	37	0.60%	0.4	0.5	0.27	0.645	32	0.40%	0.3	0.4	0.27	0.44
C18	Colon	581	10.00%	5.7	7.8	4.595	8.96	447	6.10%	4.5	6.1	4.09	7.13
C19-C20	Rectum	374	6.40%	3.6	5.1	2.945	6.1	257	3.50%	2.6	3.4	2.34	3.685
C21	Anus	24	0.40%	0.2	0.3	0.165	0.37	11	0.10%	0.1	0.2	0.15	0.18
C22	Liver	290	5.00%	2.8	4.2	1.805	4.885	127	1.70%	1.3	1.9	1.005	2.585
C23-C24	Gallbladder etc.	80	1.40%	0.8	1.2	0.555	1.675	113	1.50%	1.1	1.7	0.73	2.305
C25	Pancreas	170	2.90%	1.7	2.5	1.285	3.26	104	1.40%	1.1	1.5	0.71	1.985
C30-C31	Nose, sinuses etc.	18	0.30%	0.2	0.2	0.115	0.345	5	0.10%	0.1	0.1	0.055	0.1
C32	Larynx	69	1.20%	0.7	0.9	0.58	1.175	7	0.10%	0.1	0.1	0.025	0.1
C33-C34	Trachea,Bronchus,Lung	298	5.10%	2.9	4.4	2.13	5.42	148	2.00%	1.5	2	1.185	2.355
C37-C38	Other Thoracic organs	16	0.30%	0.2	0.2	0.135	0.18	10	0.10%	0.1	0.1	0.095	0.17
C40-C41	Bone	93	1.60%	0.9	0.9	0.535	0.71	53	0.70%	0.5	0.5	0.305	0.35
C43	Melanoma of Skin	14	0.20%	0.1	0.2	0.04	0.12	25	0.30%	0.3	0.3	0.125	0.28
C44	Other Skin	207	3.60%	2	2.7	0.955	2.555	166	2.30%	1.7	2.1	1	2.135
C45	Mesothelioma	11	0.20%	0.1	0.2	0.015	0.24	7	0.10%	0.1	0.1	0.085	0.085
C46	Kaposi sarcoma	27	0.50%	0.3	0.4	0.175	0.505	4	0.10%	0	0.1	0.01	0.055
C47,C49	Connective,Soft tissue	89	1.50%	0.9	1	0.57	0.925	70	1.00%	0.7	0.8	0.415	0.945
C50	Breast	42	0.70%	0.4	0.6	0.41	0.59	2240	30.40%	22.7	27.2	21.46	29.67
C51	Vulva	-	-	-	-	-	-	9	0.10%	0.1	0.1	0.1	0.145
C52	Vagina	-	-	-	-	-	-	8	0.10%	0.1	0.1	0.06	0.06
C53	Cervix Uteri	-	-	-	-	-	-	111	1.50%	1.1	1.4	0.83	1.475
C54	Corpus Uteri	-	-	-	-	-	-	454	6.20%	4.6	6.6	4.76	8.475
C55	Uterus unspc.	-	-	-	-	-	-	40	0.50%	0.4	0.5	0.345	0.605
C56	Ovary	-	-	-	-	-	-	219	3.00%	2.2	2.7	1.755	3.075
C57	Other Female Genital	-	-	-	-	-	-	18	0.20%	0.2	0.2	0.17	0.245
C58	Placenta	-	-	-	-	-	-	4	0.10%	0	0	0.02	0.02
C60	Penis	4	0.10%	0	0	0.045	0.045	-	-	-	-	-	-
C61	Prostate	405	7.00%	4	6.3	1.87	7.76	5	-	-	-	-	-
C62	Testis	123	2.10%	1.2	1.1	0.695	0.795	-	-	-	-	-	-
C63	Other male genital	3	0.10%	0	0	0.03	0.065	-	-	-	-	-	-
C64	Kidney	196	3.40%	1.9	2.6	1.635	3.065	138.0	0.0	1.4	1.8	1.16	1.89
C65	Renal Pelvis	7	0.10%	0.1	0.1	0.08	0.08	2.0	0.0	0.0	0.0	0.02	0.065
C66	Ureter	8	0.10%	0.1	0.1	0.03	0.155	0.0	0.0	0.0	0.0	0	0
C67	Bladder	229	3.90%	2.2	3.2	1.725	3.465	59.0	0.0	0.6	0.8	0.39	0.89
C68	Other Urinary organs	7	0.10%	0.1	0.1	0.065	0.1	2	0.00%	0	0	0.035	0.035
C69	Eye	30	0.50%	0.3	0.3	0.17	0.17	16	0.20%	0.2	0.2	0.095	0.14
C70-C72	Brain, Nervous system	212	3.70%	2.1	2.3	1.625	1.965	155	2.10%	1.6	1.8	1.16	1.755
C73	Thyroid	222	3.80%	2.2	2.5	1.7	2.47	854	11.60%	8.7	8.9	7.005	7.985
C74	Adrenal gland	22	0.40%	0.2	0.2	0.14	0.14	19	0.30%	0.2	0.2	0.095	0.095
C75	Other Endocrine	5	0.10%	0	0.1	0.04	0.04	6	0.10%	0.1	0.1	0.035	0.035
C81	Hodgkin disease	265	4.60%	2.6	2.6	1.675	2.135	230	3.10%	2.3	2.3	1.535	1.825
C82-C85,C96	Non-Hodgkin lymphoma	469	8.10%	4.6	5.6	3.195	5.795	372	5.10%	3.8	4.9	3.01	5.435
C88	Immunoproliferative dis.	0	0.00%	0	0	0	0	0	0.00%	0	0	0	0
C90	Multiple Myeloma	72	1.20%	0.7	1	0.505	1.165	48	0.70%	0.5	0.6	0.455	0.775
C91	Lymphoid Leukaemia	165	2.80%	1.6	1.8	0.915	1.36	105	1.40%	1.1	1.2	0.635	0.97
C92-C94	Myeloid Leukaemia	142	2.40%	1.4	1.5	1.02	1.42	158	2.10%	1.6	1.7	1.275	1.62
C95	Leukaemia unspc.	27	0.50%	0.3	0.3	0.18	0.305	13	0.20%	0.1	0.1	0.05	0.095
Other	Other & unspecified	137	2.40%	1.3	1.7	1.12	1.76	110	1.50%	1.1	1.5	0.805	1.895

CIR crude incidence rate, ASR age-standardized incidence rate

cancer care is available and covered by insurance. The national cancer institute of Saudi Arabia (SANCI) was founded following a royal decree in 2016 under the authority of the Saudi Health Council. It serves as a consultative entity to develop national strategies to control and combat cancer in coordination with other health authorities and related agencies in the Kingdom.

**Table 14.2** Most common cancers among Saudi, 2016 (Source: Cancer Incidence Report Saudi Arabia 2016) [1]

Site	Male	Female	All	%
Breast	42	2240	2282	17.3
Colorectal	955	704	1659	12.6
Thyroid	222	854	1076	8.2
NHL	469	372	841	6.4
Leukaemia	334	276	610	4.6
Hodgkin's lymphoma	265	230	495	3.8
Corpus Uteri	0	454	454	3.4
Lung	298	148	446	3.4
Liver	290	127	417	3.2
Prostate	405	0	405	3.1

The Saudi MOH designates the oncology facilities based on the range of the provided oncology services. There are three models of the oncology facilities; comprehensive oncology centers, specialized oncology departments, and oncology service units; the latter two are built within a hospital and are utilizing shared resources with the other hospital subspecialties. Also, there are other public non-MOH comprehensive oncology centers. Specialized oncology departments are found in MOH hospitals and other non-public MOH hospitals. The third model is oncology service units, which applies the hub-and-spoke design. This model arranges service delivery assets into a network consisting of an anchor establishment (hub) which offers a full array of services, complemented by secondary establishments (spokes) which offer more limited services.

## 14.4 Cancer Risk Factors

### 14.4.1 Obesity

The Saudi Health Interview Survey (SHIS) from 2013 showed high rates of obesity in the Kingdom. The prevalence of obesity, defined as a BMI of 30 kg/m<sup>2</sup> was 28.7%. It was higher among females than males, 33.5% vs. 28.7%. It increased with increasing age, being the highest among those aged between 55 and 64 years, reaching up to 48%. Obesity is reported to be the leading risk factor for disability-adjust life years (DALYs), accounting for 11.8% and 11.1% DALYs among males and females, respectively. In 2017, the Population-Attributable Fraction (PAF) of obesity was reported at 6.8% for cancer cases [3–5].

### **14.4.2 Smoking/Tobacco Use**

Overall, 12.1% of the population reported tobacco use. The prevalence was 23.7% and 1.5% among men and women, respectively. Individuals aged 55–64 years old reported the highest tobacco use, with 24.7% in men and 4.2% in women. Different tobacco use was reported, including cigarette 11.4% with an average of 15 cigarettes/day, Shisha smoking in 11.2%, and smokeless tobacco in 0.3%. The average age of starting smoking is 18.7 years. Secondhand smoke exposure is reported among 17.2% at home and 14.8% at work. In 2017, the Population-Attributable Fraction (PAF) of tobacco use was reported at 10% for cancer deaths [3, 4, 6].

### **14.4.3 Low Physical Activity**

The Saudi Health Interview Survey (SHIS) from 2013 reported a high percentage of individuals reporting low physical activity; overall, 60% reported a sedentary lifestyle. The estimated PAF in Saudi Arabia was 19.9% for breast cancer, 20.4% for colon cancer, and 18.4% for all-cause mortality due to physical inactivity [7, 8].

### **14.4.4 Infections**

The infection PAF is 12% for cancer cases in Saudi Arabia. Seventy-five percent of Hepatocellular Carcinoma (HCC) cases in Saudi Arabia are attributed to viral hepatitis (hepatitis B and C) with a more recent dominance of HCV over HBV. HCC is rated sixth in Saudi males and ninth in Saudi females among all cancers, with an age-standardized incidence rate of 4.8/100,000 for males and 2.4/100,000 for females [9]. HBV vaccination has become a mandatory requirement for all Saudi children at school entry in addition to a free mass vaccination program among adults in 1989–1990. HPV prevalence among women with normal cervical cytology in Saudi Arabia is 28.6%, among women with invasive cervical cancer in Saudi Arabia is 76%. However, cervix uteri cancer is not common among Saudi females accounting for 1.6% of cancer incidence [10, 11].

## **14.5 Cancer Screening Programs**

### **14.5.1 Breast Cancer**

Several pilot screening projects in different regions—Riyadh, Dammam, Jeddah, and Al-Qassim—were initiated as early as 1997 [12]. All commonly reported low uptake rates and low cancer detection compared to Western countries; however, follow-up periods were short ranging from 2 to 5 years [13]. In 2012, the MOH

initiated a nationwide Breast Cancer Early Detection (BCED) project to promote primary prevention through advertising awareness of modifiable risk factors associated with breast cancer, and secondary prevention through mammography for average-risk women [14]. Designated facilities, including mobile units across the Kingdom equipped with mammograms, were made available and accessible free of charge for citizens. The month of October is recognized nationally as the breast cancer awareness month, mirroring the international cancer calendar. Nonetheless, screening facilities are accessible throughout the year. Other nonprofit governmental and private initiatives for early detection of breast cancer are available, too [15, 16].

### ***14.5.2 Colorectal Cancer***

The Colorectal Cancer Early Detection Project was initiated by the MOH recently (2017) and aimed at average-risk individuals and the ones at increased risk of developing colorectal cancer [17]. Several healthcare centers provide the screening through fecal occult blood test and proctoscopy according to the individualized risk.

### ***14.5.3 Cervical Cancer***

Although there is no nationwide campaign advertising screening, pap smear with and without HPV testing is available in both the public and private sectors.

### ***14.5.4 Other Screenable Cancers***

A National program to screen for lung and prostate cancers is not activated. However, individualized screening as per a physician's recommendation or a patient's desire is available by the corresponding screening tools.

## **14.6 Cancer Prevention Programs**

The Ministry of Health has been advocating a healthy lifestyle with a healthy diet, physical activity, maintaining ideal body weight, and smoking cessation to decrease noncommunicable diseases, including cancer. Anti-smoking clinics were made widely accessible to assist individuals who desire to quit smoking with behavioral and pharmacologic therapy. Saudi Food and Drug Authority (SFDA) mandates that nutritional facts and calories are listed on the product to inform the consumer choices of a healthy diet. Successful control of obesity and tobacco use may reduce cancer incidence and mortality as the tobacco use PAF is 10% for cancer deaths and the obesity PAF is 6.8% for cancer cases.

HBV and HPV are recognized infections that lead to cancer development in Saudi Arabia [9, 10]. Interventions to limit the risk of contracting these infections were implemented. HBV vaccination has become a mandatory requirement for all Saudi children at school entry in addition to a free mass vaccination program among adults that was launched in 1989–1990. HPV vaccination was included in the national immunization schedule for females at 11–12 years old. Different healthcare sectors, including the private sector, offer HPV vaccination at charge for desiring individuals but it is not covered by health insurance.

## **14.7 Cancer Diagnosis**

### ***14.7.1 Imaging (Access to Imaging for Diagnosis and Later for Staging)***

Imaging facilities are available throughout the country. There are 81.7 mammographs, 251.6 CT scanners, and 158.5 MRI scanners per 10,000 cancer patients. There are 17 functioning PET CT machines in the Kingdom 13 in Riyadh, 3 in Dammam, and one in Jeddah with access time 2–3 weeks. Expanding in PET CT scans is limited due to the unavailability of radiopharmaceutical substances and cyclotrons. Nevertheless, there is a national plan to increase the number of PET CT scans in the next 5 Years.

### ***14.7.2 Laboratory***

Most immunohistochemical staining and anatomical pathology studies are performed in all tertiary cancer facilities in the Kingdom. Historically, molecular and genetics studies were done in a reference laboratory in Europe and the USA and supported by industry. However, over the last 3 years, in-house molecular studies, especially Next-Generation Sequencing (NGS) are being performed in some tertiary facilities. Many of the tests performed locally or internationally are supported by industry grants.

## **14.8 Treatment**

### ***14.8.1 Medical Oncology***

#### **14.8.1.1 MOH-Cancer Care Facilities**

Anti-neoplastic therapies are available and administrated in all models of the cancer care facilities that have been described in Sect. 14.3. Comprehensive care centers are independently regulating and purchasing their formulary. In comparison,



oncology departments and units serve a prespecified MOH essential list of anti-neoplastic agents. An essential list of anti-neoplastic agents with selected chemotherapies and targeted therapies is updated periodically to inform the must-have agents in stocks. In case there is a need for unlisted medication, an application is submitted to the central MOH oncology pharmacy for approval and supply. Anti-neoplastic agents for new or expanded indications, including chemotherapies, biologics, and immunotherapies are promptly reviewed by the SFDA for approval as they become supported by scientific evidence.

#### **14.8.1.2 Non-MOH Cancer Care Facilities**

These cancer care providers operate according to the corresponding founding governmental authority and regulate their formulary according to internal advisory committees.

#### **14.8.1.3 Medical Oncology Workforce**

Although there are local fellowship programs and several opportunities for abroad scholarships and careers in medical oncology, the number of native medical oncologists is still below what is needed to meet the increasing number of cancer patients. Therefore, nearly 85–90% of the medical oncology workforce in Saudi Arabia are non-Saudi. Unfortunately, incorrect perception of medical oncology as a depressing subspecialty might have contributed to this [18]. Better advertisement and incentives to recruit trainees to the specialty are essential.

#### **14.8.1.4 Stem Cell Transplant and High Dose Chemotherapy**

Saudi Arabia was the first Arab state to perform Hematopoietic Stem Cell Transplantation (HSCT) in 1984. 6184 HSCTs were performed in Saudi Arabia between 1984 and 2016; 3586 were performed in adults and 2598 were performed in the pediatric population. In adults, 2179 were allo-HSCTs and 1407 were auto-HSCTs. In pediatric patients, the majority (2326) were allo-HSCTs, while the auto-HSCT represented a small proportion (272). In pediatric patients, a high proportion of HSCT is performed for nonneoplastic hematologic indications, including hemoglobinopathies, primary immunodeficiency disorders, thalassemia, and bone marrow failure syndromes [19]. Five centers are providing stem cell transplant services in Riyadh, two in Jeddah, and one in Dammam. These centers provide both autologous and allogeneic stem cell transplantation distributed between MOH and other public non-MOH sectors. New services limited to autologous stem cell transplant in Makkah and Al-Madinah cities are being introduced [20]. A national marrow donor registry is being established to facilitate matched unrelated donor transplant. Also, umbilical cord blood banks are available in KFSH&RC, Riyadh.

### ***14.8.2 Radiation Therapy***

Currently, 32 linear accelerators are operational with a few more being in commissioning or planning phases. These machines are distributed in four provinces, Riyadh, Makkah, Eastern region, and Tabuk. Specialized and dedicated available radiotherapy machines included 4 Cyberknife, 6 intraoperative radiotherapy units, 4 brachytherapy units, and 1 Gamma Knife. Most existing linear accelerators can perform 3-D, IMRT, VMAT, and SBRT treatments. Around 60 radiation or clinical oncologists are currently licensed in Saudi Arabia in treating patients with radiation therapy. The Saudi Proton Therapy Center at King Fahad Medical City, Riyadh, has the first proton therapy facility in the Arab world and the Kingdom [21]. This project is going to be operational very soon.

### ***14.8.3 Surgery***

Surgical oncology is available throughout the comprehensive cancer centers and the specialized oncology departments at both MOH and public non-MOH facilities as well as the private sector. Complex oncologic procedures are referred to tertiary centers; for instance, the first two cytoreductive surgery and Hyperthermic Intraperitoneal Chemotherapy (HIPEC) were done in 2008 at KFSH&RC and King Fahad Medical City, followed by King Abdullah medical city, Makkah, King Abdulaziz University Hospital, Jeddah and King Saud University Hospital, Riyadh. More recently, King Khalid hospital, Najran, is providing PIPAC. Some of the centers receive patients from neighboring countries. Up to date, over 1,200 cases were performed [22].

### ***14.8.4 Pediatric Oncology***

A total of 803 cancer cases were diagnosed among children aged between 0 and 14 years, accounting for 4.6% of the total number of cancers reported to Saudi Cancer Registry in 2016. The reported incidents show that cancer was more common among boys than girls, 463 (57.6%) cases were reported among boys and 340 (42.4%) were reported among girls. A total of 664 cancer cases were reported among Saudi children, 129 were among non-Saudis, and 10 cases were with unknown nationality. The leading cancer among Saudi children was leukemia (30.4%), followed by brain tumors (14.6%), then Hodgkin's Lymphoma (11.6%), and NHL (9.1%) [1].

Centers that provide comprehensive pediatric cancer care are in Riyadh, Jeddah, Dammam, and Al-Qassim. There are six centers in Riyadh, three centers in Jeddah, one in Dammam, and one in Al-Qassim under the authority of MOH and other governmental non-MOH sectors.

### ***14.8.5 Survivorship Track***

Several survivorship clinics caring for long-term survivorship issues are operational within some of the specialized cancer centers. Generally, global guidelines are widely adopted to guide these issues. However, national dedicated guidelines and strategies on long-term survivorship planning and related issues in patients of different age groups who survived a cancer diagnosis have yet to be generated. Some cancer care professionals and nonprofit organizations' efforts to advocate survivorship awareness are on the horizon [23]. The need to develop a national survivorship strategy tailored to cancer, cultural and population characteristics is necessary to optimize holistic cancer care delivery [24].

### ***14.8.6 Palliative Care Track***

An effective palliative care system is essential for cancer patients diagnosed in advanced stages, suffering pain, and having end-of-life issues, especially a higher proportion of our patients are presenting in advanced stages than in western societies. The palliative care service in Saudi Arabia was started over two decades ago at the KFSH&RC in Riyadh with the progressive expansion of the specialty all over the Kingdom. Currently, there are 10 palliative care units are built-in in hospitals. They operate through consultation service within the hosting hospital, outpatient clinics, home healthcare program, and an outreach program in some. Although there are more advanced stage cancers, the per capita consumption of morphine in the country is below the mean global consumption of 6.11 mg [25]. Several factors contribute to the observed underuse of opioids, including poor awareness, the misconception on addiction, life-threatening adverse events, and strict prescribing policy. Initiatives directed toward improving education, awareness, and modifying prescribing policies to suit local cancer trends are underway [26]. The Saudi health council has issued a Do-Not-Resuscitate (DNR) policy to limit inconsistency and have a standardized approach across the healthcare facilities. Likewise, the Saudi Commission for Health Specialties (SCHS) published educational material on DNR to assist decision-making [27, 28].

## 14.9 Research and Education

Local training programs are available for all oncology subspecialties, including medical oncology, hematology, bone marrow transplant, pediatric hematology-oncology, radiation oncology, palliative care, and surgical oncology. These programs are mostly consistent with programs in North America. They are accredited and supervised by SCHS [29]. All training programs are considered fellowship/subspecialty training after successful completion of general specialty training except radiation oncology [30]. For example, a medical oncology fellowship is a 2-year program following an internal medicine residency [31]. Likewise, the hematology-oncology program requires a 2-year training after internal medicine residency with another optional year of further training in bone marrow transplant [32]. Surgical oncology often requires 3–5-year training after general surgery board certification. The pediatric hematology-oncology program is a 3-year program after completion of training in pediatrics [33]. Palliative care training (1 year fellowship) requires a background in family medicine, internal medicine, pediatric, general surgery, emergency, or anesthesia specialties. However, radiation oncology is a residency program of 5 years, starting after completing the internship year [30]. Local training programs are reviewed and accredited by the SCHS [29]. Governmental scholarships to international oncology training programs are also attainable.

Alghamdi et al. [34], recently reviewed all oncology publications from Saudi Arabia over 10 years. There was an increase in the volume of oncology publications comparing two time periods; 2008–2012 and 2013–2017. However, research quality remained the same. These findings call for a national strategy to improve cancer research. With more observed international collaboration, cancer research in Saudi Arabia is expected to continue growing in terms of quality and quantity, especially with improving research funds [35]. Funding is often secured through individual universities or dedicated research centers. Many clinical trials with and without international collaborations are open in multiple cancer centers in Saudi Arabia. Not surprisingly, the increasing research productivity in oncology reflects the increase in overall healthcare research activities, including basic sciences in Saudi Arabia [36].

### 14.10 Cost-Effective Cancer Care

Jazieh et al. [37] analyzed the future projection of cancer incidence and economic burden concluded that a projected additional increase of 63% cancer incidence is associated with increasing costs of 56% in 2030 compared to 2015. Managing costs of healthcare is one of the main focuses of the Kingdom's Vision 2030 and the national transformation program. Many strategies have been postulated, including increasing private sector share of spending in healthcare generally and in oncology care specifically, encouraging the privatization of the medical cities through a Public–Private Participation (PPP) scheme, mandating health insurance for all

citizens, and broader utilization of digital health solutions to improve accessibility with reducing costs. Besides, continuing, and growing efforts to promote a healthy lifestyle, primary prevention, and early detection of noncommunicable diseases, including malignancies.

There is no Health Technology Assessment (HTA) for the cost-effectiveness of oncology medication in the Kingdom of Saudi Arabia; however, the SFDA is in the process of registration and negotiating the pricing issues. There is a national agency to purchase medications, the National Unified Procurement Company for Medical Supplies (NUPCO). It will be the universal agent to purchase oncology medications and other medications in the Kingdom of Saudi Arabia, which will give strong bargaining power and obtain the best deals for the medication in the country.

### 14.11 Challenges and Advantages

The geographic nature of Saudi Arabia, with central cities being urbanized disproportionately to the peripheral ones, produced difficulties with equal care accessibility, timely referral to the higher specialized cancer center, and inadequate therapeutic supply on occasions. A digital referral program (Ehalati) linking peripheral to higher centers was implemented to overcome the issue. The program is directed toward all health specialties, including cancer cases requiring immediate care. Additionally, the outreach (spoke-hub) model is being applied. Other inherited challenges are the young population (70% of the Saudi population is younger than 40 years), with a life expectancy that is expected to increase to 78.4 (males) and 81.3 (females) by 2050 and increasing population capacity coupled with the projected increase in cancer incidence by 60% in 2030 compared to 2015 [37]. Saudi Arabia has many out-of-the country workers, the non-Saudi population estimated at one-third of the total (nearly 12 Million). Medical expenses have to be managed reasonably to avoid loading the healthcare system. Hence, expanding the private healthcare investment in cancer has been encouraged recently when the Council of Cooperative Health insurance mandated private healthcare insurance providers to cover cancer care expenses for insured patients up to 500,000 SAR.

People's awareness and misconceptions surrounding cancer diagnosis and treatment contribute to the late-stage presentation, DALYs, and loss of productivity. Altogether, reflecting poorly on survival and costs. A significant deficiency in the native oncology workforce and expertise resulting in out-of-the-country recruitment is a considerable challenge. The desire of some cancer patients to be treated abroad (medical tourism) is an issue that has been regulated strictly over the past years in light of treatment availability at home. Although only 1800 cases in 2016 were granted such governmental sponsorship, the cost to cases ratio is still huge. Saudi cancer registry shows progressive improvement in cancer incidence reporting; however, data collection and accuracy on patient demographics, primary tumor site, tumor morphology, stage at diagnosis, the first course of treatment, and follow-up with patients for vital status are yet to be optimized.

There are multiple healthcare sectors in KSA, and coordination is essential to avoid duplicate efforts. This is being achieved via the Saudi Health Council and its sub, the Saudi NCI. Many newly approved medications are readily available in KSA, matching their availability in other developed world countries after being reviewed by the SFDA.

### ***14.11.1 Quality of Cancer Care***

The practice of oncology in Saudi Arabia is provided at a high standard and assurance of adherence to the latest advances of care. Well-trained oncologists provide cancer care with all different specialties that most of them are trained in North America (Canada or the USA). The tertiary hospitals usually have multidisciplinary teams to discuss complex cases and generally, oncologists adhere to National Comprehensive Center Network (NCCN) guidelines. In that regard, the first and only center for coordination of NCCN collaboration outside the USA was established in Saudi Arabia to adopt the NCCN guidelines to the Middle East and North Africa in 2010. There are multiple national guidelines developed over the last couple of decades by different entities, such as the Saudi Lung Cancer Association, Saudi Oncology Society [38, 39]. Lately, the Saudi NCI launched an initiative for national guidelines in 2018 [40].

The MOH adopted several Key Performance Indicators (KPIs) for their cancer care providers to assess care quality. Additionally, both MOH and non-MOH, including private cancer care providers must meet the accreditation requirement by the Saudi Central Board for Accreditation of Healthcare Institutions (CBAHI) [41].

Several comprehensive cancer care facilities in KSA are accredited and certified by international oncology societies. There are three ESMO designated oncology centers in KSA [42]. Besides, King Abdulaziz Medical City, Ministry of National Guard, Riyadh being the first in the Middle East and North Africa to receive ASCO's standards for quality cancer care delivery (QOPI) certification. Likewise, The KFSSH&RC, Riyadh, was the first center outside Europe to obtain the Joint Accreditation Committee of the ISCT and the EBMT (JACIE) in 2010.

## **14.12 The Future of Cancer Care in Saudi Arabia**

The Saudi Ministry of Health has led many initiatives to transform oncology care in the Kingdom starting from 2016. Several workshops, stakeholder meetings, global experts, and patients' interviews have been conducted. Several themes have been

identified to shape the cancer care transformation strategy, including promoting general health awareness and primary prevention, improving early detection and screening, ensuring care accessibility, equality and quality, mobilizing and utilizing resources effectively, avoiding fragmented services, expanding services and bed capacity, measuring patients satisfaction, optimizing outcomes; specifically survival and quality of life, establishing guidelines/pathways, incorporating tele-health, and encouraging different sectors collaboration [43].

### 14.13 Conclusion

The Kingdom of Saudi Arabia is a pioneer in regional cancer care. Continuous advances are spanning a half-century (Fig. 14.3), with significant strides recently stirred by the national cancer care transformation strategy which is exploring challenges and solutions to improve cancer care further.

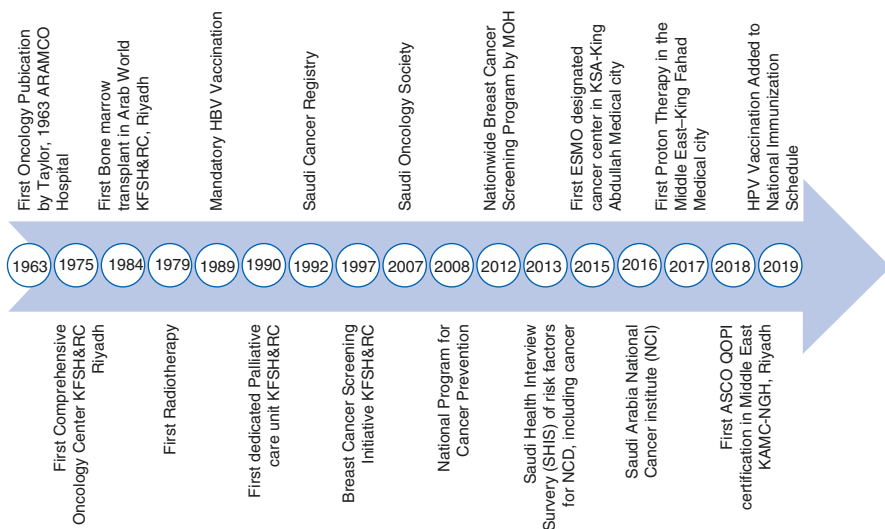


Fig. 14.3 Timeline of cancer care milestones in the Kingdom of Saudi Arabia

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## References

1. Saudi Arabia Cancer Incidence Report 2016, Saudi Cancer Registry (SCR). <http://nhic.gov.sa/en/eServices/Documents/2016.pdf>
2. Althubiti MA, Nour Eldein MM. Trends in the incidence and mortality of cancer in Saudi Arabia. *Saudi Med J.* 2018;39(12):1259–62. <https://doi.org/10.15537/smj.2018.12.23348>.
3. WHO Cancer Country Profile 2020, Saudi Arabia. [https://www.who.int/cancer/country-profiles/SAU\\_2020.pdf](https://www.who.int/cancer/country-profiles/SAU_2020.pdf)
4. WHO international agency of research on cancer, Saudi Arabia. <https://gco.iarc.fr/today/data/factsheets/populations/682-saudi-arabia-fact-sheets.pdf>
5. Obesity at glance: findings from the Saudi health information survey for non-communicable diseases 2013. <https://www.moh.gov.sa/Ministry/Statistics/Documents/obesity.pdf>
6. Smoking in the Kingdom of Saudi Arabia: findings from the Saudi health information survey for non-communicable diseases 2013. <https://www.moh.gov.sa/Ministry/Statistics/Documents/smoking.pdf>
7. Alahmed Z, Lobelo F. Physical activity promotion in Saudi Arabia: a critical role for clinicians and the health care system. *J Epidemiol Glob Health.* 2018;7(Supplement 1):S7–S15., ISSN 2210-6006. <https://doi.org/10.1016/j.jegh.2017.10.005>.
8. The Saudi health information survey for non-communicable diseases 2013 <https://www.moh.gov.sa/Ministry/Statistics/Documents/Final%20book.pdf>
9. Aljumah AA, Kuriry H, Faisal N, Alghamdi H. Clinicopathologic characteristics and outcomes of hepatocellular carcinoma associated with chronic hepatitis B versus hepatitis C infection. *Ann Saudi Med.* 2018;38(5) September–October 2018 <https://doi.org/10.5144/0256-4947.2018.358>.
10. Alsbeih G. HPV infection in cervical and other cancers in Saudi Arabia: implication for prevention and vaccination. *Front Oncol.* 2014;3(4):65. <https://doi.org/10.3389/fonc.2014.00065>.
11. Bruni L, Albero G, Serrano B, Mena M, Gómez D, Muñoz J, Bosch FX, de Sanjosé S. ICO/IARC Information Centre on HPV and Cancer (HPV Information Centre). Human Papillomavirus and Related Diseases in Saudi Arabia. Summary Report 17 June 2019. <https://hpvcentre.net/statistics/reports/SAU.pdf>
12. Knoll SM. Breast cancer screening and a comprehensive breast cancer program in Saudi Arabia. *Ann Saudi Med.* 1997;17(1):1–3. <https://www.annsaudimed.net/doi/full/10.5144/0256-4947.1997.1>
13. Abulkhair OA, Al Tahan FM, Young SE, Musaad SMA, Jazieh A-RM. The first national public breast cancer screening program in Saudi Arabia. *Ann Saudi Med.* 2010;30(5):350–7. <https://doi.org/10.4103/0256-4947.67078>.
14. Ministry of Health, Saudi Arabia. MOH initiatives & projects, breast cancer early detection <https://www.moh.gov.sa/en/Ministry/Projects/breast-cancer/Pages/default.aspx>
15. Sheikh Mohammed Hussien AL-Amoudi Center of Excellence in Breast Cancer. <https://alamoudi-breastcenter.kau.edu.sa/Default-905-AR>
16. Abdullateef Cancer Screening Center. <https://www.saudicancer.org/index.php/2014-11-17-06-36-18/2014-11-30-13-30-00>
17. The Saudi Ministry of Health. MOH initiatives & projects, colorectal cancer early detection <https://www.moh.gov.sa/en/Ministry/Projects/Colorectal-Cancer-Awareness/Pages/default.aspx>
18. Abusanad A. Only if you view it through a different lens. *Curr Oncol.* 2018;25(5):299. Epub 2018 Oct 31. <https://doi.org/10.3747/co.25.4073>.
19. Shaheen M, Almohareb F, Aljohani N, et al. Hematopoietic stem cell transplantation in Saudi Arabia between 1984 and 2016: experience from four leading tertiary care hematopoietic stem



- cell transplantation centers. *Hematol Oncol Stem Cell Ther.* 2021;14(3):169–78. <https://doi.org/10.1016/j.hemonc.2020.07.008>.
20. Al-Hashmi H, Alsagheir A, Estanislao A, et al. Establishing hematopoietic stem cell transplant programs; overcoming cost through collaboration. *Bone Marrow Transplant.* 2020;55(4):695–7. <https://doi.org/10.1038/s41409-020-0793-9>.
  21. Saudi Proton Therapy Center. <https://sptc.med.sa/en/home-en/>
  22. Alyami M, Mercier F, Traiki TB, Trabulsi N, Al-Alem I, Alzahrani A, Alqannas M, Almohaimeed K. The current status of peritoneal surface oncology in Saudi Arabia. *Indian J Surg Oncol.* 2019;10(Suppl 1):33–6. <https://doi.org/10.1007/s13193-019-00876-y>. Epub 2019 Jan 15
  23. Abusanad A. “Najia” story: a WhatsApp support group for patients with breast cancer. *Innovations in Digital Health, Diagnostics, and Biomarkers.* 1(1):16–8. <https://doi.org/10.36401/IDDB-20-01>.
  24. G20 discusses support for cancer survivors post treatment. <https://www.arabnews.com/node/1745586/saudi-arabia>
  25. World Health Organization population data 2013, Pain and Policy Studies Group: 2011 EMRO Consumption of Morphine. International Narcotics Control Board. [http://www.painpolicy.wisc.edu/sites/www.painpolicy.wisc.edu/files/EMRO\\_morphine\\_2011%20\[Compatibility%20Mode\].pdf](http://www.painpolicy.wisc.edu/sites/www.painpolicy.wisc.edu/files/EMRO_morphine_2011%20[Compatibility%20Mode].pdf)
  26. Alshammary SA, Abdullah A, Duraisamy BP, Anbar M. Palliative care in Saudi Arabia: two decades of progress and going strong. *J Health Specialties.* 2014;2(2):59.
  27. The Saudi Commission for Health Specialties, Department of Medical Education & Postgraduate Studies, Code of Ethics for Healthcare Practitioners. <http://docplayer.net/11868886-Code-of-ethics-for-healthcare-practitioners-the-saudi-commission-for-health-specialties-department-of-medical-education-postgraduate-studies.html>
  28. Arabi YM, Al-Sayyari AA, Al Moamary MS. Shifting paradigm: from “no code” and “do-not-resuscitate” to “goals of care” policies. *Ann Thorac Med.* 2018;13:67–71. [https://doi.org/10.4103/atm.ATM\\_393\\_17](https://doi.org/10.4103/atm.ATM_393_17).
  29. The Saudi Commission for Health Specialties, programs accreditation. <https://www.scfhs.org.sa/en/education/ProgramsAccreditation/Pages/default.aspx>
  30. The Saudi Board of Radiation Oncology. <https://www.scfhs.org.sa/MESPS/TrainingProgs/TrainingProgsStatement/Documents/Radiation%20Oncology%20Residency.pdf>
  31. The Saudi Board of Medical Oncology. <https://www.scfhs.org.sa/MESPS/TrainingProgs/TrainingProgsStatement/Documents/رابطكفل%20مدل%20ماروأل%20بط.pdf>
  32. Adult Hematology Fellowship Program. <https://www.scfhs.org.sa/MESPS/TrainingProgs/TrainingProgsStatement/Documents/رابطكفل%20مدل%20مضارم%20بط.pdf>
  33. Pediatrics Hematology/Oncology Fellowship Program. <https://www.scfhs.org.sa/en/MESPS/TrainingProgs/TrainingProgsStatement/ChildBloodDises/Documents/Program%20Booklit.pdf>,
  34. Alghamdi MA, Alzahrani RA, Alhashemi HH, et al. Oncology research in Saudi Arabia over a 10-year period. A synopsis. *Saudi Med J.* 2020;41(3):261–6.
  35. Alabdula'aly AI. Experience of King Abdul-Aziz City for science and technology in funding medical research in Saudi Arabia. *Saudi Med J.* 2004;25(1 Suppl):S8–12.
  36. Ul Haq I, Ur Rehman S, Al-Kadri HM, Farooq RK. Research productivity in the health sciences in Saudi Arabia: 2008–2017. *Ann Saudi Med.* 2020;40(2):147–54. <https://doi.org/10.5144/0256-4947.2020.147>.
  37. Jazieh A, Da'ar OB, Alkaiyat M, Zaatreh Y, Saad AA, Bustami R, Alrujaib M, Alkattan K. Cancer incidence trends from 1999 to 2015 and contributions of various cancer types to the overall burden: projections to 2030 and extrapolation of economic burden in Saudi Arabia. *Cancer Manag Res.* 2019;11:9665–74. <https://doi.org/10.2147/cmar.s222667>.
  38. Howington J. The first Saudi lung cancer guidelines. *Ann Thorac Med.* 2008;3(4):127. <https://doi.org/10.4103/1817-1737.43155>.
  39. Bazarbashi SN. Saudi Oncology Society clinical management guidelines development. *Saudi Med J.* 2014;35(12):1524–6.

40. The Saudi Arabia National Cancer Institute. <https://shc.gov.sa/en/NCC/Activities/Pages/ScientificTeams.aspx>
41. The Saudi Central Board for Accreditation of Healthcare Institutions. <https://portal.cbahi.gov.sa/english/home>
42. ESMO Accredited Designated Centres. <https://www.esmo.org/for-patients/esmo-designated-centres-of-integrated-oncology-palliative-care/esmo-accredited-designated-centres>
43. Ministry of Health, Saudi Arabia. Health transformation strategy. <https://www.moh.gov.sa/en/Ministry/vro/Documents/Healthcare-Transformation-Strategy.pdf>



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