

## GLOBAL HEALTH

# Radiation Oncology in Africa: Improving Access to Cancer Care on the African Continent



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Received Nov 26, 2013, and in revised form Dec 16, 2013. Accepted for publication Dec 19, 2013.

## Introduction

Although many oncology professionals are interested in international outreach, a commonly held belief is that radiation oncology cannot be part of that service due to the high cost and static nature of the equipment used to deliver radiation therapy. There are, however, outreach avenues available today for radiation therapy through both nonprofit and governmental agencies. One of the areas in greatest need of service is the African continent. In many parts of Africa, there are fewer than 1 teletherapy unit per 10 million people. While there is much work left to do, organizations such as Radiating Hope (1), individual radiation oncology departments, and international organizations are currently trying to bridge the gap between patient needs and availability of high-quality radiation therapy in Africa.

Despite the obvious interest in global outreach among oncology practitioners, many erroneously consider radiation oncology to be a discipline which is not amenable to international service endeavors or outreach because of the high cost and technical complexity of linear accelerators and modern brachytherapy equipment. Several efforts have been made, however, to address the need for high-quality radiation therapy in developing parts of the world. One of

the areas of greatest need is in northwest Africa, where the ratio of teletherapy units to people is 1:10 million.

In December 2012, a delegation of radiation oncologists, residents, and physicists altered our specialty's stereotype by embarking on a medical mission to the city of Dakar, Senegal, in West Africa. The parent organization for this trip was Radiating Hope, a nonprofit organization whose mission is to update and provide radiation equipment to developing countries and to advance cancer care in those countries. Together with faculty support from the University of California San Diego, as well as other academic and private radiation oncology centers, Radiating Hope organized a mission with the primary objective of providing Senegal with its first high-dose-rate (HDR) brachytherapy afterloader. The HDR afterloader was procured through a private donation by a clinic in New Jersey and corporate sponsorship by Nucletron (Veenendaal, the Netherlands) to upgrade the machine. Multiple private and academic institutions donated implements such as brachytherapy devices, equipment, treatment planning software, and other supplies.

It is hard to overstate the potential impact of oncology outreach efforts as cancer is a rapidly growing cause of death in Africa. In 2008, 542,000 deaths were reported on the continent, which is projected to double by 2030 (2). If social

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Conflict of interest: none.

habits such as increased smoking and alcohol consumption accompany further economic development in Africa, these numbers could rise to even greater levels. The number of new cancer cases worldwide per year is also estimated to increase to approximately 15 million by 2015, two-thirds of which will occur in developing countries (3), shifting the proportion of cancer cases occurring in the developing world from just over half to greater than 70% by 2030 (4, 5).

It is estimated that less than 25% of the population of developing countries has access to potentially life-saving radiation therapy (6). Among the obstacles is lack of radiation equipment, which poses a great barrier to cancer care in developing nations (7). An acceptable worldwide standard for cancer care is that 1 megavoltage radiation machine be available for every 120,000 to 250,000 people living in a region (8, 9). In Africa, which has the highest number of underdeveloped nations in the world, each megavoltage and brachytherapy machine serves millions of people, and some countries have only 1 megavoltage machine for more than 17 million people.

## Megavoltage machines in Africa

Radiation therapy megavoltage machines are present in only 23 of 52 African nations. Twenty-eight countries have no data for the availability of radiation therapy equipment. Of the megavoltage machines, 32% (88 machines) are cobalt teletherapy machines, and 68% (189 machines) are linear accelerators. Information regarding the availability of equipment is maintained through Directory of Radiotherapy Centers from the International Atomic Energy Agency (IAEA) regional and African and interregional project reports (10, 11). There are 58 conventional simulators and 36 computed tomography (CT) simulators. The number of megavoltage machines per million people is represented graphically in Figure 1. Of the 23 countries with radiation availability, 8 countries had a person-to-radiation machine ratio of more than 10 million:1 (12).

Lack of access to care highlights an unfortunate irony with international cancer care. Whereas developing nations have an increasing incidence of cancer, as well as a relatively higher incidence of malignancies for which radiation is the primary and integral modality (eg, cervical cancer, gastric cancer, pediatric cancers), access to radiation oncology is hampered by both scant availability as well as financial and travel limitations in these countries (8, 13).

## Brachytherapy in Africa

Brachytherapy services are available in fewer than half of African nations (11). Of the 20 countries with brachytherapy, both low-dose-rate and HDR brachytherapy delivery are used roughly in equal proportions in Africa. It has been estimated that Africa is functioning at 25% of its potential treatable capacity for cervical cancer alone (11). Cervical cancer is a disease that receives clear benefit from

brachytherapy, transforming it into a potentially curable disease. Additionally, brachytherapy has advantages of lower cost and relative ease of installation (8, 12, 14). Because of these advantages and because cervical cancer is a leading cause of death in Senegal, the objective of Radiating Hope's delegation was to provide a brachytherapy afterloader for expedited use in Senegal. Because the 2 radiation oncologists in Senegal have had brachytherapy training, the HDR equipment was able to be used immediately.

## Radiation: A cost-effective therapy

Despite the significant initial investment to build a radiation facility, radiation therapy is a cost-effective form of both curative and palliative cancer therapy (15). Cost analyses have demonstrated that 1 fraction of palliative radiation therapy is more cost effective as a treatment for bone metastases than either chemotherapy or even narcotic medication (7, 16).

Cost-effective aspects of radiation therapy include the fact that patients are treated as outpatients, buildings and equipment have a long lifespan, and the return on equipment investment is high. The cost of an entire course of radiation therapy in Senegal is \$300 regardless of duration or fractionation of treatments. Despite this minimal cost of treatment, many patients in Senegal cannot afford radiation therapy and are never treated.

## Addressing the rising demand of developing world cancer therapy

The lack of radiation therapy machines and specialists makes it difficult for people with cancer to get the care they need. For example, Senegal is staffed with 2 radiation oncologists and 3 medical physicists. This radiation team currently treats 50 patients per day, 40% of whom have cervical cancer. One of the potential solutions to ongoing cancer treatment training in developing nations may be the development of the Cancer Expert Corps at the US National Institutes of Health. Advocates for this program include C. Norman Coleman, MD, and Bhadrasain Vikram, MD, with the Radiation Research Program, who are helping design a system in which grant dollars may be available to help support tenure-track physicians' efforts to maintain education and training ties with international partners in developing countries (17). In the opinion of many policy makers, ongoing active ties between international treatment facilities and centers of excellence in the developed world are critical to long-term success, including treatment efficacy, safe treatment for patients, and suitable work environment for staff.

The difficulties of travel in developing countries contribute to the poor access to cancer care. Patients who are candidates for radiation therapy are often required to travel great distances. Analysis by the Surveillance, Epidemiology, and End Results (SEER) cancer registries

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