Cameroon

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CAMEROON COUNTRY REPORT

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ABBREVIATIONS

SPH	Sectoral Plan Health
UNDP	United Nations Development Program
GDP	Gross Domestic Product
ITU	International Communications Union
CAMTEL	Cameroon Telecommunications
CAMWATER	Cameroon Water
CAMAIRCO	Cameroon Airlines Corporation
IHC	Integrated Health Center
DHC	District Health Center
DH	District Hospital
RH	Regional Hospital
GH	General Hospital
CH	Central Hospital
LMIC	Lower Middle Income Country
SCRIMM	Société Camerounaise de Radiologie, de Radiothérapie et d'Imagerie Médicale
SRANF	Société de Radiologie de l'Afrique Noire Francophone
SFR	Société Française de Radiologie

I. GENERAL COUNTRY PROFILE:

Cameroon is a small country situated in the continent of Africa, on the border of West Africa and Central Africa. It is bordered by Nigeria to the west; Chad to the north; the Central African Republic to the east; the Congo, Gabon, and Equatorial Guinea to the south; and the Atlantic Ocean to the southwest. The political capital of Cameroon is Yaoundé, and the economic capital is Douala.

A. **GEOGRAPHY AND POPULATION**

Referred to as 'Africa in miniature' by its citizens, Cameroon boasts a total surface area of 475,650 $km^{2.}$ It spans across three climatic zones, namely:

- The Sahel (Sudano-Sahelian) to the north, marked by desert plains;
- The Savannah (grassland) in the center, marked by mountain ranges and plateaus;
- The equatorial forest to the south, marked by wet plains that include the swampy lowlands of the Niger delta along its southwestern coastline. The coastline measures about 402 km with territorial waters extending about 50 nautical miles (90 km) into the sea.

Major geographical landmarks include:

- Mount Cameroon (also known as the Fako Mountain). This is a volcano situated in the southwest region that rises 4900 km above sea level. It is the second highest peak in Africa. It is still active-- the last eruption occurred in 2001. It lies only a few kilometers from the Atlantic Ocean.
- Several rivers including: the Wouri that drains into the Atlantic Ocean; the Sanaga (515 km, the longest in the country) in the central region; and the Benue in the North.
- Several lakes including: Lake Chad to the north and the Manengouba 'twin' lakes at the border of southwest and littoral regions.
- Several waterfalls including: the 'Lobe' in the south region which falls directly into the Atlantic Ocean, and the 'Menchum' in the northwest region.

As a result of these numerous geographical landmarks, the country is impacted by variable climatic conditions all year round. The two predominant seasons, however, are the rainy season and the dry season. The rainy season runs from March to September and the dry season runs for the rest of the year. Temperatures vary greatly from region to region. For example, the Sahel is hot and dry, the equatorial region is hot and humid, and the central region is more temperate.

The total population in 2017 is estimated to be 24,546 million people, with a population growth rate of 2.6%. Like most sub-Saharan African countries, the population is predominantly young. Life expectancy stands at 56 years. Until recently, most of the population lived in rural areas. However, a huge wave of rural to urban migration resulted in an urban population growth rate of 3.6 % in 2016, and an estimated urban population of 56.7% in 2017. Incomes are generally low, with a poverty rate estimated at 13.7%. The literacy rate is 69% with a gross elementary school enrollment of 117,134. Elementary school is free (no tuition fee) in public institutions, but the burden of school supplies is still borne by individual families.

The Human Development Index score in 2016 was 0.518 (UNDP). The country is ranked 153rd.

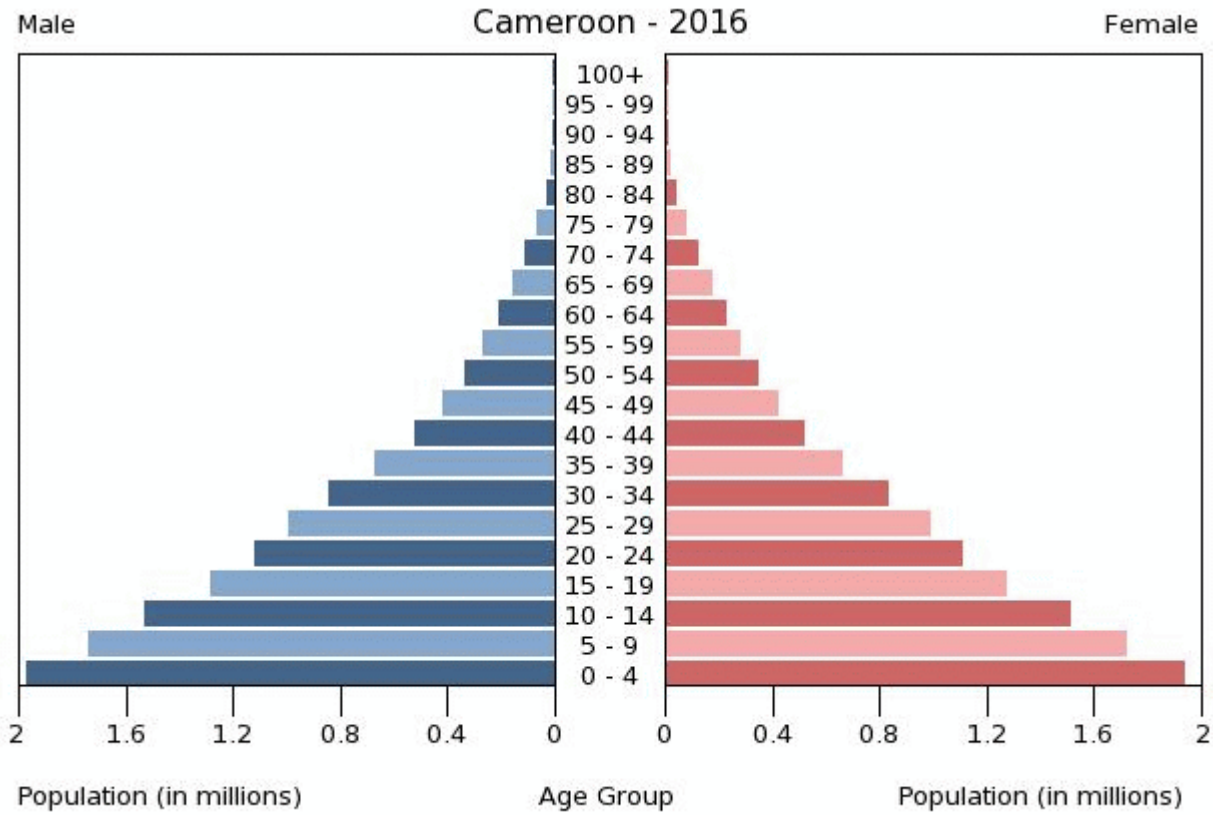
TABLE 1. Facts and figures

Political capital	Yaoundé
Economic capital	Douala
Largest city	Douala
Total population (2017)	24.546 million
Population world rank	55
Percentage of population < 15 years / > 60 years	43.6 / 5.5%
Percent of total population in urban areas (2017)	56.7%
Total surface area	475.650 km^2
Gross domestic product/growth rate (2016)	24.204 billion USD/ 5.6%
Gross national product per capita (2016)	1.200 USD
National poverty headcount ratio (2014)	37.5%
Primary completion rate	74%
Literacy rate M/F/total > 15 years (2015)	81/69/75%
Life expectancy at birth M/F (2015)	55.9 years
Maternal mortality rate (2011)	782/100.000 live births
Infant mortality rate < 5 years (2016)	88/1000
Total expenditure on health per capita (2011)	**missing**
Total expenditure of GDP on health (2014)	**missing**

Age structure:

0-14 years: 42.6% (male 5,228,047/female 5,149,228)
15-24 years: 19.55% (male 2,393,598/female 2,368,557)
25-54 years: 30.71% (male 3,762,054/female 3,718,266)
55-64 years: 3.97% (male 471,306/female 495,462)
65 years and over: 3.18% (male 360,386/female 413,899) (2016).

Graph 1. Age structure



B. **CULTURE AND HISTORY**

Cameroon is host to over 250 ethnic groups. These tribes can be grouped into clans that include: the Hausas and Fulanis in the north, the Betis in the center and south, the Bakas in the east, the Bamilekes in the west, the Sawas along the south west coastline, the Ngemba in the northwest, and others. Most of these are Bantus. These groups have different national languages, cultures, and traditions.

However, for administrative purposes, the country is considered bilingual. The two official languages are French and English, due to its colonial history. It was originally a German colony that was given, as a trustee territory, to the French and English after the First World War. The northwest and southwest regions were placed under English administration, and have remained predominantly English-speaking. The rest of the country, which was under French administration, is French-speaking. Some tribes were separated by this colonial boundary. Each part gained independence separately: the French-speaking became La République du Cameroun in 1960, while the English-speaking became Southern Cameroon in 1961. In 1961, a plebiscite was held in the English-controlled territory. The northern part of this territory voted to join Nigeria, and the southern part voted to join La République du Cameroun, forming the two-state Federal Republic of Cameroon. The two states were reunified in 1972 to form the United Republic of Cameroon, which then changed its name to The Republic of Cameroon, as it is now called. However, in spite of efforts to promote unity and

bilingualism across the whole country, tensions still exist between both parts, with the minority English-speaking part still showing discontent with the Union's mode of operation, leading to episodes of unrest. In addition, the Boko Haram insurgency has caused insecurity, mainly in the northern and extreme northern regions. The eastern region is also affected by political instability in the neighboring Central African Republic.

The Republic of Cameroon now has 10 regions, and is led by a president. H.E Paul Biya has been in power since 1982, having succeeded from the first president, H.E. Amadou Ahidjou. A prime minister appointed by the president oversees a cabinet of ministers. The legislature is bicameral, with a parliamentary House of Assembly and a Senate. Members of parliament and 70% of senators are elected by the population, while the remaining 30% of the senate is appointed by the president.

Cameroon uses a dual legal system, with the civil law practiced largely by the French-speaking majority, and the common law practiced by the smaller English-speaking part. Efforts to harmonize these two systems have met some resistance from the postulants of the common law. Customary courts equally exist at the community level (villages) and work based on local laws and customs.

Cameroon faces a huge challenge with widespread corruption from grassroots to high levels of government, both in the private and public sectors. International bodies have, in recent years, ranked it among the most corrupt countries. The government has instituted measures to fight against corruption. However, while all parties agree that improvements have been made, certain international and non-governmental bodies believe these fall short of expectations.

Table 2. Worldwide Governance Indicators 2014

INDICATOR	ESTIMATE	PERCENTILE RANK
Individual voice and accountability	-0.82	26.1
Political stability, absence of violence, terrorism	-1.2	10.5
Government effectiveness	-0.48	35.6
Regulatory quality	-1.28	8.2
Rule of law	-0.73	14.8
Control of corruption	-0.62	31.7

C. ECONOMY AND EMPLOYMENT

Cameroon is considered a lower-middle income country by the World Bank. Its GDP was 24.204 billion USD in 2016.

In 2010, 5.7 % of the adult population was reportedly unemployed and 70 % were considered underemployed. Amongst the employed, most operate in the informal sector, and are mainly involved in agriculture and 'petit' trading. The state is the biggest employer of 'white collar' workers; other private businesses (multinational, foreign, and locally owned) operating in the country make up the rest.

Table 3. MACROECONOMIC INDICATORS (2013)

GDP	14,607 billion CFA
GDP per head	696.000 FCFA
Growth rate	5.6%
Investment budget	1.055.3 billion FCFA
Total budget	2.655.3 billion FCFA
Debt rate	10.6%
Inflation rate	2.1%

Major exports include cash crops (such as cocoa, coffee, palm oil, and timber), petroleum, and earth minerals. Cameroon also exports food items to neighboring countries. Industrialization is rudimentary, resulting in the import of almost all finished products and machinery. In addition, shortages have led to the import of food items like rice, wheat flour and oil. Major trading partners include France, The European Union and China.

The larger part of locally-based industries caters to the basic everyday needs of locals. These include food products and hygiene products. Most of these are privately-owned small- and medium-sized industries. Small- and medium-sized businesses also exist in the informal sector, offering basic education, health, wellness, beauty, retail, and computer maintenance.

D. PHYSICAL AND TECHNOLOGICAL INFRASTRUCTURE

The International Telecommunications Union (ITU) ranks Cameroon amongst the least connected countries. It occupies the 148th position. The national telecommunications company known as Cameroon Telecommunications (CAMTEL) is the sole primary provider of cellular and internet connectivity. It distributes services itself or through licensed private operators (Orange, MTN, Nextel, etc). Most parts of the country are now covered by cellular networks, but in remote

areas and some urban parts with peculiar geographical features, connectivity is spotty. Internet connection is mainly through Wi-Fi. Broadband connectivity is expensive. Most service providers claim to sell 4G or 3G networks, but in practice, connectivity is not as efficient as would be expected. Most of the population possesses mobile phones. Many people use two operators simultaneously, and many use internet services connected to mobile devices. Between 2007 and 2013, mobile telephone users rose from 4.5 million to 14.8 million.

Table 5. Information technology and Telecommunications Use

INDICATOR 2015	SPH 2014	ITU 2015
Population using mobile phones	78.9%	71.85 %
Population using fixed phone	8.3%	4.5 %
Computer use	21.2%	N/A
Population using internet	16.2%	20.68 %
National territory covered by mobile telephone network	83.3%	N/A

SPH : Sectoral Plan for Health; ITU : International Telecommunications union

Electrical power is supplied by a single company (ENEO), which is partly government-owned. Power outages are frequent; voltages are usually low and unstable. According to the National Agency for Rural Electrification, in 2017, 40% of urban areas had electricity, compared to 18 % of rural areas. Most of the power comes from hydroelectric dams, which are now supplemented by thermal plants. A lot of solar powered devices are now sold in the market for household use, helping the population cope with unreliable power supply. Industries and other users with bigger power needs tend to use standby generators.

Water supply is the responsibility of Cameroon Water Corporation (CAMWATER), which is partially state-owned as well. Restricted geographical distribution, unreliable water supply, and sometimes doubtful quality have led certain communities to carry out small-scale community water supply projects. Certain households use 'burr holes' with mechanical or electric pumps, wells, or storage tanks to harness water.

Transportation within the country is predominantly by land, the biggest portion being by road. The road network stands at 77,589 km, of which only 5,133 km are paved. The major urban centers are linked by paved roads. Most of these are two-lane roads. Maintenance is poor; most roads both within towns and those connecting towns are in bad shape. Most cars are bought used. Some quality regulation exists, but maintenance of cars is substandard. Respect of traffic regulations is also lacking. Most people use some form of public transportation (taxis, buses). Privately-owned cars are a minority and are mainly found in urban areas. Within cities, traffic congestion is routine, in part due to poor roads and undisciplined users. This has led to a surge in the use of motorcycles in urban areas, with untrained riders who show little or no respect for security and safety rules. The existing railroad is very limited (only 1000 km) and is made of tracks constructed during the colonial

and immediate post-colonial era. The railroad serves mainly for the transport of goods; transportation of people is limited to three regions (Center, Littoral and the Adamawa). Trains are outdated. Road and train accidents are therefore not uncommon. 1170 deaths were recorded from road traffic accidents in 2013.

Air transportation is very sparse. There are three international airports (Douala, Yaoundé, Garoua) and four national airports. The national airway company (CAMAIRCO) operates local flights connecting Douala and Yaoundé to each other, and to five other regional capitals: Bamenda, Bafoussam, Ngoundéré, Garoua and Maroua. Airline companies in other countries maintain a schedule of local and international flights.

II. NATIONAL HEALTH CARE PROFILE:

Life expectancy in Cameroon is relatively low. Like most sub-Saharan African countries, health care resources are limited. Access to health care is hindered by poverty, geographical distance, poor transportation, unavailability of health services and human resources, and ignorance.

The highest causes of mortality and morbidity are infectious diseases including malaria, HIV and tuberculosis. In 2015, fever due to malaria resulted in an estimated 28.6 % of consultations and 40% of hospital admissions. Maternal mortality rates are also very high. Additionally, there has been a rise in noncommunicable diseases, especially cardiovascular disease, diabetes, and occupational diseases. Trauma from road traffic accidents has also become a public health concern, due to the increased use of motorcycles as a form of paid transportation.

Table 6. Disease epidemiology.

Diseases or groups of diseases	Contribution to DALY	Contribution to mortality (%)
HIV/AIDS	11.48%	14.24%
Neonatal diseases	11.27%	8.47%
Malaria	10.77%	8.78%
Lower respiratory tract infections	10.12%	10.52%
Diarrheal diseases	5.57%	5.01%
Nutritional deficits	5.03%	3.74%
Cardiovascular diseases	4.67%	11.56%
Road traffic accidents	3.95%	4.38%
Mental illness/substance abuse	3.53%	0.86%
Unintentional accidents	2.88%	2.87%
Cancers	2.02%	4.45%
Complications of pregnancy, childbirth and perinatal period	1.95%	2.17%
Musculoskeletal diseases	1.82%	0.14%
Neglected tropical diseases	1.82%	0.22%
Tuberculosis	1.41%	2.08%
Chronic respiratory diseases	1.38%	1.47%
Sexually transmitted infections	1.31%	1.01%
Cirrhosis	1.30%	2.42%
Neurologic illnesses	1.15%	0.87%
Chronic renal disease	0.76%	0.83%
Others	1.81%	13.91%
Total	100.00%	100,00%

A. NATIONAL HEALTH CARE STRUCTURE

1. Structure and Policy

The nation is served by a three-level pyramidal health care system, with three sub-sectors: public, private and traditional. The Ministry of Health has established a Sectoral Plan for Health for the years 2016-2027. Its major components are health promotion, disease prevention, and disease treatment.

Table 7. Health Care system

LEVEL	ADMINISTRATIVE STRUCTURES	PREROGATIVES	HEALTH INSTITUTIONS	DIALOGUE BODIES
CENTRAL	Ministry of Health	Elaboration of concepts, policies and strategies Regulation Coordination	General hospitals, Central hospital, University teaching hospitals, Gyneco-obstetric and pediatric hospitals, National Centre for Procurement of Essential Drugs and Consumables (CENAME)	National Council for Health, Hygiene and Social Affairs.
INTERMEDIATE	10 regional delegations	Technical support to health districts	Regional hospitals, specialized regional hospitals, regional centers for pharmacy supplies	Regional Fund for Health
PERIPHERAL	189 health districts	Implement health programs	District hospitals , district health centers, clinics, etc.	District Health Committee and District Management Committee

The referral system is bottom (peripheral) to top (central). Both private and public health institutions are involved in the peripheral and intermediate levels. All eight institutions of the central level are public or government owned. Four are in the Yaoundé, the administrative capital; three are in Douala, the economic capital; and one is in Sangmelima, in the southern region. There are plans to construct two more in the northwest and southwestern regions. There are also military hospitals in almost all regions, of which those in Yaoundé and Douala may be classified as central institutions. National Social Insurance Fund owns and runs two hospitals of this rank. Each of the already existing central institutions has a diagnostic imaging center equipped with advanced imaging equipment. Six of the ten regions have one hemodialysis center each; the Littoral region has three: two public and one private. The only cardiac surgery center is run privately by the Catholic church and is located in the northwest region. Other specialties organize missions to different hospitals, sporadically or with

some degree of regularity (e.g. cardiac surgery, neurosurgery, orthopaedic surgery, ophthalmology, etc.).

Pharmaceutical and laboratory products and equipment are controlled and regulated by the Ministry of Health. Essential drugs and consumables are supplied through the National Center for the Provision of Essential Drugs and Consumables. In 2011, they covered about 60 % of the nation's needs. It was evaluated that stocks ran out ***for a total of*** 14 days in 2015.

There is an Enlarged Program of Immunization (EPI) which covers 12 vaccines given free to children less than 5 years of age. These vaccines include Tuberculosis, Poliomyelitis, Diphtheria, Pertussis, Tetanus, Hepatitis B, Haemophilus type B, Pneumococcus, Rotavirus, Yellow Fever, Measles and Rubella.

2. Health Infrastructure and Workforce

There are a total of 4,034 health institutions, of which 2,709 are privately owned (church and lay private).

Table 8. Regional distribution of health institutions

REGION	Population	IHC/DHC	DH	RH	GH/CH	TOTAL
Adamawa	1,125,438	148	8	1	0	157
Centre	3,906,883	797	29	1	11	838
East	888,682	213	13	1	0	227
Extreme North	3,856,740	296	30	3	0	329
Littoral	3,175,664	575	39	2	3,619	619
North	2,271,914	257	14	1	0	272
Northwest	1,999,831	336	30	1	0	367
South	766,981	298	9	2	1	310
Southwest	1,533,964	271	14	2	0	287
West	1,978,322	595	32	1	0	628
TOTAL	21,504,419	3786	218	15	15	4,034

Following a general census of health personnel carried out in 2011, a National Plan for Human Resource Development was established. The 2011 census revealed that there are 38,207 healthcare workers (66% in the public sector and 34 % in the private sector), with a ratio of 1.07 per 1000 inhabitants (WHO recommends 2.3 for every 1000 inhabitants). There is only one nurse per 3,157 inhabitants and per doctor per 11,135 inhabitants. Most of these healthcare providers work in urban areas, with 55% working in three major cities (Douala, Yaoundé and Bafoussam).

There was an estimated deficit of 27.750 healthcare workers in 2011. The Ministerial Plan is to improve the situation by better management of human resources and increased production through training and employment. There are several training institutions for medical doctors, of which only one has a residency program, only one has a dental school, and two have pharmacy programs. 92 other institutions train nurses, midwives, physiotherapists, laboratory technicians, and others.

Table 9. Estimated number of health workers according to training.

HEALTHCARE PERSONNEL	Number
General Practitioner	1,420
Specialist	422
Dentist	58
Pharmacist	162
Nurse	18,954

3. **Healthcare Expenditure and Financing**

Up to 2016, the country had not elaborated a national strategy for health financing. In 2012, the health sector was financed to the tune of 728 billion FCFA (1.2 billion USD), which was about 5.4 % of the GDP. Most of this was generated from households (cash and carry system). There has been a steady increase in the amount allocated by the government to the ministry of health since 2008. However, the proportion of this allocation to the national budget has been in decline since 2011. In 2015, the government granted 207.1 billion FCFA (0.345 billion USD) to the Ministry of Health, representing 5.5 % of the national budget.

Table 10. Percentage distribution of health financing by type of source (2012)

Households	70.6 %
Government	14.6%
Private sector	7.7%
International donor organizations	6.9%
NGO and others	0.22%

Health services are therefore covered by three main methods: payments from households, insurance, or state subsidies. However, only a very small minority of services are subsidized by the state either completely or partially. For example, management of malaria for infants under 5 years of age and ARV therapy for HIV/AIDS are subsidized by the state.

4. **Access and quality of care:**

Access and quality of care vary geographically and between the rich and poor. Better services are available in urban areas, where there are high concentrations of infrastructure and workforce, and are inaccessible to the poor because of high costs. In this limited resource setting, certain health services are not available at all due to lack of specialized human resources and equipment.

III. NATIONAL RADIOLOGY PROFILE

Medical imaging services in Cameroon include diagnostic, interventional, and radiation oncology services. Most services are concentrated in urban areas, and either private- or public-owned.

A. INFRASTRUCTURE AND EQUIPMENT

1. Imaging Modalities

The past decade has seen significant growth in quality, quantity, and distribution of equipment and infrastructure. There are between 100 and 150 medical imaging centers nationwide. Most imaging centers are located in urban areas, with about half in Douala and Yaoundé, the nation's two major cities. Like in most LMIC, the majority of imaging centers (above 80 %) have only conventional x-ray (most are not computerized) and/or ultrasound machines. In these small centers, most of the equipment is either donated, refurbished, or have been in use for more than ten years.

The government has financed and opened at least one diagnostic imaging center in every region of the country, equipped with advanced imaging modalities (2-4 slice CT, ultrasound, digital radiography, mammography, and dental radiography). The same equipment is seen in the central hospitals, the only difference being that they have more powerful 16 slice CT scanners. There are several privately owned imaging centers with similar equipment: six in Douala, six in Yaoundé, one in Bafoussam, and one in the northwest region.

Five MRI machines are currently installed and functional: two 1.5 Tesla scanners in Yaoundé (one privately owned, one in the military hospital), and three 0.3-0.4 Tesla scanners in Douala (one public and two private).

There are only three operational DEXA scanners: two in Douala and one in Yaoundé. The one in Douala is public-owned, the others are privately run. There is a single nuclear medicine service in the public-owned Yaoundé General Hospital. The two public-owned radiation oncology units are based in Yaoundé and Douala, but only the one in Douala is functional at this time.

Interventional radiology is limited mainly to ultrasound-guided biopsies and insertion of drains and central IV catheters. There is no functioning angiography suite. Pacemakers are placed in some centers by cardiologists.

2. IT infrastructure :

A few of the larger services have basic IT infrastructure like internet and intranet. Only one center is known to possess an RIS. Most units have one or two computer workstations linked to the CT scanner or the computerized X-ray machine. In most cases, images are interpreted on the same

workstation used for image acquisition. In most units, the system for image acquisition and interpretation is completely independent of the system for reporting. Image storage facilities are rare (PACS, external hard drives, etc.). When they exist, intranet connectivity to the imaging machine is not guaranteed 24/7. Most images are stored on the hard drives of the machines on which they are produced, and deleted progressively to make more space. Some units offer clients images on CD. However, most referring physicians do not have time to look at the CDs during their consultations. They may not even have computers or DICOM-compatible computer software available to be able to access these images when they are available. In rural areas, lack of power supply may also be a limitation. There is, therefore, still a huge preference for printed images.

Only two centers actively use teleradiology. In one center, this is accessible only by staff of the imaging department. In the other, both imaging staff and client have controlled access to images and reports.

In practice, clinicians and radiologists upload images on telephone and internet applications to discuss cases both locally and internationally.

3. **Maintenance**

Most of the equipment in use functions at less than 80 % of their capacity. Most equipment becomes dysfunctional during the period of warranty. A lot of equipment is not functional at all.

Most centers (both big and small) do not have maintenance contracts. Technicians and engineers are called in when the machines breakdown, and for complex problems they are flown in from abroad. There is usually no preventive maintenance. The technicians on the ground are usually not adequately trained to handle machines from various manufacturers.

Manufacturers are represented locally, mainly by entrepreneurs who are more preoccupied with the profitability of their business and do not have appropriate technical knowledge or staff to handle medical equipment.

B. **HUMAN RESOURCES**

1. **Radiologists and radiation oncologists:**

Most of radiologists and radiation oncologists are trained at home or in other African countries with have similar infrastructure. They are mainly concentrated in the major cities of Yaoundé and Douala. There is, at least, a public service radiologist in every public regional imaging center.

There are about fifty radiologists (1 radiologist for every 500,000 inhabitants) around the country; half of them work in Douala or Yaoundé. There are only five radiation oncologists working in Douala and Yaoundé (1 radiation oncologist per 5 million inhabitants).

Some of these specialists have migrated to developed countries in pursuit of better working conditions and remuneration. It is worth noting that the few locally-based specialists have to bear

the load of diagnosis, teaching, and research. Some of them, usually the older, more experienced ones, also hold administrative functions that have reduced the time available for clinical duties.

2. **Technologists:**

There are above a hundred technologists nationwide. Most of the small peripheral centers are run and managed by technologists. Most are trained locally or in other African countries. The majority are trained on the job by older technologists or foreign volunteers, without any academic certification or degree. Less than 10% of technologists have an academic degree or diploma (higher national diploma, bachelor's degree, or master's degree).

3. **Medical physicists, IT specialists, and maintenance engineers:**

There are a few physicists and engineers with some experience in medical equipment. Most are not trained specifically in medical physics and engineering. Even fewer have had any kind of specific training with the manufacturers. There have limited resources to work with. Most equipment is installed by foreign engineers and physicists sent by the manufacturers or their representatives in industrialized countries. They also handle complex maintenance issues, but are usually not on contract and are only called in sporadically when these problems arise.

4. **Professional bodies and societies:**

All medical school graduates must obtain a license from the National Medical Council to practice within the country. Both radiologists and radiation oncologists can become members of the Cameroon Society of Radiology, Medical Imaging, and Radiation Oncology (SCRIMM). This is not a licensing body, and it operates in large part as a scientific fraternity. The Society is affiliated with the Radiology Society of French-Speaking Sub-Saharan Africa (SRANF), which itself is affiliated with the Societé Francaise de Radiologie (SFR) of France. Radiology and radiation oncology technologists can be members of the Cameroon Association of Technologists in Medical Imaging and Radiation Oncology. Some of these professionals are associates or international members of foreign societies, such as the RSNA or SFR.

C. EDUCATION AND RESEARCH

1. **Residency and medical schools:**

Only the University of Yaounde offers residency programs in some specialties, at its Faculty of Medicine and Biomedical Sciences. A four-year diagnostic radiology residency program has been in place since the late 90s. A radiation oncology program was run from 2010 to 2015 and stopped after graduating two specialists. To graduate as specialist, a resident must complete eight 6 month rotations over a four-year period, pass an examination in every module studied during the first three years of residency, pass a final examination at the end of the fourth year, and write a dissertation. There is no fellowship program available locally. Some of the residents and specialists may attend rotations and fellowships in developed countries like France and Belgium.

There are six medical schools, five public and two private. Recently, a harmonized curriculum was adopted for undergraduate medical studies in all specialties, including radiology.

Only two medical schools have permanent faculty, most of which are concentrated in the University of Yaounde. The other schools recruit part-time radiology lecturers.

Diplomas for both medical school graduates and residents are awarded by the Minister of Higher Education.

2. **Radiologic technologists' education:**

Most of the technologists are trained on the job without a well-defined curriculum or any kind of certification. However, there are several academic centers that provide education leading up to a diploma or degree. One public school offers up to a master's degree, five schools offer bachelor's degrees (one public and three private), and all ten schools offer higher national diplomas.

Recently, a national curriculum was elaborated for these different degrees and diploma. Students must sit for a national examination in order to obtain the Higher National Diploma. Bachelor's and master's degrees are awarded by the institutions themselves, following written examinations, rotations, and the public defense of a dissertation.

3. **Medical physicists**

Medical physicists can undergo 5-year training in one university institute in Douala. Others are trained abroad.

4. **Continuous medical education**

There is no organized program for CME or system for awarding credits. Most professionals seek this personally by attending conferences locally and abroad. Some hospitals may organize scientific meetings, which they may attend. On rare instances, professionals may benefit from refresher courses abroad, sponsored by the state or other donors.

5. **Research and global health radiology**

Research is mainly limited to dissertation work by students and a handful of studies carried out by lecturers. Most research is self-sponsored. This, in addition to limited infrastructure, equipment and human resources, makes research very challenging. There is no radiology research institute or program. The Radiology Society of French-Speaking Sub-Saharan Africa publishes a journal bi-annually called 'Journal Africain d'Imagerie Medicale'.

There are few, if any, radiology global health initiatives carried out, partly due to lack of resources. However, radiology has been part of other health initiatives organized mainly by clinicians of other specialties. They have been few small scale international radiology partnerships, mainly equipment donations and refresher courses for staff.

6. **Study materials and funding :**

Funding for tuition and books is mainly generated from family income. In addition, most institutions are located in major cities and university towns, where the cost of living is high.

Medical imaging textbooks are not readily available locally, and are usually ordered from abroad. This increases the already relatively high cost of these books. There is no radiology library in the country. Most medical schools have libraries mostly filled with very old books. It is not unusual for textbooks to be photocopied by students.

Students and professionals now use free online radiology websites and journals for information and research. However, this may be limited by unstable power supply and internet connectivity. Most professionals and students cannot afford subscriptions to paid websites and journals.

D. REGULATIONS, SAFETY AND QUALITY CONTROL

The main regulatory bodies of the sector include:

- The Ministry of Health
- The National Agency for Radioprotection
- The Ministry of Higher Education (for education and research).
- The Cameroon National Medical Council

The National Agency for Radioprotection has carried out several activities to ensure radiation protection and these include:

- Evaluation of radiation protection in all facilities both old and new
- Sporadic checks to enforce compliance with regulations
- Closure of some facilities
- Radiation protection seminars for all persons working with ionizing radiation
- Appointment and training of a staff representative who works directly with the Agency
- Acquisition, distribution, and management of dosimeters

Most centers have not developed standard protocols for image acquisition and reporting. There is still a huge reliance on manufacturer protocols which can be ill-adapted to certain populations.

There is no regulation or procedure in place for disposal of radiology equipment. Obsolete and dysfunctional equipment is usually abandoned in store houses and hospital corridors. Some of it

is donated to smaller centers without prior reassessment or quality control. The risk of such equipment being mishandled by unscrupulous persons cannot be overemphasized.

Hygiene and sanitation are still a great concern in most facilities. The centers are housed in buildings that were designed for other purposes. Infrastructural modifications that promote hygiene, such as sterilization units and running water, are expensive. Products such as protective accessories for ultrasound probes, disinfectants, and sterile gloves are not readily available in most centers or even in the market. When in short supply, clinical units (surgery, internal medicine) are given precedence over radiology units. Disposable supplies are sometimes sterilized and reused several times. Most centers were designed to serve adults, which comprise the majority of patients. The pediatric population is not given the attention it deserves because imaging this population is less lucrative. Equipment and products adapted to their needs are scarce.

Quality control is almost completely lacking. Neither the machines, images, nor the staff are subjected to any kind of quality evaluation. The quality of care is also impacted by the lack of subspecialty training at all levels.

IV. **CONCLUSION**

Giant strides have been made in the domain of medical imaging and in the health sector as a whole over the last decade. Both government and private entities have invested in this sector. There have been improvements in quality, quantity, and geographical distribution of infrastructure, equipment and human resources. However, the gap between expected and existing morbidity, mortality, and Disability Adjusted Life Year (DALY) is still wide.

The progress of medical imaging in Cameroon, like other lower-middle income countries, has been stalled by limited financial resources and political will. The sector still lags behind other medical specialties, but as its importance and central role are now widely accepted, it is expected to grow.

Disparities exist in access to imaging services based on financial strength, level of education and geographical location. Imaging services, like other health services, are offered on a 'cash and carry' basis. Most imaging centers, together with laboratory services, are the financial powerhouses of health institutions, and the finances they generate are often needed to run other 'cost' services. The lower classes, the less educated, and those living in rural areas have little or no access to these services.

Education and sensitization of the general population, as well as human resource development through training (including subspecialty training) are some of the areas that need particular attention.

Public-private-NGO partnerships, integrated in a global health approach, may provide part of what is needed to bridge the gap between 'the expected' and 'the existing,' and may help to reduce the disparities that exist between communities within the nation.

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