Chapter 13
General Oncology Care in Palestine

Khalid Halahleh, Niveen M. E. Abu-Rmeileh, and Mohammad M. Abusrour

13.1 Demographics of the State of Palestine

At present, the state of Palestine is referred to the areas of historic Palestine that are controlled by the Palestinian authority, namely the West Bank, including East Jerusalem, and the Gaza Strip. The state of Palestine is located at the eastern coast of the Mediterranean Sea to the West of the Jordan River. The state includes 16 governorates—11 in the West Bank and 5 in the Gaza Strip. According to the Palestinian Central Bureau of Statistics, the total population in 2020 is estimated to be about 5.1 million; 3.05 million live in the West Bank and 2.05 live in the Gaza Strip, with an average age of 21 years. This indicates that 66% of the population is under 30. Males make up 51% of the population and females 49%, whereas the sex ratio stands at 103.4; meaning that there are 103 males for every 100 females. The Gross Domestic Product (GDP) per capita is estimated to be $3378 in 2019 [1].

K. Halahleh
Medical Oncology Hematology Section, Hematopoietic Cell Transplantation and Cell Therapy Unit-King Hussein Cancer Center, Amman, Jordan

N. M. E. Abu-Rmeileh
Institute of Community and Public Health, Berzeit University, Birzeit, Palestine

M. M. Abusrour (✉)
Augusta-Victoria Hospital, Jerusalem, Palestine
e-mail: mabusrour@doh.gov.ae

H. O. Al-Shamsi et al. (eds.), *Cancer in the Arab World*,
https://doi.org/10.1007/978-981-16-7945-2_13

13.2 Cancer Statistics in Palestine

13.2.1 Cancer Epidemiology

It was challenging to receive accurate data on cancer incidence and mortality in the occupied Palestinian territory until 1998. The Ministry of Health has published the first cancer report, including statistics for both the West Bank and the Gaza Strip [2]. This report was the first product of the Palestinian Cancer Registry (PCR). The registry was based at two hospitals: one in the West Bank and one in the Gaza Strip. From the establishment of the registry until 2008, the data of both locations were combined in one report. Afterward, data was reported separately for the West Bank and the Gaza Strip.

Although the Palestinian Cancer Registry is almost 25 years old, the reported statistics are still elementary and limited to incidence rate and percentage of site-specific cancer stratified by age and sex. Survival statistics, case fatality statistics, and age at diagnosis and recovery in addition to effective management plans are not reported.

13.2.2 Cancer Statistics

The cancer incidence rate was 117.8 per 100,000 population in 2019. The rate has a steady slow increase compared with 2013 (79.5 per 100,000 population) and 2016 (86.4 per 100,000). It is not clear whether this is an actual increase in cancer cases or is it due to an improvement in the reporting system.

In the West Bank, breast cancer was the most common cancer, 16.9% of all cancer cases in 2019 (incidence rate was 19.9 per 100,000 population). The second most common cancer was colorectal cancer, 12.6% of all cancer cases (Incidence rate was 14.8 per 100,000 population). The third highest incidence rate was lung cancer 8.4 per 100,000 population (7.2% of all cancer cases). (Table 13.1) [3, 4]. Similarly, in the Gaza Strip, breast cancer (18.0%) and colon cancer (10.7% of all cancer cases) were at the top [5].

The most common cancer among females was breast cancer [3, 4] (40.0% in the West Bank and 32.3% in the Gaza Strip), colorectum cancer (15.6% in the West Bank and 9.2% in the Gaza strip), and thyroid cancer (9.2% in the West Bank and 7.7% in the Gaza Strip) [3, 4]. These three types were common cancers reported among females in the last 10 years.

Among males, the most common cancers in the West Bank were lung cancer [3, 4] (14.1%), colorectum cancer (14.1%), prostate cancer (9.9%), and bladder cancer (9.8%). While in the Gaza Strip, the most common cancers were colorectum cancer (13.1%), lung cancer (11.5%), leukemia (9.2%), Non-Hodgkin's Lymphoma (7.8%), and prostate cancer (7.6%).

Table 13.1 Percentage of reported cancer cases by sex and diagnosis, West Bank, Palestine 2019 [3, 4]

Site	IDCO3	Male	%	Female	%	Total	%	Incidence rate per 100,000
Lip, oral cavity & pharynx	C00-C08	21	0.7	13	0.4	34	1.1	1.3
Oropharynx & nasopharynx	C10-C11	11	0.4	1	0.0	12	0.4	0.4
Esophagus	C15	11	0.4	4	0.1	15	0.5	0.6
Stomach	C16	43	1.4	35	1.1	78	2.5	2.9
Small intestine	C17	5	0.1	8	0.3	13	0.4	0.5
Colorectal	C18-C20	194	6.1	206	6.5	400	12.6	14.8
Anus	C21	3	0.1	1	0.0	4	0.1	0.1
Liver	C22	36	1.1	15	0.5	51	1.6	1.9
Gallbladder & biliary	C23-C24	12	0.4	16	0.5	28	0.9	1.0
Pancreas	C25	57	1.8	33	1.0	90	2.8	3.3
Ill-defined digestive organs	C26	6	0.2	2	0.1	8	0.3	0.3
Nose & nasal sinuses	C30-C31	5	0.2	3	0.1	8	0.3	0.3
Larynx	C32	35	1.1	4	0.1	39	1.2	1.4
Trachea, bronchus & lung	C33-C34	194	6.2	33	1.0	227	7.2	8.4
Thymus, adrenal gland & other endocrine glands	C37, C74-C75	6	0.2	11	0.3	17	0.5	0.6
Heart, mediastinum & pleura	C38	4	0.1	2	0.1	6	0.2	0.2
Bones	C40-C41	24	0.7	15	0.5	39	1.2	1.4
Melanoma	C43	3	0.1	5	0.2	8	0.3	0.3
Skin	C44	87	2.8	74	2.3	161	5.1	6.0
Mesotheliom	C45	3	0.1	0	0.0	3	0.1	0.1
Kaposi sarcoma	C46	1	0.1	1	0.0	2	0.1	0.1
Retroperitonium	C48	1	0.1	1	0.0	2	0.1	0.1
Connective & soft tissue	C49	18	0.6	16	0.5	34	1.1	1.3
Breast	C50	7	0.2	529	16.7	536	16.9	19.9
Vulva	C51	0	0.0	3	0.1	3	0.1	0.1
Vagina	C52	0	0.0	1	0.0	1	0.0	0.0
Cervix uteri	C53	0	0.0	16	0.5	16	0.5	0.6
Uterus	C54-C55	0	0.0	112	3.5	112	3.5	4.2
Overy	C56	0	0.0	53	1.7	53	1.7	2.0
Fallopian tube	C57	0	0.0	2	0.1	2	0.1	0.1
Prostate	C61	136	4.3	0	0.0	136	4.3	5.0
Testis	C62	40	1.3	0	0.0	40	1.3	1.5
Kidney, renal pelvis & ureter	C63-C64	37	1.2	29	0.9	66	2.1	2.4
Bladder	C67	134	4.3	14	0.4	148	4.7	5.5
Eye & adnexa	C69	3	0.1	1	0.0	4	0.1	0.1

(continued)

Table 13.1 (continued)

Site	IDCO3	Male	%	Female	%	Total	%	Incidence rate per 100,000
Brain & nerves system	C70-C72	67	2.1	−56	1.4	11	3.5	4.1
Thyroid	C73	44	1.4	122	3.8	166	5.2	6.2
Malignant neoplasm without specification of site	C80	12	0.4	10	0.3	22	0.7	0.8
Hodgkin's disease	C81	46	1.5	45	1.4	91	2.9	3.4
Non-Hodgkin's lymphoma	C82-C85, C96	68	2.2	64	2.0	132	4.2	4.9
Multiple myeloma	C90	30	0.9	16	0.5	46	1.4	1.7
Leukemia	C91-C95	83	2.6	74	2.3	157	4.9	5.8
Other hematologic disorders	C42	23	0.8	30	0.9	53	1.7	2.0
Total		1510	47.6	1664	52.4	3174	100.0	117.8

The percentage of cancer among children is relatively low compared to those of older ages in 2019. The most common cancer among children was leukemia (42% of all cancers in the West Bank and 26% of all cancers in the Gaza Strip). The second most common pediatric cancer in the West Bank was brain and nervous system cancers (33% of all cancers), followed by Non-Hodgkin's Lymphoma (17%) [4]. While in the Gaza Strip, brain and nervous system cancers accounted for 16.5% of all cancers and Non-Hodgkin's Lymphoma 17.1% [3].

Regional variations between governorates within the West Bank and the Gaza Strip were reported on:

- http://site.moh.ps/Content/Books
- http://www.moh.gov.ps/portal/wp-content/uploads/2020/06/MOH-Annual-Report-2019.pdf

However, these variations were not consistent over time and the interpretation of high or low percentages in certain areas was difficult to interpret.

13.2.3 Cancer Mortality

Mortality in Palestine is mainly due to Non-Communicable Diseases (NCDs). In 2019, cardiovascular diseases were the leading cause of death in the West Bank (29.9%) and the Gaza Strip (49.6%). Cancer was the second leading cause of death which accounted for 16% of the total deaths in the West Bank (Cancer mortality rate was 42.9 per 100,000) and 10.3% of total deaths in the Gaza Strip [3]. Lung cancer (17%), colon cancer (14.9%), and breast cancer (11.2%) were the leading causes of death among other cancers in the West Bank (Table 13.2) [4].

Table 13.2 Percentage of top reported cancer deaths by sex and site, West Bank, Palestine 2019 [3, 4]

Site	IDCO3	Male	Female	Total	%
Lip, oral cavity, & pharynx	C00-C14	6	1	7	0.6
Esophagus	C15	7	3	10	0.9
Stomach	C16	21	26	47	4.1
Colon	C18	87	85	172	14.9
Rectum	C20	6	10	16	1.4
Liver	C22	35	29	64	5.5
Gallbladder	C23	9	8	17	1.5
Pancreas	C25	31	23	54	4.7
Nasal cavity & middle ear	C30	0	1	1	0.1
Larynx	C32	7	1	8	0.7
Lung	C33-C34.9	160	36	196	17.0
Thymus	C37	1	2	3	0.3
Bones	C40-C41.9	14	7	21	1.8
Skin	C43-C44	9	4	13	1.1
Retroperitoneum & peritoneum	C48	0	1	1	0.1
Connective & soft tissue	C49	5	4	9	0.8
Breast	C50	0	130	130	11.2
Vulva	C51	0	1	1	0.1
Uterus	C53- C55.9	0	25	25	2.2
Overy	C56	0	23	23	2.0
Prostate	C61	48	0	48	4.2
Testis	C62	1	0	1	0.1
Kidney	C64	14	6	20	1.7
Urinary bladder	C67	36	5	41	3.5
Eye	C69	0	1	1	0.1
Brain & other nerves system	C70-C72.9	44	38	82	7.1
Thyroid gland	C73	1	4	5	0.4
Adrenal gland	C74	1	3	4	0.3
Lymph nods	C77	2	0	2	0.2
Without specification of site	C80	2	5	7	0.6
Hodgkin's disease	C81	3	5	8	0.7
Non-Hodgkin's lymphoma	C82-C85.9	7	6	13	1.1
Leukemia	C90-C95.9	53	38	91	7.9
Lymphoid, hematopoietic & related tissue	C96	5	10	15	1.3
Total in West Bank		615	541	1156	100.0
Total in Gaza		2842 (9.9%)	2477 (10.8%)	5319	33.7 per 100,000

13.3 Cancer Risk Factors

Few studies reported cancer risk factors in Palestine. Most of them were focused on breast cancer risk factors. A cross-sectional study was conducted in the Gaza Strip, in 2014, reported selected risk factors. Positive family history of breast cancer, high Body Mass Index (BMI), hypertension and diabetes are common risk factors for breast cancer among Palestinian women [6].

Classical cancer risk factors such as tobacco control, obesity, and unhealthy nutrition habits were studied separately or with other Non-Communicable Diseases. The rate of tobacco smoking among adults (≥18) was 36.7%. Cigarette smoking was 28.2%, while waterpipe tobacco smoking was 12.9% [7]. The prevalence of current waterpipe tobacco smoking among university students aged 18–25 years old was 24.4%, which was higher than the prevalence of current cigarette smoking (18.0%). The prevalence of waterpipe tobacco smoking (36.4%) and cigarette smoking (32.8%) was higher among men compared to women (18.0%, 3.6%, respectively) [8]. The prevalence of tobacco smoking was reported high among students 12–15 years old in 2016, where 17.5% of the students (28.6% of boys and 7.1% of girls) were current cigarette smokers [9].

The WHO STEPS survey was conducted in Palestine in 2010–2011. The prevalence of overweight (BMI ≥25 kg/m^2) and obesity (BMI ≥30 kg/m^2) was 57.8% and 26.8% among adults, those between 15 and 64 years old. The prevalence of obesity was higher among women than men (30.8% vs. 23.3%) [10].

13.4 Cancer Screening Programs

In Palestine, cancers that are amenable to early detection are being diagnosed at a later stage than in high-income countries. The establishment of early detection programs may be the most feasible strategy in the country. The only active screening program in Palestine is for breast cancer. The Palestinian Breast Cancer Program (PBCP) is a national program, established in 2008, for early breast cancer detection.

The program introduced a mobile mammography unit with centralized image reading taking place at the Palestinian Ministry of Health. The Ministry of Health began providing free mammograms for women younger than 40 years old and for young women who were considered at high risk in 2008–2009 in the West Bank and in 2010 in Gaza. In 2014, Augusta-Victoria Hospital (AVH) and national PBCP introduced a mobile mammography unit with centralized reading at AVH to increase patient access to breast cancer screening. There are 19 mammographic machines in the West Bank and 20 mammographic machines in Gaza (19 in the government sector, with the remainder in the private and non-governmental sector) [5].

Although the Palestinian Breast Cancer Program has been relatively successful in detecting cancers at an early stage; it still needs considerable improvement to be truly effective. Indeed, there are financial constraints. However, a major challenge is in public education to overcome cultural barriers against screening.

13.5 Cancer Prevention Programs

In Palestine, cancer care is focused on treatment with little emphasis on other elements of the cancer care continuum that includes screening and prevention. For instance, there is no cancer control plan for preventable cancers such as lung, head and neck, tobacco-related cancers, alcohol-related cancers, or cervical cancer.

Particular attention is needed to combat rising cancer rates in the future [6]. Over one-third of cancers can be prevented through controlling known risk factors [7]. Unfortunately, many cost-effective prevention measures have yet to be implemented in Palestine. Lung, breast, and colon cancer are three of the most top 10 common cancers in Palestine that could be prevented. Unfortunately, there are no effective national programs addressing preventable cancer risks in Palestine.

Although smoking rates remain high in the region, there has been some progress in combating smoking in Palestine. In 2015, taxes on tobacco products have also increased. Unfortunately, there are currently no smoking cessation clinics available for counseling.

No organized programs for cervical cancer screening or for Human Papillomavirus (HPV) vaccination in young people currently exist in Palestine. More pressingly, given the unique situation in Gaza as a conflict zone, there is an important public health requirement that needs to be addressed to adequately educate the population that might have been exposed to increased levels of potentially carcinogenic and toxic materials.

13.6 Cancer Diagnosis

13.6.1 Imaging Diagnosis

Cancer diagnosis is an extremely complex task, requiring advanced radiological, nuclear diagnostics, and cyto-molecular markers. Almost every specialized hospital has a conventional diagnostic section, including general X-rays machines, Computed Tomography (CT) scans, Magnetic Resonance Imaging (MRIs). However, fragmented biopsies can be performed safely by experienced radiologists. Recently, the use of advanced imaging modalities such as Positron Emission Tomography (PET/CT) scan was introduced in Palestine, in 2018. However, the country lacks expert personnel. Nuclear medicine specialists are not available in Palestine. Consequently, all images are to be reviewed and reported by doctors abroad. Currently, three PET-CT scans are available in the country. All three are located outside the Ministry of Health. Fortunately, one is in the most comprehensive cancer center at AVH in East Jerusalem. AVH has a strong collaborative agreement with the King Hussein Cancer Center (KHCC) in Amman. All images are being reviewed and reported by experts on nuclear medicine at KHCC. The second is in a general hospital in the south of Palestine and a third is in a private diagnostic center in the north. Regulations pertaining to the use of advanced imaging modalities such as PET/CT scans have

been implemented, approved, and regulated by the referral department, Ministry of Health medical committee [11].

13.6.2 Cytogenetics and Molecular Genetics

Treating cancer or hematological conditions requires an established cytogenetic-molecular laboratory for the Next-Generation Sequencing (NGS). In Palestine, most cancer departments lack such facilities. The only established advanced diagnostic laboratory is at August-Victoria Hospital- East Jerusalem, which was established in 2016. The laboratory has conventional cytogenetic, Fluorescence in situ Hybridization (FISH) analysis and molecular tests for most of the hematological disorders and some solid tumors like lung and colon cancer. Despite the progress we have achieved, we are still lacking more sophisticated diagnosis methods such as liquid biopsy or evaluating circulating tumor DNA (ct-DNA) components. It is difficult to access specialized laboratories equipped for either ct-DNA detection or molecular testing on cancer specimens, leading to most of the specimens being referred outside.

13.7 Treatment

13.7.1 Medical Oncology

Nowadays, there are two main branches of cancer care in Palestine: governmental and non-governmental branches. For those who have not been referred elsewhere, there are four government hospitals in the West Bank and three in the Gaza Strip that are able to treat most of the patients. These hospitals have small oncology and hematology units (10–15 beds), without specialized pathology laboratories or advanced diagnostic facilities. However, surgery and chemotherapy facilities are generally available in these hospitals, but no radiotherapy services are present on-site.

Recently, two non-governmental hospitals have opened their oncology and hematology services, National University Hospital in Nablus, and Al-Istishari Hospital in Ramallah city. Each has a limited vacancy with 20 beds for inpatients and 10–15 beds for outpatient's chemotherapy infusion. Both hospitals are equipped with pathology and advanced conventional laboratory sections with two pathologists on-site in each hospital.

Currently, Augusta-Victoria Hospital Cancer Care Center, located in East Jerusalem, is the only comprehensive cancer center in Palestine. It was established in 2006, after the introduction of radiotherapy services, supported by the Norwegian government and operated by the Lutherian Federation. This center includes more advanced pathology, cytogenetic-molecular facilities, apheresis unit (1 machine),

and (1) PET-CT scan. The AVH has two departments for oncology and hematology with 10–15 beds, more expanded outpatient care, a radiotherapy unit with three linear accelerators, and isolated Bone Marrow Transplantation (BMT) units of 4 beds for high-dose chemotherapy consolidation.

13.7.1.1 Hematology

Before 2008, most hematology patients were referred to neighboring countries like Jordan, Egypt, and occupied 1948 land hospitals. Despite the progress we have made in medical oncology, advanced hematology and Bone Marrow Transplantation services are still lacking. There are fragmented hematology services in most government hospitals. Two non-government hospitals operate and serve hematology services. However, not in a systematic and complete manner. An additional sophisticated hematology department was established in AVH, in 2016, helped by a European Union's (EU) grant for complete hematology and Bone Marrow Transplantation services. The hematology section contains 10–15 beds for inpatients, larger outpatient care and Hematopoietic Cell Transplantation units of four isolated beds for stem cell infusions [12].

Bone marrow Hematopoietic Cell Transplants (HCTs) are available in Palestine, by using high-dose chemotherapy infusions (autologous transplants). Adult and pediatric patients requiring Hematopoietic Cell Transplant must be referred to neighboring countries' hospitals in occupied Palestine 1947 land or travel abroad to Jordan or Egypt. This entails significant distress and cost to the patient, their families, and the Health Care Providers (HCPs). Several models have been initiated, leading the Palestinian government to establish a Hematopoietic Cell Transplant to cover this demand in collaboration with Al-Najah National University Hospital (NNUH) and Augusta-Victoria Hospitals (AVH). Each unit has only four beds isolated for high-dose chemotherapy. This situation will change soon as several leading hospitals announced plans to include Bone Marrow Transplant services shortly. They will include different types of allogeneic transplants: matched, mismatched, unrelated, and haploidentical transplants.

13.7.1.2 Immunotherapy/Targeted Therapy/Biological Agents

Conventional oncology drugs are available in each hospital with occasional shortages in Gaza Strip hospitals due to logistical and political reasons. In Palestine, it is extremely difficult to have access to approved and highly expensive medications, including the newer immunotherapy drugs and targeted agents. Not all United States Food and Drug Administration (FDA) approved medications are easily accessible to patients. Patients are mainly offered medications (not listed in the formulary list of the Ministry of Health) after gaining special approval from the referral department's medical committee in the Ministry of Health on specific medication or intervention, "Referral path in MoH." All these immunotherapy drugs and targeted agents given

to a selected limited number of patients have no universal use in governmental and non-governmental hospitals due to the high cost. Cost-effective analysis is yet to be made. Hospitals offering those drugs usually request them directly from the pharmaceutical companies and, if indicated, the drug cost would be covered.

13.7.2 Radiation Oncology

In Palestine, radiation therapy services are extremely limited. Radiation oncology is currently offered in one facility with only three linear accelerators available in East Jerusalem to serve all Palestinian oncologic needs (1/1,000,000 inhabitants). 3D, Intensity-modulated radiation therapy (IMRT) planning is implemented. There is no brachytherapy available, and all patients must be referred abroad. The problem is not just the lack of new radiation therapy machines. Introducing isotopic machines in the West Bank is not just a money shortage issue. The military occupation and the daily obstacles prevent patients from freely moving, also affect cancer care outcomes. Although financial investment in technology is undeniably necessary, many deaths from untreated cancer also occur for political reasons in the form of the deliberate denial of access to care [13].

13.7.3 Surgery

In Palestine, there are no structured oncology surgery services, and we are lacking in specialized centers for oncology surgery. The surgery is getting a step forward to improving in the form of acquiring new physicians, specialized in oncology surgery, and subspecialized in breast surgery for instance. There was an established collaborative training program for oncology surgery with King Hussein Cancer Center in Jordan. Two physicians have just graduated and started their mission in Palestine. However, there are no robotic surgeries for cancer or Hyperthermic Intraperitoneal Chemotherapy (HIPEC) procedures available. Oncology patients can have their surgeries in governmental and non-governmental hospitals, where they are being treated for their cancers.

13.7.4 Pediatric Oncology

The incidence of pediatric hematology and oncology cases is within the expected range, with a total of 170 children in the West Bank, reportedly (aged 0–17), diagnosed with cancer in Palestine in 2019 [14, 15]. There is underreporting of children cancer cases in the Gaza Strip. By contrast to high-income countries, 10% of new cancer patients were children less than 17 years of age. The three most common

cancers in children are leukemia (30%), brain and other central nervous system tumors (20%), and lymphomas (14%) [16].

There are three pediatric oncology departments in the West Bank and one in the Gaza Strip, located in both public and private hospitals. In 2012, Huda Al Masri Pediatric Cancer Department was the first and only public cancer department for children in Huda's name at Beit-Jala Hospital. Two other facilities were established in East Jerusalem and in the north of Palestine-Nablus. These facilities are well staffed with pediatric oncologists, nursing staff, therapists, and only in East Jerusalem is equipped with radiation oncology. However, the most significant limitation in pediatric oncology in Palestine remains the lack of coordination and lack of Hematopoietic Cell Transplant centers.

13.7.5 Palliative Care Track

Palliative care is an emerging specialty in Palestine with no organized national program in place to date [17]. Several small non-profit organizations exist, but their efforts are limited by several factors that include financial constraints and general societal aversion to the notion of palliation [18]. There is an urgent need for a comprehensive palliative care platform for hospital and home-based care, as well as a need for psychosocial programs and integrated research for end-of-life care [17–20].

There are two palliative care facilities in the West Bank and East Jerusalem. Al-Sadeel Society, registered as Non-Governmental Organization (NGO), provides palliative care services in Bethlehem city, focusing on educating physicians, nurses, patients, and their families about the fundamental practices [18]. The second is within AVH in East Jerusalem with a dedicated, though small inpatient service, but with no at-home care available. The Lutheran World Federation has secured the permits necessary and begun construction of the Elder Care and Palliative Medicine Institute (ECPMI) in 2019. This 144-bed facility on the Mount of Olives will nearly double the capacity of AVH [21, 22].

Recently, a training program was opened in collaboration within the three facilities Al-Sadeel, Palestinian, MoH, Augusta Victoria Hospital at Ibn-Sina College for Health Sciences to train undergraduate nursing students on palliative care [20]. Hospice and end-of-life care services are not available for terminally ill Palestinian patients.

13.8 Research and Education

Despite the improved cancer care in Palestine, it was not integrated with the health research. There is a mismatch between the distribution of disease burden and diseases investigated in published articles from Palestine between 2000 and 2015 [20]. The number of published Palestinian medical and health research articles increased

over time, almost doubling every 5 years (13% between 2000 and 2004, 32% between 2005 and 2010, and 55% between 2011 and 2015). However, cancer research is one of the most understudied fields relative to cancer burden, representing only 3% of the total health research compared to infectious (20%), nutritional (11%), and mental and substance use (11%). The highest priority should be given to research investigating conditions that most substantially contribute to disease burden. Cancer is one of the leading causes of death in Palestine approaching 14% [23]. This gap can be explained by several factors that include researchers' interest and expertise. Limited research infrastructure and funding resources drive researchers to accept the funder agenda that is not commonly aligned with local community needs. This should be implicated in establishing a national medical and health research priority-setting in Palestine. This fosters a dialog between researchers, policymakers, funders, and end-users/patients [24].

Despite the relatively limited research capacity, recent publications led by investigators in Palestine are appearing in premiere medical journals [20, 23–25]. Research specifically targeting the Palestinian population should be undertaken to establish a proper future cancer care plan, which will likely be different from other societies. Therefore, treatment protocols based on a western population must be modified to fit the unique patient population in Palestine with different genetic makeup.

There are two Palestinian medical schools in the West Bank and one in Gaza. In 2005, the Palestinian Oncology Society was established with a total of 59 members, including medical oncologists, hematologists, general surgeons, and pathologists. The mission is educational and has no major effects on policymakers. In Palestine, there is only one medical oncology training program for 3 years with 1 year abroad, registered under the Palestinian Medical Council (PMC). One or two graduates annually. We do not currently have an established training program in both hematology and Bone Marrow Transplantation.

Further, epidemiology cancer research in Palestine is in its early stages, utilizing descriptive types of studies. The available research is limited to knowledge, perception, and attitude about cancer types and their symptoms. Most of the research was focused on breast cancer [26–29].

13.8.1 Publications

A list of publications is provided in Appendix.

13.9 Cost-Effective Cancer Care

Healthcare in Palestine has been a major concern of the Palestinian government since 1994, when the Palestinian authorities took over the administration of healthcare after the signing of the Oslo Accords. Investment in healthcare has been

supported by the World Health Organization (WHO) and foreign donors, especially the United States Agency for International Development. Despite major challenges, primary healthcare in Palestine is among the best in its neighboring Arab countries in terms of life expectancy and maternal, infant, and child mortality rates. Cancer treatment is covered by the government health insurance in Palestine and in neighboring countries. About 13.5% of the healthcare budget goes to patients with malignant tumors.

13.10 Challenges and Advantages

13.10.1 Specialized Oncology Services

Before 2000, cancer care in Palestine was fragmented with no cooperation between oncologists, pathologists, surgeons, and radiologists. Cancer care focuses on treatment with little emphasis on other elements of the cancer care continuum, such as prevention, early detection, screening, and diagnosis. Comprehensive cancer care centers were not present. Cancer care was given in isolated sections in government hospitals only. Few support services were in place, such as palliative care, nutritional and psychosocial support, or rehabilitation services. Because of the lack of specialized services, most of our patients were referred to neighboring countries.

In 2008, the Ministry of Foreign Affairs (MFA) of Norway funded a 6-year program. This project has been implemented through Norwegian Church Aid. The aim was to establish a comprehensive cancer center for adults and pediatrics in East Jerusalem at Augusta-Victoria Hospital (AVH). AVH is a non-profit, Non-Governmental Organization, operated by the Lutheran World Federation. The hospital will cooperate with the Palestinian Ministry of Health. Aside from cancer care, the center planned to provide training and conduct research also [30].

13.10.2 Oncology Physicians

The shortage of cancer specialists in the region is acute, with only 5 radiation oncologists, 6 pediatric hematologists, 20 medical oncologists, 6 hematologists, 7 surgical oncologists, and 15 surgical pathologists, with little hemopathology training, registered in the Department of Health in Palestine and Palestinian Medical council [31]. Consequently, only one radiation oncologist and two medical oncologists are available per 100,000 population, which is half the number seen in the USA and the EU. However, it is like neighboring countries like Lebanon [32, 33]. Most oncologists and hematologists receive their training in different parts of the world, such as Europe, Jordan, specifically at the King Hussein Cancer Center, and other neighboring countries.

13.10.3 Cancer Care Capacity Building

Besides government hospitals located in the West Bank (N-3), Gaza Strip (N-3), and East Jerusalem (N-1), there are centers serving cancer patients in the private sector (N-3). In the West Bank, there are three oncology departments including Ramallah Medical Complex, Al-watani, and Jenin Hospitals in North Palestine. Three Gaza Strip centers, including Ranteesy Hospital, European Gaza Hospital, and the recently opened Children cancer department in the children's hospital. There are two medical oncology departments in the West Bank, Al-Najah National University Hospital, and a recently opened department in Al-Istishari hospital in the heart of Ramallah city. There is a comprehensive cancer center in East Jerusalem, Augusta-Victoria Hospital cancer care center (AVH CCC). There is a strong collaboration between governmental and non-governmental sectors through the referral department in the Ministry of Health.

In 2006, the first radiation service in Palestine was opened and accredited by the Joint Commission International, with the help of WHO and the International Atomic Energy Agency at AVH CCC. However, despite substantial progress, Augusta-Victoria Hospital Cancer Center is the most qualified cancer center with established advanced diagnostic services and imaging studies like PET-CT scans. In 2017, Al-Najah National University Hospital opened an oncology-hematology service with preliminary autologous Hematopoietic Cell Transplantation (HCT). In 2020, a third department was opened in Al-Istishari Hospital.

13.11 The Future of Cancer Care in Palestine

Cancer care in Palestine is improving and there is a strong collaboration between public and private facilities. This led to the creation of an organized referral system between the Ministry of Health hospitals, non-government, and private sectors. Collaborative efforts have been made to reduce the population's demands for cancer care.

Several new cancer care facilities have been announced to open in both public and private hospitals. One of the major advances is the plan to develop a national comprehensive cancer center in Ramallah City in the heart of the West Bank-Khalid Al-Hasan Cancer Center-currently on-hold. The design is already completed, and the center will initially operate with 250 beds, with plans to expand to 500 in the future. Specialized units for radiotherapy, medical and surgical oncology, hematology, palliative care, and Hematopoietic Cell Transplantation are planned with a projected opening within 10 years. Besides providing much-needed oncology care, the center will train medical graduates for careers in medical oncology, hematology, radiation oncology, and others. This will foster progress toward more integrated clinical care. A research network will be formed to partner with national and international leading cancer centers [34].

13.12 Conclusion

The Palestinian healthcare system is improving, despite the political and financial constraints. Primary healthcare is amongst the best five healthcare systems in the Arab region. Cancer care is available in several public and private healthcare facilities. However, lacking a more specialized cancer subspecialty, for example, Hematopoietic Cell Transplantation. Comprehensive oncology care is present in one large cancer center in East Jerusalem and plans to open new facilities soon, Khalid Al-Hassan cancer Center. Highly trained Health Care Providers (HCPs), along with government financial and logistic support, have improved cancer care in Palestine. Strong national and international collaborations will enhance comprehensive cancer care and research initiatives with Arab and other countries.

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

Appendix: List of Publications

1. Cancer care in the Palestinian Territories. Lancet Oncol. 2018;19(7):e359–64. https://doi.org/10.1016/S1470-2045(18)30323-1.
2. Cancer care in the Palestinian territories—the ASCO post. 25 Oct 2018 https://ascopost.com. Accessed 28 May 2021.
3. The Palestinian National Institute of Public Health. Performance of mammography screening in the Palestinian National Institute of Public Health. http://pniph.org/site/article/15. Accessed 7 June 2018.
4. Azaiza F, Cohen M, Awad M, Dauod F, et al. Factors associated with low screening for breast cancer in the Palestinian. Cancer 2010;116:4646–55.
5. Al Waheidi S, McPherson K, Chalmers I, Sullivan R, Davies EA. Mammographic screening in the occupied Palestinian Territory: a critical analysis of its promotion, claimed benefits, and safety in Palestinian Health Research. JCO Global Oncol. 2020;6:1772–90.
6. Black WC, Haggstrom DA, Welch HG. All-cause mortality in randomized trials of cancer screening. J Natl Cancer Inst. 2002;94:167–73.
7. Gøtzsche PC, Jørgensen KJ. Screening for breast cancer with mammography. Cochrane Database Syst Rev. 2013;13(6):CD001877.
8. Marmot MG, Altman DG, Cameron DA, et al. The benefits and harms of breast cancer screening: an independent review. Br J Cancer 2013;108:2205–40.
9. Mittra I. Breast cancer screening in developing countries. Prev Med. 2011;53:121–2.
10. Mukhtar TK, Yeates DRG, Goldacre MJ. Breast cancer mortality trends in England and the assessment of the effectiveness of mammography screening: population-based study. J R Soc Med. 2013;106:234–42.
11. Portaluri M, Abu-Rmeileh N, Gianicolo E. Radiation therapy in palestine: not only money, but also real accessibility. Int J Radiat Oncol Biol Phys. 2017;98(3):504–5. https://doi.org/10.1016/j.ijrobp.2017.03.038.

12. Abu-Rmeileh NM, Gianicolo EA, Bruni A, et al. Cancer mortality in the West Bank, occupied Palestinian territory. BMC Public Health 2016;16:76.
13. Seir RA, Kharroubi A. Implementation of palliative care in Palestine: cultural and religious perspectives. Open J. 2017. https://doi.org/10.17140/PMHCOJ-SE-1-102.
14. Ambroggi M, Biasini C, Toscani I, Orlandi E, Berte R, Mazzari M, Cavanna L. Can early palliative care with anticancer treatment improve overall survival and patient-related outcomes in advanced lung cancer patients? A review of the literature. Support Care Cancer 2018;26(9):2945–53.
15. Khleif M, Dweib A, et al. Palliative Care and Nursing in Palestine. J Palliat Care Med. 2015;S4:003. https://doi.org/10.4172/2165-7386.1000S4003.
16. Khleif M, Imam A, et al. Quality of life for Palestinian patients with cancer in the absence of a palliative-care service: a triangulated study. Lancet. 2013;382:S23.
17. Khleif A, Shawawreh M, et al. Palliative care situation in Palestinian Authority. J Pediatr Hematol Oncol. 2011;33:S64–7.
18. Albarqouni L, Elessi K, Abu-Rmeileh NME. A comparison between health research output and burden of disease in Arab countries: evidence from Palestine. Health Res Pol Syst. 2018;16:25.
19. Abdalla B, Mansour M, Ghanim M, Aia B, Yassin M. The growing burden of cancer in the Gaza Strip, vol 20, www.thelancet.com/oncology. August 2019.
20. Giacaman R, Khatib R, Shabaneh L, Ramlawi A, Sabri B, Sabatinelli G. Health status and health services in the occupied Palestinian territory. Lancet. 2009;373:837–49.
21. Atrash F, Gil Z, Nammour W, Billa S. Building independence in health care and a partnership between Nations, vol 19. www.thelancet.com/oncology. July 2018.
22. Ashour A, Safi J, et al. Environmental risk factors associated with breast cancer in Gaza strip. Arch Food Nutr Sci. 14 Jan 2019.
23. Panato C, Abusamaan K, Bidoli E, Hamdi-Cherif M, Pierannunzio D, Ferretti S, Daher M, Elissawi F, Serraino. Survival after the diagnosis of breast or colorectal cancer in the GAZA Strip from 2005 to 2014. BMC Cancer. 2018;18(1):632. https://doi.org/10.1186/s12885-018-4552-x.
24. Economics of pediatric cancer in four eastern Mediterranean countries: a comparative assessment. JCO Glob Oncol. 2020;6:1155–70. https://doi.org/10.1200/GO.20.00041.
25. AlWaheidi S. Breast cancer in Gaza-a public health priority in search of reliable data. Ecancermedicalscience. 2019.
26. Qumseya BJ, Tayem YI, Dasa OY, Nahhal KW, Abu–Limon IM, Hmidat AM, Al–Shareif AF, Hamadneh MK, Riegert–Johnson DL, Michael B. Wallace barriers to colorectal cancer screening in Palestine: a national study in a medically underserved population. Clin Gastroenterol Hepatol 2014;12:463–9.
27. Genomic analysis of inherited breast cancer among Palestinian women: genetic heterogeneity and a founder mutation in TP53. Int J Cancer. 2017;141(4):750–6. https://doi.org/10.1002/ijc.30771.

28. Baloushah S, Salisu WJ, Elsous A, Muhammad Ibrahim M, Jouda F, Elmodallal H, Behboodi Moghadam Z. Practice and barriers toward breast self-examination among Palestinian women in Gaza City, Palestine. Sci World J. 2020:7484631. https://doi.org/10.1155/2020/7484631

References

1. The Palestinian Central Bureau of Statistics (PCBS). http://www.pcbs.gov.ps
2. Health inforum: the first report on oncology in Palestine. 1(15). 15 Nov 2002. Available at www.who.int/disasters/repo/8485.doc. Accessed 8 Oct 2018.
3. Ministry of Health, Health Annual Report, Palestine 2019, June 2020.
4. Ministry of Health, health annual report, Gaza, Palestine 2019, April 2020.
5. UNFPA and Palestinian Ministry of Health. Pathway to survival: the story of breast cancer in Palestine. https://healthclusteropt.org/admin/file_manager/uploads/files/1/2-BC in Palestine, Final for print 2019.pdf.
6. Katzke VA, Kaaks R, Kühn T. Lifestyle and cancer risk. Cancer J. 2015;21(2):104–10. https://doi.org/10.1097/PPO.0000000000000101.
7. Cancer Control. Knowledge into action. WHO guide for effective Programmes. Module 2: prevention. World Health Organization; 2007.
8. Tucktuck M, Ghandour R, Abu-Rmeileh NME. Waterpipe and cigarette tobacco smoking among Palestinian university students: a cross-sectional study. BMC Public Health. 2017;18(1):1.
9. Global Youth Tobacco Survey. West Bank 2016. Fact sheet.
10. Palestine STEPS Surveu 2010-0211. Fact Sheet.
11. The Use of Positron Emission Tomography (PET) for Cancer Care Across Canada, Time for a National Strategy, Susan D. Martinuk, 2011. https://www.triumf.ca/sites/default/files/TRIUMF-AAPS-Martinuk-PET-Across-Canada-REPORT.pdf. Accessed 1 July 2020.
12. Closeout Audit of Fund Accountability Statement of Augusta Victoria Hospital, New Bone Marrow Transplantation Program in West Bank and Gaza, Cooperative Agreement AID-294-A-13-00001, May 1, 2015, to August 31, 2016 https://www.oversight.gov/report/usaid/closeout-audit-fund-accountability-statement-augustavictoria-hospital-new-bone-marrow
13. Abu-Rmeileh NM, Gianicolo EA, Bruni A, et al. Cancer mortality in the West Bank, occupied Palestinian territory. BMC Public Health. 2016;16:76.
14. The Palestine Information Centre. Ministry of health reveals statistics about cancer in the Palestinian Territories. https://English.palinfo.com/news/2017/2/5/ministry-of-health-reveals-statistics-about-cancer-in-palestine.
15. http://site.moh.ps/index/Books/BookType/2/Language/ar. Accessed 19 Apr 2021.
16. https://www.pcrf.net/huda-al-masri-pediatric-cancer-department.
17. Khleif M, Dweib A, et al. Palliative care and nursing in Palestine. J Palliat Care Med. 2015;S4:003. https://doi.org/10.4172/2165-7386.1000S4003.
18. Khleif M, Imam A, et al. Quality of life for Palestinian patients with cancer in the absence of a palliative-care service: a triangulated study. Lancet. 2013;382:S23.
19. Seir RA, Kharroubi A. Implementation of palliative Care in Palestine: cultural and religious perspectives. Open J. 2017; https://doi.org/10.17140/PMHCOJ-SE-1-102.
20. Khleif A, Shawawreh M, et al. Palliative care situation in Palestinian Authority. J Pediatr Hematol Oncol. 2011;33:S64–7.
21. Elder Care and Palliative Medicine Institute (ECPMI). https://jerusalem.lutheranworld.org. Accessed 28 May 2021.
22. Albarqouni L, Elessi K, Abu-Rmeileh NME. A comparison between health research output and burden of disease in Arab countries: evidence from Palestine. Health Res Pol Syst. 2018;16:25. https://doi.org/10.1186/s12961-018-0302.

23. Al Waheidi S, McPherson K, Chalmers I, Sullivan R, Davies EA. Mammographic screening in the occupied Palestinian Territory: a critical analysis of its promotion, claimed benefits, and safety in Palestinian Health Research. JCO Glob Oncol. 2000;6:1772–90.
24. Abdalla B, Mansour M, Ghanim M, Aia B, Yassin M. The growing burden of cancer in the Gaza Strip, vol 20. www.thelancet.com/oncology. Aug 2019.
25. Khalid Halahleh MD, Robert Peter Gale MD. Cancer care in Palestinian Territories. Lancet Oncol. 2018;19:e359–64.
26. Pathway to survival: the story of breast cancer in Palestine. 2018.
27. Azaiza F, Cohen M, Awad M, et al. Factors associated with low screening for breast cancer in the Palestinian authority: Wiley Subscription Services, Inc., A Wiley Company, p. 4646–55.
28. Nissan A, Spira RM, Hamburger T, et al. Clinical profile of breast cancer in Arab and Jewish women in the Jerusalem area. Am J Surg. 2004;188(1):62–7.
29. Bendel M. Breast cancer in the Gaza strip: a death foretold. Physicians for Human Rights–Israel; 2005, p. 1–27.
30. Evaluation of the Strategic Cancer Care Initiative (SCC, Phase I&II evaluation-of-the-strategic-cancer-care-initiative-SCCI-phase-III). 22 Dec 2016.
31. American Society of Clinical Oncology. The state of cancer care in America, 2017: a report by the American Society of Clinical Oncology. J Oncol Pract. 2017;13(4):e353–94.
32. Zeidan YH, Geara F. Lebanon: an evolving hub for radiation therapy in the Arab world. Int J Radiat Oncol Biol Phys. 2015;91:888–91.
33. Corn BW, Symon Z. Radiation therapy in the Middle East: local and regional targets. Int J Radiat Oncol Biol Phys. 2014;90(5):975–8. https://doi.org/10.1016/j.ijrobp.2014.06.029.
34. Qatar Red Crescent Society Call No. (RES/QRC/2020/11). Call for Scientific Papers on Cancer in Palestine. https://www.jobs.ps/tenders/call-for-scientific-papers-on-cancerin-palestine-2579.html

Khaled Halahleh is a senior consultant Medical Oncologist Hematologist. He served as the Head of the Hematology section at August-Victoria Hospital Cancer Care Center, Jerusalem (2007–2013). Dr. Halahleh holds specialty certificates from the Jordanian Board of Medical Oncology and the Palestinian Board of Medical Oncology and Hematology. Currently, he serves as a senior consultant in Medical Oncology Hematology and Bone Marrow Transplantation Program at King Hussein Cancer Center, Jordan. He is an active member of several KHCC's institutional committees, including the Institutional Review Board, Drugs and Therapeutics Committee and Venous Access Device Committee. He is the author of 11 peer-reviewed articles and publications. His research interest is allotransplants in myeloid and lymphoid malignancies.

Niveen M.E. Abu-Rmeileh is a Professor of Epidemiology and Public Health at Birzeit University. She obtained her doctoral degree from the University of Glasgow. She has led national, regional, and international research. She is a board member of the Global Implementation Society (GIS). She is a member of the Eastern Mediterranean-Advisory Committee for Health Research (EM-ACHR) and the WHO-Eastern Mediterranean Research Ethics Review Committee (ERC). Dr. Abu-Rmeileh was ranked among the 100,000 most cited scientists, top 2 percent in their subfields. Her research interest is focused on three broad categories: Non-Communicable Diseases (with special focus on diabetes, cancer, and tobacco smoking), Reproductive Health, and Information Systems for Health.

Mohammad M. Abusrour was born and raised in Palestine. He is a graduate of Columbia University, USA, with a master's degree in Medical Physics. Mr. Abusrour has extensive experience in Nuclear Medicine Technology, Diagnostic Imaging Physics and Radiation Therapy Physics. Mr. Abusrour worked in hospitals in the USA and Palestine. He worked for Augusta-Victoria Hospital in Jerusalem (2006–2008). Mr. Abusrour has participated in IAEA projects to establish reference dose levels for patients in diagnostic radiology. Currently, he works as a senior specialist in healthcare quality related to diagnostic imaging and radiation oncology. Moreover, he serves as a member of the National Radiation Protection Committee in the UAE and other working groups.