Chapter 12
General Oncology Care in Oman

Itrat Mehdi, Abdul Aziz Al Farsi, Bassim Al Bahrani, and Shadha S. Al-Raisi

12.1 Oman Demographics

The Sultanate of Oman is an Arab country, bordering Saudi Arabia, UAE, and Yemen. The total area of Oman is about 309,500 km^2. Oman is more densely populated in its cities, where 80% of the population lives. The current population of Oman is 5,462,006 as of December 2020, males 3,222,910 (59%) and females 2,239,097 (41%), and rank 120 in the Global list [1–3]. The population density in Oman is 16 per km^2. The median age in Oman is 30.6 years (Fig. 12.1). Life Expectancy is 77.4 years, while the Population growth rate is 3.4% annually. The country has a fertility rate of 2.92 births per woman, as one of the fastest-growing populations [1, 2, 4]. Current projections believe that the growth rate will peak in 2020. After 2025 the growth rate will continue to slow, getting down to 0.62% by 2050 [4, 5].

Oman is an ethnically diverse country. There are 38.7% foreigners, mostly expatriate workers from Bangladesh, India, Pakistan, Philippines, and Egypt. Oman has a mortality rate of 3.3 deaths per 1000 populations. It is a relatively young population with 65% less than 30 years of age (Fig. 12.1). The literacy rate in Oman is 93%. The economy is based on agriculture, fishing, and overseas trading. Petroleum revenues account for 40% of GDP. The per capita income is 41,680 dollars [4, 6, 7].

I. Mehdi (✉) · A. A. Al Farsi · B. Al Bahrani
National Oncology Centre, The Royal Hospital, Muscat, Oman
e-mail: bassim.albahrani@moh.om

S. S. Al-Raisi
Department of Non-Communicable Diseases, Ministry of Health, Muscat, Oman

H. O. Al-Shamsi et al. (eds.), *Cancer in the Arab World*,
https://doi.org/10.1007/978-981-16-7945-2_12

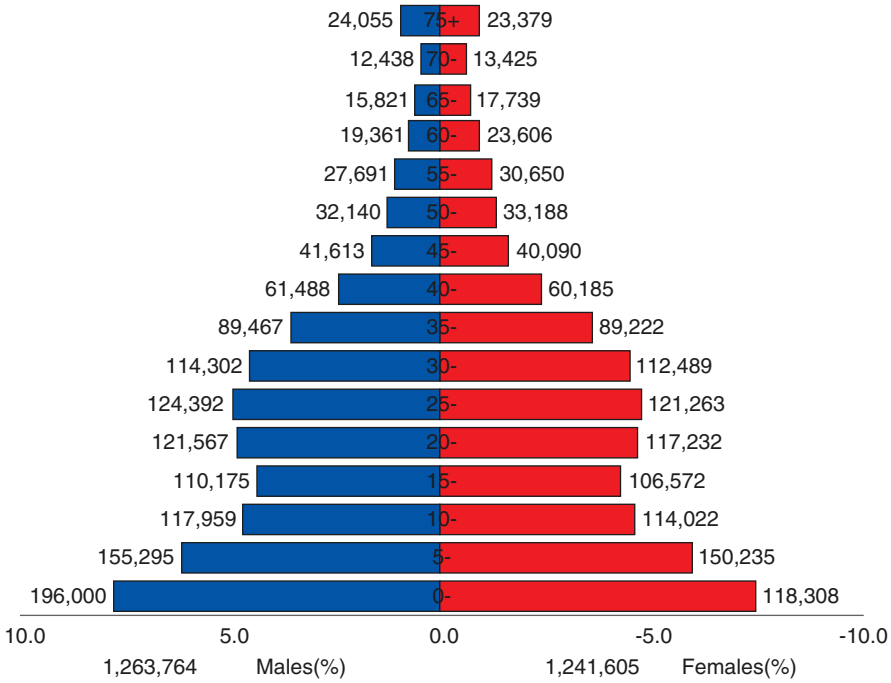

Fig. 12.1 Population pyramid Oman 2017 (Used With Permission from MoH Oman) [3]

12.2 Cancer Statistics in Oman

Cancer is the leading cause of death with 6% of disease-related mortality [8]. The age-adjusted annual incidence of cancer ranges from 70 to 110 per 100,000 population, which is lower than other regional countries [9, 10]. The leading male cancers in order of prevalence are prostate, colorectal, liver, hematologic, gastric, and lung (Fig. 12.2). The leading female cancers in order of prevalence are breast, thyroid, colo-rectum, hematologic, and uterine (Table 12.3 and Fig. 12.3) [3, 5, 6, 11]. The already known and established risk factors for any cancer are diet, smoked and charcoal prepared food (Gastric Cancer and Colon Cancer), higher life expectancy, obesity, smoking, and diabetes [12].

An increasing number of patients are diagnosed with cancer every successive year (Fig. 12.2, Tables 12.1 and 12.2) [6]. The number of cancer cases registered in 2017 was 2101. Of these, 1892 (90.05%) were among Omanis (1005 females, 887 males), and 188 (8.95%) were among Non-Omanis (123 females, 65 males). One hundred and twenty-seven cases (6.7%) were reported in people aged below 14 years. The median age at cancer diagnosis was 53 years. The crude incidence rates for cancer in Oman were 70.2 per 100,000 for males and 80.9 per 100,000 for females. The Age Standardized Rate (ASR) was 113.3 per 100,000 for males and 114.2 per 100,000 for females. A total reported 193 males and 173 females died of

Yeras	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Frequency	958	903	939	964	1,020	1,059	1,346	1,309	1,426	1,537	1,726	1,880	1,892

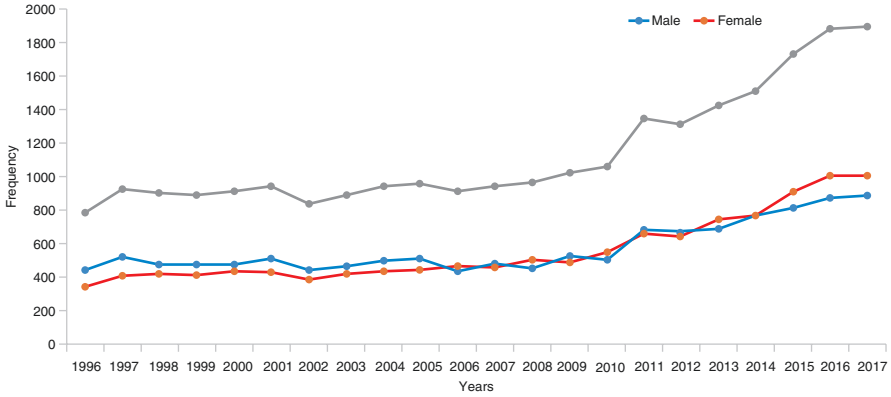

Fig. 12.2 Cancer trends 1996–2017 (used with permission from MoH Oman) [3]

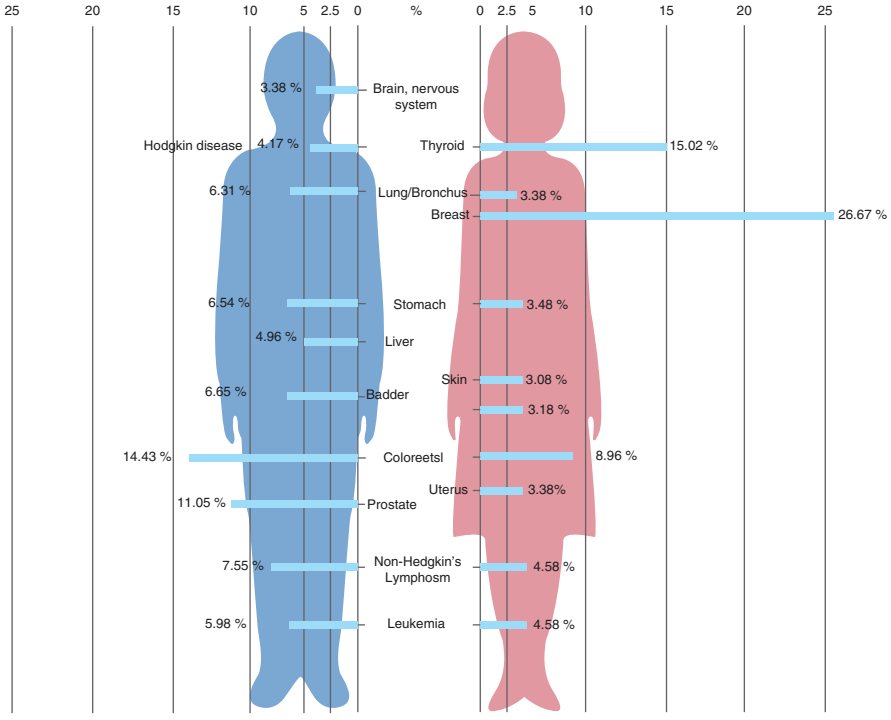

Fig. 12.3 Ten most common cancers in Oman 2017 [6]

Table 12.1 Male cancers Oman 1996–2017 [3, 6]

Site	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Stomach	54	43	36	33	50	33	58	65	55	56	47	57	58
Lung and bronchi	30	30	40	29	30	25	44	33	42	50	45	57	56
Colon and rectum	37	37	32	29	42	43	63	71	71	71	88	81	128
Liver	34	18	20	30	18	19	29	34	31	57	51	67	44
Prostate	40	29	55	41	48	49	68	84	83	83	93	98	98
U. Bladder	28	27	33	25	26	36	35	35	48	53	43	50	59
NHL	43	41	43	45	41	41	57	54	55	62	68	64	67
CNS	17	10	14	14	23	18	20	29	18	29	24	31	30
Kidney	12	6	5	7	18	22	14	15	16	26	21	15	17
Leukemia	41	38	37	45	46	42	66	35	40	53	57	54	53
Esophagus	12	11	9	5	8	15	10	10	10	15	10	7	11
Pancreas	7	6	5	8	10	14	17	16	23	13	18	22	26
Skin	18	17	24	25	29	22	25	27	36	24	24	33	26
HL	14	20	11	18	17	17	23	27	20	25	30	36	37
Thyroid	10	6	7	12	13	3	12	17	19	32	31	46	29

Table 12.2 Frequency of female cancers 1996–2017 [3, 6]

Site	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Breast	99	101	108	125	124	139	164	159	182	174	220	272	268
Stomach	33	28	18	15	24	23	25	29	31	34	23	26	35
Lung and bronchi	9	13	6	11	15	18	14	20	17	16	19	16	34
Colon and rectum	21	25	32	30	36	36	39	59	52	72	70	78	90
Liver	9	11	4	5	16	15	10	14	17	32	29	35	20
Uterus	7	9	10	13	13	14	24	15	17	19	24	30	26
Cervix	26	30	25	30	13	36	31	26	26	32	34	34	32
U. Bladder	9	15	10	10	10	9	8	11	9	15	12	16	15
NHL	26	23	27	30	31	41	42	29	35	33	57	46	46
CNS	10	13	11	14	12	20	14	8	13	18	20	30	35
Kidney	11	4	6	17	8	9	21	10	16	15	17	10	17
Leukemia	23	23	30	38	26	33	32	34	37	46	42	36	46
Esophagus	5	6	10	6	8	5	4	9	3	3	5	3	3
Pancreas	8	4	1	7	4	5	8	9	15	11	11	12	14
Skin	17	15	11	18	21	26	24	21	25	20	36	29	31
HL	8	5	9	15	11	14	23	10	21	15	17	17	14
Thyroid	36	40	38	40	52	40	75	75	111	96	144	164	151

Table 12.3 Frequency of cancers 2017 [6]

Male			Female		
Topography	Frequency	Percentage	Topography	Frequency	Percentage
Colo-rectal	128	14.43	Breast	268	26.67
Prostate	98	11.05	Thyroid	151	15.02
Non-Hodgkin lymphoma	67	7.55	Colo-rectal	90	8.96
Urinary bladder	59	6.65	Non-Hodgkin lymphoma	46	4.58
Stomach	58	6.54	Leukemia	46	4.58
Bronchi and lung	56	6.31	Stomach	35	3.48
Leukemia	53	5.98	Uterus	34	3.38
Liver	44	4.96	Bronchi and lung	34	3.38
Hodgkin's lymphoma	37	4.17	Uterine cervix	32	3.18
Brain and nervous system	30	3.38	Skin	31	3.08

cancer in 2017 [3]. According to GLOBOCAN, the projected new cancer cases expected in 2030 and 2040 are 5761 and 8549 in Oman [5]. Over time, changing trends of incidence have been observed, as colorectal cancer has surpassed stomach cancer, lung cancer is being diagnosed 2–3 times more frequently, thyroid cancer in females has increased five times [6] (Table 12.3).

12.3 Healthcare System in Oman

Oman spent around 2.6% of its GDP (11% of the budget) on health care, rising by 12.9% annually. It is not possible to specifically tell about the amount spent in oncology. Firstly, the MoH and Ministry of Education are involved in cancer care services. Secondly, the diagnostic, screening, and treatment facilities are done by different sections of MoH. Oman has 69 hospitals (as in 2016), with a total of over 6400 beds, which are expected to grow at an annual rate of 3.1%. Only two hospitals have a cancer care services unit. The government operates 80% of hospitals [13–16]. The Omani government is inclined to increase the role of the private health sector, to cope with the increasing demand. New hospitals like Sultan Qaboos Medical City in Muscat, along with International Medical City in Salalah will contribute to meeting the increasing demand. The population growth is putting additional pressure on the health care system. An estimated 95% of the population now live within five miles of a medical center. Cancer care services visited in Oman are high, as the public healthcare system is free. This is saturating the system and increases healthcare costs. Omani nationals have free access to healthcare, though expatriates seek medical care in private hospitals. The insurance-financed healthcare and private hospitals are still far from comprehensive and do not cover all cancer treatment like expensive targeted therapy, and immunotherapy. There are NGOs and private charities which do help a number of patients [17].

In 2014, the government commenced a long-term plan for the healthcare sector entitled Health Vision 2050; including extension of existing cancer care services, establishment of two comprehensive care hospitals, and satellite oncology units [13, 14, 17]. The plan, which according to the World Health Organisation (WHO) serves "as a model for strategic planning in health," envisions large-scale investment in the healthcare sector to create a well-organized, equitable, efficient, and responsive health system. The Health Vision 2050 has pointed out the need to move part of cancer care out of the hospitals and closer to communities and homes, for better service and reduced burden. Oman requires an additional 7000 doctors by 2050. The country now has an accredited medical university and many Omani doctors have obtained their postgraduate medical training overseas in Australia, Canada, the United Kingdom, and the United States.

12.4 Oncology Care in Oman

12.4.1 Access to Cancer Care services

There is an integrated system of primary, secondary, and tertiary medical facilities with a reasonably well-organized referral system by e-referral portal of MoH. All hospitals are interlinked, and the patient's electronic medical records can be accessed by the treating team from anywhere. The MoH through treatment abroad committee sends patients abroad or to GCC for a treatment modality if it is not locally available. A small number of patients travel abroad on their own expenses, often treated at more than one center and in more than one country.

12.4.2 Multi-sectoral Efforts to Prevent and Control Cancer

The Ministry of Education, social welfare, environmental health, PDO all support a coordinated effort for prevention and control of cancer. Cancer prevention strategies include health education, vaccinations (HPV, Hepatitis), and regular primary health care follow-ups. There is an integrated referral pathway from primary to tertiary care. The treatment facility including oncology surgery, radiation oncology, stereotactic radiotherapy, systemic therapy, bone marrow transplant, and liver transplant is available. There are specialized sub-specialty hospitals for ENT, neurosurgery, dermatology, and orthopedics. There are oncology outreach clinics in Salalah. The prime pathology is Royal hospital for the main focal and referral point. The patients who are cured of cancer follow in an outpatient clinic as per protocol and long-term survivors are followed in survivorship clinics or shifted to tertiary/primary care. A dedicated palliative care team is there for pain management, palliative symptom care, and end-of-life care once the patient is transited to palliative symptomatic care [18, 19].

12.4.3 National Oncology Center: The Royal Hospital

The National Oncology Center (NOC) is the oldest center established in December 2004 by MoH, as an extension of the Royal Hospital in Muscat. The NOC comprises medical oncology, radiation oncology, hemato-oncology and BMT, pediatric hematology, and oncology. The center treats around 70% of all cancer cases in Oman. There are sub-specialty clinics for breast and gastrointestinal tumors. Combined clinics for breast, ear-nose-and-throat, gynae-oncology, pain clinics, and outreach clinics are routinely held. There is a multidisciplinary tumor board. Psycho-social support is available by social workers, counseling nurses, occupational therapists, speech therapists, and dieticians. The patients are given free accommodation during their treatment. The treatment facility for treatment, which is free of charge, is available to Omani nationals only. The NOC is a designated and approved center for Integrated Palliative care by ESMO (European Society for Medical Oncology) and is an approved center with UICC (Union Internationale Cancer Control).

12.4.4 Other Cancer Centers

As infectious diseases have been effectively abridged, Oman is now contending with the rise in Non-communicable diseases like diabetes, obesity, hypertension, and cancer. The hospitals in Oman provide high-quality healthcare. There are two cancer care hospitals in Muscat, The Royal Hospital, and the Sultan Qaboos University Hospital. The healthcare system is primarily in the public sector; the Ministry of Health (MoH), is the main health care provider especially the oncology services [14, 17, 20]. The MoH provides healthcare in a 3-tiered system: primary health care centers, secondary hospitals, and tertiary referral hospitals. Private hospitals and clinics, licensed by the MoH, are playing an increasingly important role in cancer care like Burjeel hospital, NMC, Al Hayat, and Muscat private hospital [7, 13]. The two cancer centers are supported by ancillary diagnostic facilities like radiology, pathology, gastroenterology, urology, respiratory medicine, genetics center, nuclear and molecular imaging centers [21].

12.4.5 National Cancer Registry

The Oman National Cancer Registry, established in 1985 as a hospital registry, helps guide policymakers in setting priorities for cancer control activities. The registry began functioning as a population-based registry in 1996 and publishes an annual report on cancer incidence. Cancer diagnosis notification was made mandatory in 2001. The registry also collects data from treatment abroad committees and

Omani patients diagnosed in Qatar [3, 6]. In 2002 and 2007, the International Agency for Research on Cancer (IARC) published Oman's data in its publication "Cancer incidence in five continents volume VIII and IX," Oman being the second Arab nation to contribute. In October 2019, on the 20-year anniversary cancer registry released a comprehensive 20 years compilation of cancer data on the trends of cancers and the lists of the most common cancers, and the regional distribution of cancer cases [3, 6, 10, 16].

12.4.6 Community Obligations

NOC along with Oman Cancer Association (OCA) helps to provide professional guidance by advocating community wellness. NOC liaises between different hospitals, polyclinics, community nursing, and social welfare in the care of oncology patients by providing only logistic and financial support. It works in association with MoH and cancer center for conferences and is not doing any research work. There is a patient awareness group at NOC and is actively involved in community awareness programs for different cancers, through print and electronic media. There is a need to develop patient support groups with the participation of educated and willing patients to help patients in coping with a cancer diagnosis, treatment, and treatment-related side effects. Patients with cancers are liable to develop psychological issues especially depression, with a need to incorporate psychologist's advice and support in managing cancer patients [19].

12.4.7 The Cancer Care Plan

A cancer care plan is based on need assessment of population for convenient and high-quality care focusing patients. It emphasizes the need for prevention, easy access to services, and a road map for future improvements in services. There is a need to streamline existing cancer care services, focusing on patient needs to ensure a continuum of care. The major focus of efforts should be on providing state-of-the-art services and searching for new partners in the public and private sectors to facilitate prompt diagnosis and treatment. It also aims to increase the public understanding of a healthy lifestyle and risk factors, screening, early diagnosis, and prompt treatment. This should translate into improved survival and outcome, decreasing the burden on the health care system. There is a need to bridge the gap in research and clinical practice. There are many taboos and false beliefs in society due to cultural influences, which need to be addressed. The Individual Cancer Care Plan, made for patients by treating physicians at NOC, should facilitate communication between caregivers and families/patients, at every step of management to enhance confidence in the health system and help them cope with the disease. We monitor it by

setting targets of performance indicators every year, with a vision to improve it. Efforts should be directed to facilitate the establishment of hospice and home care services. The patients need to be educated about hospice care, and enrolment in trials [6].

12.5 Cancer Risk Factors

In Oman, chronic Non-Communicable Diseases related to lifestyle like coronary artery diseases, hypertension, diabetes mellitus, and cancer; are now emerging as significant potential health challenges [21]. The aging population along with factors like obesity (53%), lack of physical activity, smoking (15%), Westernized lifestyle, change in diet, and other environmental factors contribute to an increased cancer incidence [6, 11]. The International Agency for Research on Cancer (IARC) predicted the doubling of cancer cases in the period 2008–2020 from 1400 to 2500 [22].

12.6 Cancer Screening Programs

A pre-emptive screening for common cancers is integral to improve diagnosis at an early stage, decrease disease burden, improve outcome, and is cost-effective. The MoH and OCA (Oman Cancer Association) run breast cancer screening by mobile mammography services, and a vast number of female patients benefit from it. An analysis of the impact of screening on early-stage detection was submitted for publication, which showed that T1 increased from 28.70% to 71.30%, while T4 decreased from 61.48% to 38.52%. The N0 increased from 32.75% to 67.25%. A comprehensive guideline for breast screening is developed available at www.mog.gov.om. A cancer colon and Hepatocellular screening in susceptible population groups is evolving. A comprehensive Genetic center is recently established under MoH where tests and genetic counseling services are available for hereditary and familial cancers [18].

12.7 Cancer Prevention Programs

In 2018, Oman launched its national policy and action plan for the prevention and control of Non-Communicable Diseases including Cancer. This multisector plan was developed to reduce mortality of NCDs by 25% in 2025 through reinforcing the cooperation between stakeholders from industry, education, information, Sports affairs, Regional municipalities, Council for planning, civil society, and international organizations [13, 17, 21, 23]. These include Oman anti-smoking society, Oman Medical Association, Oman Cancer Association, World Health Organization

(WHO), and UNICEF [7, 13]. In addition, several departments in the MoH help in planning, implementation, and monitoring of cancer control and prevention activities like the National Oncology Centre, the directorate general of primary healthcare, and the directorate general of specialized services. This helps to ensure a coordinated and integrated approach between primary, secondary, and tertiary services. HPV vaccination is available but not mandatory at present for everyone.

12.8 Cancer Diagnosis

The cancer care services are supported by sophisticated pathology services including molecular, Fluorescent in situ hybridization (FISH), Immunohistochemistry (IHC), and cytogenetic testing facility. Some genetic tests are sent abroad as well like RAS, BRAF, Oncotype DX, PIK3C, etc. Nuclear imaging centers provide PET scan, bone scan, densitometry, MIBG, PSMA PET, and other scans. A genetic center is established for specialized genetic tests and genetic counseling [24]. The challenges in diagnosis are access, coping up with demand, and limited availability.

12.9 Treatment

The oncology services in Oman started in 1990, the Medical Oncology department was established in 1996 at the Royal hospital, and subsequently, National Oncology center was established in 2004 at the Royal Hospital under MoH. It has expanded to meet the ever-growing needs of the community. Omani nationals have free access to cancer care services. This includes sophisticated diagnostic services up to PET Scans and most recently incorporated therapeutic modalities like targeted therapy, bone marrow transplant, and immunotherapy. Enrolment in Clinical trials is a legitimate treatment option for many diseases and patients. Unfortunately, in Oman, we do not have access to clinical trials as would be desired.

12.9.1 Medical Oncology

Two centers in Oman have a medical oncology and chemotherapy facility, the Royal hospital National Oncology Centre under MoH and Sultan Qaboos University hospital (Ministry of Higher Education). In addition, there are satellite units in Salalah and Sohar. These provide outpatient clinics, diagnostic services, daycare treatment, and inpatient facilities. The chemotherapies are prepared within the NOC Pharmacy. Most state-of-art treatment options are available locally in Oman. Several patients are sent abroad for specialized management at high-volume specialized institutes if the required services are not available locally [6, 9, 11].

12.9.2 Radiation Therapy

National Oncology Centre—The Royal Hospital is the only center with a radiation oncology facility at present, while Sultan Qaboos University Hospital (SQUH) is likely to start radiation therapy in the near future. The two facilities are concentrated in Muscat and patients travel from all over Oman for treatment. The NOC has facilities for IMRT (Intensity Modulated Radiotherapy), Brachytherapy, and SBRT (Stereotactic Body Radiation Therapy). There are two Linear accelerators in NOC and two more are planned to be installed in SQUH [6].

12.9.3 Surgery

Oncologic surgery is still an evolving specialty in Oman, with countable oncology surgeons. They are in breast, colo-rectal, osteo-oncology, hepatobiliary, faciomaxillary, gynecologic-oncology, and uro-oncology. There are multi-modality and multi-specialty combined clinics like breast, ENT, and neuro-oncology. There is a multidisciplinary forum like the tumor board for discussion and consensus decision-making as per current guidelines [11].

12.9.4 Pediatric Oncology

There are two pediatric oncology units, one in NOC Royal Hospital and the other in SQUH dealing with hematologic and solid tumors. They also have inpatient services, outpatient specialty clinics, and daycare facilities. Adolescent oncology is evolving as a further subspecialty with a dedicated trained consultant and team [11].

12.9.5 Survivorship Track

The outcome and survival in malignant diseases have improved, thus increasing the number of long-term cancer survivors. These patients need to follow up due to the risk of relapse, chances of subsequent tumors, long-term sequel of cancer treatment, and their affiliation to a primary cancer care team. A survivorship clinic is run by NOC on a regular basis to cater services to these patients [6].

12.9.6 Palliative Care Track

Cancer patients often present with advanced-stage disease in the developing world, shifting the aim of management from curative to a palliative intent. Oman lacks the required palliative and hospice care, resulting in an increased burden on existing cancer care facilities and compromising the desirable care of potentially treatable cancers. The idea of hospice care is still not morally, socially, or religiously very acceptable in society, probably due to closed integrated families [6, 9]. There is a policy of DNR approved by MoH, ethical experts, and religious factions.

12.10 Research and Education

MoH has set guidelines and priorities for research [25, 26]. NOC is actively involved in undergraduate and postgraduate teaching. NOC has organized one to two international oncology conferences every year since 2009. NOC made several presentations in international conferences and meetings and has published over 150 articles in international journals [27–55]. The research areas of interest at present are Microsatellite Instability, Mismatch Repairs, Colorectal Tumour Bank, Stomach cancer, Breast cancer molecular subtypes, Bevacizumab in Ovarian Cancer, anti-EGFR (epidermal growth factor receptor) in mCRC, utilization of palliative chemotherapy near the end of life, Changing Trends, Management outcomes and survival of Common Cancers, Castration-Resistant Prostate Cancer, the Effect of Diet and Obesity On Colonic Cancer, Impact of Body Mass Index, diet and diabetes on incidence, RAS mutation and clinical outcome of colorectal cancer, Synchronous and metachronous tumors, Chemotherapy induced Neutropenic necrotic Enterocolitis, Rapid Rituximab infusion, Young age Breast Cancer in Oman, Prognostic determinants of gastric cancer, Renal cell carcinoma metastasizing to larynx, Does Traditional WASAM (Cautery Burn) Therapy Facilitate an Early and Extensive Loco regional Metastasis of Breast Cancer?, Primary Gastric Choriocarcinoma, Lean philosophy within cancer-care service in Oman, Breast cancer in Kindlers syndrome, Non-traumatic avascular necrosis of femoral head, Lobbying for regulatory reforms of narcotic analgesics in Middle East, Epidemiology of Lung Cancer in Oman, Cancer Incidence in Oman (1996–2015), and 20-year trends of cancer incidence in Omanis. A lot of presentations, both oral and abstract, were done in local, regional, and international meetings in the Gulf region, Europe, and the USA. The important ones were Outpatient Cisplatin Administration, stress and fatigue in Breast cancer, Brain metastasis in Her-2 (human epidermal growth factor receptor 2) positive Breast cancer, and RAS mutations and ethnicity [27–55].

12.11 Cost-Effective Cancer Care

Effective and prompt management of cancer is increasingly challenged with the escalating cost of diagnosis and treatment with the incorporation of new modalities of diagnosis and integration of more effective drugs. The management has to be balanced with resource allocation and cost-effectiveness due to increasing economic pressures. The paradigm is shifting to cancer prevention, screening, and genetic screening to reduce the economic burden. A comprehensive genetic center was established recently for genetic testing and counseling. The early-stage diagnosis cut down the management cost and was observed with breast screening programs. We are seeing a higher proportion of early-stage curable, treatable breast cancer with less frequency of a relapse. Oman is therefore allocating resources to health education, genetic testing, prevention, and screening with the objective of early detection and cost-effectiveness. These potential programs include familial and genetically determined tumors like colon, sero-positive hepatocellular carcinoma, gastric cancer, endometrial cancer, ovarian cancer, pancreatic cancer, and prostate cancer [54].

Oman is also introducing health economics principles in cancer care for expensive tests and medications in collaboration with the pharmaceutical industry. The country is expanding the use of approved generics and biosimilar. The authorities have developed and approved local institutional guidelines for management and follow-up with the objective of judicious and cost-effective use of laboratory, radiology, and healthcare services.

12.12 Challenges and Advantages

Oman has certain advantages and specific challenges in cancer care plans and services. Oman has a young population, with almost everyone being vaccinated for hepatitis. Local population has free access to comprehensive primary and specialized healthcare services. There is a facility to send patients abroad by MoH, if any needed treatment is not locally available.

The challenges are multi-dimensional and include a high population growth rate, traditional tribal system, social taboos, beliefs, herbal and traditional medications, and a tendency of health tourism. The literacy rate is half in the population over 65 years of age, who influence public opinion. There is a need to invest in health education, prevention and screening programs, diagnostic services, and therapeutic interventions. There is a need for capacity building by training the workforce and investing in cancer care. Increasing economic pressure globally is a challenge with resource allocation, better planning, setting priorities, and implementing cost-effectiveness. There is a need for continuing political will and support and commitment to achieve the set objectives [19, 25, 26].

12.13 The Future of Cancer Care in Oman

Cancer-related mortality is often predestined, but with the execution of the comprehensive Cancer Care Plan, there will be expectantly less mortality in the future. To accomplish these objectives all the partners (public and private, physicians, nurses, patients, and families) must operate concurrently to meet the challenges and realize the targets. There is a need to focus on strengthening the Cancer Control Program, improve Cancer Registry, focus on early detection and prevention, improve integrated cancer management, accessibility, establish integrated palliative care services, engage civil society, capacity building, human resource development, and improve public awareness.

Infrastructure development, lobby for funding, emphasis on research, need to develop clinical pathways and guidelines. There is a continued need for quality assurance, implementing Key Performance Indicators, performance monitoring, and improving patient experience. We need to make a prompt and swift access to cancer services individually or by an integrated referral pathway, decrease referral abroad, make new drugs available for treatment, empower more patients in decision-making, implement patient safety protocols, maintain, and get new certifications, and ensure effective capacity building [56, 57].

12.14 Conclusion

Cancer management is a very dynamic discipline due to a rapid pace of research and development. It is a challenge to offer state-of-the-art cancer care due to increasing cost and access to treatment. Each country has to balance its objectives and resources to have an optimal strategy. There is a necessity for capacity building, reinforcement of cancer control, concentrating on early detection and prevention, developing integrated management, developing local management guidelines, and authenticating palliative care services. Civil society and Non-Governmental Organizations should be involved to the optimum. There is a need for infrastructure improvement, lobby for funding, stress on research, need to develop clinical pathways, demand for quality assurance, implement performance indicators and monitoring, and improve patient experience. It is mandatory to make prompt and swift access to cancer services by everyone through an integrated referral pathway. All the new effective drugs should be made available for treatment, empower patients in decision-making, execute patient safety protocols, maintain and acquire new accreditations, and ensure capacity building.

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

References

1. Ševčíková H, Raftery AE. Probabilistic population projections. J Stat Softw. 2016;75(6):3849.
2. UN World Population Prospects. United Nations Department of Economic and Social Affairs. 2019.
3. Cancer incidence in Oman 2017, Directorate of Non-Communicable diseases, Ministry of health Sultanate of Oman; www.moh.gov.om.
4. Oman Popul Rev. 2020. Available at https://worldpopulationreview.com/countries/oman-population/.
5. GLOBOCAN database (September 2018)—https://gco.iarc.fr/today/home a--: GLOBOCAN database (September 2018)—https://gco.iarc.fr/today/home, Accessed July 21st 2020.
6. Al-Lawati JA, Al-Zakwani I, Fadhil I, Al-Bahrani BJ. Cancer incidence in Oman (1996–2015). Oman Med J. 2019;34(4):271–3.
7. Al Hasni ZS. The tourism sector, its importance in achieving economic growth in the sultanate of Oman. Int J Adv Res. 2019; https://doi.org/10.21474/IJAR01/9666. 5 Sept 2019
8. Chang Mo O, Lee D, Kong HJ, Lee S, Won YJ, Jung KW, Hyunsoon. Causes of death among cancer patients in the era of cancer survivorship in Korea: attention to the suicide and cardiovascular mortality. Cancer Med. 2020;9(5):1741–52. https://doi.org/10.1002/cam4.2813.
9. Al-Madouj AN, Eldali A, Al-Zahrani AS. 10-Year cancer incidence among nationals of the GCC states 1998-2007. Gulf Centre for Cancer Control and Prevention; 2009.
10. Khoja T, Zahrani A. Epidemiology on cancer in gulf region. 2010. http://www.Amaac.org.
11. Al-Lawati NA, Shenoy SM, Al-Bahrani BJ, Al-Lawati JA. Increasing thyroid cancer incidence in Oman: a join point trend analysis. Oman Med J. 2019;35(1):e98. https://doi.org/10.5001/omj.2020.16.
12. Song W, Powers S, Zhu W, Hannun YA. Substantial contribution of extrinsic risk factors to cancer development. Nature. 2016;529:43–7.
13. Al-Riyami A. Health vision 2050 Oman: a committed step towards reforms. Oman Med J. 2012;27(3):190–1.
14. World Health Organization. Health system profile: Oman 2015. 2015.
15. Ghannem H, Becerra-Posada F, IJsselmuiden C, Helwa I, de Haan S. National research for health system mapping in 5 countries in the eastern Mediterranean region and perspectives on strengthening the systems. East Mediterr Health J. 2011;17(3):260–1.
16. Oman Health Vision 2050. Under secretariat for Planning Affairs, Ministry of Health Sultanate of Oman. 2014. Available from: https://www.moh.gov.om/documents/16506/119833/Health+Vision+2050/7b6f40f3-8f93-4397-9fde34e04026b829.
17. Al Mawali AHN, Al Qasmi AM, Al Sabahi SMS, Idikula J, Elaty MAA, Morsi M, Al Hinai AT. Oman Vision 2050 for Health Research: a strategic plan for the future based on the past and present experience. Oman Med J. 2017;32(2):86–96.
18. Al-Azri M, Al-Rubaie K, Al-Ghafri S, Al-Hinai M, Panchatcharam SM. Barriers and attitudes toward breast cancer screening among Omani women. Asian Pac J Cancer Prev. 2020;21(5):1339–47. https://doi.org/10.31557/APJCP.2020.21.5.1339.
19. Al-Azri M, Al-Awisi H, Al-Rasbi S, El-Shafie K, Al-Hinai M, Al-Habsi H, Al-Moundhri M. Psychosocial impact of breast cancer diagnosis among Omani women. Oman Med J. 2014;29(6):437–44.
20. Al-Maawali A, Al Busadi A, Al-Adawi S. Biomedical publications profile and trends in gulf cooperation council countries. Sultan Qaboos Univ Med J. 2012;12(1):41–7.
21. World Health Organization. Non-communicable Diseases Country Profiles 2011 WHO Global Report 2011. 2011.
22. Latest Global Cancer Data. Cancer burden rises to 19.3 million new cases and 10.0 million cancer deaths in 2020. International Agency for Research on Cancer—World Health Organization. 2020. Press release No. 292, Lyon France. 15 Dec 2020.

23. Sabah Al-Bahlani and Ruth Mabry. Preventing non-communicable disease in Oman, a legislative review. Health Promot Int. 2014;29(suppl 1):i83–91. https://doi.org/10.1093/heapro/dau041.
24. Anna Rajab I, Rashdi A, Al Salmi Q. Genetic services and testing in the Sultanate of Oman. Sultanate of Oman steps into modern genetics. J Community Genet. 2013;4(3):391–7. https://doi.org/10.1007/s12687-013-0153-1.
25. Guidelines for Responsible Conduct of Clinical Studies & Trials. Centre of Studies and research. Directorate General of Planning and Studies. Ministry of Health, Oman. 2016. Available from: http://mohcsr.gov.om/clinical-trials-and-studies-guideline/.
26. Health Research Priorities. Centre of studies and research. Directorate General of Planning and Studies, Ministry of Health, Oman. 2014. Available from: http://mohcsr.gov.om/health-research-priorities/.
27. Mehdi I, Shah AH, Moona MS, Verma K, Abussa A, Elramih R, El-Hashmi H. Synchronous and metachronous tumors—expect the un-expected. J Pak Med Assoc. 2010;60:905–9.
28. Moona MS, Al R, Alarabi R, Hussain A, Ahmed M, Mehdi I. Study of ER (estrogen receptor), PR (progesterone receptor), and Her-2/Neu status in patients with breast cancer. JMJ. 2010;10(2):141–3.
29. Moona MS, Mehdi I. Nasopharyngeal carcinoma presented as cavernous sinus tumor. J Pak Med Assoc. 2011;61:1235–6.
30. Aromatase inhibitors, a viable option for recurrent granulose cell tumor ovary: overview and case report. J Pak Med Assoc. 2012;62(5):505–7.
31. Anaplastic large cell lymphoma of scrotal skin. J Pak Med Assoc. 2011;61:1140–3.
32. Renal cell carcinoma metastasizing to larynx. Gulf J Oncolog. 2012;11:70–4.
33. Chemotherapy induced neutropenic necrotic enterocolitis—review article. J Pak Med Assoc. 2012;62:718–23.
34. Mehdi I, Kashmiri AH. Chronic myeloid leukemia in Libya. South Asian J Cancer. 2012;1(1):25–6. www.Journal.sajc.org Thursday June 28, 2012: IP: 37.40.61.242
35. Monem EA, Al-Bahrani B, Mehdi I, Nada A. Rapid rituximab infusion: local center experience. Gulf J Oncolog. 2013;14:52–6.
36. Mehdi I. Be a true listener, rather than a good conversationalist. South Asian J Cancer. 2013;2(4):218–9.
37. Kamal V, Itrat M, Nazhia I, Hussein H. Unusual presentation of cancer colon. J Obstet Gynecol. 2013; https://doi.org/10.1007/S13224-013-0436-9. On line ISSN 0975-6434. Print ISSN 0971-9202
38. Mehdi I, Monem EA, Al Bahrani BJ, Al Kharusi S, Nada AM, Al Lawati J, Al Lawati N. Young age breast cancer in Oman: issues and implications. South Asian J Cancer. 2014;3(2):101–6. https://doi.org/10.4103/2278-330X.130442.
39. Mehdi I, Monem AA, Al Bahrani B, Ramadhan F. Molecular subtypes of breast cancer in Oman. Correlation of age, stage, and outcome—an analysis of 542 cases. Gulf J Oncolog. 2014;15:38–48.
40. Monem EA, Mehdi I, Al Bahrani BJ, Nada AM, Al Kharusi S. Utilization of chemotherapy at the end of life (EOL): a local experience. J Pak Med Assoc. 2014;64:863–8.
41. Baraka BA, Al Bahrani BJ, Al Kharusi SS, Mehdi I, Nada AM, Rahabi NH. The external Auditory Canal as an unusual site for metastasis of breast cancer: a case report. Gulf J Oncolog. 2015;17:85–7.
42. Al-Lawati T, Mehdi I, Al Bahrani B, Al-Harsi K, Al Rahbi S, Varvaras D. Does alternative and traditional WASAM (local cautery) therapy facilitate an early and more extensive loco-regional metastasis of breast cancer? Gulf J Oncolog. 2016;22:37–42.
43. Essam AM, Venniyoor A, Nagdev S, Mehdi I, Al Bahrani B. Long term survival in a case of metastatic papillary renal cell carcinoma. South Asian J Cancer. 2017;6(1):19–24. https://doi.org/10.4103/2278-330X.202562.
44. Venniyoor A, Essam AM, Ramadhan F, Keswani H, Mehdi I, Al Bahrani B. High occurrence of non-clear cell renal cell carcinoma in Oman. Asian Pac J Cancer Prev. 2016;17(6):2801–4.

45. Venniyoor A, Mehdi I, Balakrishnan R, Al Bahrani B. Early chemotherapy in metastatic prostate cancer improves survival: a quick note to surgical colleagues. Indian J Surg. 2020;82(6):1206. https://doi.org/10.1007/s12262-020-02213-y.
46. Venniyoor A, Mehdi I, Balakrishnan R, Al Bahrani B. Long term survival in a case of metastatic papillary renal cell carcinoma. 2017;6(1):19–24. https://doi.org/10.4103/2278-330X.202562.
47. Mehdi I, Al Bahrani BJ. Are we prepared to implement a lean philosophy within cancer-care service in Oman? Saudi Med J. 2017;38(7):691–8. https://doi.org/10.15537/smj.2017.7.17712.
48. Mehdi I, Al Bahrani BJ, Al Lawati TM, Mandhari ZA, Al Lawati FR. Breast cancer in a patient with kindlers syndrome. J Pak Med Assoc. 2017;67(8):1283–6.
49. Mehdi I, Al Bahrani BJ, Kamona A, Al Lawati FR, Vennyor AJ. Non-traumatic avascular necrosis of femoral head in malignant disease: is it disease induced or treatment related? J Pakistan Med Assoc. 2018;68(2):310–7.
50. Mehdi I, Al Bahrani B. Lobbying for regulatory reforms of narcotic analgesics in the current social environment of the Middle East. Gulf J Oncolog. 2018;27:52–9.
51. Mehdi I, Al Bahrani B. Expanding role of bio markers in Colo-rectal cancer (CRC). Int J Cell Sci Mol Biol. 2017;3(1):1–5. https://doi.org/10.19080/IJCSMB.2017.03.555605.
52. Mehdi I, Al Bahrani B. Fast food chains and obesity in Oman. J Cancer Epidemiol Prev. 2020;5(4):1–6. https://doi.org/10.36648/cancer.5.4.6.
53. Mehdi I, Al Bahrani B. Medical tourism in Oman. Cancer Rep Rev. 2020;4:1–5. https://doi.org/10.15761/CRR.1000212.
54. Al Bahrani BJ, Mehdi I. A potential 2nd wave of COVID-19: an approaching reality. J Pak Med Assoc. 2020;70(12):2299–301.
55. Al Bahrani BJ, Mehdi I, Monem EA, Al Farsi AAM, Al Lawati N, Nada AM. Laterality of colorectal cancer (CRC) in Oman. Cancer Sci Res. 2021;4(1):1–7.
56. Burney IA. The trend to seek a second opinion abroad amongst cancer patients in Oman, challenges and opportunities. Sultan Qaboos Univ Med J. 2009;9(3):260–3.
57. Al Balushi M, Al Mandhari Z. Radiation oncology in Oman: current status and future challenges. Int J Radiat Oncol Biol Phys. 2020;108(4):851–5. https://doi.org/10.1016/j.ijrobp.2020.05.059. Epub 2020 Jul 11

Itrat Mehdi has postgraduate training in the UK, having vast experience in clinical Oncology, research, and postgraduate teaching. He is a member of international organizations like ASCO, ESMO, ESACC, SGM, etc. He is on the editorial board and is a reviewer of many international indexed journals like BMJ, JPMA, JPMR, World Journal series, SQUMJ, OMJ, J Nephrology Urology and Transplant, and GJO. He has been part of many collaborative studies and clinical trials, supervised many postgraduate students, and been an examiner in Oncology. He has presented numerous papers at local and international meetings. He has over 70 publications in local and international journals.

Abdul Aziz Al Farsi, MD, MRCP(UK), FRCPC, graduated from the college of medicine SQUH in 2001. He joined the Internal Medicine Program OMSB in 2003. He became a member of the Royal College of Physicians UK in 2006 and joined the department of medical oncology at the Royal Hospital that year. Dr. Aziz completed his studies at McMaster University, Hamilton, Canada where he finished internal medicine and medical oncology residency from 2010 till 2015. He completed research and clinical fellowship in thoracic malignancies at the same university in June 2017. Currently, he works as Senior Consultant and Head of Adult Oncology, National Oncology Center, Muscat, Oman.

Bassim Al Bahrani, a Senior Medical Oncologist at the Royal Hospital in Oman. A visiting Professor at the postgraduate program on Health Economics, Management and Policy at the University of Peloponnese in Corinth, Greece. He has done his advanced training in Medical Oncology in Australia and earned a fellowship from the Royal Australasian College of Physicians year 2000. He is an honorary Fellow of the Royal College of physicians and surgeons of Glasgow, ESMO Certified, and a Ph.D. from the University of Rome Tor Vergata. He is a member of many international Oncology associations and the author of over 56 research articles published in peer-reviewed international journals.

Shadha S. Al-Raisi, is the Director of Non-Communicable Diseases (NCD) in the Ministry of Health, Oman. She is involved in the management of NCDs and mental illness in PHC, the provision of services for people living with disabilities, and the development of a surveillance system for NCDs in the country. Among a number of committees, she is the rapporteur of the National NCD committee and a member of the GCC NCD committee. Dr. Al-Raisi has degrees in Medicine and Biomedical science from the University College of Cork, Ireland, and a master's degree in Public Health from the London School of Hygiene & Tropical Medicine.