

The role of diagnostic and therapeutic radiology in the field of public health

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The 2002 edition of *Health in the Americas* (1), serially published by the Pan American Health Organization (PAHO), contains reflections on the demographic, socioeconomic, and epidemiologic changes that have taken place in the Americas in recent years, and documents the increase in life expectancy to the current average of more than 70 years in all countries of the Region (excluding Haiti) (1). According to the 2006 on-line edition of *Health Statistics from the Americas* (2), another PAHO publication that presents data for 37 countries, life expectancy at birth for the five-year period from 2005 to 2010 in both sexes is expected to range from 65.4 years (in Guyana) to 80.7 years (in Canada), with a mean of 73.3 years and a standard deviation of 5.17 years (except in Haiti, where the estimated life expectancy is 53.5 years). Steady aging of the population represents a considerable challenge for health ministries in the Americas as the prevalence of chronic illnesses, which affect older people in the population, is on the rise.

According to statistics for 2006, the 10 leading causes of death in 31 countries in the Region account for between 43.1% and 59.8% of all deaths recorded in these countries (2). Cerebrovascular diseases are among the 10 leading causes of death in both sexes in all 31 countries, and ischemic heart disease is among such causes in all countries except Dominica, Haiti, and Honduras. Among men, prostate cancer is one of the 10 leading causes of death in 17 countries. In addition, chronic diseases of the lower respiratory tract, heart failure and its complica-

tions, and ill-defined heart conditions are among the main causes of death in 14 of the countries. In women, influenza and pneumonia are among the 10 leading causes of death in 30 countries; ischemic heart disease, in 28; and heart failure, in 25. Breast and uterine cancers continue to rank among the 10 leading causes of death in 16 countries, followed by colon cancer in 6 countries, and cancer of the trachea, bronchus, and lung in 5 countries (2).

Within this context, the application of radiological technologies takes on enormous importance. The diagnosis of cerebrovascular diseases, cardiac anomalies, and neoplasms is made easier thanks to diagnostic radiology; moreover, certain treatments of choice for these illnesses are based on interventional radiology. Many types of radiation used in both conventional radiology and computed tomography are ionizing in nature; others, such as those used in ultrasound and magnetic resonance imaging, are non-ionizing. Some technologies depend on the use of radiation produced by X-ray equipment, whereas others are based on the visualization of radioactive substances administered to the patient and absorbed by the body. Radiotherapy can involve the use of radiation-generating equipment, such as linear accelerators, or radioactive sources in cobalt teletherapy units and sealed cesium-137 sources used in gynecological applications.

The main objective of these radiological techniques is to prolong the patient's life and to decrease morbidity. As its use increases, the technology becomes more complex. The efficient and safe use of diagnostic and therapeutic procedures involving radiation sources requires that the staff performing the procedures be appropriately educated and trained. Clinicians, radiologists, radiation oncologists and nuclear medicine specialists,

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medical physicists, technologists, and nursing staff all form part of this large, interdisciplinary team of radiology service health workers. Southon (3) analyzes the benefits of having access to professional networks that can support the national policies surrounding health services—which include radiology services—and improve the quality of healthcare delivery.

In their normative and regulatory role, health ministries are responsible for overseeing and ensuring the quality of radiology services. One way to accomplish this task is through accreditation programs. The article by Jiménez et al. (4) examines the potential characteristics of such programs in developing countries, particularly in the context of basic imaging services such as radiography, fluoroscopy, mammography, and ultrasound, through a combination of physical and clinical features.

It is a recognized fact that radiological procedures should be subject to quality control programs that include a robust radiation safety component. These programs unquestionably improve the quality of radiological images and decrease the dose of radiation received by patients and operators. But do such programs increase diagnostic accuracy? This question was investigated by a research group that, with support from PAHO, assessed the quality of diagnostic radiology services in five countries in the Region that differ widely in their social and technological characteristics: Argentina, Bolivia, Colombia, Cuba, and Mexico. Fleitas et al. (5) present the results of this research, which shows that the training and experience of radiologists and radiology technicians are very important in improving diagnostic accuracy. This research involved screening and diagnostic mammography, among other types of radiology services.

Performing mammography on all women beyond a certain age, including asymptomatic women, is a public health strategy for the early detection of breast cancer that has given rise to substantial controversy. In this special issue, Feig (6) shows that the benefits of this strategy outweigh the limitations of the technique's low sensitivity and the risks related to the doses of radiation received. Currently, mammography remains the only recognized screening technique for detecting breast cancer.

Imaging techniques may be diagnostic or interventional. Diagnostic techniques make it possible to obtain morphological (static) or physiological (dynamic) information. Among the resources now available for this purpose are conventional radiology, ultrasound, magnetic reso-

nance and nuclear medicine. This last technology, based on the visualization of radioactive substances inside the patient's body, makes physiological as well as morphological studies possible. Positron emission tomography (PET), one of the newer technologies, has not only revolutionized our knowledge of the functioning of the human brain but is also becoming an indispensable tool for localizing and delimiting neoplasms. Few PET units are in operation in Latin America and the Caribbean. As explained by Robilotta (7), Brazil is one of the most advanced countries in this field.

It should be emphasized that technological advances have occurred not only in the field of diagnostic imaging. As the incidence of cancer throughout the world increases, new forms of treatment are being sought. Together with surgery and chemotherapy, radiotherapy offers the possibility of curative or palliative treatment that can prolong survival and diminish morbidity. Castellanos (8) reports on current needs and challenges in the field of radiotherapy.

To cure a tumor with radiation, very large doses of radiation are needed. New imaging techniques make it possible to visualize the volume of the site requiring treatment so that radiation can be applied only to the tissues affected by the tumor. However, despite the advances described by Castellanos, it is impossible to prevent the healthy tissues surrounding the tumor from being irradiated, albeit at lower doses. The effects of radiation on these tissues are addressed by Hendry et al. (9), who quantify the risks associated with different doses.

In radiotherapy it is essential that the dose delivered to the patient match the prescribed dose. In 1969 the International Atomic Energy Agency and the World Health Organization established a postal dose audit program that made it possible to verify whether high-energy radiotherapy units were properly calibrated. In the Region of the Americas this program is run by PAHO. Izewska et al. (10) report the results of audits performed between 1969 and 2003 in countries of Latin America and the Caribbean and conclude that great strides have been made.

Unfortunately, miscalibration of treatment units is not the only source of dosimetry errors in patients who undergo radiotherapy. Borrás (11) describes an overexposure error in 28 patients in Panama that resulted from the inappropriate use of a computerized treatment planning system. She also describes the measures that were taken by the treatment facility in Panama and by PAHO in order to prevent similar errors from happening in the future.

When is irradiation considered excessive? The doses used for radiotherapy are 1 000-fold higher than those used for diagnostic purposes. Are they all dangerous? How can health ministries ensure that patients do not receive harmful doses? Who controls the sources of radiation? Who allows radiology units to be imported to or built in a given country? Arias (12) reports on the development of radiological protection programs and outlines the role of regulatory entities in this area.

According to Arias, the tissues and organs belonging to the embryo and fetus are among the most sensitive to radiation. Irrational fear of radiation leads many pregnant women who have undergone radiological tests or treatment to worry about the effects of radiation on their developing baby and to consider terminating their pregnancy. Brent (13) describes some of these cases and the outcome of counseling provided for women in such situations.

People fear not only ionizing radiation, but also non-ionizing radiation produced by electromagnetic fields, such as those coming from cell phones. Any radiation, whether it be ionizing or non-ionizing, must be subject to rules and standards. Skvarca et al. (14) explain the exposure limits and the measurement protocols for non-

ionizing radiation, based upon current practice in Argentina.

Since radiological technology is an expanding area, many more contributions on additional topics could have been solicited for this special issue in order to illustrate different aspects of diagnostic and therapeutic radiology. The aim of the articles selected for the issue is to direct the attention of readers of the *Revista Panamericana de Salud Pública/Pan American Journal of Public Health* toward a fascinating field that is perhaps little known but offers enormous potential that was unthinkable only a few years ago. Thanks to the technologies applied in this field, patients no longer need to undergo prolonged hospital stays and can enjoy a longer, better life.

Radiology offers hope and better prospects for the future. The articles and reports in this special issue are intended to encourage readers to delve more deeply into this innovative field. I am extremely grateful to all the authors who, at my request, submitted original contributions on specific topics for this issue. Thanks to their generosity and to the efforts of editors involved, perhaps somewhere in the Americas someone's life will be saved or improved.

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