



Brazil's Challenges and Opportunities

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Introduction

The Federative Republic of Brazil is a unique country born from a blend of many cultures. It is the largest country of the South American continent, both in acreage and population, and the fifth largest in the world. A common characteristic of large countries is the diversity of weather, geographic features, environments, and especially people and their culture. It is in this characteristic that the uniqueness of the country as well as the arduousness of designing health interventions lays.

The same diversities that make Brazil a unique place also contribute to socioeconomic, infrastructural, and epidemiologic differences that interfere deeply with the health system. Within its territory there are places that can be called islands of excellence, next to areas where access to health care is a real challenge.

Composed of 26 states and 1 federal district, with a population of 200 million, Brazil has a vast range of ethnic backgrounds owing to its ancient history and massive immigration.

These characteristics have an impact in cancer epidemiology, implying that numerous factors must be taken into

account when considering cancer development, screening, and treatment. A high-quality and complex network of health services is needed to respond to these demands (1, 2).

Historical development

First inhabited by many tribal groups, Brazil (which makes reference to Brazilwood, a tree that was common on the Brazilian coast) was discovered by Pedro Álvares Cabral and explored and colonized by Portugal starting in 1500. Brazil remained as a Portuguese colony until 1808, when the court was transferred from Lisbon to Rio de Janeiro. Independence came a few years later, in 1822, with the creation of the Empire of Brazil, a parliamentary and constitutional monarchy. Despite evolving into a presidential republic in 1889, the system was shaken when an authoritarian and dictatorial military government ruled the nation from 1964 until 1985. A few years later, in 1988, Brazil approved its new constitution that defined the actual system, a federal republic.

During a 500-year period Brazil suffered from slavery, of both native and African people; invasions from the Dutch and French; as well as serving as refuge for several nations

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such as Japan, Italy, and Germany after the great wars. These facts played a key role in the national economic development, geographic features, and ethnic configuration, and thus in the health epidemiology development.

Today Brazil is a continental country where most infrastructures are concentrated in states' capital cities and other large urban centers (eg, São Paulo and Rio de Janeiro: 11.253 million and 6.320 million inhabitants, respectively). In addition to the country's geographic magnitude, the country is the largest economy in Latin America and the seventh in the world. According to the latest available data, a gross domestic product of \$2505 trillion and an average per capita income of \$12,526 were reported. Consideration must be given to the inequitable distribution of the income, with very few accounting for the largest part of the wealth (3).

Brazil is now dealing with a demographic transition (aging of the population plus a decrease in population growth rate) and also a rise in life expectancy, currently of 73.62 years. Individuals in the workforce (48%) are originally from the countryside, with most ranging in age from 20 to 34 years. The proportion of population aged 60 years or older is approximately 11% (jumping from 5% in the 1960s) (4).

From all the data and facts presented, we can conclude that although the heterogeneous nature of the country is a difficulty to overcome when designing, implementing, and evaluating interventions, it definitely holds the key to an effective improvement and growth of the health system. Interventions to ameliorate the coverage and quality of the health system should always take into consideration the diversity and the size of the country and use it as a tool for a better Brazilian health system.

Health system

The Brazilian health system comprises a multiplicity of private and public institutions that were developed in different historical times.

At the beginning of the 20th century, public health projects, assumed in a practically military style, were used to implement public health actions. During the 1920s and 1930s, individuals' civil and social rights were associated with their situation in the labor market, and the Brazilian state's model for intervention in social issues was formed (5).

Until the 1980s, Brazil's social protection system was increased; administration processes and decision making were completely without public involvement, and the processes involved huge bureaucratic formalities. The Ministry of Health was provided with insufficient funding, and the health system comprised the social security system that offered medical care throughout the retirement and pension institutes on the basis of work-related classes. At that time, persons with sporadic work had an insufficient supply of public services, and often they did not have the financial condition to defray private medical support (6).

In the early 1970s, financial support from the federal government was created to permit the renovation and construction of private hospitals. The liability to provide health care was stretched to trade unions, and philanthropic associations made it possible to provide assistance for rural employees. Direct sponsorships to private companies for the provision of health care to their workers were exchanged for income tax deductions, promoting development of medical care sources and propagation of private health care plans (5).

In 1988 a multifarious public health care system (the Unified Healthcare System or Sistema Único de Saúde, SUS), which is based on the doctrine of health as a civilian's right and the state's obligation, was created. The SUS aims to offer comprehensive, curative, and preventive support throughout decentralized administration and establishment of health services and encourages society involvement at all administrative levels. The in-depth implementation of the SUS has been hindered by chronic underfunding and the concentration of 20th century health assistance in more developed regions.

Currently the Brazilian Health System has 3 subdivisions: the public (SUS), in which assistance is sponsored and provided by the state (federal, state, and municipal levels); the private, in which assistance is supported in several ways with private resources or public-private partnership (in which nonprofit institutions can benefit by providing services for both the SUS and patients with private insurance); and the private health insurance area, with diverse systems of health plans, changing insurance premiums, and tax supports (5).

Cancer epidemiology

The Brazilian National Cancer Institute (Instituto Nacional de Câncer, INCA) (7) estimates 576,580 new cancer cases for 2014 (302,350 in men; 274,230 in women). Excluding nonmelanoma skin tumors, prostate cancer is the most common type among men, and breast cancer is the most frequent in women. Table 1 summarizes the estimates of new cancer cases for 2014, as well as estimated risk per 100,000 inhabitants in different sites.

The 5 most common primary tumor locations related to cancer mortality in men are lung, prostate, stomach, esophagus, and liver, with mortality rates of 15.54, 13.65, 9.39, 6.53, and 5.46 per 100,000 persons, respectively. In women, breast, lung, cervix, stomach, and colon represent the sites that are associated with higher mortality rates (12.10, 8.18, 4.72, 4.23, and 4.08 per 100,000 persons, respectively).

Regarding the pediatric population, 11,840 new cancer cases are expected in 2014 (excluding skin cancer non-melanoma). The Southeast and Northeast regions have the highest expected (aged 0-19 years/2014) numbers of new cases, with 5600 and 2790 cases, respectively, followed by the South (1350 new cases), Midwest (1280 new cases), and North (820 new cases). These numbers represent 2% to 3% of all cancer in Brazil, and approximately 40% of

Table 1 Estimates of cancer incidence in Brazil, 2014

Primary site	New cancer cases (n)	Estimated risk (per 100,000)
Prostate	68,800	70.42
Female breast	57,120	56.09
Colon and rectum		
Male	15,070	15.44
Female	17,530	17.24
Lung		
Male	16,400	16.79
Female	10,930	10.75
Stomach		
Male	12,870	13.19
Female	7520	7.41
Cervical	15,590	15.33
Oral cavity		
Male	11,280	11.54
Female	4010	3.92
Esophagus		
Male	8100	8.18
Female	2770	2.70
Leukemia		
Male	5050	5.20
Female	4320	4.24
Non-Hodgkin lymphoma		
Male	4940	5.04
Female	4850	4.77
Hodgkin lymphoma		
Male	1300	1.28
Female	880	0.83
Thyroid		
Male	1150	1.15
Female	8050	7.91
Central nervous system		
Male	4960	5.07
Female	4130	4.05
Bladder		
Male	6750	6.89
Female	2190	2.15
Larynx		
Male	6870	7.03
Female	770	0.75
Ovary	5680	5.58
Skin (nonmelanoma)		
Male	98,420	100.75
Female	83,710	82.24

this pediatric population will need radiation therapy treatment at some point of the medical approach.

Cancer prevention and screening programs

Cancer prevention policies in Brazil are mainly focused on reducing the number of smokers and the number of human papillomavirus (HPV) infections. In 2014, 27,000 new cases of lung cancer are expected in Brazil, of which 90% are estimated to be directly related to smoking. Brazil has

become a prominent country regarding antismoking strategies during the past years, as the rate of smokers decreased from 38% in 1989 to 15% in 2006 and then to 12% in 2012. This drop was followed by a decrease in the number of new cases of lung cancer: from 17,800 new diagnoses in men in 2010 to 16,400 in 2013. Data from the International Tobacco Control, coordinated by the University of Waterloo, have demonstrated that the increase on cigarette taxes was the main driving factor of reduced cigarette consumption in Brazil (8).

Another objective of the health authorities is to reduce HPV prevalence/incidence in women. In 2014 the government launched a program to vaccinate girls aged 11 to 13 years against HPV types 6, 11, 16, and 18. In 2015, girls aged 9 and 10 years will also be vaccinated (9). Human papillomavirus is responsible for 95% of cervix cancer cases, which is still the third most common cancer among Brazilian women (Table 1). Nonetheless, the annual rate of new cases is also decreasing. In 2010 there were 18,430 cases of cervix cancer, and for 2014 the estimation is approximately 15,590. This is a prediction based on the increased access of women to screening programs. The Brazilian health system offers screening for women aged 25 to 64 years (8).

Regarding breast cancer, early diagnosis is still a major challenge in Brazil. However, similarly to cervix cancer, screening for breast cancer is also taking its place, especially concerning women aged 50 to 69 years, according to World Health Organization recommendations. The number of mammograms performed in the public health system is increasing year by year. In 2010, 1.7 million exams were performed, whereas in 2012 this number increased to 2.3 million. In addition, regarding investments to improve diagnostic tests or techniques and basic access, the government is investing in breast cancer awareness campaigns at health promotion programs (10).

Although the number of new cases of cancer in Brazil is still growing (an increase of 11% in the number of new cases in 2014 compared with 2012 is expected), this number may also reflect the improved access to diagnosis and reporting (8).

Nevertheless, there is still a considerable amount of advanced disease at presentation in daily practice. Hence, the real impact of the prevention and screening programs will be properly evaluated only after an improvement in the health care coverage as well. Furthermore, radiation therapy treatment access still is a challenge in many localities of the country, resulting in longer queues and sometimes impacting treatment success.

Brazilian Society for Radiation Oncology

In the 1940s the Brazilian College of Radiology was founded, and at that time radiation oncologists and nuclear physicians were included in that society.

Over the years there has been a growing dichotomy in light of technological advances and specific scopes

of action of each medical specialty. However, the interconnection between representatives of radiology and radiation oncology remained until 1998, with mutual benefits of this union, such as the financing of medical events, annual fees collected by members, and the common use of the headquarters, among others.

In 1998 the idea of creating a specific medical society in radiation oncology became real. It took place the next year with the creation of its own statute, and its own representative board was born. Nevertheless, this new society remained associated with the Brazilian College of Radiology, owing to the assumption of its founders of an inability to remain self-sustaining.

In 2009 the Brazilian Society of Radiotherapy (Sociedade Brasileira de Radioterapia, SBRT) acquired its own premises, and at the end of 2011 the separation from the Brazilian College of Radiology was completed. Then radiation oncology went on to be recognized as an independent medical specialty with independent and strong representation in the Brazilian governmental agencies related to health, such as the Brazilian Ministry of Health and Brazilian Medical Association (specialty #51).

Today the SBRT consists of 425 associate members, and its aims are mainly 3: to study and discuss all issues related to the practice, teaching, and research of radiation therapy and related matters; to represent scientific and professional interests of its members in several health organizations; and to promote the raising of financial resources to be used in the development of the specialty. In addition, the SBRT is also involved in clinical guidelines generation and raising population interest in approval of new techniques (such as intensity modulated radiation therapy for head and neck tumors, 3-dimensional conformal treatment) for treatment and quality improvement.

Moreover, it organizes an annual meeting and has partnerships with the American Society for Radiation Oncology, the European Society for Radiotherapy and Oncology, the Asociación Latinoamericana de Terapia Radiante Oncológica, and other Brazilian and international medical societies.

Education and training of radiation oncologists

According to the Brazilian government, radiation oncology is defined as a medical specialty that uses ionizing radiation to treat and prevent certain diseases.

To become a radiation oncologist, the physician must undergo, after graduation in medicine (which is 6 years, including a 2-year internship), a medical residency program with a minimum duration of 3 years. After the training period several evaluations must be undertaken so as to obtain the title of specialist, issued by the SBRT and Brazilian governmental agencies responsible for health management (eg, after training a radiation oncologist undergoes National Commission of Nuclear Energy [Comissão

Nacional de Energia Nuclear, CNEN] appraisal on nuclear issues and radioprotection).

In Brazil, the radiation oncologist is able to perform actions in the treatment of cancer and other diseases that involve prescription of ionizing radiation. The use of unsealed sources of radiation is not included in the training of Brazilian radiation oncologists (nuclear physicians only).

Currently there are 61 new residency positions available per year in Brazil, distributed among 30 educational institutions with health programs established and certified by the Ministry of Education and Culture. According to data from the INCA, the estimated number of patients with pathologies requiring radiation therapy was 350,000 for the year 2014 (7). In addition to these new cases, others diagnosed in previous years also enter into this equation, increasing this estimate to 400,000 cases. On the basis of the recommendation of the World Health Organization and data from the CNEN, in Brazil there is a demand for specialists in radiation therapy, which will probably be served by the recent increase in the annual number of places available for medical residency programs.

Cancer service organization and access to cancer services

In 1998 the INCA, supported by the Ministry of Health, designed a strategy for the expansion of oncologic care in the country. The goal was to offer complete and integrated assistance for all people, with actions involving education, research, information, prevention, and assistance.

The Centers and Units for High Complexity Oncologic Assistance (respectively, Centros de Assistência de Alta Complexidade em Oncologia and Unidades de Assistência de Alta Complexidade em Oncologia) were then created with the purpose of providing a comprehensive approach to malignant tumors, from diagnosis and staging to treatment: surgery, radiation therapy, and chemotherapy, all properly complemented by support services, rehabilitation, and palliative care.

From 2005 to 2006, a revision and update of this concept was made, and the National Policy for Oncologic Care was implemented with the foundation of a regional Oncology Care Network, to tailor cancer prevention and treatment to the needs of each state and region of the country. Besides the entire public infrastructure directed to cancer care and prevention, the government also has the help of the private or public university hospitals and of a network of philanthropic institutions registered at the SUS.

Following these actions, aware of the high demand for treatment, including difficult access to the public system and delays in authorization of procedures by the private health insurances, another project, named EXPANDE, was created to provide proper assistance to the entire population. This project contemplated a number of pieces of radiation therapy equipment to be installed in the country, but

it never took off. Few linear accelerators were acquired by the government and installed in facilities that already had the appropriate infrastructure. More equipment was supposed to be installed in places with no previous facilities. The idea partially failed because the system faced many problems like the lack of local budget for building a bunker or even for maintenance of the equipment that would be received.

Afterward, with the growing demand for cancer treatment including radiation therapy, a huge investment was made by the Ministry of Health in 2012 and after, with the acquisition of 80 linear accelerators with capability to deliver high-quality radiation therapy, including 3-dimensional conformal radiation therapy and capability to upgrade for intensity modulated radiation therapy. An expansion of 39 already-existing services and the creation of 41 more is intended, with a federal investment of more than \$250 million. There is hope to assist all the geographic areas of the country properly, avoiding patient migration for treatment (11).

According to the CNEN, there are 241 radiation therapy facilities distributed unequally across the country (Fig. 1 and Table 2) (12).

Parallel to that action, since May 2013, the “60-day law” is in effect: patients with cancer must start their first treatment at SUS no more than 60 days after diagnosis.

The services and units that provide radiation therapy will be stimulated to adopt a third working period, and the Ministry is willing to help by providing technical and financial resources and by establishing new contracts with the private health care network to assist the patients from SUS.

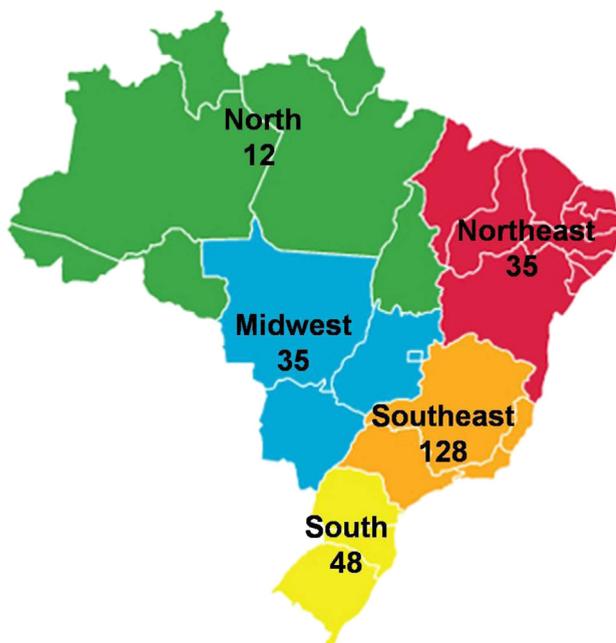


Fig. 1. Distribution of radiation therapy services by geographical region in Brazil.

Table 2 Distribution of equipment by geographic region in Brazil

Region	Linear accelerators	Cobalt units	HDR units
Southeast	185	37	72
South	54	9	12
Northeast	47	8	18
Midwest	18	2	6
North	10	6	11
Total	314	62	119

Abbreviation: HDR = high-dose-rate brachytherapy equipment.

There will be a growing demand for qualified human resources, and a number of health care specialists will need to be trained, especially radiation oncologists and medical physicists.

What to expect

Brazil has a growing economy that has been attractive for all sorts of investments: developments are expected from agriculture and farming to industry and health care.

The international community is focusing on specific aspects of the country, such as natural resources, energy, infrastructure, and tourism, which includes a significant amount of “health tourism.” People mostly from Latin America and Africa are attracted by the high quality of the services offered by the private health system in the main cities, as well as geographic proximity and language.

Authorities are demonstrating a higher commitment to health care, and regarding radiation therapy, the alert has already been heard. Yet it will take some time to set up all goals in the area. The availability of equipment in all regions, with better access for people to radiation therapy facilities, will provide a more appropriate treatment for all cancer patients, with reduction or ending of waitlists, and adequate treatment timing. This will require a huge increase of human resources in the country, with efforts directed to training and development of qualified personnel.

Allied to this, research is a key point. Radiation oncology is becoming visible in the country. High-quality publications originating from Brazilian experience in radiation therapy are emerging. Grants and financial support for research should also increase in the view of this progress. The country has a lot to offer and still a lot to grow.

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