

Diffusion of Radiologic Technology in Sub-Saharan Africa: A Jefferson College of Health Professions Study

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According to the World Health Organization (WHO), industrialized nations must share the responsibility for providing healthcare among the disadvantaged.¹ Socioeconomic progress in poor and hard-to-reach populations hinges greatly on health services, including new technologies and the means to effectively employ them. Certainly, a nation's health and degree of economic development is linked to its national security and prosperity, a theory also known as "health creates wealth."²

With regard to the diffusion of medical technology internationally, more than three-fourths of the global population have no chance of receiving an examination utilizing diagnostic imaging.³ In 1985, WHO recommended that all institutions in developing nations possess at least 1 ultrasound machine.⁴ The need for ultrasound in developing nations was further supported in a 2003 article by Goldberg.⁵

The countries of sub-Saharan Africa (SSA) are among those in desperate need of advanced imaging technology. Factors that thwart its profusion in SSA are poor planning, lack of professional training, maintenance problems—due to poorly trained and/or a dearth of skilled repair technicians—and insufficient financial resources.^{6,7} That funding challenges affect the diffusion of medical technology⁸ in SSA is not surprising, given that the public sector healthcare budget ranges from \$20 to \$50 per capita (as

compared to the United States' budget of \$5,700 per capita). In SSA the lack of established policies for technology assessment and maintenance makes appropriate purchases and keeping the existing devices in service problematic.⁶ When a society is unable to use a currently available technology, there may be healthcare implications related to missed diagnoses or the inability to monitor treatment.⁹

As in many other non-industrialized nations, AIDS and other endemic diseases are a primary focus of healthcare in SSA, and rightly so. However, the importance of radiologic technology to aid in the diagnosis of the sequelae of these diseases and treatment follow-up cannot be overstated.¹⁰

An unfunded study was conducted as part of a master's thesis in the Radiologic and Imaging Sciences program at Thomas Jefferson University's College of Health Professions. The purpose of the study was to examine the manner in which advanced imaging technology, including computed tomography (CT), magnetic resonance imaging (MRI), ultrasound (US) and nuclear medicine (NM) has spread throughout SSA. It was hypothesized that SSA would have a substantial amount of US equipment, and less CT, MR and NM equipment. It was further hypothesized that a significant amount of the equipment would be nonfunctional due to the lack of trained biomedical technicians in SSA.

A survey was sent to 156 institutions in SSA via email and the postal service with the goal of examining the pattern of diffusion of these modalities, and the status of functional equipment. A total of 40 (25.6%) completed surveys were returned and revealed that 100% of the institutions that responded had ultrasound equipment (commensurate, perhaps, with the 1985 WHO recommendation that every institution in all developing nations should have at least 1 ultrasound machine). After US, CT was the most common modality, followed by MRI and then NM. With regard to the presence of functioning equipment, ultrasound was the modality with the most equipment out of service (41%), followed by CT and NM. All of the MRI units were reported to be functional. While almost half (46%) of the institutions reported having biomedical technicians in-house, there was no correlation between the presence of these technicians and the amount of functioning equipment. The study results confirmed the need for better trained biomedical technicians who have reliable access to replacement parts, and it was theorized that the biomedical technicians are not trained to repair advanced imaging equipment.

The chief limitation of this study was its small sample size, and a comprehensive database of healthcare institutions within SSA would likely improve the ability to perform future research. While this study focused on the nations of SSA, the results should translate to other impoverished nations facing similar funding struggles in the socialized medicine environment. Improved funding by governmental and nongovernmental agencies for advanced imaging equipment would offer more opportunities to the people of these nations for improvement in diagnosis and treatment of disease.

More developed countries can assist these nations in need through donations of "gently used" and/or refurbished radiologic equipment. However, the cost of upgrading and repairing these expensive technologies may be prohibitive for the recipient nations, and create a worse situation than not having the machines.¹¹ The Radiological Society of North America (www.RSNA.org) and the American College of Radiology International Volunteer System (<https://internationalservice.acr.org/>) have resources for volunteer physicians who wish to aid in the training and use of this equipment.

Helping lesser developed neighbors attain the means to improve the health of their populations necessarily takes many forms, and advanced diagnostic imaging is an important component in the diagnosis and treatment of disease. Radiologic equipment is very expensive to both own and maintain, especially for those countries with limited economic resources. The effective diffusion and adoption of radiologic technology represents a critical "weapon" of disease prevention and cure, and therefore, merits concerted international public health attention.

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