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The Stagnation and Decay of Radiation Oncology Resources: Lessons From Nigeria

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The global incidence of cancer has increased by 20% in the past decade, with low-income and middle-income countries (LMIC) accounting for the majority of cases (1). By 2020, about 70% of new cancer cases will occur in LMIC (2); however, these countries are inadequately prepared for the global cancer epidemic. Radiation therapy is a particularly cost-effective modality for cancer treatment (3). Adequate access to radiation therapy is a crucial component of modern multidisciplinary cancer care. Within a 20-year period of 2005 to 2025, 100 million cancer victims in the developing countries will require radiation therapy, for cure or for the relief of symptoms such as pain and bleeding (4). Estimates show that by 2020, 84 LMICs will need 9169 teletherapy units, 12,149 radiation oncologists, 9915 medical physicists, and 29,140 radiation therapy technologists (5). Despite this enormous need, radiation therapy machine downtime remains high in existing radiation therapy centers of LMIC (4). Although much has been reported on the technical and human resource needs of LMIC, little has been said regarding efforts to stem the decay of existing resources. This report appraises the current status of radiation oncology in Nigeria, documents its recent regressive path, and suggests solutions to salvage and ultimately improve what radiation therapy resources remain.

Health Care Delivery in Nigeria

Health care in Nigeria is the responsibility of a decentralized 3-tier system of government. The federal government formulates and implements an overall national health policy, manages the specialists and teaching hospitals, and is largely responsible for the training of medical professionals. The 36 state governments independently oversee the secondary health facilities and a few tertiary institutions owned by states, and the local governments are concerned with executing plans for primary health care services (6).

The federal government largely dictates the tone of health care delivery and finances the state and local governments through statutory financial allocations that come mainly from oil revenue. Federal government allocation to health as a proportion of total budget has fluctuated from 2% to 7% in the past 20 years (7, 8). In 2015, budgetary allocation to health care was 5.78% of the national budget, totaling N264.5 billion (N1 $\leq$US$0.05) (9). This has dipped to 3.65% of the national budget in the 2016 appropriation awaiting the approval of the National Assembly at the time of this writing (10). Although Nigeria is reckoned as Africa's largest

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economy, that country's sparse health care allocation for a population of nearly 180 million limits her total health expenditure per capita to a paltry $115 US between 2011 and 2015, and places her as 187th of 190 countries in the World Health Organization ranking of world health systems (11, 12).

The problem of a limited health fund is not peculiar to Nigeria. What is particularly worrisome is how the governments of certain LMIC, like Nigeria, appropriate that meager allocation. Their prioritization criteria, and their willingness to make far-sighted changes and plans based on global trends, are limited. For example, although Nigeria is a country in which more than 90% of its citizens lack health insurance, the Nigerian government appropriated a dismissive 2% of its 2015 health-allocated fund for the development of the national health insurance scheme (9). In spite of the changing global movement to address chronic diseases, the country failed to define measures toward combating cancer in the national health development plan for 2010 to 2015 (13). One may argue that Nigeria, as a nation with an average life expectancy of 53 to 54 years, should be less concerned with combating chronic diseases, but health statistics tell otherwise. The worldwide mortality from cancer has exceeded that of human immunodeficiency virus/acquired immunodeficiency syndrome, malaria, and tuberculosis combined (14), and these trends are projected to increase in the developing countries (15). According to the GLOBOCAN report (16), the cancer incidence in Nigeria was 102,000 annually in 2012, causing 75,000 deaths per year. The 5-year prevalence in the adult population is 223,000. Nigeria contributed 8.3% of the estimated 847,000 new cancer cases that occurred in Africa in 2012. Indeed, it has been argued that the GLOBOCAN statistics for Nigeria are rather too conservative. The annual incidence may have exceeded 500,000 (17), but the pervasive underreporting of cases and the absence of a developed nationwide population-based cancer registry make it difficult to verify this speculation.

Cancer Registration

There are few population-based or hospital-based cancer registries in Nigeria. In the absence of a nationwide cancer registry, previous research and planning have relied heavily on the Ibadan registry, which is the most developed of all hospital-based registries in the nation. No single cancer registry has sufficient data to give a true estimate of cancer incidence in the general population, and considerable confusion has been the result (18). In 2009, the Nigerian National System of Cancer Registries (NSCR) was established by the Nigerian Federal Ministry of Health, the Society of Oncology and Cancer Research of Nigeria, and the Institute of Human Virology Nigeria. The NSCR, with the consent of hospitals, now collates data from 25 registries within the country and also advocates for cancer registration. The poor progress to date toward attaining a functional population-based cancer registry has been blamed on the lack of financial support, ignorance of the need for cancer registration, and poorly trained staff and registry personnel (18).

The most common cancers in Nigeria are those of the prostate and liver in men, and breast and cervix in women (19). Overall, combining the sexes, breast cancer is the most common, followed by cervix, liver, and prostate cancers. The diagnosis and staging of cancers are dependent on typical investigations like biopsy, X rays, and ultrasonography. There is limited use of modern and advanced technologies such as mammography, computed tomography (CT), magnetic resonance imaging, flow cytometry, frozen section histology, or isotope bone scan. Surgeries and chemotherapy are administered in virtually all teaching hospitals and some private hospitals, and in many occasions are the only interventions, even for cancers that require radiation therapy. More than half of cancer patients in Nigeria will require radiation therapy service at least once (3). Because the existing radiation therapy centers in Nigeria are within tertiary teaching hospitals managed by the federal government, poor government policies and a failure to prioritize cancer care has had an enormous effect on the development of sound radiation oncology practice.

Survey

The authors surveyed all commissioned radiation therapy centers in Nigeria to assess major equipment and personnel in September 2015. Radiation therapy personnel (radiation oncologists, medical physicists, radiation therapy technologists, oncology nurses, mold room technicians, and maintenance engineers) were defined as those staff who have received formal training within the country, outside of the country, or both, in their specialty. Data from all radiation therapy centers in Nigeria were collected through site visits and cross-checked with staff on the ground. Follow-up phone calls were made to each of the radiation therapy centers between January and February 2016 to ascertain whether or not there had been recent developments. The major equipment evaluated included linear accelerators, cobalt 60 machines, high-dose-rate (HDR) and low-dose-rate (LDR) brachytherapy equipment, conventional and CT simulators, orthovoltage equipment, treatment planning systems, and mold rooms (Table 1). The only private hospital with megavoltage equipment for radiation therapy in Nigeria is located in Lagos and was included in this study for transparency. The findings are presented in Table 2, which compares the results from previous surveys conducted in 2001, 2010, and 2011. The net loss or gain of any particular radiation therapy equipment in 2015 was calculated using the year with the highest number of that equipment as the benchmark.