Access to cancer treatment and diagnosis in the Eastern Mediterranean Region

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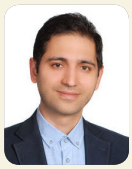
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The burden of noncommunicable diseases (NCDs), including cancers, is increasing in the Eastern Mediterranean Region (EMR). Based on estimates, cancer incidence and mortality in the region will double within the next 20 years. Improvements in the infrastructure and access to the essential cancer care services would improve patient outcomes and decrease the cancer burden in the EMR region.

We studied the access of cancer patients to diagnostic and therapeutic services in the EMR countries. We compiled data from various sources including, WHO, national and global reports. In addition, we perform international surveys in six EMR countries with different demographic and income conditions, including Iran, Oman, Jordan, Lebanon, Sudan and Pakistan. We found that EMR countries have variable conditions regarding access to diagnostics facilities, including CT scanners, MRI, and PET-CT scanners. While some countries lack a single PET/PET-CT scanner, high-income countries have installed more than 10 per 10,000 patients.

Surgical oncology and subspecialties for cancer surgery are not available in most of the EMR countries. Radiotherapy coverage in Syria, Afghanistan, Yemen and Pakistan, is less than 30%, while the coverage of radiotherapy services in Oman, Morocco and Iraq is equal to 60%, 80% and 80%, respectively. In contrast, this figure is about 200% in Qatar and 400% in Jordan.

The availability of oncology medicines is acceptable in most EMR countries, except Afghanistan, Sudan, Palestine and Iraq, where access to essential systemic treatment is limited. Out-of-pocket (OOP) expenses in low- and middle-income countries reach 70–75%, indicating the need to establish insurance industries in these countries.

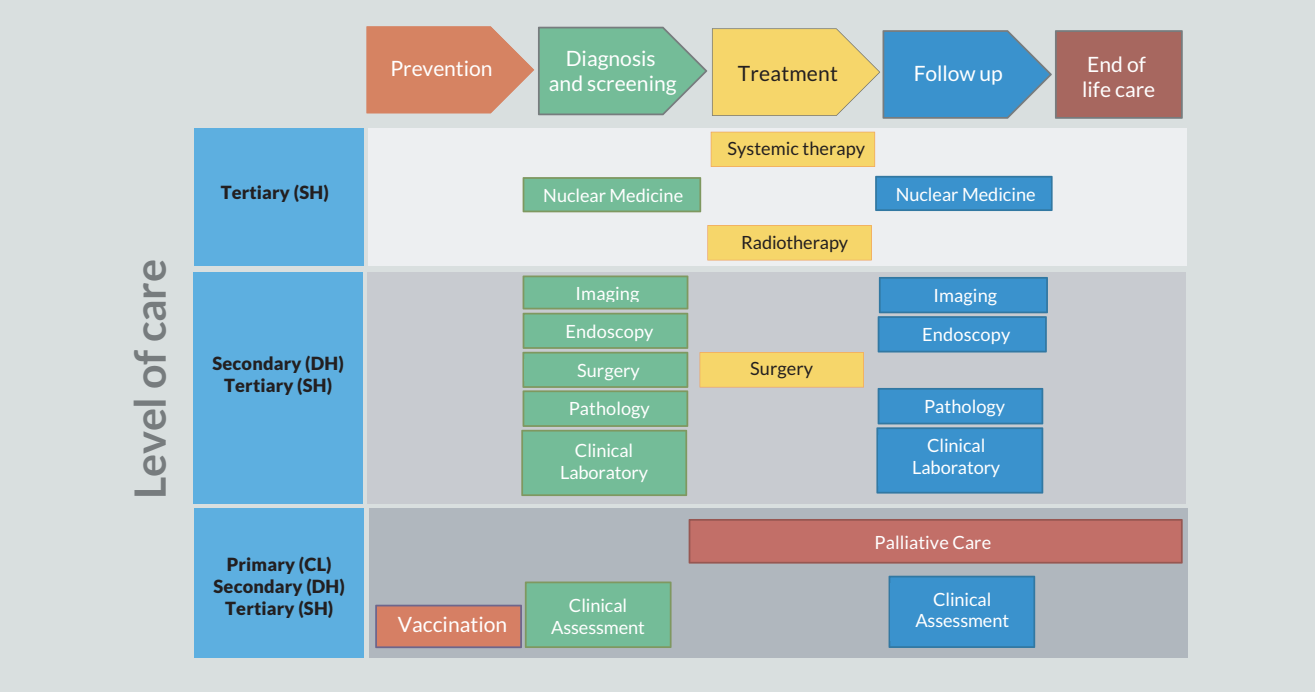
EMR countries need to regularly monitor the access of cancer patients to diagnostics and treatment technology. They should also have a plan for providing these facilities against future challenges, in terms of increasing incidence and burden of cancer in the region.

Introduction

The Eastern Mediterranean Region (EMR) is facing an upward trend in the burden of all noncommunicable diseases (NCDs), including cancer. The incidence rate of cancer is going to increase cancer incidence considerably over the next 20 years. It is projected that in 2040 the cancer incidence will be doubled solely based on population ageing and growth *(1)*.

The diagnosis of cancer at an early stage and access to optimal treatment had a demonstrable effect on the decline of cancer mortality in most developed countries *(2, 3)*. Cancer patients are usually diagnosed at the advanced stage in developing countries *(2, 4)* where human resource (HR),

Figure 1: Healthcare service delivery model used to identify priority medical devices list *(Taken from WHO Priority Medical Device in Cancer Management)*



physical capacity, and equipment are limited. However, recent awareness campaigns over the last two decades showed a trend for downstaging in several countries *(5)*. The mortality to incidence ratio in the low- and middle-income countries (LMICs) is 20% higher than that in high-income countries *(1)*. This difference is associated with access, quality of care, and cancer care efficiency *(6)*. Hence, scientific approaches are needed to assure more affordability of cancer care in ways that would benefit all stakeholders *(7)*.

The Sixty-sixth World Health Assembly endorsed the World Health Organization (WHO) Global Action Plan to prevent and control NCDs between 2013–2020 (resolution WHA66.10). One of the NCDs resolution targets is to ensure "80% availability of the affordable basic technologies and essential medicines, including generics, required to treat major noncommunicable diseases in both public and private facilities"*(8)*. In 2014, WHO developed a project to address the medical devices needed for cancer management; the main goal was to increase their accessibility, especially in LMICs (Figure 1). The results led to a list of priority of medical devices for clinical interventions for cancer care (screening, diagnosis, treatment and palliation) at global and country levels for six different malignancies (breast, cervical, colorectal, leukemia, lung and prostate) *(9)*.

Cancers are usually discovered through clinical examination, medical imaging and procedures such as endoscopy and cystoscopy, while final confirmation is made by histopathology tests. Besides, standard medical imaging and, recently, nuclear medicine methods such as bone scans and PET scans can increase accuracy for cancer staging. Treatments for cancers include surgery (resection of tumours and possibly affected areas such as lymph nodes), systemic therapy (including chemotherapy, nuclear therapy, hormone therapy, targeted therapy and immunotherapy), and radiotherapy (including teletherapy and brachytherapy) *(10)*.

We aim to investigate the existing conditions in EMR countries regarding diagnostic and therapeutic services for cancer patients, except prevention, early diagnosis and palliative care that are discussed elsewhere.

Method

We used various sources of information to assess the access to diagnosis and treatment of cancer patients in the EMR, including:

a) A review of the literature

We reviewed the following documents in this study:

- WHO Cancer Country Profile 2020.
- Assessing National Capacity for Prevention and Control of Noncommunicable Diseases: The 2015 Report of the Country Capacity Survey in the Eastern Mediterranean Region *(11)*.
- World Health Organization. Global Atlas of Medical Devices (2017) *(9)*.
- International Atomic Energy Agency, IRAC (Directory of Radiotherapy Centres).
- World Health Organization. Global Health Expenditure Database.
- ESMO International Consortium Study on the Availability, Out-of-Pocket Costs, and Accessibility of Antineoplastic Medicines in Countries Outside Europe *(12)*.

Table 1: Workforce and human resource related to cancer treatment and diagnosis per 10,000 new cancer patients *(Resource, WHO Cancer country profile 2020)*

Country	Income	Radiation oncologist	Medical physicist	Surgeon	Radiologist	Nuclear medicine	Medical and pathology lab scientists
Bahrain	**High**	n/a	286.3	1917.9	n/a	47.7	n/a
Kuwait		n/a	n/a	223.3	558.3	139.6	n/a
Oman		n/a	75.3	1673.7	n/a	27.1	n/a
Qatar		n/a	158.7	531.7	n/a	39.7	4000
Saudi Arabia		24.5	102.1	n/a	1114.2	32.3	n/a
United Arab Emirates		n/a	74.4	n/a	1064.4	31.9	n/a
Iran	**Upper middle**	22.2	31.8	115.5	211.1	18.2	n/a
Iraq		n/a	23.7	531.7	n/a	39.7	4000
Jordan		20	n/a	n/a	n/a	26.6	1835.2
Lebanon		n/a	11.6	1472.8	231.3	8.7	309.4
Libya		n/a	n/a	n/a	95.1	15.9	n/a
Djibouti	**Lower middle**	n/a	0.0	252.2	n/a	0.0	44.5
Egypt		n/a	15.5	1859.4	283.2	8.1	164.4
Morocco		n/a	9.5	480.1	135.5	12.3	112.7
Pakistan		1.8	n/a	128.7	57.5	14.4	n/a
Palestine		n/a	n/a	n/a	n/a	n/a	n/a
Somalia		n/a	n/a	15.1	n/a	0.0	n/a
Sudan		n/a	10.9	116.5	n/a	1.2	13.6
Syria		n/a	12.9	n/a	n/a	4.3	n/a
Tunisia		n/a	18.9	205.7	n/a	37.8	225.2
Afghanistan	**Low**	n/a	n/a	n/a	n/a	n/a	n/a
Yemen		n/a	4.6	78.9	207.1	4.6	844.3

- Current Status of Nuclear Medicine Practice in the Middle East *(13)*.
- World Bank Country Classification.
- Global Cancer Observatory (Globocan).

b) A "cancer technology survey" in six countries during 2015, including Iran, Lebanon, Jordan, Oman, Pakistan and Sudan that was updated in 2020.

c) The reports of the imPACT mission implemented in these six countries from 2010–2018.

We used "Tableau, 2021" software for mapping geographical date.

Results and discussion

Human resource development (HRD) for cancer control

Since there is limited information on HR conditions in EMR countries, we obtained data from studies conducted by the Cancer Country Profile and previous surveys (Table 1). There are no exact data about the number of medical and radiation oncology specialists in this region.

Although there are more than 100 surgeons for every 10,000 patients in most EMR countries, there is no detailed information on specialist cancer surgeons, including oncology surgeons, urologic oncologists and paediatric surgeons. Therefore, there is a shortage of human resources in this regard (Table 1). Specialists and facilities are concentrated in capitals and large cities, and specialists are not well distributed across the countries.

Despite the lack of a precise number of radiologists and pathologists in all countries of the region, radiology and pathology specialties are advancing toward subspecialties. Organ-based radiology is developing and has an important role in the correct interpretation of radiography results regarding diagnosis and determining the stage of disease progression *(14)*. Similarly, pathologists are working in a subspecialty manner on specific groups of diseases. Therefore, it is necessary to consider these points when providing the required specialists and improving the patients treatment quality *(14)*.

According to the findings of the cancer technology survey, paediatric oncology faces serious limitations in Sudan and Pakistan, where most children are treated by adult oncologists. However, there are limitations in terms of paediatric radiotherapy in most EMR countries, and children are treated by adults' radiation oncologists.

The main problem in many EMR countries is the migration of specialists to high-income countries and those who stay in these countries after completion of the training courses. Considering the growing incidence of cancers in developing countries, this brain drain of specialists can quickly lead to serious challenges and shortcomings in the region *(15)*.

HRD governance and training

Unlike in Jordan, Lebanon, Pakistan and Sudan, ministries of health were responsible for training specialists and monitoring the activities of the private health sector in Iran and Oman. Iran, Jordan, Pakistan, Lebanon and Sudan have great capacities for training specialists in the fields related to cancer diagnosis

Table 2: **Health insurance and out-of-pocket expenses in EMR countries – WHO database** *(Resource: https://apps.who.int/nha/database/ViewData/Indicators/en)*

Country	Income	Domestic General Government Health Expenditure (GGHE-D) as % Current Health Expenditure (CHE)	Share of out-of-pocket expenditure on healthcare, 2017	Voluntary Health Insurance (VHI) as % of Current Health Expenditure (CHE)	Compulsory Health Insurance (CHI) as % of Current Health Expenditure (CHE)	Government Subsidy to Social Health Insurance (TRAN) as % of Social Health Insurance (SHI)
Bahrain	High	58.00%	30.60%	11.5%	0.0%	0.0%
Kuwait	High	87.40%	12.60%	0.0%	0.0%	-
Oman	High	87.70%	6.70%	3.5%	0.0%	-
Qatar	High	80.70%	8.90%	9.2%	0.0%	-
Saudi Arabia (2016)	High	66.7%	16%	13.2%	0.0%	-
UAE	High	72.00%	18.90%	7.6%	0.0%	-
Iran	Upper intermediate	51.20%	41.80%	7.0%	32.1%	86.1%
Iraq	Upper intermediate	41.90%	58.00%	0.0%	0.0%	0.0%
Jordan	Upper intermediate	44.80%	30.40%	15.5%	15.7%	78.6%
Lebanon	Upper intermediate	50.00%	33.20%	15.8%	23.9%	24.5%
Libya (2011)	Upper intermediate	63.3%	36.7%	0.0%	0.0%	-
Djibouti	Lower intermediate	47.00%	26.50%	0.0%	11.2%	0.0%
Egypt	Lower intermediate	33.00%	60.10%	0.8%	4.1%	0.0%
Morocco	Lower intermediate	42.90%	53.90%	0.7%	20.3%	0.0%
Pakistan	Lower intermediate	31.60%	60.20%	1.0%	0.9%	0.0%
Sudan	Lower intermediate	18.00%	72.50%	1.0%	10.7%	73.6%
Syria (2012)	Lower intermediate	45.3%	53.7%	0.0%	0.0%	-
Tunisia	Lower intermediate	57.10%	39.10%	3.1%	30.6%	0.0%
Afghanistan	Low	5.10%	75.50%	0.0%	0.0%	-
Yemen (2015)	Low	10.2%	81%	1.1%	0.0%	-

and treatment, including radiology, pathology, cancer surgery, radiation oncology and medical oncology. Although Oman also has capabilities in this regard, HR supply largely depends on the return of migrated specialists from developed countries because most training courses, especially in diagnostics, are held abroad.

Cost of cancer care: Insurance status and out-of-pocket expenses

A wide disparity and lack of equity in terms of out-of-pocket (OOP) expenses is highlighted in the EMR (Table 2). The rate of OOP expenses in high-income countries (25%) was much lower in comparison to upper-middle-income countries (50%) and low-income countries (70%).

Governments fund more than 65% of the current health expenditures (CHE) of patients in high-income countries. This figure is about 40% in upper-middle-income countries and 63% in Libya. It is variable in lower-middle-income countries, from 18% in Sudan to over 40% in Tunisia, Syria and Morocco (Table 2).

Compulsory, optional and social insurance services do not provide full coverage for the treatment of patients in the region. Accordingly, the share of insurance coverage is less than 10% in the high-income countries in this region. Moreover, compulsory insurance covers more health expenses in Iran (30%), Tunisia (24%), Lebanon (20%) and Morocco (20%).

Out-of-pocket expenses also vary based on the income level of each country. This is about 6–30% in high-income countries, 40–60% in middle-income countries, 70% in Sudan and 75–80% in Afghanistan and Yemen. Therefore, the development of the insurance industry, especially in low-income countries, seems to be a priority to reduce OOP expenses in this region.

Health insurance coverage and reducing OOP expenses is the mainstay of improving access to care, increasing health insurance coverage could increase individuals access to prevention, early diagnosis, timely treatment and follow-up. Studies on previously uninsured adults in United States showed that when individuals are included in an insurance programme (Medicare) their access to care and preventive programmes was significantly increased *(16)*. Patients who do not have health insurance are less likely to access high quality treatment and they have less chances of survival than insured people *(17)*. The 2010 Patient Protection and Affordable Care Act (ACA) is the largest healthcare system change in the United States, which focused on improving the health insurance coverage. Recent studies have showed significant improvements in individuals' access to the continuum of cancer care after establishment of the ACA, and we could suggestt similar programmes and regulations for improving health insurance status in EMR countries *(18)*.

Diagnostic imaging

While diagnostic imaging such as conventional X-rays, ultrasound, mammography, CT and MRI are available in most EMR countries, Table 3 and Figures 2 and 3 show a lack of equity and an essential need for CT scans and mammograms in Iraq, Pakistan, Somalia, Sudan, Tunisia, Yemen, Syria and Afghanistan. The number of MRI scanners was less than 10 for 10,000 new cancer patients in Pakistan, Somalia, Sudan and Afghanistan.

Nuclear medicine

Advances in nuclear medicine have made undeniable contributions to the determination of the extent and stage,

Table 3: **Medical Equipment in EMR countries, per 10,000 new cancer patients** *(Resource; cancer country profile 2020)*

Country	Income	Mammography	CT scanner	MRI scanner	PET or PET/CT scan	New cancer patients
Bahrain	**High**	9.5	74.2	49.4	2.8	1048
Kuwait		Unknown	273.6	234.5	30.7	3582
Oman		45.2	138.5	111.4	6.0	3322
Qatar		111.1	246	309	15.9	1260
Saudi Arabia		81.7	251.6	158.5	11.0	24485
United Arab Emirates		129.6	422.8	373.9	12.7	4707
Iran	**Upper middle**	58.6	77.5	27.5	0.5	110115
Iraq		19.4	74.2	49.4	2.8	25320
Jordan		38.5	110.1	58.7	6.4	10898
Lebanon		185.6	161.9	63.6	9.3	17294
Libya		Unknown	98.3	52.3	1.6	6308
Djibouti	**Lower middle**	59.3	59.3	14.8	0.0	674
Egypt		26.4	54.3	15.1	1.5	128892
Morocco		43.6	53.0	22.7	2.3	52783
Pakistan		0.9	17.2	4.6	0.3	173937
Palestine		Unknown	Unknown	Unknown	Unknown	
Somalia		3.0	6.0	2.0	0.0	9942
Sudan		7.8	17.9	5.0	0.0	9398
Syria		n/a	25.9	19.4	0.9	25746
Tunisia		141.6	91.9	31.5	1.9	23170
Afghanistan	**Low**	1.0	3.6	1.5	0.0	15894
Yemen		17.4	66.8	23.5	0.0	19450

as well as the treatment, of cancers *(13)*. Since most common cancers, such as breast and prostate cancers, affect the bones, bone scintigraphy can facilitate the examination of the bones affected in cancer patients *(19)*. On the other hand, positron emission tomography (PET) helps to evaluate visceral metastases as well as the treatment response rate, especially in diseases such as lymphoma *(20)*.

Based on a study conducted by the International Atomic Energy Agency (IAEA), most EMR countries *(13)* are equipped with facilities related to single-photon emission computed tomography (SPECT) and gamma spectroscopy. However, the quantity of equipment was lower than that needed at the time. Currently, there are no accurate or available statistics on the number of devices in the region, and more studies are needed in this field.

PET or PET-CT scanning was higher than 10 per 10,000 in Kuwait, Saudi Arabia and UAE, and higher than 5 per 10,000 in Lebanon, Qatar, Jordan and Oman, but lower than 5 per 10,000 in Morocco, Syria, Libya, Egypt, Iran, Bahrain and Pakistan (Table 3). Other countries in the region lack PET or PET-CT scanning.

In terms of access to basic diagnostic molecules, most countries in the region have access to I-131 and Mo99. Regarding therapeutic molecules, I-131 is easily accessible in almost all EMR countries *(7)*.

Endoscopy

The cancer technology survey showed that all endoscopy modalities required for cancer diagnosis were available in the six study countries (Iran, Jordan, Lebanon, Oman, Pakistan and Sudan). Nevertheless, in Sudan, the prominent public cancer centre had a shortage of endoscopy services, endoscopy was mainly available in private centres where the cost can be 300 times higher. There was no significant waiting time for most diagnostic services, except for breast mammography, which could reach a maximum of two months, and an MRI appointment could take up to three months. Waiting time was not a significant barrier to cancer diagnosis, whereas financial support for patients was the main limitation in accessing diagnostic services.

Guidelines for the management of cancer patients

Approved national guidelines and protocols for cancer referrals and management are crucial for cancer care. These guidelines can guarantee the provision of the best possible diagnosis and treatment for patients based on the circumstances of each country. According to the WHO country capacity survey conducted in 2015, national guidelines for the diagnosis and treatment of cancer have been developed in all EMR countries except Libya, Palestine, Syria, Tunisia, Afghanistan, Pakistan, Somalia, Djibouti and Yemen (Table 4). Although all the details of the guideline developments are not available, they usually adopt international guidelines.

There is no specific referral plan for patients in most LMICs and relevant guidelines are not available. In other words, it is not clear what path the patient should go through from the

Table 4: **Treatment and palliative process,** *Cancer country profile 2020 and WHO EMR Country Capacity Survey 2016*

Country	Cancer management guideline	Number of treatment services (surgery, radiotherapy, chemotherapy)	Public cancer centres per 10,000 population	Pathology services	Bone marrow transplant	Palliative care availability	Cancer surgery (public	Subsidized chemotherapy (public)	Year
Bahrain	Available[1]	3	19.1	Available	Available	Available	Available	Available	2020
Kuwait	Available	3	11.2	Available	Not available[2]	Not available	Available	Available	2019
Oman	Available	3	6.0	Available	Available	Available	Available	Available	2019
Qatar	Available	3	7.9	Available	Not available	Not available	Available	Available	2016
Saudi Arabia	Available	3	4.1	Available	Available	Available**	Not available	Available	2019
UAE	Available	3	6.4	Available	Not available	Available	Available	Available	2019
Iran	Available	3	3.4	Available	Available	Not available	Available	Available	2019
Iraq	Available	3	17.4	Available	Not available	Not available	Available	Available	2016
Jordan	Available	3	3.7	Available	Available	Available**	Available**	Available	2019
Lebanon	Available	2	2.9	Available	Available	Available**	Available**	Available	2019
Libya	Not available	3	7.9	Available	Not available	Not available	Available	Available	2019
Djibouti	Available	1	Unknown	Available	Not available	Not available	Unknown	Unknown	2019
Egypt	Available	3	Unknown	Available	Available	Available	Available	Available	2019
Morocco	Available	3	1.9	Available	Available	Not available	Available	Available	2019
Pakistan	Not available	2	Unknown	Available	Not available	Not available	Available	Available	2019
Palestine	Unknown	Unknown	Available	Available	Unknown	Not available	Available	Available	2016
Somalia	Not available	0	Unknown	Available	Not available	Not available	Not available	Not available	2019
Sudan	Available	3	0.8	Not available	Not available	Unknown	Available	Available	2019
Syria	Available	3	3.0	Available	Not available	Not available	Available	Available	2019
Tunisia	Available	3	6.3	Available	Available	Not available	Not available	Not available	2016
Afghanistan	Not available	unknown	Not Available	Not available	Not available	Not available	Not available	Not available	2019
Yemen	Available	1	0.8	Available	Not available	Not available	Available	Available	2016

1. Available; in all the rows means generally available

*2. Not available; in all rows means generally not available ** Available according to the technical survey findings*

primary treatment level to specialized and subspecialized centres after being diagnosed with cancer or manifesting its symptoms (Table 4).

Based on the survey results, most specialists in all six EMR countries studied (i.e. Oman, Iran, Lebanon, Pakistan, Sudan and Jordan) stated that they follow international guidelines such as NCCN (National Comprehensive Cancer Network) to treat patients. The most important challenges of applying international guidelines are lack of facilities, the high cost of treatment in some cases, and other conditions specific to each country. There were no standard national guidelines, those generally accepted by most specialists, in the six countries studied. Although there are some documented experiences related to national guidelines for breast cancer, colorectal cancer, prostate cancer and melanoma in Iran, breast and prostate cancers in Sudan and for paediatric, breast and haematological malignancies in Lebanon, there is no nationwide audit or monitoring of the implementation of these guidelines and the treatment of patients based on the standards contained in them. Some private centres have their own internal monitoring systems (e.g. the American University of Beirut Medical Center in Lebanon and King Hussein Cancer Center in Jordan).

Adapting international guidelines according to national situations and consideration, execution monitoring, and auditing is recommended for EMR countries. It is especially recommended for low- and middle-income countries where many of the expensive treatments listed in international guidelines are not accessible.

The multidisciplinary cancer management team

National institutions in Iran, Lebanon, Jordan, Sudan, and Oman have experience regarding the provision of comprehensive treatment to cancer patients, according to established protocols, by multidisciplinary teams consisting of all specialties such as pathology, radiology, surgical, medical and radiation oncology organized at each cancer site. Although this is not performed in all centres in these countries, many of the Iranian, Lebanese, Jordanian and Omani patients are treated by such multidisciplinary teams *(21)*. Apart from these examples, due to the absence of organized tumour boards in most non-academic and community hospitals, cancer specialists usually hold meetings or participate in University Hospital Tumour Boards to discuss some of their patients when they see it necessary *(22)*.

Surgery

It is estimated that around 70% of the patients with solid tumours undergo surgery. Surgery is often curative in the absence of metastatic disease, and 49% of cured cancer patients are treated with surgery.

As previously mentioned, the number of registered surgeons and anesthesiologists is acceptable in most EMR countries. A WHO survey in 2015 also showed that most countries in the region have access to cancer surgery services and equipment. Based on the Cancer Country Profiles 2020, the number of

Table 5: **Provision of radiotherapy in the Eastern Mediterranean Region (EMR): Relation between RT facilities, population and cancer incidence**
International Atomic Energy Agency, DIRAC (Directory of Radiotherapy Centers)

Country	Income	Number of Photon And Electron Beam RT	Number of Brachy Therapy	Number of new cancer patient per year	Patients need RT	Patient / RT unit	Coverage
Bahrain	**High**	1	?	1,048	524	524	100
Kuwait		4	1	3,582	1,791	448	100
Oman		2	1	3,322	1,661	831	60
Qatar		3	1	1,260	630	210	200
Saudi Arabia		31	9	24,485	12,242.5	395	130
United Arab Emirates		5	1	4,707	2,353.5	471	100
Iran	**Upper middle**	121	14	110,115	55,057.5	459	100
Iraq		19	0	25,320	12,660	666	80
Jordan		45	18	10,898	5,449	121	400
Lebanon		23	3	17,294	8,647	376	130
Libya		6	1	6,308	3,154	526	100
Djibouti	**Lower middle**			674	337	0	
Egypt		119		128,892	64,446	542	100
Morocco		42	23	52,783	26,391.5	628	80
Pakistan		58	10	173,937	86,968.5	1,499	30
Palestine				4,779	0	0	
Somalia				9,942	0	NA	NA
Sudan		10	2	9,942	4,971	497	100
Syria		7	2	25,746	12,873	1,839	27
Tunisia		23	14	23,170	11,585	504	100
Afghanistan	**Low**			15,894	7,947	0	
Yemen		1	0	19,450	9,725	9,725	5

surgeons in most EMR countries is also favourable, especially in Oman and Egypt who have the highest number of surgeons for every 10,000 patients, however, patients in Afghanistan and Somalia have limited access to these services (Table 2). There is limited data on the number of surgical subspecialists in most EMR countries, such as cancer surgeons, breast surgeons, and urologic oncologists.

Based on our survey, cancer surgery services in EMR countries varies from fully specialized sections for cancer treatment, organ-based subspecialty (e.g. breast cancer surgery, urologic cancers surgery, and head and neck cancers surgery), to general surgery in non-specialized structures. The results also indicated that the duration of delay in surgery and treatment of patients is usually less than three or four weeks, suggesting an acceptable level of accessibility to surgical treatments for cancer patients in this region.

Given this status in the region, it would be highly recommended to develop subspecialty surgical training courses and to support patients tundergoing surgical procedures in specialized centres.

Systemic therapy, chemotherapy, hormone therapy, targeted therapy and immunotherapy

Systemic therapy currently plays an important role in the treatment of cancers. There are different types of systemic therapy. Chemotherapy, hormone therapy, target therapy and other immunotherapies are the main types of systemic treatment, and this treatment has been used to reduce the risk of recurrence, increase the survival rate of cancer patients as well as metastatic patients, reduce acute symptoms, and prevent rapid progression of the disease *(23)*. However, the main issue is providing the medicines, and the problem with targeted therapies and immunotherapies is the high cost of these drugs *(23)*.

There has always been a debate about the supply of oncology medicines. Because of the high cost of these drugs, countries must find more cost-effective alternatives. It is especially important for LMICs to determine which cancer medicines must always be available. In 1985, the WHO Expert Committee prepared a list of cost-effective drugs and published it under the title of the "WHO Essential List of Oncology Medicine" *(24)*. This list has been updated recently in 2019 "WHO Model List of Essential Medicines"*(25)* One of the main objectives of such a list was to ensure the full accessibility of these drugs for cancer patients in low-income countries *(24)*.

A survey conducted by the ESMO International Consortium in 2017 *(12)* investigated non-European countries, including EMR countries, in terms of accessibility and availability of the drugs mentioned in the "WHO Essential List of Oncology Medicine". The results showed that the availability of oncology medicines is at a good level in most EMR countries, except Afghanistan, Sudan, Palestine and Iraq. In fact, the drugs mentioned in this list are always available in most countries. Afghanistan and possibly Yemen are experiencing far more serious problems than other

countries, in a way that essential medicines are not available to patients in more than half of the cases.

In terms of drug expenses, 100% of expenses in Afghanistan and Pakistan and 50–100% of expenses in Morocco are paid by patients. In Iran, patients' share of drug expenses is less than 25%. However, these data are related to the years before 2017, and now conditions have changed. The implementation of the Health System Transformation Plan in Iran in 2017 has reduced cancer patients' share of drug expenses to less than 10%.

Developing a list of essential medicines for cancer treatment is probably the first step for every country to supply these drugs and ensure their accessibility. The next step is to ensure that these drugs are administered only by their exact indication *(26)*. For instance, as an expensive anti-cancer drug, Herceptin is only required for 20% of patients with breast cancer with positive Her2 receptors. Accordingly, a serious supervision mechanism has been developed in Iran to ensure drug administration is only for indicated cases *(27)*. The biosimilar drug production technology is a new approach developed recently for reducing the burden of expensive drugs and is used in India *(26)* and Iran to supply the required drugs. Compulsory licensing is another approach developed in Thailand, India and Iran to increase access to expensive drugs by producing expensive drugs and providing them to patients without observing their patent *(28, 29)*. Of course, this approach can be associated with some disadvantages, and governments should consider the pros and cons of this strategy *(25, 6)*. Similar difficulties exist regarding the immunotherapy drugs or personalized medicines because they are newly developed agents and have not attracted the attention of health authorities in the Middle East. However, given the increasing development and proven effectiveness of these drugs in a wide range of cancer patients, long-term planning for accessibility of these drugs is inevitable.

The cancer technology survey indicated that not only the drugs mentioned in the WHO Essential List used, but also newer and more effective medicines were provided to patients in Oman, Jordan, Lebanon and Iran. Ministries of health provide these drugs to patients for free in Oman, Jordan and Lebanon (for people who have no insurance). There is no essential list in Pakistan and Sudan. Although cancer drugs are entirely free in Sudan, they are not necessarily available in 100% of cases.

The WHO Country Capacity Survey, 2015, reported that subsidized chemotherapy is available in almost all EMR countries. Somalia, Tunisia and Afghanistan have severe restrictions on chemotherapy services (Table 4). The survey findings also backed this result. Accordingly, chemotherapy beds are available in all six studied countries (Oman, Iran, Jordan, Pakistan, Somalia and Lebanon), and the general principles of patient, physician and caregiver safety are observed. Oncology medicines are prepared and injected under the highest international standards in several centres in Iran, Jordan and Lebanon. Also, there is virtually no waiting time for chemotherapy counseling or hospitalization in any of these six countries.

The main problem with the accessibility of chemotherapy services is that most specialized centres are located in major cities. Patients living in small towns and villages have to travel for hours to receive these services. Other countries in the region can use Oman's successful experience in this regard.

To increase cancer patient's access to treatment and optimize the existing specialized human resources, the Ministry of Health of Oman created "satellite clinics" (SC) located in regional hospitals outside the capital city (more than 250 km from Muscat). Internists and nurses from these hospitals have been trained for six months at the National Centre of Oncology (NCO) and programmed to be retrained and participate in national conferences and seminars as part of their continuous medical education programme. Patients are first seen by a medical oncologist and a radiation oncologist from the NOC who attend a SC every month. The staff from the SC also participates in these clinics. Patients under follow-up are also seen as needed. SC's staff maintains continuous communication with the NOC via email, fax and telephone. The SC has a dedicated area with a security cabinet and a trained pharmacist for the preparation of the oncology medicines. The SC is included in the oncology medicines plan.

Bone marrow transplantation

Most EMR countries lack equipment and infrastructure for bone marrow transplantation. The WHO Cancer Country Profiles 2020 reported that bone marrow transplantation is generally available in Oman, Saudi Arabia, Iran, Egypt and Morocco, and there are restrictions in other countries (Table 4). However, the "cancer technology survey" results demonstrated that some private medical centres in Pakistan offer services related to bone marrow transplantation, fully funded by patients. In Lebanon and Jordan, cancer centres and university hospitals have specialized BMT units, some covered by insurance, some by ministries of health, and some by donations. It seems that EMR countries can take advantage of each other's experiences in establishing dedicated medical centres and the training required for specialized personnel.

For example, The BMT Centre at the Shariati Hospital in Iran, is an internationally recognized state-of-the-art transplantation centre, that performs over 400 transplants every year (including 150 on children) and is an excellent opportunity for training in the region.

Radiation therapy

About 50% of cancer patients need to receive radiotherapy

Figure 2: Distribution of CT Scanner devices in EMR Countries, 2021 (Number of CT scanner per 10,000 new cancer patients)

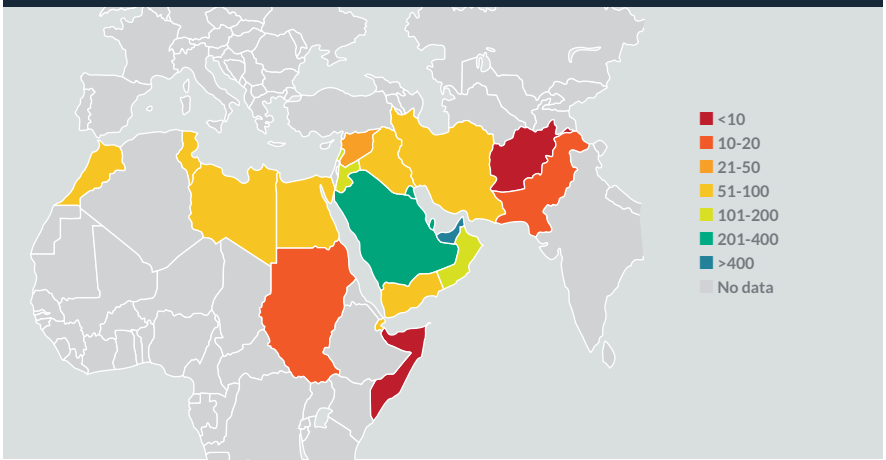


Figure 3: Distribution of mammography devices in EMR Countries, 2021 (Number of devices per 10,000 new cancer patients)

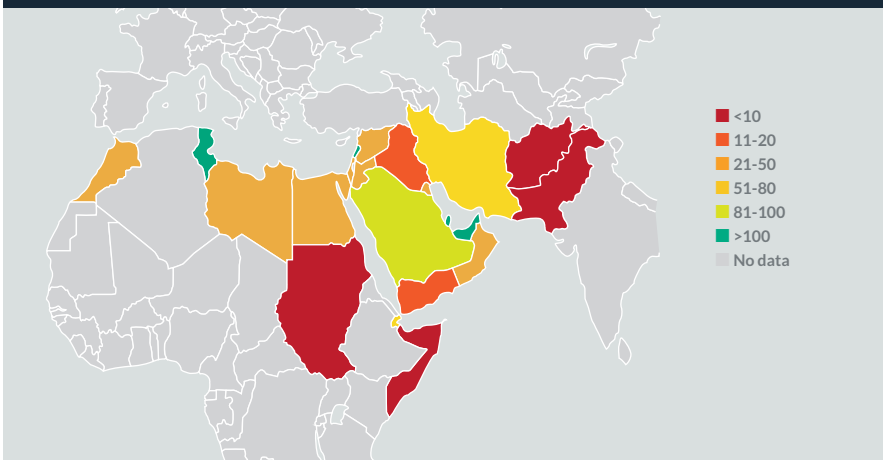
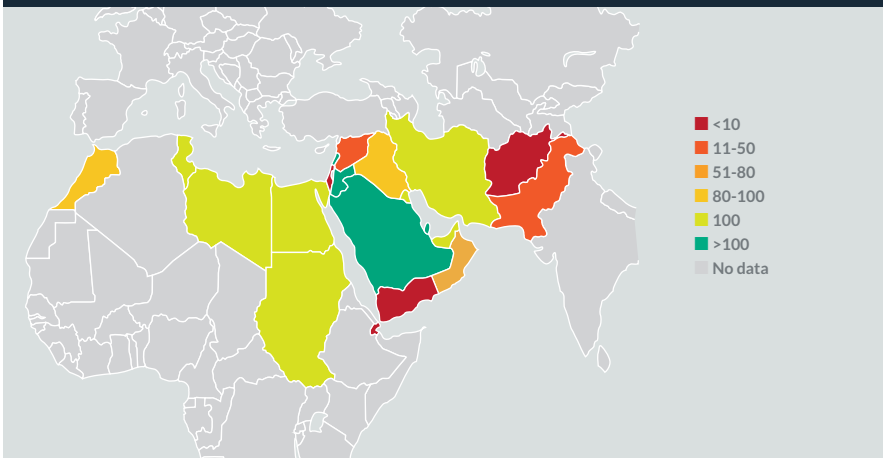


Figure 4: Figure 4: Coverage of needs for radiotherapy devices in EMR Countries, 2021 (1,000 patients need a minimum of one radiotherapy device)



(30, 31). Lower- and middle-income countries face serious restrictions on providing radiotherapy services to their patients worldwide, as 50% of patients in most of these countries do not have access to radiotherapy services *(32)*. Recent studies showed a strong association between access to radiotherapy and enough radiotherapy devices, indicating that other access factors, such as radiation megavoltage machines in a country, are an important factor in radiotherapy *(31)*.

Because the initial capital investment in radiotherapy units and housing is costly and they require highly specialized staff required to plan and deliver radiotherapy, the provision of radiotherapy is often seen as exceedingly expensive *(33)*. However, due to the high throughput of the equipment and its long life, and because most patients are treated as outpatients, radiotherapy is, in fact, one of the most cost-effective modalities of cancer therapy *(34)*.

The findings of the "cancer technology survey" showed that radiotherapy centres in all six studied countries provide services related to 3D conformal radiation therapy, linear particle accelerator, 3-D treatment planning system, CT simulation, and patient immobilization. On the other hand, a limited number of newer technologies, such as intensity-modulated radiation therapy (IMRT), are being developed and are available to treat patients, especially in Oman, Jordan and Lebanon. This new technology is also available to patients in Iran's public and private healthcare sectors. Although some techniques such as stereotactic radiosurgery (SRS) have been introduced in Iran, Oman, Lebanon, Jordan and Pakistan, they may not be widely available to patients in Iran, Oman and Pakistan. These facilities are available in Iran's private healthcare sector to a limited extent. The conflicts and political instability in the region have negatively impacted on provision of the services; the new sanctions imposed on Iran have restricted the accessibility of such equipment. Radiotherapy quality assurance programmes are carried out in most EMR countries, and all six countries studied have planned and developed programmes to evaluate and ensure the quality of radiotherapy care.

There is no accurate and precise information on the number of radiation oncologists, medical physicists, radiation therapy technologists and biomedical engineers in EMR countries. Reports show no serious shortage in these personnel in Iran,

Oman, Lebanon, Jordan, Lebanon and Pakistan. Nevertheless, the repair and maintenance of devices and equipment are considered a major problem in Sudan and Iran (especially after international Sanctions).

International estimates suggest that 50% of cancer patients need radiotherapy. On the other hand, a radiotherapy device can annually provide standard services to 500 patients *(33, 34)*, based on GLOBOCAN's estimates of the annual incidence of cancers in each of the EMR countries and the IAEA data (DIRAC) on the number of teletherapy devices,

Fortunately, there are enough radiotherapy devices in most EMR countries, as the availability of these devices is about 100% and more in 13 of the 21 countries in the region (Table 5; Figure 4). However, there is a lack of equity on access to radiotherapy devices. There are serious restrictions on access to radiotherapy devices in Syria, Afghanistan, Yemen and Pakistan, as less than 30% of the needs of patients is met. The coverage of radiotherapy services in Oman, Morocco and Iraq is equal to 60%, 80%, and 80%, respectively, whereas this figure is about 400% in Jordan and 200% in Qatar.

The EMR countries have different conditions in terms of brachytherapy. Although brachytherapy is very cost-effective and inexpensive and causes minimal complications, it is not yet well developed in many countries in the region *(35)*. However, there are a few but an insufficient number of brachytherapy devices in some countries such as Iran, Saudi Arabia, Jordan, Sudan and Tunisia. Morocco, equipped with 23 brachytherapy devices versus 40 teletherapy seems to be the leading county in this region in this regard. This is also being considered even in the countries with 100% and more coverage of radiotherapy.

Incidence of cancer varies between EMR countries; accordingly, the need for radiotherapy services are also variable. On the other hand, an increasing awareness of patients and physicians about the possibility of using radiotherapy can increase the need and demand for radiotherapy services. Since the incidence of cancer is increasing in EMR and developing countries, the existing equipment that covers 100% of needs may fail to do so in the near future. For example, two teletherapy devices in Oman met all the radiotherapy needs in 2015. These two devices can currently meet only 60% of the demand considering the increasing incidence of cancers in recent years (GLOBOCAN data from 2012–2018). Therefore, these countries should develop multi-year vision plans to achieve the desired goals by 2040.

Another problem is the geographical distribution of radiotherapy centres. Since these centres are mainly located in large cities, many patients cannot easily receive radiotherapy services due to the long distances between their place of residence and these centres. To overcome this problem, the government of Oman has constructed some hostels to accommodate the patients visiting radiotherapy centres for free. Some charity centres in Iran and Jordan provide inexpensive and low-cost accommodations for needy patients. Lebanon is a small country, and patients may choose the closest centre to them, and that offers less expensive treatment than the cancer centre that they are primarily using.

The issue we addressed regarding the accessibility of diagnostic and treatment facilities was simply the number of devices and geographical access. Most oncology centres are located in large cities, while many people live far from these cities. Studies have shown that long distances from centres can lead to a delayed or late diagnosis in the advanced stages of the disease. On the other hand, some treatments such as chemotherapy or target therapy should be performed every week for six months to one year. Some other treatments, such as radiotherapy, should be done in 35 daily sessions *(36)*. The distance between the patient's residential place and the medical centres providing such services may discourage the patient from initiating or continuing the treatment *(37, 38)*.

It has also been proven that patients can achieve better therapeutic results in centres with a high volume of clients, whereas receiving treatments in distant centres may be associated with more complications and less desirable therapeutic effects *(39)*. Therefore, the establishment of necessary infrastructure to increase the access to early diagnosis services in all areas, development of national referral guidelines, rapid referral of patients to the appointed centres, and the provision of travel and accommodation facilities to patients can effectively prevent delayed diagnosis and treatment among patients living in distant areas *(16)*.

Some models of remote service delivery have been designed in recent years to respond to the increasing need for palliative care in distant areas. Accordingly, patients receive the necessary services under the supervision of a physician, who has completed specialized courses in palliative care. These physicians work under the supervision of a team of specialists and consult them whenever necessary on a daily or weekly basis *(40)*. In addition, such medical centres can plan to provide services, such as chemotherapy, radiotherapy, and follow-up tests, to patients by physicians or nurses who are in direct contact with a team of specialists *(41)*. This can be an appropriate solution to reduce the problems of long-term treatment in cancer patients from a distant area.

There has been a successful initiative in India called the Pend Harker Model, which involved task shifting and the empowerment of an alternative oncology workforce. This model of cancer care delivery is widely used across four states in India. The model involved creating nodal cancer units in government-run district hospitals and creating a physician point of contact for cancer in every unit. The method involved

training general physicians for a month and giving them techno-mentoring backup for every cancer patient they see. They were supposed to play multiple roles, including early diagnosis, patient care, including chemotherapy and palliative care. One of their essential roles is advocacy and public education *(42)*. Benchmarking from this kind of model could be recommended, especially for countries with a lack of human resource and infrastructures in the EMR region.

Future direction

The EMR countries are challenged with an increasing incidence and mortality of cancer projected to double by 2040. Therefore, availability and access to quality cancer care need to be augmented. More broadly, there is a need to develop core and essential diagnostic and treatment facilities, in particular in low-resource countries. There is a need to enhance innovative financing mechanisms to improve access to cancer care.

EMR countries have different and variable conditions in terms of the accessibility of diagnostic and therapeutic services for cancer patients. A major challenge of cancer care in many countries is the supply of human resources specialized in cancer diagnosis and treatment. In addition, many medical specialists in these countries migrate to more developed countries to pass specialized training courses. The migration of specialists in the developed countries is another problem in this regard. Therefore, these countries need to take advantage of regional potential to train specialized personnel, empower their educational systems to provide specialized training courses, and provide better living facilities for medical specialists in order to guarantee the human resources needed for cancer diagnosis and treatment. For example, Pakistan, Iran, Lebanon and Jordan have provided adequate infrastructure for training specialized and subspecialized oncology specialists; other countries in the region can become both models for these four countries in the development of infrastructure and plan training courses in cooperation with them *(15)*.

To scale up access to essential technologies for cancer diagnosis and treatment in the EMR:, there is a need to invest in cancer surveillance and develop a robust information system, including a population-based cancer registries (at least covering a representative region of each country), a mortality system and an information system for all early detection programmers ensuring linkage among them.

The insurance industry has not much developed in EMR countries, and the majority of cancer diagnosis and treatment costs are funded either by patients or governments. Expanding insurance companies and finding solutions to reduce treatment costs should be among the top priorities of EMR countries, especially LMICs such as Afghanistan, Pakistan, Yemen and Morocco. ASCO, NCCN and BHGI have published guidance on implementation of resource-stratified guidelines and can be very useful for planning in LMICs and the EMR *(43, 44)*.

Afghanistan, Iraq, Pakistan, Somalia and Sudan currently face serious restrictions on diagnostic facilities such as CT scans and MRIs. These countries hence need to plan to meet the required equipment and facilities.

A national list of essential oncology medicines should be developed based on the WHO Essential Medicines List and the resources available to ensure access for all cancer patients to them; the list should be updated regularly. Consider developing and updating a national plan to ensure access to cancer diagnosis and treatment as part of the NCCP, including facilities and equipment based on the current availability, geographical distribution, needs and resources available. National inventory should be implemented and kept updated. The technology available in neighbouring countries should also be considered for possible collaboration.

Adaptation of cancer early diagnosis referral guidelines from the primary healthcare level to the secondary and tertiary levels based on the specific conditions of each country is another priority that should be considered in the development of cancer control programmes in the region in addition to the development of national resource-appropriate guidelines for cancer diagnosis and treatment. The establishment of the necessary infrastructure to implement and monitor the proper implementation of the locally adapted guidelines is an important step and should be taken into account in all countries of the region.

Another top priority in all EMR countries is the development of multidisciplinary teams and the establishment of the necessary infrastructure for decision-making and planning for the treatment of patients in these teams. National and regional collaboration is feasible and the use of online video conferencing, virtual training and using digital technologies for learning should be encouraged.

As the first cancer treatment modality, surgical procedures require the supply of subspecialized human resources. Although specialized surgeons, such as general surgeons, are available in most countries in the region, it is especially important to recruit trained organ-based specialists in cancer surgery.

One of the top priorities for some EMR countries, especially for the LMICs, including Afghanistan, Pakistan and Yemen, concerning systemic therapy is to prepare a list of essential medicines and provide the necessary infrastructure for the permanent and free supply of them.

The availability of radiotherapy devices and equipment is less than 30% in Yemen, Afghanistan, Syria, Sudan and Pakistan. Therefore, these countries need to plan to provide the necessary equipment and facilities for radiotherapy. Since the

estimates show that the number of cancer patients will almost double in the next 10 to 20 years, other EMR countries should also plan to provide appropriate equipment and facilities for cancer diagnosis and treatment *(45)*. Collaboration across the region, and government investment into cancer care at the patient level, would result in vast improvements in access to cancer care. ■

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Key recommendations:

- Build capacity and train subspecialists for cancer care including paediatric oncologists and onco-surgeons.
- Expand the insurance industry and providing the required infrastructure to reduce out of pocket expenditure, particularly in low-income countries in the region.
- Develop and implement national clinical practice and patient referral guidelines according to the specific conditions of each country in the region.
- Prepare and update the essential cancer medicines list, and ensure the proper accessibility and availability of medicines in each country, particularly in low-income countries.
- Plan how to supply the equipment for surgery, chemotherapy, radiotherapy and cancer diagnostic services, given the increase in the incidence rate of cancer over the next 10 to 20 years.
- Establish a cancer care network in the region for capacity buiding, exchange programmes, consultation services and medical tourism.
- Conduct regular surveys and assess the status quo of human resources including specialists, subspecialists, equipment, infrastructure and access to cancer care at regional, national and subnational levels.

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