

Chapter 5

General Oncology Care in Iraq



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5.1 Iraq Demographics

The Republic of Iraq lies in western Asia encircling the Mesopotamian plain. It has an area of 437,072 km²; fed by the Euphrates and Tigris rivers. The population, estimated to be 40,384,685, continues to grow at a rate of 2.4% per year and the fertility rate is 3.9%. Almost 70% lives in urban areas and only 5% are over 60 years old with a life expectancy at birth reaching 72 years. There are 18 governorates in Iraq, including three in the Kurdistan Region (KRG). The capital, Baghdad, is the second largest city in the Arab World, following [Cairo](#) with a population of eight million [1–4].

The fifth largest proven conventional oil reserve globally, with 141 billion barrels, is present in Iraq, which is considered the third largest oil exporters [4]. Owing to the continuous conflicts over the past four decades, merely 30–40% of the countries have been properly explored. In 2019, the Gross Domestic Product (GDP) grew by an estimated 4.4% due to improved security conditions, higher oil prices, and increased agricultural production. The GDP in Iraq was worth 234.09 billion US dollars in 2019, according to official data from the World Bank and projections from Trading Economics (<https://tradingeconomics.com/iraq/gdp>); representing 0.20% of the world economy [1, 4, 5].

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5.2 Cancer Statistics in Iraq

It has been estimated that the highest incidence of cancer within the coming 15 years will be registered in the Eastern Mediterranean Region (EMR) for reasons attributed to population growth, aging, lifestyle modification, urbanization, and exposure to carcinogens [19]. The types and burden of cancers are variable in different countries in the region [20]. In Iraq, the Ministry of Health (MOH) established the Iraqi Cancer Registry (ICR) in 1974 in collaboration with the International Agency for Research on Cancer (IARC), France. Since then, several reports have been published recording the ICR for the years (1976–1985), (1986–1988), (1989–1991), (1992–1994), (1995–1997), (1998–1999), followed by successive reports yearly. The pooled data from all governorates are registered by well-trained staff, instructed on Cancer Registry Program 4 (Can Reg 4) and ICD-O code, who work at the cancer registry units in the major hospitals [21, 22]. The filled forms are referred at three-month intervals to the cancer registry section of the Iraqi Cancer Board (ICB); where they are checked for accuracy and completeness, then introduced in the Alphabetical Index into the system to prevent duplication [23].

The age-standardized incidence and mortality rates of cancer among the Iraqi population in 2018 as displayed in the Global Cancer Observatory [24] are 105.5 and 64.7, respectively (Table 5.1). The latest ICR [25] has illustrated that the total number of new cancer cases during 2018 was 31,502, with an incidence rate of 82.6/100,000 population; 43% occurred in males and 57% in females (Table 5.2). The top registered cancers were breast cancer (19.7%), bronchus and lung (8.2%), colorectal (6.1%), leukemia (6.0%), and urinary bladder (4.9%) (Table 5.3, Fig. 5.1). Among males, the top three cancers were bronchus and lung (13.4% with an incidence of 9.5/100,000 male population), followed by urinary bladder (8.6%) and leukemia (7.8%). On the other hand, the top three cancers among females were breast (34.1% with an incidence of 32.3/100,000 female population), thyroid gland (6.1%), and colorectal (5.1%). Among children, the total number of cancers was 1715, representing 5.44% of total cases of cancer at all age groups. The most prevalent childhood malignancy was leukemia (3.6%) followed by Brain/CNS (1.9%) and Non-Hodgkin Lymphoma (0.9%) [25].

Overall, the most common causes of malignant related deaths in Iraq were due to cancers of the bronchus and lungs (18.9%), breast (12.3%), and leukemia (12.1%) (Fig. 5.2) [25].

Table 5.1 Incidence, mortality, and prevalence of cancer in Iraq by cancer site [24]

Cancer	New cases				Deaths				5 year prevalence, all ages	
	Number	Rank	%	Cum. Risk	Number	Rank	%	Cum. Risk	Number	Prop.
Breast	5141	1	20.3	4.03	1727	2	11.9	1.4?	13006	66.9
Lung	2123	2	8.4	1.36	2066	I	14.2	1.32	2039	5.18
Leukemia	1614	3	6.6	0.48	132?	3	9.1	0.41	4437	11.28
Bladder	1454	4	5.7	0.89	596	6	4.1	0.33	3465	8.81
Brain/nervous system	1342	5	5.3	0.50	1085	4	7.5	0.45	3189	8.11
Non-Hodgkin lymphoma	1250	6	4.9	0.49	476	10	3.3	0.21	3013	7.66
Colon	926	7	3.7	0.49	528	8	3.6	0.27	1888	4.80
Stomach	791	8	3.1	0.40	750	5	5.2	0.38	1006	2.56
Hodgkin lymphoma	650	9	2.6	0.16	168	16	1.2	O.0	1934	4.92
Thyroid	631	10	2.5	0.22	69	23	0.48	0.03	1823	4.63
Prostate	556	11	2.2	0.80	159	19	I	0.14	1051	5.28
Liver	539	12	2.1	0.32	538	7	3.7	0.32	443	1.13
Ovary	534	13	2.1	0.42	362			0.34	1279	6.59
Kidney	530	14	2.1	0.23	195	15	1.3	0.10	1214	3.09
Pancreas	503	15	2.0	0.31	500	9	3.4	0.31	380	0.97
Larynx	491	16	2.0	0.32	360	12	2.5	0.24	1189	3.02
Rectum	409	„	1.6	0.19	235	14	1.6	0.11	847	2.15
Gall bladder	293	18	1.2	0.18	253	13	1.7	0.16	329	0.84
Cervix uteri	244	19	0.96	0.20	159	18	II	0.15	612	3.15
Oral cavity	237	20	0.94	0.13	146	20	1.0	0.08	568	1.44
Corpus uteri	215	21	0.85	0.22	60	24	0.41	0.01	552	2.84
Multiple myeloma	187	22	0.74	0.11	143	21	0.98	0.09	374	o.95
Nasopharynx	1'4	23	0.69	0.07	125	22	0.86	O.O<i	487	1.24
Testis	173	24	0.68	0.08	32	30	0.22	0.03	551	2.77
Esophagus	172	25	0.68	0.10	165	17	II	0.10	165	0.42
Melanoma of skin	96	26	0.38	0.04	34	29	0.23	0.02	239	0.61
Salivary glands	96	27	0.38	0.05	57	25	0.39	0.03	223	0.57
Anus	56	28	0.22	0.03	so	26	0.34	0.03	119	0.30
Hypopharynx	51	29	0.20	0.03	28	31	0.19	0.01	81	0.21
Oropharynx	40	30	0.16	0.02	38	27	0.26	0.02	99	0.25
Kaposi sarcoma	40	31	0.16	0.02	23	32	0.16	0.01	92	0.23
Mesothelioma	36	32	0.14	0.02	35	28	0.24	0.02	39	0.10
Vulva	23	33	0.09	0.02	16	33	0.11	0.01	66	0.34
Vagina	18	34	0.07	0.02	12	34	0.08	0.02	44	0.23
Penis	5	35	0.02	0.01	3	35	0.02	0.00	13	0.07
All cancer sites	25320			11.1	14524			7.07		139.32

Table 5.2 Distribution and incidence rates/100,000 population of new cases of cancer by gender, ICR, Iraq, years 1994–2018 [25]

Year	Male no. %		Female no. %		Total no. %		IR ^a
1994	4230	54.4	3555	45.6	7785	100	38.91
1995	4344	54.7	3604	45.3	7948	100	44.69
1996	4466	53.5	3894	46.5	8360	100	45.69
1997	4521	52.7	4071	47.3	8592	100	45.67
1998	4774	52.9	4259	47.1	9033	100	45.74
1999	4556	50.9	4380	49.1	8936	100	43.95
2000	5376	49.4	5512	50.6	10,888	100	52.00
2001	6758	50.6	6574	49.4	13,332	100	61.83
2002	6964	49.8	7021	50.2	13,985	100	62.97
2003	5698	50.6	5550	49.4	11,248	100	49.17
2004	7525	51.8	6995	48.2	14,520	100	61.63
2005	7505	49.5	7667	50.5	15,172	100	54.26
2006	7377	48.5	7849	51.5	15,226	100	52.84
2007	6656	46.8	7557	53.2	14,213	100	47.88
2008	6589	46.5	7591	53.5	14,180	100	44.46
2009	7201	47.3	8050	52.7	15,251	100	48.16
2010	8544	46.3	9938	53.7	18,482	100	56.89
2011	9352	46.2	10,926	53.8	20,278	100	60.82
2012	9268	43.9	11,833	56.1	21,101	100	61.69
2013	10,568	45.4	12,740	54.6	23,308	100	66.41
2014	11,411	44.5	14,187	55.5	25,598	100	71.10
2015	11,205	44.4	14,064	55.6	25,269	100	68.41
2016	11,194	43.8	14,362	56.2	25,556	100	67.45
2017	12,502	43.1	16,521	56.9	29,023	100	78.14
2018	13,612	43.0	17,890	57.0	31,502	100	82.62

^aIncidence rate**Table 5.3** Distribution of the top ten cancers in Iraq, ICR, 2019 [25]

	Top ten cancers/all	No.	%
1	Breast	6206	19.70
2	Bronchus and lungs	2579	8.19
3	Colorectal	1936	6.15
4	Leukemia	1899	6.03
5	Urinary bladder	1542	4.89
6	Brain and CNS tumors	1541	4.89
7	Thyroid	1413	4.49
8	Non-Hodgkin lymphoma	1268	4.03
9	Skin	1142	3.63
10	Prostate	1023	3.25
Total top ten	20,549	20,549	65.23
Total other sites	10,953	10,953	34.77
Grand total	31,502	31,502	100

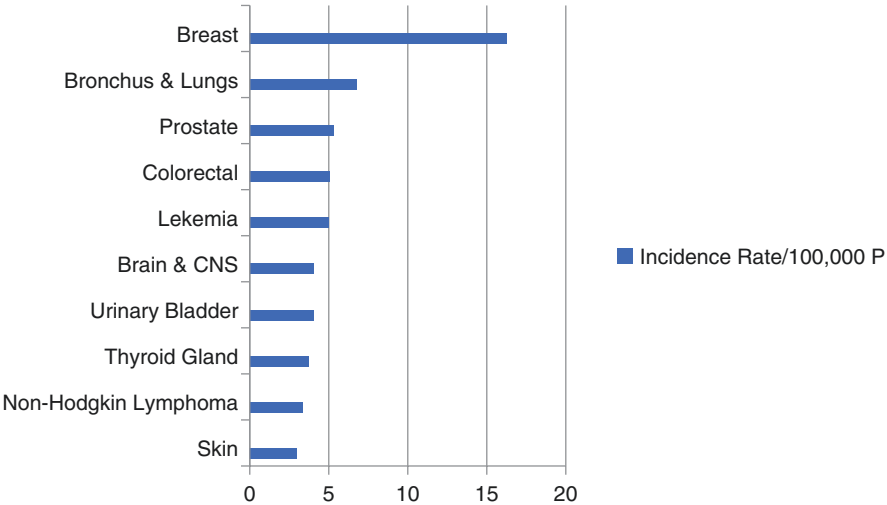


Fig. 5.1 Incidence rate/100,000 population of the top ten cancers in Iraq, IRC, 2019 [25]

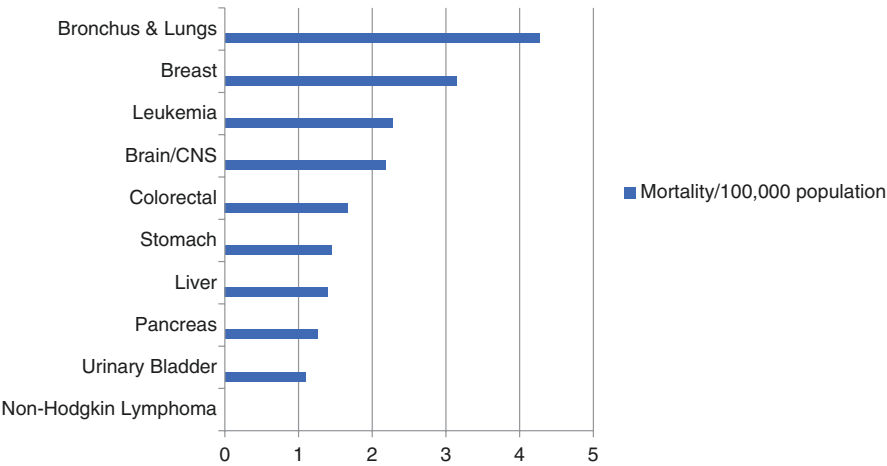


Fig. 5.2 Mortality rates: top ten cancers in Iraq/100,000 populations, ICR, 2018 [25]

5.3 Healthcare System in Iraq

Before 1980, the United Nations (UN) reported that Iraq had the most robust health-care system in the Middle East with respect to its infrastructure, competent specialists, and free universal health service coverage [6]. The consequences of the successive wars, sanctions, civil conflicts and political instability yielded a shortage in the medical resources, expertise, and funds [4–8]. Currently, the government spends 6–7% of its GDP on the health sector, providing free of charge services to all

citizens through a network of Primary Health Care Centers (PHCC) and public hospitals. Specialized care is also presented by private hospitals, the costs of which are met out-of-pocket as the health insurance program has not initiated yet in Iraq [1, 3].

The latest Annual Statistical Report of the Ministry of Health/Environment (MOH) in Iraq (<http://www.moh.gov.iq/arabic>) has displayed that there are 286 governmental hospitals, 143 private hospitals, and 2808 PHCC; the PHCC and units serve 0.7/10,000 populations. The number of hospital beds per capita is 1.3/1000 population, of which 70–75% are in general hospitals and 25–30% in specialized clinics and centers. Currently, there are 37 functioning medical colleges distributed at the government and private levels. The rates of physician, paramedical, and nursing staff are equivalent to 0.93, 2.3, and 2.2/1000 population, respectively. The adult mortality rate/1000 population is 2%. The main registered causes of death among the population are ischemic heart disease (12%), followed by cancer (9%) and cerebrovascular accidents (8%) [1, 9].

5.4 Oncology Care in Iraq

At the beginning of the twentieth century, Baghdad was a pioneer among the Arab World in cancer management. X-ray machines were introduced in the Radiology Institute of Baghdad since 1920, followed by installing cobalt-60 units in the 1950s, Cs-137 for brachytherapy in the 1960s, and linear accelerators in the 1970s [10]. Between 1950 and 1980, Iraq hosted many patients and students from neighboring countries, providing quality healthcare and medical education [11, 12]. During the gulf wars (1990, 2003), Iraq was exposed to various ammunitions of massive destruction, which raised the debate upon their probable carcinogenicity. The UN sanction (1990–2003) imposed an embargo on a range of diagnostic and therapeutic cancer equipment, including linear accelerators, certain chemotherapy drugs and radioisotopes, suspecting that they might be converted into chemical weapons [8, 13].

With the objective of addressing the cancer burden in Iraq, the MOH established the “Iraqi Cancer Board” (ICB) in 1985, which is represented by various specialties from different governorates. The ICB consists of specific functional units to coordinate their relevant programs, i.e. registration, prevention, early detection, treatment, palliative care, and research. In 2010, members of the ICB designed a “National Cancer Control Plan” (NCCP) for Iraq [14], in accordance with the cancer control strategy, recommended by the World Health Organization (WHO) [15–17]. Ongoing efforts have been exerted to ensure translation of the NCCP into implemented financed, evidence-based actions. Documentation of the cancer data is carried out through the national population based “Iraqi Cancer Registry” (ICR), which pools information on newly diagnosed cancer cases from medical record departments of all hospitals and laboratories (public and private) of the governorates.

Excluding the Kurdistan Region (KRG), currently there are about 35 public cancer care facilities, i.e., hospitals, centers, and units, distributed over the Iraqi governorates (10 of which are in the capital), comprising approximately 2000 beds. The largest public tertiary hospital in Baghdad, the “Medical City Teaching Complex”

(MCTC), includes four specialized cancer centers. KRG established “Zhianawa Cancer Center” in Sulaymaniyah equipped with brachytherapy, and “Hiwa Cancer Hospital.” The latter is considered the second largest provider of public oncology care following “Al-Amal National Cancer Center” in Baghdad [5, 18]. Nowadays, Iraq is investing in the private health sector to upgrade cancer services and save the money it spends yearly on the medical evacuation program.

5.5 Cancer Risk Factors

The prevalence of tobacco smoking exceeds 30% among men in the EMR [26]. World Health Organization (WHO) estimated that tobacco-related cancer deaths have reached 18.4% [27]. The latest population based “STEPS Survey of Non-Communicable Disease” (NCD) risk factors carried out on 4071 Iraqi adults revealed that 38.0% of men and 1.9% of women were current smokers of tobacco. The daily tobacco users constituted 19.6% of the Iraqi adult population (36.1% men, 1.8% women). About 0.4% of men were users of smokeless tobacco. Six in ten smokers had tried to stop smoking 1 year before the survey. Approximately, 56% and 52% of adults were exposed to second-hand smoke at the workplace and at home, respectively. The average monthly expenditure on cigarette smoking was (34485) Iraqi dinars in 2015, whereas the cost of 100 packs of manufactured cigarettes, as a percentage of per capita GDP, was 2.4% [28, 29].

The same STEPS survey [28] displayed that 33.5% of the adult population in Iraq were obese (25.6% men, 42.6% women), while 65.4% were overweight (58.7% men, 73.1% women). Overall, 47% have experienced insufficient physical activity (34.9% men, 60% women). The median time spent on average activity per day was 25 min, whereas 82.3% did not engage in any physical activity. It has been recently estimated that about 50% of men and 35% of women in the EMR are currently overweight or obese [30]. Studies on alcohol consumption have demonstrated that 97.8% of Iraqi adults were lifetime abstainers (95.8% men, 100% women), only 0.6% were current drinkers [2, 28].

5.6 Cancer Screening Programs

In 2001, a “National Program for Early Detection of Breast Cancer” in Iraq was initiated by the MOH through establishing four main specialized referral training centers for early detection in Baghdad, Basra, and Mosul, in addition to specialized clinics in the major hospitals of each governorate. The main objectives of the program are early detection of breast cancer, reduction in cancer-related morbidity and mortality, and public promotion of cancer prevention and control [8, 17, 33–36]. The Ministry of Higher Education and Scientific Research (MOHESR) supported MOH by developing a “National Cancer Research Program” in 2010, focusing on breast cancer and a “National Cancer Research Center” (NCRC) in 2012. In

addition to the research and training activities, the NCRC of Baghdad University has launched several awareness campaigns among the society on early detection of the disease [38]. Chaired by community leaders, a series of educational seminars were carried out covering almost all Universities, Ministries, Council of Ministers, Iraqi Parliament; and extended to reach the rural areas. Under the supervision of WHO/IARC, the NCRC developed an online information system database for patients with breast cancer. Numerous implemented activities of the aforementioned programs were sponsored by WHO, through provision of some urgently needed equipment and facilitating training of the staff running the breast cancer centers and clinics [8, 17, 36, 39, 40]. Although cervical cancer is not common in Iraq, yet there are sporadic activities for screening through Pap smears. It has been reported that 9.9% of Iraqi women (aged 30–49 years) had a Pap smear test at least once in a lifetime [28, 37]. Currently, there are active plans to initiate screening for colorectal and cervical cancers in Iraq.

5.7 Cancer Prevention Programs

The International Union against Cancer (UICC), World Cancer Declaration Target Report [31], shows that Iraq has made significant progress in key preventive areas including:

- Implementation of tobacco control legislation in accordance with the WHO MPOWER tool [32].
- Existence of national regulations on the prohibition of public availability of alcohol [2, 28].
- Launching national public mobilization campaigns on tobacco control, promotion of physical activity and healthy diet. Anthropometric measurements and obesity screening have been introduced in schools [2, 28].
- Implementation of the WHO STEP wise surveillance survey on the NCD risk factors [28, 31].
- Reduction of stigma and myths around breast cancer through public awareness campaigns reaching rural areas. Initiation of breast cancer early detection programs supported by research projects [8, 17, 33–36].

5.8 Cancer Diagnosis

5.8.1 Imaging

It has been registered in 2019 that there are 152 Computed Tomography (CT) scans and 90 Magnetic Resonance Imaging (MRI) machines, constituting 3.9 and 2.3/100,000 population, respectively [1]. Positron Emission Tomography/Computed Tomography (PET/CT) is available in the Medical City Teaching Hospital and in

private oncology centers in Baghdad, Najaf, and Erbil. There are five Gamma Cameras in Baghdad and Gamma knife procedures are readily practiced in Erbil [1]. Excluding Baghdad and Erbil, there is very limited access to nuclear medicine diagnostic and treatment facilities.

5.8.2 Laboratory

Iraq is in the process of establishing accreditation for cancer diagnosis according to the international standards, in collaboration with IAEA, WHO, and the Royal College of Pathologists through adopting Good Laboratory Practice (GLP).

5.8.3 Cytogenetic and Molecular Genetics

The “Iraqi Center for Research on Cancer and Medical Genetics,” affiliated to Mustansiriya University since 1995, focused on the study of the genetic material in cancer cells and carried out the transplantation of human and animal cells, in vivo and vitro. In 2016, the MCTC organized a plan of action to upgrade the genetic test procedures in different fields, focusing on hematology. The prevalence of BRCA1 and BRCA2 as common founder mutations among Iraqi families at risk of breast cancer was explored [54]. Great efforts were placed to ensure the availability of the requested resources, including sufficient infrastructure, competent trained manpower, logistics and financial support. During 2019, several advanced genetic tests were introduced in the diagnostic service for the first time in Iraq to serve leukemia patients. The provided examinations included, but not limited to, the molecular genetic tests for AML patients, i.e., FL3, NPM1, PML-RARA mutations for APL, JAK2 mutations for MPN, BCR-ABL quantitative assessment for CML patients, in addition to assays for MPL and CALR mutations. At a subsequent stage, cytogenetic tests were provided to the clinical laboratory service in the “Center of Hematology,” MCTC, complementing the molecular genetics through adding cytogenetic analysis of chromosomal translocations in AML and MDS and baseline analysis of Philadelphia chromosome for patients with CML.

5.9 Treatment

5.9.1 Medical and Radiation Oncology

Oncology care is provided through specialized oncology and radiotherapy hospitals. Clinical oncologists are licensed by the Ministry of Health to perform chemotherapy and radiotherapy. It has been recorded that out of 11,585 specialized

physicians in Iraq, there were 128 medical or radiation oncologists [41]. Excluding KRG, 72 medical oncologists and 58 radiation oncologists have been officially registered at the present time in the Iraqi MOH, whereas 75 postgraduate medical students are completing their board-certified studies in oncology and radiotherapy. In addition, there are 42 oncology physicians currently running the cancer care facilities in KRG. Nevertheless, the total number in most governorates is still lower than that requested to reach a coverage rate of 80% and is obviously far less than the international recommendations on oncology consultant staffing [42]. This shortage emphasized the urgent need for the MOH and MOHESR in Iraq to invest in qualifying human resources in all aspects of cancer care [12, 42, 43].

5.9.2 Medical Oncology

The MOH imports cancer drugs and medical equipment through the “State Company for Marketing Drugs and Medical Appliance” (KIMADIA) and distributes throughout all governorates, where chemotherapy is administered at specialized public tertiary hospitals and cancer centers free of charge [44]. As the provision of affordable access to cytotoxic medicine is a major challenge in the cancer care of patients in middle- and low- resource settings, WHO developed its “Model Lists of Essential Medicines,” to support countries in prioritizing their reimbursable medicine [45]. Within the past decades, many of the essential cancer drugs were in short supply in Iraq. The situation improved recently when the government increased the allocated budget to the MOH [1, 4, 5]. The UICC declared that Iraq has made progress towards achieving the world cancer control targets through improving the free access to accurate diagnosis and multimodal treatment of cancer, adding that almost 80% of the treatment protocols are covered and the waiting lists for radiotherapy in the cancer centers have been significantly shortened [31].

5.9.2.1 Hematopoietic Stem Cell Transplantation

The first published article on Hematopoietic Stem Cell Transplantation (HSCT), submitted by the “Iraqi Bone Marrow Transplantation Center” in 2016, had reported 88% survival rate in lymphoma patients [50]. The same year witnessed the start-up of the first HSCT center in KRG, as a capacity-building collaborative project, initiated by the “Hiwa Cancer Hospital” and the Italian Agency for Development Cooperation [51]. To perform 1200 cases of HSCT in Iraq, around 100 BMT-specialized single bedrooms are needed. At the present time, the “Specialized Bone Marrow Transplant Center,” affiliated to the MCTC in Baghdad, comprises four fully equipped rooms; yet the number is scheduled to reach 25, within the coming 2 years. Autologous SCT has been initiated in Iraq since 2013, more than 180

transplantation procedures have been performed mainly on lymphoma and myeloma patients. Allogeneic SCT is not yet available in Iraq, the MOH is still sending the patients outside Iraq for such procedures. The main challenge remains in ensuring high-quality post transplantation follow-up to avoid mortality complications, specifically, in the absence of some advanced diagnostic and therapeutic equipment requested for immune-compromised patients.

5.9.3 Radiation Therapy

Progress in radiation oncology has been proceeding in Iraq through continuous establishment of specialized centers and rehabilitation of the staff. Within the past 5 years, national societies for radiation/clinical oncology and medical physics have been established. Currently, there are 21 Mega Voltage Machines in Iraq, six in Baghdad [1]. A high dose rate Brachytherapy has been functioning in Zhianawa Cancer Center. The directory of Radiotherapy Centers has revealed the registered public oncology facilities within the corresponding governorates [46]:

- Baghdad: Al-Amal National Oncology Hospital, [Kadhimiya Teaching Hospital](#), and Medical City Radiotherapy and Nuclear Medicine Center
- Babylon: Babylon Oncology Center, Marjan Hospital, and Al Imam Jaafar al-Sadeq Hospital
- Basra: Children Specialist Hospital, [Educational Oncology Centre](#), and Basra Hospital
- Erbil: Rizgary Teaching Hospital—Oncology Center
- Karbala: Holy Karbala Hospital
- Maysan: Al Maysan Hospital and Maysan Oncology Center
- Mosul: Hazim Al-Hatiz Radiotherapy and Nuclear Medicine Hospital
- Holy Najaf: Al Najaf Hospital, Oncology Specialists Centre, and [Middle Euphrates Cancer Centre](#)
- Dhi Qar: Al Naseriya Hospital
- Al-Anbar: AlRamadi Hospital and Ramady General Hospital
- Sulaimaniya: Zhianawa Cancer Center and Hiwa Cancer Hospital.

5.9.4 Surgery

Cancer patients receive surgical treatment by specialized surgeons, following international guidelines, in tertiary public hospitals and private centers. Robotic surgery has not been commonly practiced in Iraq yet. Postgraduate studies in the fields of surgical oncology have been initiated within the past few years by the Arab and Iraqi Boards for Health and Medical Specializations.

5.9.5 Pediatric Oncology

In 2010, the first “Children Cancer Hospital” in Iraq was opened in Basra as the largest state of the art referral specialty care facility. It includes 101 beds, imaging department with MRI, automated laboratories and oncology departments provided with linear accelerators. Within the MCTC in Baghdad, the 240 bed “Children’s Welfare Hospital” offers public services by a competent specialized multi-disciplinary team for diagnosis and treatment of childhood neoplasms. The oncology unit receives an average of 300 new malignant cases per year. Improvement in childhood cancer services was achieved over the past two decades through better availability of WHO essential chemotherapy drugs, introduction of advanced diagnostic/screening tools and bone marrow transplant services, provision of satellite telemedicine e-learning training program, in collaboration with Sapienza University in Rome, fostering consultation and quality control, using Tele-Pathology, introduction of ATRA, adapted APL protocols, strengthening research in coordination with Japanese institutes and promote training in accredited international centers [47–49].

5.9.6 Survivorship Track

The diagnosed cases of cancer have been officially registered in the ICR. Survivorship is estimated through follow-up of cancer patients and routine review of the related death records. In 2020, the Global Cancer Observatory reported that the age-standardized mortality rate in Iraq was 90.5 and 81.2 for males and females, respectively, while the risk of dying from cancer before the age of 75 was 9.7%.and 8.7% for males and females, respectively [24].

5.9.7 Palliative Care Track

In general, access to palliative care in the EMR has been hampered due to deficient national policies, low financial resources, lack of trained staff, and limited access to pain relieving drugs [52, 53]. Pain management units have been established in most tertiary hospitals of the Iraqi governorates during the past 15 years. In cases of cancer, prescription of morphine and other opioids is the responsibility of the examining oncologists, who refer patients to these clinics, where they are comprehensively assessed through history, clinical, laboratory, and imaging examinations. In 2016, a 2-year fellowship in pain management was initiated by the MOHESR for certified

Iraqi Board specialists. The curriculum includes intensive training in pain management clinics, followed by theoretical and practical examinations.

5.10 Research and Education

5.10.1 Research

In general, numerous research studies on the burden of cancer in Iraq have been published by Iraqi specialists in international peer reviewed journals, and are readily available online. Among the specialized journals are the Iraqi Journal of Cancer and Medical Genetics, started in 2010.

5.10.1.1 The Iraqi Regional Comparative Breast Cancer Research Project

Emphasizing the role of research as one of the basic pillars in the adoption of a national cancer control strategy, a National Breast Cancer Research Program was established by the Iraqi MOHESR in 2009, from which stemmed the NCCR in 2012. Following a visit to Lyon, the Founding Director of NCRC, author of this chapter, organized an online information system for breast cancer patients in coordination with the screening unit of IARC. In the same year, the WHO office of EMR, planned to utilize that database model to compare the demographic characteristics, clinicopathological presentations, and management outcomes of breast cancer patients in the region through developing a “Regional Comparative Breast Cancer Research Project” [8, 17, 36, 39]. The first consultative meeting was organized by WHO/EMRO in Egypt (2012), in collaboration with the Iraqi NCRC, IARC, IAEA and Susan G. Komen, to discuss the plan of action for that project. A detailed proposal was submitted to IARC for ethical approval and sponsorship following the second regional meeting which was carried out in 2015, through coordination between WHO/EMRO, IARC, NCRC (Iraq), and King Hussain Cancer Center (Jordan), with the participation of eight countries including Iraq, Jordan, Egypt, Lebanon, Sudan, Saudi Arabia, Oman, and Kuwait.

A *Memorandum of Understanding* has been developed recently between IARC and the Iraqi Cancer Board in Iraq. The objectives are to conduct high-quality, evidence-based research in cancer prevention and control, focusing on registration, descriptive epidemiologic studies, training, and biological material transfer. The scheduled activities include building capacity in the cancer registry through developing a detailed plan for 2020–2023, providing software for Can Reg5 users,

utilizing the WHO standard population guidelines to strengthen quality control, designing a standard operating manual for complete resources, and finally disseminating the results on international databases and evaluating the activities of the NCCP.

5.10.2 Education and Training

5.10.2.1 Local Education and Training

The Iraqi Board for Medical Specialization [55] grants a certified Board in Oncology for postgraduate students. In general, the officially registered educational training programs belonging to the Iraqi MOHESR and MOHE, i.e., Dip., MSc, PhD, Iraqi Board, Arab Board for Health Specialization [56] and Kurdistan Board of Medical Specialties [57], graduate hundreds of oncology specialists annually, yield numerous studies on cancer care. Hopefully, this will help in addressing the shortage of oncology physicians. Many of the teaching hospitals in Iraq are recognized training centers by the Arab League Council in various medical specialties. The syllabus of these training programs requires subsequent evaluations, enrollment in recognized international centers, and submission of a thesis or peer-review publications for final graduation [58].

5.10.2.2 International Collaborations and Country Program Frameworks

In addition to the educational and training opportunities on cancer control offered through WHO and IARC, IAEA signed a Country Program Framework (CPF) with the Republic of Iraq in 2017 for the years (2018–2023). The CPF focused on building the capacity of the health sector, particularly on nuclear medicine and radiotherapy. Previously, the Iraqi Atomic Energy Commission was responsible for all nuclear activities in medicine, general healthcare, production of radioactive isotopes and pharmaceuticals for both diagnostic and therapeutic purposes. At present, due to the harmful consequences of wars and instability, IAEA has been supporting Iraq to ensure rehabilitation with respect to the maintenance of medical equipment, used in radiotherapy. The core program includes provision of requested equipment and sponsoring training programs on quality assurance. The project involves collaboration with IAEA/PACT (Program of Action for Cancer therapy) and WHO to implement the Iraqi NCCP. The Capacity Building Program executed its first activities in 2017, through training Iraqi pathology leaders in the UK, under the supervision of the Royal Colleges [59].

5.11 Cost-Effective Cancer Care

Excluding the private sector, the whole spectrum of cancer care services (including diagnostic imaging and laboratory tests, chemotherapy, radiotherapy, other relevant drugs, and medical appliances) is being provided by MOH freely without any charges in specialized oncology hospitals and cancer centers. Article 31 (1) of the Iraqi Constitution guarantees citizens the right to health care and commits the state to maintain public health freely through provision of prevention and treatment in hospitals and health institutions. Article 31 (2) guarantees individuals and entities the right to build hospitals, clinics, or private health care centers under state supervision [1, 4, 5, 44]. Currently, MOH is collaborating with the private sector to cover the requested cancer care specifically in the field of treatment. Purchasing internationally approved generic chemotherapy drugs supported in lowering the overall costs.

5.12 Challenges and Advantages

The economy of Iraq is mainly run by the government with limited role of the private sector. Over 90% of Iraq revenues and 65% of its GDP come from the oil sector. Decades of conflict, sanctions, and economic planning yielded a culture of government reliance for livelihoods [1, 4]. As an upper middle-income country, the health sector is still facing considerable challenges because of political instability and security issues. Financial allocations are urgently needed to strengthen the existing cancer care infrastructure, the surveillance and quality assurance systems, and to build the capacity of the human resources. Currently, the Iraqi health system is stepping forward, in collaboration with the private sector, international organizations (i.e., WHO, IAEA, and IARC) and foreign strategic financial investors, transitioning from emergency response to developmental reconstruction and rehabilitation in order to address the health needs of millions of vulnerable Iraqis and refugees (<http://www.emro.who.int/media/news/statement-on-iraq-by-dr-ahmed-al-mandhari.html>).

5.13 The Future of Cancer Care in Iraq

Nowadays, there are significant investment opportunities in the healthcare sector of Iraq. The MOH, aware of the challenges facing the system, has developed plans to overcome the existing obstacles. The current 4-year governmental program has approved the purchasing of 20 advanced linear accelerators, to be distributed among

the radiotherapy centers all over the governorates. New specialized oncology centers are scheduled for construction during the coming year. The private sector is actively cooperating with MOH, to strengthen cancer care in Iraq. Andalus Specialized Cancer Treatment Center in Baghdad is well equipped with PET and cyclotron 8300-tonne particle accelerator, providing sophisticated private oncology services. Several charities have started to invest in the field of oncology to support the public cancer control activities, such as the Society for Cancer and Friends, Mosul Oncology Society, the Iraqi Medical Physics Society, and the Breast Cancer Society of Iraq.

Currently, WHO is assisting MOH in the institutionalization of a National Health Account to support in the development of healthcare policy financing systems and social insurance through compiling relevant data on the country's health expenditures [60]. In 2020, WHO has planned a mission on cancer control, in collaboration with IEA/PACT and IARC, to aid the ICB in implementing the following:

- Update the NCCP for the years (2020–2024).
- Assess and endorse the national strategy for prevention and control of NCDs.
- Evaluate the budget specified for the ICB and coordinate with the relevant stakeholders.
- Review the essential medical list focusing on cancer drugs and assess the access to chemotherapy.
- Evaluate the status of the universal health coverage for cancer and support the role of private sectors.
- Strengthen the ICR through assessing the registration of mortality coverage and surveillance systems.
- Specify international advisers to upgrade skills of the Iraqi staff in implementing the NCCP.

5.14 Conclusion

Iraq is emerging from the deep economic strains and decades of conflicts through accelerating progress to address the accumulated development and healthcare deficit. The government has actively planned to upgrade the capacity of its health sector, to ensure that specialized oncology services are delivered freely to all Iraqis on a sustainable basis. Recently, the UICC declared that Iraq has made progress towards the world cancer control targets through improving free access to accurate diagnosis and multimodal treatment of cancer. Hundreds of cancer specialists have been graduated annually by the MOHESR and MOHE to compensate for the shortage in oncology physicians. Together with the private sector, several charities have started to invest in the field of oncology to support public efforts. Currently, international organizations including WHO, IARC, and IAEA are actively collaborating to scale up cancer care and to support the implementation of the NCCP, focusing on cancer registration, prevention, early detection, treatment, palliative care, and research.

Conflict of Interest Authors have no conflict of interest to declare.

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