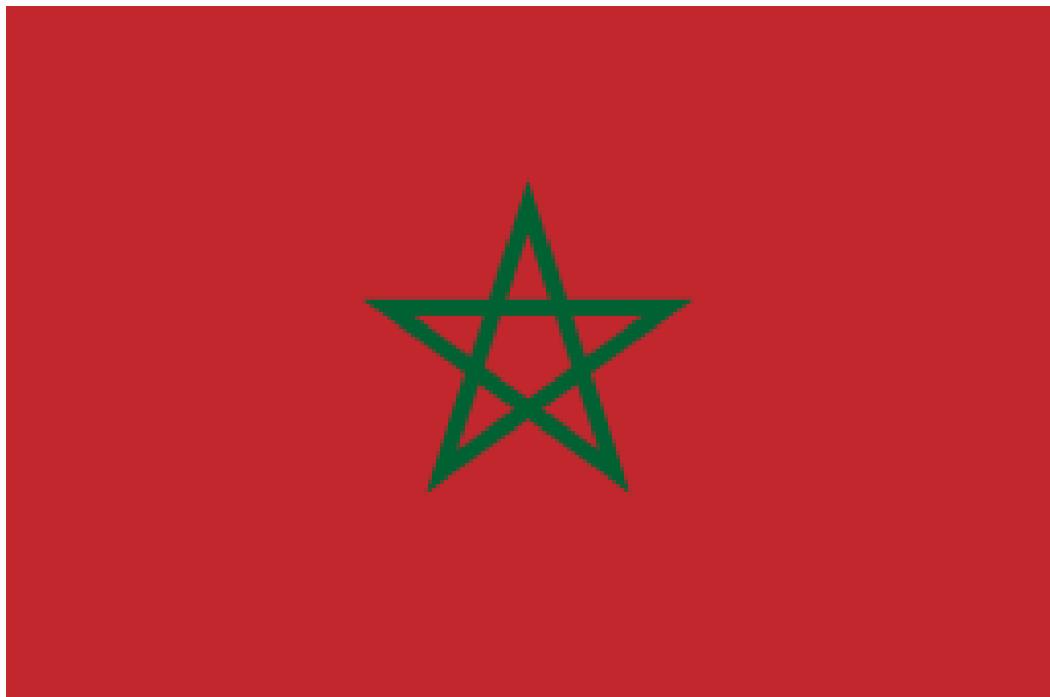




Morocco

Sean Kalagher
August 2022

MOROCCO



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TABLE OF CONTENTS

GENERAL COUNTRY PROFILE	3
GEOGRAPHY AND POPULATION	3
HISTORY AND POLITICS	4
ECONOMY AND EMPLOYMENT	5
PHYSICAL AND TECHNOLOGICAL INFRASTRUCTURE	5
NATIONAL HEALTH CARE PROFILE	7
NATIONAL RADIOLOGY PROFILE	14
CONCLUSION	14
REFERENCES	16

General Country Profile:

Geography and Population

Morocco, known officially as the Kingdom of Morocco, occupies over 716,000 square kilometers on the northwestern coast of Africa with shores along the Mediterranean Sea and the Atlantic Ocean (Figure 1). The mountain Jebel Musa in the north is fabled to be the African pillar of Hercules, which along with the Rock of Gibraltar in Europe, brace the Strait of Gibraltar. Except for small Spanish exclaves along Morocco's Mediterranean coast, the two countries come closest across the Strait between Point Marroquí in Spain and Point Cires in Morocco, where waters span just 13 kilometers - on a clear day, Spain can be seen on the horizon. Morocco's African neighbors are on its eastern border: Algeria in the north and Mauritania in the south, bordering what was previously known as Western Sahara. This sparsely populated province, formerly a colony of Spain, was annexed by Morocco in 1975. [1, 2]

The northern reaches of Morocco enjoy a Mediterranean climate. The Rif and Atlas mountains receive significant yearly rainfall due to their elevation and the meeting of polar and tropical air masses. Further south and inland, the climate is hot and dry. [1, 3] Excluding Western Sahara, which is mostly desert, over two-thirds of the land is used for agriculture (pasture, arable land, and permanent crops in that order). Over ten percent of Morocco is forested. Coastal Atlantic waters boast rich fisheries. [1]

Most of Morocco's more than thirty-six million people live near the coasts. Morocco ranks fortieth among nations for population, slightly less than Canada and slightly more than Saudi Arabia. The median age of a Moroccan is twenty-six years. See figure 2 for distribution. The growth rate was estimated at 0.92% in 2021. [1] Sixty-four percent (64 %) of the population is considered urban with an annual urbanization rate of 1.88% [1]. Females can expect to live to 75 and males to just under 72. Literacy is about 83% for males and 65% for females. Education is compulsory from age 7-13. School life expectancy, the number of years of education a child can expect to receive, is fourteen. By comparison, the measure is sixteen years in the United States and Canada and only seven years in nearby Chad. [1] GDP per capita in 2019 was about \$7,500 (2010 USD). [1]

Chart 1.

Table 1: General Facts		Comment
Population	36,561,813	World rank 40
Capital	Rabat	Pop. 578,000
Median age	30	World rank 137
Area	716,550 sq km	Incl. W. Sahara
Real GDP per capita (USD)	\$7515 (2019)	World rank 156
Life expectancy	73.6	World rank 147
Infant Mortality Rate	19/1,000	World rank 92
Obesity prevalence	26.10%	World rank 45
Total expenditure on health. % GDP	5.30%	Excl. W. Sahara

History and Politics

Morocco's long and fascinating history has been popular since prehistoric times and is well known through antiquity. Berber tribes inhabited the region millennia before the Phoenicians and Romans set up colonies along the coast, leaving ruins that persist even now. Arabs invaded the region in the seventh century bringing their language and Islam, which still dominate today. [5] Most Moroccans have a mixed heritage of Berber and Arabic language and culture. Ninety-nine percent of Moroccans are Muslim; the remainders are Christians and Jews. Politically, several dynasties have controlled Morocco since the Arab invasion. The current Alaouite family dates back to the 1660s. However, their reign was interrupted by Spanish control in the late 1800s and French control beginning in the early 1900s. Morocco was officially a protectorate of France from 1912 till its independence in 1956. Vestiges of this colonization include widespread use of the French language in business and government and a legal system that combines civil code (Napoleonic origin) with Sharia law (Islamic). English is increasingly spoken in tourist areas. [1]

Government and Legal System

The Kingdom of Morocco is a parliamentary constitutional monarchy. The head of state and a current hereditary monarch is King Mohammed VI. The government also includes an elected legislative branch and a judicial branch. Recent decades have been notable for a desire for political change and increased individual voice among the country's youth manifesting as protests, boycotts, and online dissent. By way of example, forty-nine percent of Moroccans polled between the ages of 18-29 support rapid domestic political change. [6] To his credit, the reign of Mohammed VI has ushered in extensive progressive changes, including fairer elections, decreased censorship, and acknowledgment of human rights violations. This response to dissatisfaction reflects elements of political stability and civil peace. [6] There are dozens of different political parties in the country, which speaks to a significant level of tolerance for opposition.

There exists considerable corruption in the country. According to Transparency International, 31% of public service users paid a bribe in the last 12 months, and over half of Moroccans polled believe this will worsen over the next year. [7] This institute ranks Morocco 86/180 for transparency among nations. There is also high unemployment (over 22% youth unemployment) and high rural poverty rates (over 19% vulnerable). [6] Government policy review is outside the scope of this report, but there are likely many opportunities for constructive government intervention. The 2020 World Justice Project Law Index ranked Morocco 79/180 on the rule of law, pointing out that the current level of the rule of law may impede progress. Overall, the Kingdom of Morocco is a moderate parliamentary monarchy that is primarily peaceful and tolerant and has made significant strides towards progress over recent decades.

Economy and Employment

Morocco is considered lower middle-income according to the World Bank. [9] In 2019 real GDP was 280 billion USD, GDP growth was 2.5% and inflation was 0.2%. GDP composition by sector in 2017 was 56% services, 30% industry, and 14% agriculture. Industries include phosphate mining, automotive parts, leather goods, and aerospace. The labor force is just over 10 million, and unemployment is about 9%. [1] The top three exports are electrical machinery, motor vehicles, and fertilizer. The top three trading partners are Spain, France, and the People's Republic of China. [10] Morocco receives international aid of usually between one to two billion dollars annually, varying from year to year. Numerous international agencies fund the donations, including the UN, USAID, and OECD. [12]

Physical and Technological Infrastructure

Morocco stands out among low to middle-income nations for electrification. In 2020 availability of electricity is quoted at 100% including rural. Electricity is considered affordable and reliable. [1, 13] Sixty-eight percent of electricity comes from fossil fuels with the remainder split between hydroelectric and other renewables. [1] There are about five fixed telephone lines per 100 inhabitants, but 128 subscriptions for mobile phones per 100 people. Telecommunications are considered near state of the art and among the best in Africa, utilizing fiberoptics and microwaves. Broadband internet is considered affordable and widely available. [1] Speed is variable but improving. Internet penetration is about 65% in 2019 and increasing. World rank is number 33. Rural access lags urban. The central nature of internet provision makes it susceptible to censorship. [14] Two state-run television networks are broadcast nationally. Interestingly, the library at the University of al-Quarawiyyin Library in Fez is considered the oldest continuously operating library in the world and was founded in 859 CE (AD). [1]

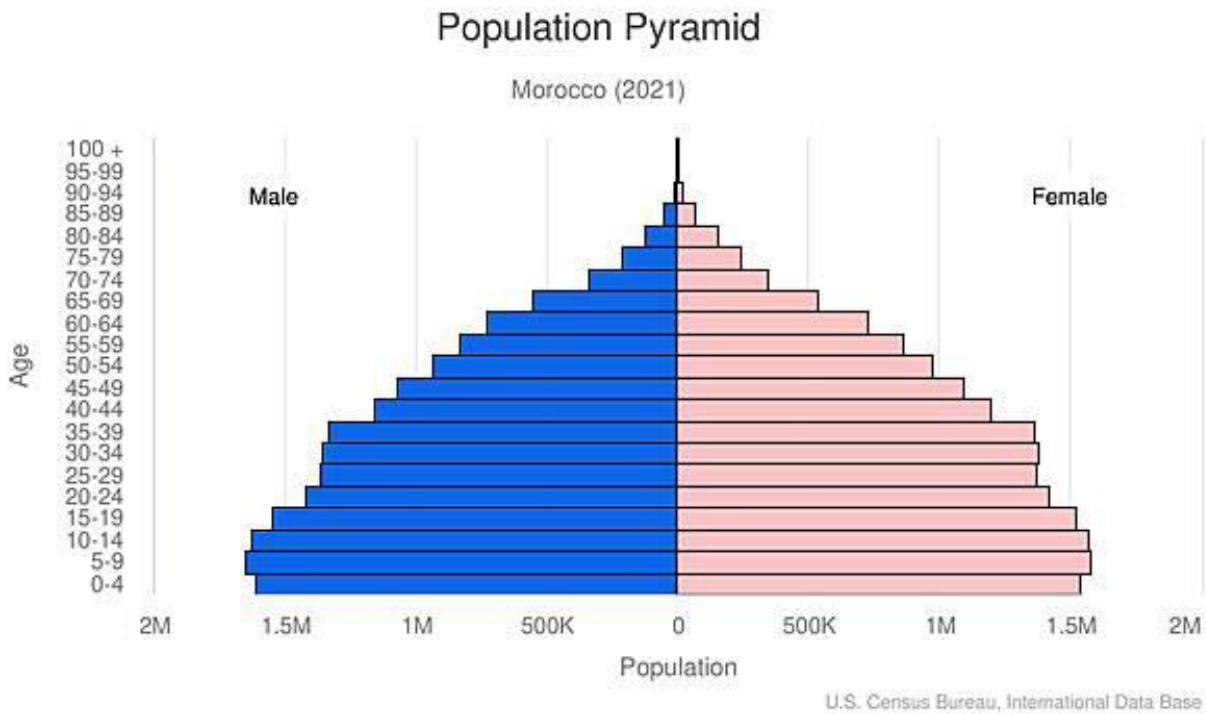
There are 62 airports in Morocco, 36 of which are paved. One heliport exists. Just over 2000 km of railway connect the country by train, and over 57,000km of roads span the nation. World rankings are 73 and 80 respectively. [1] According to the International Trade Administration, road systems are considered some of the best in Africa. [15] Several seaports serve the country with the largest in Tangiers. Drinking water sources are improved for 91% of the population, 98% for the urban population and 79 % for the rural population. These data do not include Western Sahara. [1] Morocco has recently committed several billion dollars to a national water plan to ease shortages and provide the population with clean water. The plan includes the creation of several new dams. [15]

Figures:

Figure 1. : Map of Morocco



Figure 2: Population Pyramid



National Health Care Profile:

Morocco's national health care profile is one of change, achievements, and challenges. As the population continues to grow, it is also aging. Many live in remote rural areas that are underserved. Morocco suffers from chronic understaffing of medical personnel. Nevertheless, the nation has made incredible strides toward economic growth and health improvement over the past few decades. However, as the standard of living and life expectancy has risen, so has the burden of non-communicable and "lifestyle" diseases. While numerous health care markers are attained, persisting problems and new challenges can be identified and targeted for future improvement.

At the founding of independent Morocco in the mid-1950s, health care practitioners numbered in the hundreds. The Ministry of Health was created in 1982. By 1992, 70% of Moroccans had access to health care. In 2011, health care was recognized as a constitutional right in Morocco. [16] RAMED is a public health insurance scheme for the poor and vulnerable that in 2012 gave access to free publicly available services to an additional 8.5 million people. [16, 17]

Children born in Morocco now can expect to live to about 75 years, and life expectancy continues to rise. [18] Morocco has a death rate estimated in 2021 as 6.53 deaths/1,000 population, ranking 135 in the world (these data include former Western Sahara). [19] However, this measure must be taken in the context of other population metrics, including average age, since for example, several more economically developed countries with older average population ages score high. [20] By way of comparison, Canada ranks 84 and Burundi ranks 155.

Mortality statistics for children show improvement in Morocco. [19, 21] The under-five mortality rate is 24.1 per 1,000 live births; it was 28 in 2013. The under-five mortality rate was almost 80/1,000 in 1990 and was down to 47.2 by 2001. [21] Of the current 24/1,000, 18 are accounted for by infant mortality, which ranks 92 among the world's countries. [19, 21] Fourteen of these 24 are attributed to neonatal mortality. [21] Despite these improvements, children in Morocco remain at higher risk for death than in developed nations. Almost one-quarter of child deaths under the age of five are due to communicable diseases. [22] See figure 1 below. As many communicable diseases are preventable and treatable, this should be a target for improvement.

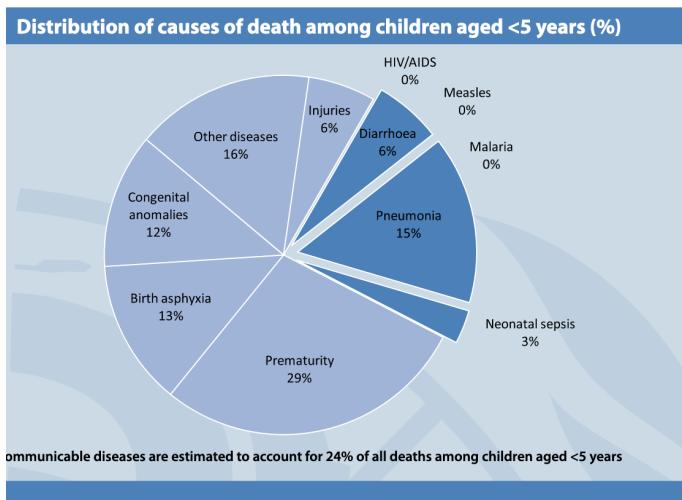


Figure 1. Causes of death for Moroccan children [22]

Major headway in vaccination has been made over the past few decades largely through government mandates and public funding. For example, coverage for 1-year-olds for BCG, DTP3, measles, HepB3, and polio are now 99% up from the 70-80 percent ranges in the 1990s. [23] These efforts have led to, for example, the elimination of neonatal tetanus; no reported polio cases since 1987, and no reported diphtheria since 1991. Cases of measles and meningitis are also decreasing due to vaccination. [23] A second dose of measles and rubella vaccines was introduced to the vaccine schedule in 2014. [23] About 2.6% of children under five years of age are characterized as 'underweight', which is world rank 102. [19]

The maternal mortality ratio is 70/100,000, ranking 84 globally [19]. The ratio was 174/100,000 in 2001. [21] Just over half of pregnant women (54%) attend at least four prenatal visits. About 87% of births are attended by skilled health professionals. The caesarian section rate is 21% of births. [21]

Improvements in health care in Morocco for adults have been most noticeable in the realm of communicable diseases. Over the past several decades, smallpox has been eradicated in Morocco while typhus, malaria, and tuberculosis have all been controlled. [24] Tuberculosis remains a threat to public health in Morocco. The Ministry of Health funds a national tuberculosis program, which provides free services to tuberculosis patients and funding other tuberculosis control programs. [23] In 2010, the country was certified as malaria-free by the WHO, and there are ongoing efforts to maintain this status as some cases are introduced from

foreign travel from sub-Saharan regions. [23] The adult prevalence of HIV/AIDS is less than 0.1% (2019 est.). Numbers are estimated at 21,000 and less than 500 HIV/AIDS deaths annually. These data do not include former Western Sahara. [19]

There is a major shift in disease burden taking place in Morocco, much like elsewhere in the world. In 2012 the burden of disease attributable to communicable diseases was 17.8%, 75.3% for non-communicable diseases, and 6.9% for injuries. [23] See Table 1 and Figure 2.

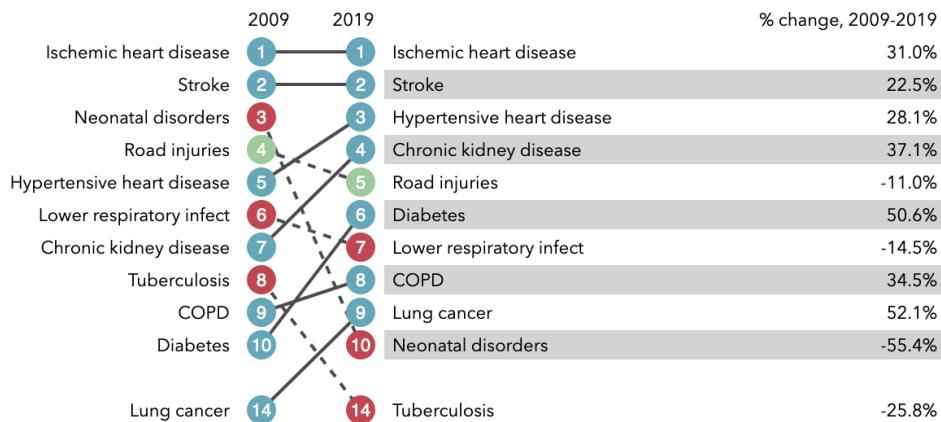
Table 1. Causes of Death [23, 25]

2012	Injuries	Communicable	Non-Communicable Diseases			
	6.9	17.8	75.3			
% of all deaths	-	-	Cancer	Respiratory	Cardio Vascular	Diabetes
	-	-	11.1	4.5	33.6	11.9

Figure 2. [18]

What causes the most deaths?

- Communicable, maternal, neonatal, and nutritional diseases
- Non-communicable diseases
- Injuries



Top 10 causes of total number of deaths in 2019 and percent change 2009-2019, all ages combined

See related publication: [https://doi.org/10.1016/S0140-6736\(20\)30925-9](https://doi.org/10.1016/S0140-6736(20)30925-9)

Non-communicable diseases (NCDs) including “lifestyle” diseases are becoming an increasing burden on public health in Morocco. One out of three Moroccan men smoke tobacco daily, though just two percent of women. [22] Hypertension, high blood sugar, being overweight, and high cholesterol affect 35.8, 10.8, 48.5, and 37.2 % of the population, respectively. [22] Adult obesity prevalence is estimated at 26%, ranking 45 worldwide. For comparison, Canada ranks 26 and Venezuela ranks 50. [19] Please see figure 3 below, which depicts factors driving death and

disability and the trend over the last decade. Among these are several good targets for public health measures, including education/prevention, screening, and early treatment strategies.

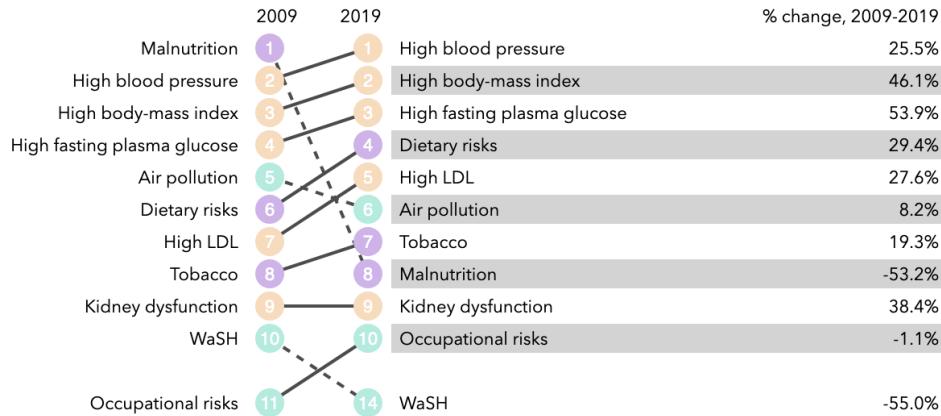
Figure 3. [18]

What risk factors drive the most death and disability combined?

● Metabolic risks

● Environmental/occupational risks

● Behavioral risks



Top 10 risks contributing to total number of DALYs in 2019 and percent change 2009-2019, all ages combined

See related publication: [https://doi.org/10.1016/S0140-6736\(20\)30752-2](https://doi.org/10.1016/S0140-6736(20)30752-2)

National Health Care Structure:

Health care in Morocco is universal in principle but not entirely in practice. The Ministry of Health in Morocco is the government agency that sets and implements government health policies. [26] However, a combination of private and public sources supply health care to Moroccans, and a variety of payment schemes exist. Overall, the health care system in Morocco is notable for high out-of-pocket expenses, low expenditure as a percentage of GDP, and understaffing of providers and support personnel compared with similar countries.

Health care in Morocco has both public and private provisions. The public health sector is reported to include 2,689 primary health care facilities and 144 hospitals [16]. The public sector comprises the Ministry of Health, the Royal Armed Forces, local communities, and other ministerial departments. [26, 27] In 2006, the whole public service totaled 38,000 care professionals. [27] More than half the population in 2012 was covered by public insurance schemes - either the Mandatory Health Insurance scheme or the Medical Assistance scheme. [23] Public and private employees are covered by Mandatory Health Insurance (AMO). [16, 17] Since 2005, all Moroccans have been required to be part of one of these basic medical schemes. [16]

Despite the multiple options for insurance and coverage, Moroccan citizens express dissatisfaction with the public health system. Complaints include low quality of care, inequities in access to services and facilities, and the discrepancy between urban and rural areas. [16] Private care can fill in some gaps, but remains financially out of reach for many Moroccans. Dissatisfaction with the public health care system is reportedly linked to lack of staff, lack of training programs, poor rural access to care, distrust of hospitals, centralization of healthcare administration with lack of coordination with local institutions, lack of transparency of government-run facilities, as well as deficient leadership and management. [29]

The private health sector in Morocco is reported to account for 6,763 private practices and 439 clinics. [16] Private health care is divided into for-profit and nonprofit segments. [27, 30] The non-profit segment includes the National Fund for Social Security (NFSS), the Mutuals and National Fund of Social Welfare Bodies (NFSWB), the Moroccan Red Crescent (MRC), and other NGOs. In 2006, the non-profit private segment had 1874 beds. The for-profit segment of the private system, which includes over 100 radiologist offices and many general practices with sonographic capabilities, had 6156 beds in 2006 and had 10,800 health care professionals. [27]

There are over 530 hospitals in Morocco as of 2020. Of those, about 33 hospitals can provide tertiary care services, and 108 of these hospitals can provide secondary care services. [31] However, hospitals and clinics are situated mainly in urban locations. About 11% of people live more than 10 kilometers from Morocco's primary health care facility. [22] Hospital bed density is estimated at 1 beds/1,000 population (2017). [19] The total number of hospital beds in 2021 is estimated at above 40,000, including over 25,000 public hospital beds estimated in 2019. [32]

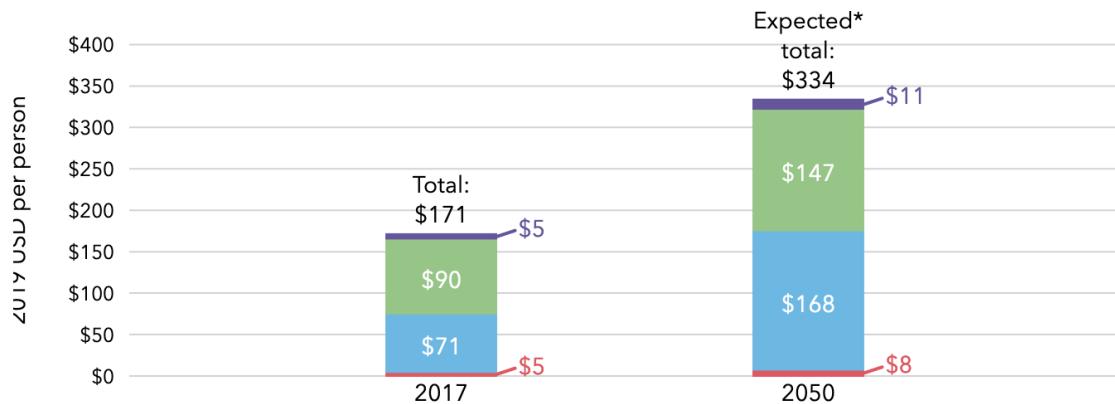
A formal patient referral system for Morocco is not described; however, the system operates like a pyramid with patients first being seen in primary care settings and being referred for specialty care individually. [24] The referrals are informally made on 'referral cards' – the patient may return with the card with possible feedback for the referring provider. [24]

Expenditure on health as a percentage of GDP was 5.3% in 2018 (excluding former Western Sahara). [19, 33] Similar countries of Lebanon, Iran, and Jordan spend between 6.8 to 9.7% of GDP on healthcare. [29] Out-of-pocket expenditure on health care for Moroccans was about 54% of total health care spending in 2010. [16] It was reported at 47% in 2018. [33] Total per capita expenditure on health almost doubled from about 100 USD in 2005 to about 189 USD in 2013. [23] See figure 4 for a graphical breakdown of expenditures by type.

Figure 4. [30]

How much is spent on health - now, and in the future - and from which sources?

- Prepaid private spending
- Out-of-pocket spending
- Government health spending
- Development assistance for health



Source: Financing Global Health Database 2019

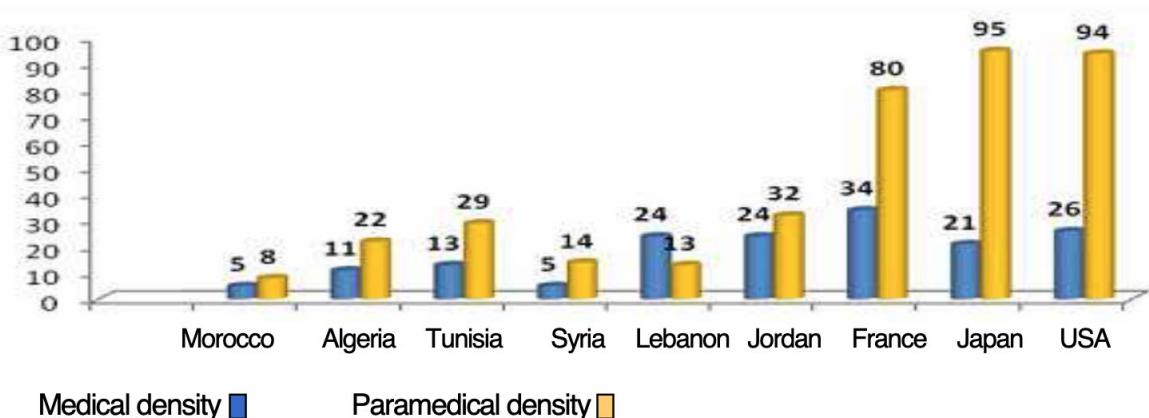
*"Expected" is the future growth trajectory based on past growth.

See related publication: [https://doi.org/10.1016/S0140-6736\(20\)30608-5](https://doi.org/10.1016/S0140-6736(20)30608-5)

Morocco has a shortage of medical professionals. Only 7.9 health care workers are available for each 10,000 Moroccans. [30] There are approximately 7.3 physicians/10,000 population (2017) [34], which falls below the WHO goals of 1/650. [30] In 2011, there were about 9.0 nurses/midwives, 2.7 pharmacists, and 1.4 dentists per 10,000 population. [22] See figure 5 for a comparison of Morocco with other countries.

Figure 5. [29]

Graph 9 - Country comparative analysis of medical and paramedical density between 2002-2006 (for 10000 inhabitants)



Measures to increase the number of providers will be required for Moroccan health care to continue to progress. One interesting idea proposed to improve the number of physicians serving in rural locations and retaining their services is compulsory medical service. The ministry of health proposed in 2012 a two-year service obligation for all new medical graduates in underserved locations. The intention would be to provide a positive experience and to offer monetary incentives. [35]

The pharmaceutical sector in Morocco is the second largest on the African continent and supports about two-thirds of domestic demand while exporting significant amounts to mainly neighboring countries. [23] Although Morocco has a well-developed pharmaceutical industry for an LMIC, medicine prices are high compared with neighboring countries.

The Ministry of Health is implementing numerous campaigns for preventative and therapeutic care with outreach to the rural, poor, and burgeoning elderly population. [23, 26] There are specific campaigns for HIV, TB, childhood vaccinations, nutrition, maternal medicine and specific outreach for the poor and vulnerable, including geriatric patients. [17, 23] Examples include screening, education, and treatment for TB and HIV [23], as well as the creation of nursing homes. [27] However, reports of large-scale efforts for preventative and therapeutic strategies for non-communicable diseases and “lifestyle” diseases are scarce.

In conclusion, Morocco has made incredible strides in improving public health and providing health care coverage for its citizens. As the disease burden continues to shift towards NCDs, so should preventative and therapeutic efforts. Additional targets for improvement include increased expenditure on healthcare, including medical/paramedical staff, increased access to rural and elderly care, and strategies to make basic healthcare affordable for all Moroccans.

National Radiology Profile:

Available information about the national profile of radiology in Morocco is sparse. Searching in French yields more than in English (a search in Arabic might be more fruitful). Official government statistics reveal that specialist physicians, including radiologists, are highly concentrated in Morocco's more populous provinces and urban areas. [36, 37] The online journal *Aujourd'hui le Maroc* reported in June 2021 that there are 454 public radiologists and 283 private radiology clinics nationwide. Dr. El Alami, the president of the Moroccan Society of Radiology [38], said in an interview in 2019 that about 700 radiologists practice in Morocco. Further, 58% are private, 32% are public, 5% are academic, and 5% are military. [39]

There are several pathways to training radiologists within Morocco, including at the beginning of post-graduate training and later through a sub-specialization. About 200 physicians are pursuing a specialty diploma designation for radiology, equivalent to finishing a radiology residency in North America or Europe. [39] Sites include Rabat, Casablanca, Marrakech, Fez, and Oujda. [37, 39] At Mohamed V University, the training requires four years. [37] Moroccan radiologists are organized. Their main professional organization is the Moroccan Society of Radiology. [38] Moroccan radiologists recently brought legal action to keep non-radiology physicians from opening imaging clinics and interpreting imaging studies on the basis of concerns over patient/radiation safety, conflict of interest, and lack of training. [40]

Information about roles and numbers for non-physician radiology professionals and radiation oncologists is lacking in online searches. However, these people do exist in the Kingdom. Radiation therapy is available in major Moroccan population centers. [41] Technologist jobs are advertised, and at least one training program is available in the capital. [42] Based on an assessment by RAD-AID in association with the University of Texas in 2019, there is a need for more physicists, radiation safety officers, and technologists. They noticed sub-optimal and inconsistent radiation safety measures, imaging protocols, and PACS accessibility/utilization. [37, 43]

According to a report in June 2021, the public sector has 129 CT scanners, 82 mammography units, 99 ultrasounds, and 24 MRIs. [44] Numbers for the private sector are not readily available. Most common types of radiologic exams and frequencies are not readily available. However, plain film and ultrasound capabilities are reported to be fairly widespread. [37]

Conclusion:

Morocco is a country in ascendency both economically and in terms of health care. Amazing strides have been made in both arenas over the past several decades. Currently, the radiology profile in Morocco is patchy and understaffed. A modern medical imaging industry with some level of standardization is a necessary next step for further advancement of health care. Infrastructure and finances to support this are not at the level of high-income countries, but they are adequate, and the country is ready to improve radiology services. Implementing this broadly and equitably while including increased training opportunities, human resources, and quality assurance will be challenging. RAD-AID began investigating radiology in Morocco

before the COVID situation and initiated involvement in academic exchange. [37, 43] Continued educational exchanges would likely be the next best step through RAD-AID to support advancing imaging care in the Kingdom. Representatives from all facets of radiology from physicists and technologists to interventionalists and mammographers should be included.

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