

Chapter 8

General Oncology Care in Lebanon



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8.1 Lebanon Demography

Lebanon is relatively a small country located on the eastern coast of the Mediterranean Sea. Its surface area is around 10,452 km² [1]. Lebanon was established in September 1920. The country is divided into governorates (Mohafazat), and each governorate is divided into districts (Caza) except Beirut and Akkar [1]. The eight governorates are Akkar, North Lebanon, Baalbek-Hermel, Beqaa, Mount Lebanon, Beirut, Nabatiyeh, and South Lebanon. These governorates are divided into 25 districts. The total Lebanese population in 2019 was around 4,546,618 people, excluding foreign residents and refugees. Among the Lebanese residents, 24.6% (1,118,468 people) are aged less than 15 years, 65.7% (2,987,128 people) are aged between 15 and 65 years, and 9.7% (441,022 people) are aged more than 65 years. 50.6% of the Lebanese population are females and 49.4% are males (Fig. 8.1) [2]. The life expectancy in Lebanon at birth is 79 years [3].

8.2 Cancer Statistics in Lebanon

The National Cancer Registry in Lebanon is managed by the ministry of public health (MOPH) and started in 2002. The overall incidence of cancer in Lebanon in 2020 is 253.5/100,000 in males and 262.2/100,000 in females [5, 6]. The number of new cases in 2020 is 11,589 with the most common cancers being Breast cancer 16.9%, Lung cancer 12.1%, Prostate cancer 8.9%, Colorectal cancer 7.8%, and

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H. O. Al-Shamsi et al. (eds.), *Cancer in the Arab World*,
https://doi.org/10.1007/978-981-16-7945-2_8

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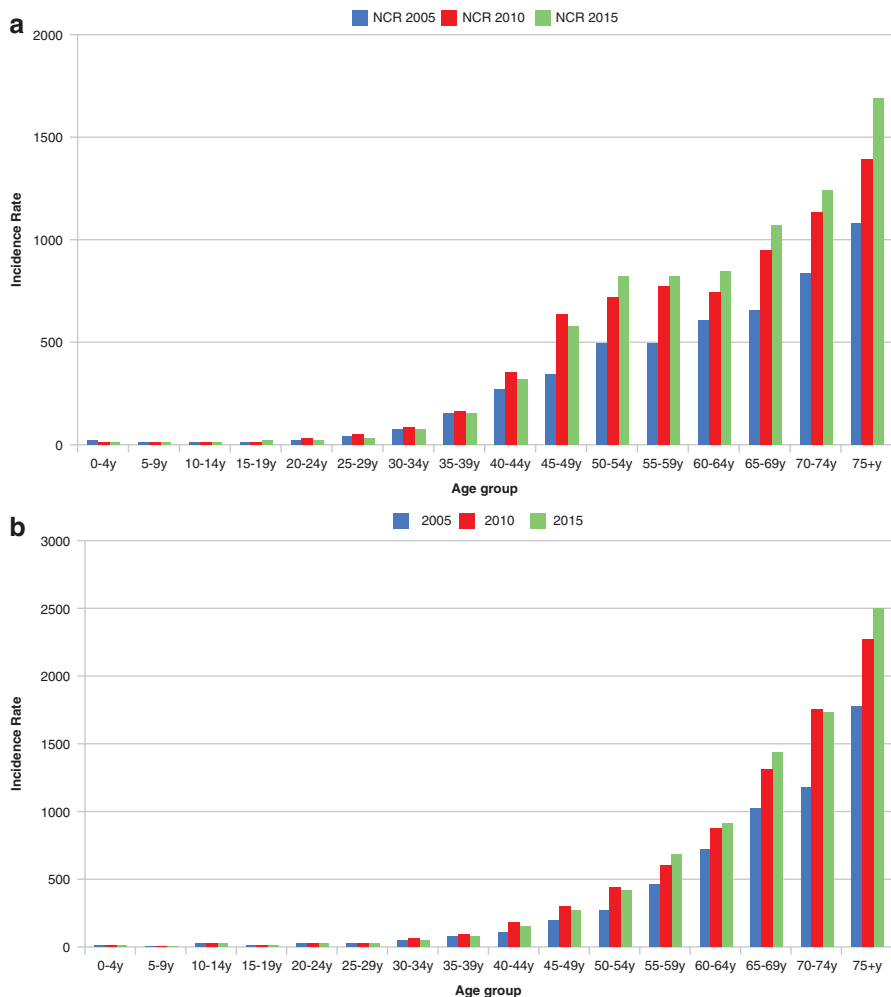


Fig. 8.1 Cancer Age-Specific Incidence Rate (100,000), Lebanon, 2005, 2010, 2015, (a) Females, (b) Males (Source: Republic of Lebanon—Ministry of Public Health—National Cancer Registry 2015) [4]

Bladder cancer 5.4%. The number of cancer deaths in 2020 is around 6438 [7, 8]. In 2016, cancer distribution according to age was as follows: 2.9% in patients age < 15, 39.1% in patients aged between 20 and 65 years, 46.8% in patients aged 65 years or older, and 11.3% in patients had missing age [9]. In 2019, cancer mortality represented 18.92% of hospital mortality in Lebanon. Hospital cancer deaths are distributed as follow lung cancer in 23.3% of the cases, breast 10.3%, colon 7%, pancreas 7%, leukemia 5.6%, liver and biliary ducts 5.2%, cancer of unknown primary 4.6%, bladder cancer 4.1%, neoplasm of the brain 3.9%, and prostate cancer 3.8% (Table 8.1) [2].

Table 8.1 Percentage (% of total) by primary site and age group (Source: Republic of Lebanon—Ministry of Public Health—National Cancer Registry 2016) [4]

Primary site	All ages	Age group													ICD (10th)						
		0-4y	5-9y	10-14y	15-19y	20-24y	25-29y	30-34y	35-39y	40-44y	45-49y	50-54y	55-59y	60-64y		65-69y	70-74y	75+y	Unsp.		
Lip	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	C00		
Tongue	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	C01-C02	
Mouth	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	C03-C06
Salivary glands	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	C07-C08
Tonsil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	C09
Other oropharynx	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	C10
Nasopharynx	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	C11
Hypopharynx	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	C12-C13
Pharynx unsp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	C14
Oesophagus	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	C15
Stomach	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	C16
Small intestine	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	C17
Colon	6.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.5	0.5	0.5	0.5	0.5	0.6	0.6	1.5	1.1	0.0	C18
Rectum	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.3	0.1	0.2	0.1	0.2	0.1	0.3	C19-C20
Anus	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	C21
Liver	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.1	0.1	0.1	0.3	0.1	C22
Gallbladder etc.	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	C23-C24
Pancreas	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.2	0.2	0.3	0.2	0.2	0.3	0.2	0.2	C25
Nose & sinuses & etc.	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	C30-C31

continued

Primary site	All ages	Age group										ICD (10th)							
		0-4y	5-9y	10-14y	15-19y	20-24y	25-29y	30-34y	35-39y	40-44y	45-49y	50-54y	55-59y	60-64y	65-69y	70-74y	75+y	Unsp.	
Bladder	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.4	0.3	0.3	0.4	0.4	C67
Other urinary organs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	C68
Eye	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	C69
Brain & nervous system	1.4	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	C70-C72
Thyroid	4.2	0.0	0.0	0.0	0.0	0.1	0.2	0.4	0.5	0.5	0.5	0.3	0.3	0.3	0.2	0.1	0.2	0.7	C73
Adrenal gland	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	C74
Other endocrine	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	C75
Hodgkin disease	1.6	0.0	0.0	0.1	0.2	0.2	0.3	0.2	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.1	0.1	C81
Non-Hodgkin lymphoma	4.2	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.1	0.4	0.4	0.4	0.5	0.4	0.3	0.6	0.3	C82-C85; C96
Immuno-proliferative dis.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	C88
Multiple myeloma	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.1	0.2	0.3	0.0	C90
Lymphoid leukemia	1.5	0.2	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.4	0.0	C91
Myeloid leukemia	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.0	C92-C94
Leukemia unsp.	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	C95
Other & Unspecified	4.1	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.2	0.3	0.4	0.4	0.4	0.4	0.6	0.8	OTHER
All sites, total	100.0	0.6	0.3	0.5	0.8	0.9	1.4	2.7	3.6	5.9	8.3	10.7	10.7	10.6	9.2	7.8	13.2	12.8	All
All sites but C44	94.6	0.6	0.3	0.5	0.8	0.9	1.4	2.6	3.6	5.8	8.1	10.3	10.4	10.1	8.8	7.3	11.5	11.6	Not C44

^aC44 refers to non melanoma skin cancer

8.3 Healthcare System in Lebanon

Lebanon has one of the most developed healthcare systems in the Middle East and North Africa (MENA) region through excellent hospital infrastructure, availability of novel equipment, and world-renowned physicians and healthcare professionals. The 2018 Health Care Access and Quality ranked Lebanon in the 33rd rank worldwide being the first in the MENA area [10]. Most of the university hospitals in Lebanon require healthcare professionals to do advanced training in most developed countries. This prerequisite is a source of diversity and excellence in patient care and allows collaboration with worldwide peers in the fields. Despite all difficulties, economic and political instability, the healthcare system continues to grow and improve showing remarkable resilience. According to the World Health Organization (WHO) estimates, Lebanon spent 10.7% of its Gross Domestic Products (GDP) on health in 2000 dropping to 6.4% in 2018 through a successful targeted strategy mainly in the field of investment in technology [10, 11].

The Lebanese healthcare system is based on a collaboration between the public and private sectors. In 2019, the numbers of private and public hospitals in Lebanon were 118 and 28, respectively. Furthermore, the Lebanese MOPH established an accreditation system to assure the best quality of care through strict rules, regulations, and continuous updates of standards [10].

In 2014, the MOPH founded Universal Health Coverage as part of the Lebanese National Health Strategy. This universal coverage is established by filling the gaps in cost coverage. In fact, almost half of the Lebanese population is covered by the National Social Security Fund (NSSF) which is an autonomous public organization established in 1963 to provide health coverage to most of the Lebanese residents working in the private sector [12]. Furthermore, Lebanese are covered by other governmental organizations including the army, civil servants cooperative, internal security forces, general security forces, state security forces, mutual funds, or private insurances. The MOPH serves the rest of the Lebanese population non-adherent to any of the listed organizations. This strategy made treatment accessible to almost all Lebanese patients [13].

8.4 Oncology Care in Lebanon

Cancer incidence has been steadily increasing in Lebanon challenging the healthcare system. The MOPH established the national cancer database in 2002. The most recent estimate of cancer cases in 2020 is around 11,589 new cases compared to 7200 new cases in 2004 [8]. Cancer care is provided mainly in university hospitals including the Naef Basil Cancer Institute at the American University of Beirut Medical Center (AUBMC) established in 1995, Hotel Dieu de France, the Lebanese American University Medical Center Rizk Hospital, Mount Lebanon Hospital, Clemenceau Medical Center, and other cancer centers. Outside university hospitals,

medical oncology services are also provided in peripheral hospitals and private clinics. Since 1999, the MOPH has provided free provision of cancer drugs to cancer patients who do not have any other financial coverage accounting for around half of the Lebanese population. This major step in cancer care provided equity in health-care access to all Lebanese cancer patients. In a report by the MOPH, the average cost of cancer care increased steadily between 2008 and 2013 reaching \$52 million in 2016. The average drug cost by patient was around \$8400 in 2016. This increase was insignificantly affected by the MOPH strategy of providing access to novel immunotherapy and targeted therapy [14].

8.5 Cancer Risk Factors

In 2017, globally, around 30–50% of cancer can be prevented by modifying or avoiding risk factors including smoking, obesity, alcohol use, unsafe sex practice, infections like hepatitis B (HBV), hepatitis C (HCV), and Human Papilloma Virus (HPV), and exposure to ultraviolet light or ionizing radiation. Tobacco smoking is prevalent in Lebanon mainly in the young adult population. 38% of Lebanese people smoke cigarettes [15]. Alcohol consumption is also high among Lebanese, being 39.8%. 73.4% of the Lebanese people eat a non-healthy diet, meaning eating less than 5 servings of fruit and/or vegetables and 61% have a decreased physical activity and do not reach WHO recommendations on physical activity for health. In 2018, a total of 253 cases of HBV and a total of 103 HCV were reported [15, 16].

8.6 Cancer Screening Programs

Several cancer screening programs are established in Lebanon aiming for early detection of disease. Lebanon follows the international guidelines of cancer screening including the American Society of Clinical Oncology (ASCO) and the European Society of Medical Oncology (ESMO) guidelines for screening. The breast cancer screening program was established in 2002 by the Lebanese breast cancer foundation educating young women on early breast cancer detection through annual breast cancer awareness campaigns targeting all populations in addition to several other campaigns throughout the year [17]. The Lebanese breast cancer foundation also helps in establishing national screening guidelines for breast cancer prevention and recommends yearly mammography starting at the age of 40 [18]. In addition to breast cancer, colon cancer, and HBV, lung cancer screening is advocated in Lebanon using an annual low-dose CT scan of the chest but remains with very limited applicability. Women are encouraged to do cervical cancer by PAP smear screening through a national campaign for the prevention of cervical cancer [19].

8.7 Cancer Prevention Programs

The MOPH and Lebanese cancer societies established cancer prevention and control programs that play an important role in raising awareness through educating the general population about cancer prevention, screening, counseling, and cancer research [17]. The MOPH developed national guidelines in collaboration with the Lebanese order of physicians, the Lebanese society of medical oncology, and the Lebanese society of gastroenterology for the prevention of colon cancer through colonoscopy [20]. Furthermore, the HBV vaccination program for newborns started in 1998 aiming to screen and vaccinate high-risk populations for the prevention of hepatocellular carcinoma among other morbidities due to HBV. Moreover, the National Tobacco Control Program of the MOPH established a smoking cessation program to spread awareness about this disease. Also, the Tobacco Control Law (174/2011) was introduced in August 2011 for Tobacco Control and Regulation of Tobacco Products' Manufacturing, Packaging, and Advertising that forbid smoking in indoor, at workplaces, and in public transportation [21]. The HPV prevention vaccine is supported for the prevention of cervical cancer. However, a population-based vaccination program for cervical cancer is still not established [19].

8.8 Cancer Diagnosis

8.8.1 Imaging

According to the 2014 National Cancer Registry (NCR) data, 110 Computerized Tomography (CT) scans and 41 Magnetic Resonance Imaging (MRI) machines are available in Lebanon. The numbers of these diagnostic modalities are increasing and higher in 2020. PET-CT scan availability is high in Lebanon in relation to the population number having more than 2.2 machines per million people. Based on the latest 2020 national data from the Lebanese society of nuclear radiology and the MOPH, 16 physicians with nuclear medicine training are available, in addition to 50 technologists and 6 radiochemistry specialists for cyclotron units. Regarding the equipment, Lebanon has 24 Single Photon Emission Computed Tomography (SPECT), 3 SPECT-CT, and 18 Positron Emission Tomography (PET)-CT (unpublished data from the Lebanese society of nuclear medicine). In 2021, there are 2 cyclotrons, one mini and one big cyclotron with extra-large targets. These cyclotrons produce ^{18}F , ^{11}C , and ^{68}Ga as radioactive materials. In addition, ^{18}F -fluorodeoxyglucose (FDG), $^{18}\text{FNaF}$, ^{18}F -DOPA, ^{13}N ammonia, ^{11}C -methionine (MET), ^{68}Ga -DOTA-TOC, and ^{68}Ga -PSMA are all available radiotracer materials. Furthermore, advanced theragnostic agents including ^{131}I -iodine, lutecium DOTATE, lutecium PSMA, and actinium PSMA are also used. Additionally, radio-embolization of liver lesions using Yttrium is used for the treatment of primary or

metastatic liver masses (unpublished data from the Lebanese society of nuclear medicine). Those procedures are only available in private university hospitals.

8.8.2 Laboratory

Advances in laboratory testing revolutionized the management of malignant disorders through better characterization and classification of the disease. According to the 2020 WHO cancer country profile, the 2005 number of medical and pathology lab scientists per 10,000 cancer patients was 309.4 [7].

8.8.3 Cytogenetics and Medical Genetics

Novel cytogenetics techniques are present in Lebanon and mainly in big centers and university hospitals. Tertiary centers in Lebanon are national referral centers for peripheral blood, bone marrow, amniotic fluid, skin and lymph node karyotyping, and cytogenetic analysis for both constitutional and non-constitutional disorders. These tertiary centers are equipped with metaphase and image-capture platforms as well as highly trained and dedicated staff with many years of technical and analytical expertise. They also provide Sanger Sequencing and Fluorescent in Situ Hybridization (FISH) for numerous disorders including CLL, multiple myeloma, CML, and solid tumors.

8.8.4 Molecular Diagnostics

Big molecular laboratory centers in Lebanon are national and regional referral centers for Molecular Microbiology, Histocompatibility (HLA), and Molecular Pathology. They utilize a wide range of molecular techniques from conventional Polymerase Chain Reaction (PCR) to Reverse Transcription (RT)-PCR, and quantitative PCR for diagnosis and residual disease monitoring like testing for FLT3, NPM1, JAK2, CALR, BCR-ABL_{bcr-abl} International Scale, and common and major translocations for both Acute Myeloid Leukemia (AML) and Acute Lymphoblastic Leukemia (ALL) in addition to solid tumors like sarcomas. Quantitative real-time PCR is utilized to follow all patients on treatment and the tests cover a large panel of infectious organisms as well as important genes adopted for targeted therapy including EGFR, KRAS, and BRAF like in colon cancer. State-of-the-art liquid biopsy testing is also available in big centers and has been introduced to assist in cases requiring frequent monitoring as well as for patients where a re-biopsy is not an option. The molecular lab at the AUBMC, affiliated with the

American Association for Molecular Pathology (AMP) and its Director, is currently the Chairman of the AMP International Affairs Committee (2021) is particularly equipped with Next-Generation Sequencing platforms, that are currently utilized for targeted gene panels for Leukemias, solid tumors, and immunoglobulin variable heavy chain gene (IGVH) Somatic Hypermutation assessment in Chronic Lymphocytic Leukemia (CLL). Next-Generation Sequencing (NGS) is available at AUBMC and is now done for myeloid hematologic diseases. Other NGS panels will also be available for solid tumors.

8.9 Treatment

8.9.1 Medical Oncology

Oncology treatment in Lebanon is provided by doctors specialized in malignant hematology, medical oncology, or hematology/oncology. The Lebanese physicians are very well-trained oncologists who did advanced training outside the country including Europe (mainly France, Belgium, the United Kingdom, and Germany) and the United States of America. In university hospitals, hematology/oncology is divided into subspecialties according to organs. This specialized treatment is important to refine the quality of care. All Lebanese oncologists are registered in the Lebanese Order of Physicians (LOP). In 2021, there are around 173 adult Lebanese hematology/oncology physicians including 21 physicians who are registered at the LOP but are currently practicing outside Lebanon (Data from the LOP).

8.9.2 Radiation Therapy

Radiation oncology is a well-developed medical specialty in Lebanon, attracting patients from different parts of the region for its state-of-the-art equipment and well-renowned physicians. The radiation oncology department at the AUBMC, for example, provides treatment for an average of 900 new patients per year (unpublished data from the AUBMC). There are 12 radiation oncology centers in Lebanon, and practically all of them are part of a larger medical center or hospital. Traditional 2D/3D conformal radiation therapy as well as Intensity Modulated Radiation Therapy (IMRT) are available in most of the centers in the country, whereas High-dose-rate brachytherapy, Stereotactic Radiosurgery (SRS), Stereotactic Body Radiation Therapy (SBRT) and modern Image-Guided Radiotherapy (IGRT) techniques are only available in few centers all located in Beirut. Through well-developed physician training and skills, in addition to modern machinery and technology, patients benefit from improved oncologic outcomes with reduced radiation toxicity. Radiation therapy is covered by third-party payers for eligible patients,

including insurance and the National Social Security Fund (NSSF) etc. If the patients have no healthcare coverage, the Ministry of Public Health (MOPH) provides financial coverage at a few governmental hospitals. Finally, there is still a shortage in the number of available radiation oncologists in the country, whose total number remains less than 30 in 2021. Many radiation oncologists have clinics in at least two radiation therapy facilities to be able to cope with the patient load.

8.9.3 Surgery

Advanced cancer surgery is provided in big hospitals, mainly university hospitals, by surgeons specialized in surgical oncology, which is organ specific. Robotic surgery is provided in highly specialized centers. Hyperthermic Intraperitoneal Chemotherapy (HIPEC) is also provided mainly for gynecologic and gastrointestinal malignancies.

8.9.4 Pediatric Oncology

Based on the 2015 NCR of the MOPH, the most common cancers in the pediatric Lebanese population are hematologic malignancies with 29% for leukemias and 19% for lymphomas, followed by Central Nervous System malignancies (10.4%), followed by malignant epithelial tumors and melanoma (8.5%), soft tissues sarcomas (8.3%), malignant bone tumors (7.2%), neuroblastoma (4.8%), germ cell tumors (3.9%) and others more rare tumors like renal and hepatic tumors (Table 8.2) [22]. There are around 10 pediatric cancer treatment centers in Lebanon with 30 pediatric hematology/oncology physicians. As part of the Lebanese Pediatric Society, a group of pediatric hematologists and oncologists was founded in 2001, aiming to standardize pediatric oncology treatment across the different treatment centers in Lebanon. Furthermore, palliative pediatric care started in 1990 to address patient quality of care mainly for patients with non-curative diseases [23]. Among children's cancer centers the Children's Cancer Center for Lebanon (CCCL) was the first to be established in 2002 at the AUBMC and affiliated with St Jude Children's Research Hospital being a tertiary care center and receiving referrals from Lebanon and the region. Later many other centers were founded. The following are examples of hospitals comprising pediatric oncology units (list being not exhaustive): the pediatric oncology unit at Geitawi hospital, Saint-George hospital, Hotel-Dieu de France, Rafic Hariri University Hospital, Rizk Hospital, and many others. Most pediatric cancer patients do not pay out-of-pocket bills. A big amount of the treatment bill is covered by third-party payers (NSSF, MOPH, and others) and the rest of the bill is covered by Non-Governmental Organizations (NGOs). In fact, the yearly needed budget for a single tertiary center is around \$15 million USD [24].

Table 8.2 Reported pediatric cases (% of total) by main ICCC-3 group and age group (Source: Republic of Lebanon—Ministry of Public Health—National Cancer Registry 2015) [4]

ICCC main groups	0–4 years	5–9 years	10–14 years	15–19 years	0–19 years
I. Leukemia & myeloproliferative & myelodysplastic dis	11.3	8.8	3.5	5.5	29.1
II. Lymphomas & recitucloendothelial neoplasms	1.4	4.2	5.1	9.2	19.9
III. CNS & miscellaneous intracranial & intraspinal neo	2.8	3.0	2.5	2.1	10.4
IV. Neuroblastoma & other peripheral nervous cell tumor	3.9	0.7	0.2	0.0	4.8
V. Retinoblastoma	1.2	0.7	0.0	0.0	1.8
VI. Renal rumeurs	1.6	0.9	0.2	0.2	3.0
VII. Hepatic rumeurs	0.2	0.0	0.0	0.0	0.2
VIII. Malignant bone tumors	0.7	0.7	3.2	2.5	7.2
IX. Soft tissue & other extraosseous sarcomas	2.1	1.8	1.6	2.8	8.3
X. Germ cell & trophoblastic & neoplasms of gonads	0.7	0.5	0.5	2.3	3.9
XI. Other malignant epithelial neo. & malignant melanomas	0.7	0.7	1.6	5.5	8.5
XII. Other & unspecified malignant neoplasms	0.5	1.2	0.2	0.9	2.8
All sites	27.0	23.1	18.7	31.2	100.0

ICCC-3 International Classification for Childhood Cancer, 3rd

8.9.5 Survivorship Track

Patients are followed based on international guidelines. Most survivor patients get involved in cancer societies to spread awareness about the disease through campaigns in addition to sharing their experience and supporting other cancer patients.

8.9.6 Palliative Care Track

In June 2013, the MOPH recognized Palliative Care (PC) as a specialty which was as important as it is to establish PC as an independent specialty, it is not enough by itself to quickly move the specialty forward. The palliative care track in Lebanon is still continuously developing. The National Committee for Pain Control and Palliative Care (NCPCPC) was established in May 2011, under the Ministry of Public Health (MOPH) with the main objective to work toward the development of palliative care. Well-established hospital-based and outpatient clinic palliative care programs and services are still very limited due to many factors related mainly to

financial and personnel-related challenges. Home care palliative care services (Home Hospice) are provided through Non-Governmental Organizations (NGOs) mainly in the Beirut area occasionally extending beyond Beirut but rarely covering rural areas. Their main goals are to provide home-based patient care and 24 h home consultation services to minimize patient suffering(s) and support family members/caregivers taking care of terminal patients, but also, they participate in spreading knowledge about palliative care among healthcare providers and the public. Although establishing PC as a specialty, conducting national awareness campaigns about the importance of this specialty, and establishing (though limited) hospital and home-based PC services, have helped this specialty find its way through the healthcare system and the general population; however, many challenges lie ahead that will hinder further progress which is highly needed. Third-party payers are still not clearly covering these services whether at home or in the hospitals, thus increasing the financial burden on families and patients as they pay from out-of-pocket. Moreover, these challenges may hinder the establishment of PC fellowship programs for physicians and palliative care specialty education for nurses; an endeavor greatly needed as the health care system needs increase. Addressing challenges at a population health system level requires national efforts. National standards that regulate palliative care services are currently under development which will help in improving those services and request financial coverage for patients.

8.10 Research and Education

Lebanon has the biggest and most renowned higher education system in the MENA region. The first medical school in the Middle East was established in Beirut in 1867 by an evangelical missionary named the American University of Beirut (AUB). In 1875, a second medical school was established by the Jesuit missionary at the University of Saint Joseph (USJ). In 1983, a public medical school was established as part of the Lebanese University. Later, four additional medical schools were founded as part of the following universities: Beirut Arab University, Saint-Esprit University of Kaslik, University of Balamand, and the Lebanese American University. All the mentioned medical schools have a hematology/oncology training program [25]. There are two radiation oncology programs in Lebanon at the AUBMC and USJ.

Lebanon is well known for its focus on research compared to other countries in the MENA region. It comprises one of the highest research per physicians or scientists. Almost all medical schools in Lebanon integrate research modules as mandatory fields during medical studies which help early integration of doctors in the research field. In addition to retrospective studies, clinical trials, translation research, and basic science research are also well developed leading to publications in high-impact factor journals. Clinical trials are either multi-institutional within Lebanese institutions, regional or international. Those researches are concentrated within academic centers and regulated by the Institutional Review Board.

8.11 Cost-Effective Cancer Care

The burden of cancer cost is increasing due to several factors including the aging of the population, increasing cancer cases, increasing diagnoses, and treatment costs. In addition, national economic load and explosions causing damage to hospitals and cancer centers increased the financial burden. Novel diagnostic techniques are more costly, increasing the financial weight on MOPH, third-party payers, and patients.

In 2010, WHO recognized Lebanon for its effective strategy in decreasing its health cost from GDP by mainly decreasing out-of-pocket payments. This was possible through a series of reforms by the MOPH. Part of the reform was improving the public health sector including hospitals and laboratories. This decreased the cost spent in private hospitals mainly for the low-income population. Also, MOPH was able to negotiate with the private hospitals for the cost of services. Furthermore, the use of approved generic drugs lowers health care costs. Regulating the use of medical technology was also one of the important components of this reform. This reform led to a decrease in percentage of GDP from 12.4% to 8.4% and a decrease in out-of-pocket from 60% to 44% [26].

8.12 Challenges and Advantages

8.12.1 *Facilities Providing Cancer Care*

Cancer care is provided mainly by private hospitals, primarily academic hospitals, and to a lesser extent by public hospitals. Lebanon currently has around 29 public hospitals and 128 accredited private hospitals. Oncology care is delivered in big academic hospitals in addition to small peripheral hospitals and private clinics.

Lebanon is leading in the treatment of oncologic diseases in general and malignant hematologic diseases. It includes one of the biggest transplant activities in the MENA region. The Hematopoietic Stem Cell Transplant activity reached 897 transplants between 2012 and 2016 with 303 (33.8%) allogeneic transplants and 594 (66.2%) autologous transplants [27]. Autologous stem cell transplantation is provided at four centers including the AUBMC, Makassed General Hospital (MGH), Middle East Institute of Health (MEIH), and Mount Lebanon hospital (MLH). Centers for allogeneic stem cell transplantation are three, the AUBMC, MGH, and MEIH. The bone marrow transplantation program at the AUBMC was founded in July 2004. It has been accredited by the joint accreditation committee ISCT-European Blood and Bone Marrow Transplantation (EBMT) (JACIE) since 2016. In addition, a cellular therapy program is under development that will provide patients horizons for novel and effective therapies [27].

8.12.2 Treatment Availability

Most of the treatments are available in Lebanon, including immunotherapy, chemotherapy, and novel target therapies. Many patients also get access to newly approved drugs through compassionate use programs. National cancer treatment guidelines were developed by the MOPH to standardize national cancer treatment and organize cancer drug provision to patients [28].

8.13 The Future of Cancer Care in Lebanon

In summary, Lebanon includes tertiary cancer centers that represent national and regional referral centers. Worldwide renowned physicians and healthcare professionals are key players in cancer treatment in Lebanon. Almost all cancer treatments are available in Lebanon which is crucial for continuous improvement of patient care.

Despite development in governmental health care services, Lebanese people still have a negative perception of those services. Implementing more standardized national cancer treatment guidelines developed through experts in the field is crucial. Cancer centers in public hospitals should be developed and healthcare workers at these centers, primarily nurses, should get specialized training in oncology services. This will encourage patients, mainly those with low income, to seek care in affordable public hospitals.

After the conflict in Syria, numerous Syrian refugees moved to Lebanon increasing the Lebanese total population by around 30%. This influx of refugees increased the burden on the Lebanese government and notably on the healthcare system. However, despite all constraints, the healthcare system showed significant resilience with its continued ability to provide acceptable healthcare and most importantly providing cancer drug coverage. This economically deprived population with absent financial coverage by third-party payers is in urgent need to enable access to healthcare, similar to the Lebanese population. The United Nations High Commissioner of Refugees (UNHCR) and NGOs help refugees by covering those vulnerable patients offering them a decent level of care [29]. However, as of 2014, the UNHCR decreased the percentage of in-hospital coverage from 85% to 75%, limiting access to a big number of refugees who are not able to pay 25% of the bill out of pocket.

The advancement of molecular techniques increased our ability to detect targetable mutations. Targeted therapy and immunotherapy are rapidly emerging, replacing conventional chemotherapy in many types of cancer. The drawback of these drugs is their availability, accessibility, and affordability especially in middle-income countries like Lebanon. In addition, given the current economic crisis in Lebanon, the MOPH and third-party payers might not be able to afford novel expensive treatment jeopardizing patient care. Moreover, due to the current economic situation, many healthcare workers immigrated outside Lebanon putting healthcare again in a stressful situation. These difficulties might render advanced expensive

treatments accessible only for high-income individuals leading to inequity in cancer care.

Enhancing research in the country will be an asset to improve patient care. Developing national clinical trials and involving Lebanese patients in regional and international clinical trials will enrich our healthcare and benefit our patients.

Our wishes as physicians are to build a health care system resilient enough to face economic, political, and natural constraints minimizing the burden of these constraints on patients. Continuous review and constant update of local treatment guidelines, improvement of health care coverage system to ensure a universal coverage of cancer patients in Lebanon, building a health care strategic plan considering these constraints, continuous update of cancer epidemiology and mortality data to build health care strategy based to national statistics are important steps to build this resilient health care system.

8.14 Conclusion

In conclusion, Lebanon, a relatively small country, comprises the most advanced and well-reputed cancer care and well-renowned physicians. Despite economic constraints, it remains one of the most developed countries in terms of healthcare and notably cancer treatment. Strategies to overcome difficulties affecting the healthcare system are needed.

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

Acknowledgments We would like to thank the following doctors for their help in providing resources and information: Dr. Jean El-Cheikh, Dr. Antoine Finianos, Dr. Alain Abi Ghanem, Dr. Mohamad Haidar, Dr. Rami Mahfouz, Dr. Raya Saab, and Dr. Bassem Youssef from the American University of Beirut Medical Center.

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