IAEA BRIEF 2016/1

Human Health

Enhancing Patient Care In Africa Through Safe Medical Imaging

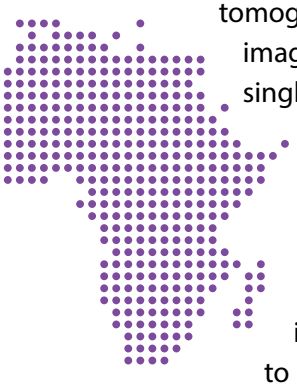
SUMMARY

❶ Medical physicists can ensure that radiation medicine is applied safely and effectively in diagnosis or treatment, improving quality of services and health-related quality of life. Yet, in Africa there is critical shortage of these professionals.

❷ IAEA Member States are encouraged to put in place policies to ensure that every medical imaging centre (especially those with equipment emitting high radiation doses) employs qualified medical physicists or at least has medical physics services.

INTRODUCTION

Africa is rapidly acquiring high-tech medical imaging equipment such as multi-slice helical computed tomography (CT) scanners, as well as hybrid imaging technologies like combining single photon emission computed tomography and positron emission tomography with CT. However, without proper specialized support, this advancement in technology has the potential of significantly increasing the population's exposure to ionizing radiation.



The safe use of these technologies requires proper quality assurance procedures, calibration of imaging equipment and optimization of the radiation dose to the patient, which may not be properly done in the absence of a qualified medical physicist. The degree of involvement of the medical physicist is determined by the complexity of the radiological procedures and the associated radiation risks.

Africa is rapidly acquiring high-tech medical imaging equipment. However, without proper specialized support, this advancement in technology has the potential of significantly increasing the population's unnecessary exposure to ionizing radiation.

Unfortunately, in most African countries[1], there is a critical shortage or absence of qualified medical physicists in hospitals, clinics and other health care facilities that use radiation technology. This problem is particularly critical in diagnostic imaging units (either in diagnostic radiology or nuclear medicine) that usually have no qualified medical physicist in their workforce. This may lead to patients receiving non-optimized radiation procedures, resulting in inadequate diagnosis or treatment, or in extreme cases even suffering from the harmful effects of radiation due to overexposure.

LEARNING FROM OTHER COUNTRIES

The important role of medical physicists in ensuring safety for patients is fully understood in countries with advanced health systems. For example, according to a recent European Union (EU) directive[2], all EU member States are required to ensure that each

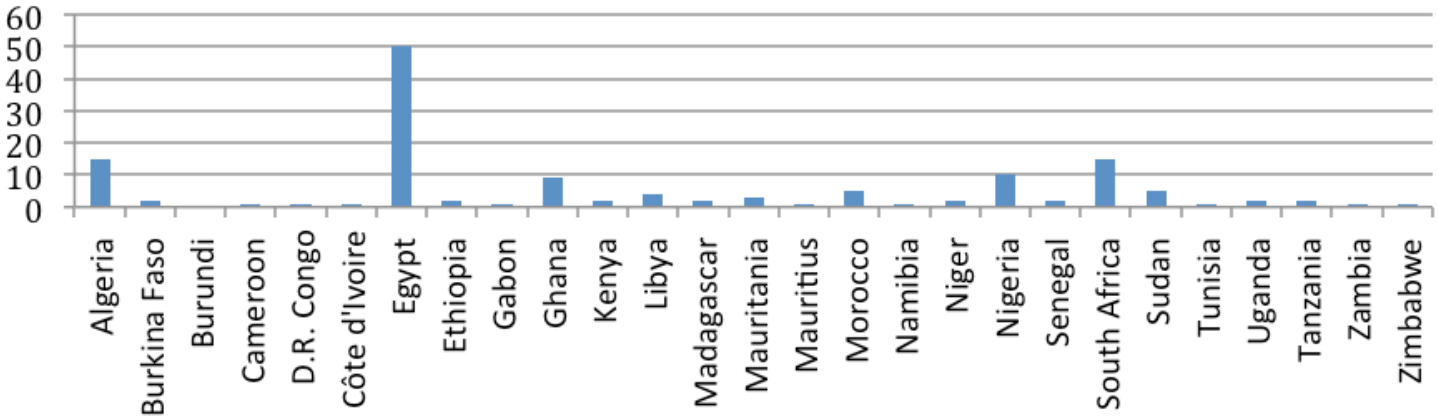


Fig. 1: Number of medical physicists employed in medical imaging in Africa.
(The countries missing in this graph do not have any medical physicists in imaging.)

radiation medicine service provider shall have at least one medical physics expert to act or give specialist advice, as appropriate, on matters relating to radiation physics, dose optimization, quality assurance and radiation safety.

In Egypt, one of the conditions for authorization of nuclear medicine and diagnostic/interventional radiology practices is that there must be a qualified expert in radiation protection.[3] In South Africa it is also a requirement for all nuclear medicine facilities[4] and diagnostic/interventional radiology[5] practices to appoint a medical physicist to establish and implement an optimization programme, which includes the establishment of diagnostic reference levels and periodic audits and reviews.

This is not the case in most African countries, which have very limited regulatory requirements for the employment of medical physicists in medical imaging facilities that require precise attention for radiation dose optimization and quality assurance procedures. This is partly due to the lack of awareness of the need for qualified medical physicists, or recognition of their role to ensure that patients are imaged or treated safely and effectively. There is an urgent need to address this problem through effective national measures.

IAEA SUPPORT

In Africa, for medical imaging alone, three IAEA technical cooperation projects have been implemented in the recent years, namely: 'Promoting Regional and National Quality Assurance Programmes for Medical Physics in Nuclear Medicine' — Phase I (2005–2010) and Phase II (2011–2013); and 'Strengthening Medical Physicists' Capacities to Ensure Safety in Medical Imaging, with an Emphasis on Paediatric Imaging Safety', which was launched in 2014.

The core objectives relate to promoting the role of medical physicists and building their capacities to enhance patient safety, including workers and public safety during medical imaging procedures in Africa.

Furthermore, the IAEA Dosimetry and Medical Radiation Physics Section and Radiation Safety and Monitoring Section have implemented several initiatives in this area. These include medical physics developments for quality assurance and clinical applications of ionizing radiation, as well as assisting Member States in competence and skill development for optimization of protection in medical exposures.

The recommendations from these projects as well as from the related technical documents and the

International Basic Safety Standards, GSR Part 3,[6] are summarized in this IAEA Brief. The African health ministries may wish to adopt/adapt some of these key recommendations.

RECOMMENDATIONS FOR CONSIDERATION

1. Recognize the Important Role of Medical Physicists

Member States are encouraged to recognize that a medical physicist is a health professional with specialist education and training in the concepts and techniques of applying physics in medicine and competent to practise independently in one or more of the subfields of medical physics (e.g. radiation oncology, nuclear medicine and diagnostic radiology).

Medical physicists are the health professionals with specialist academic education and clinical training on the concepts and techniques of applying physics in medicine. They are thus competent to ensure that patients are imaged or treated safely and effectively with radiation technologies. For medical imaging, the medical physicist's roles include:

(i) assessing radiation doses and associated risks to patients and personnel, which is especially critical for pregnant women and children;

(ii) dose optimization to minimize exposure and improve safety;

(iii) calibration and monitoring of imaging equipment;

(iv) implementing appropriate quality assurance programmes, including quality control measures;

(v) advising on installation design and technical specifications, and participating in the procurement, acceptance and commissioning of medical imaging equipment;

(vi) guaranteeing that all radiological practices comply with national regulations as well as with international guidelines and standards; and

(vii) providing radiation protection education and training to other health professionals.

A medical physicist measures uniformity of images from a gamma camera as part of the quality assurance process.
(Photo: IAEA)

2. Medical Physics Services in All Imaging Centres

Member States are encouraged to put in place legislative and regulatory requirements to establish posts and employ, in particular, medical physicists to serve in radiology and nuclear medicine departments (both public and private) so as to enhance the proper utilization of equipment, improve image quality and increase radiation safety in the workplace.

Every medical imaging facility requires the service of a medical physicist, whose degree of involvement is determined by the complexity of the radiological procedures and the associated radiation risks. It is essential that the relevant national authorities establish mechanisms so that all medical imaging centres in the country have access to medical physics services either by employing a permanent staff member or hiring regular services.

3. Training More Medical Physicists

Member States are encouraged to assess their national training needs related to medical physics and introduce academic and clinical training programmes, where necessary and justified.

These programmes should be based on the minimum requirements presented in the harmonized curriculum developed under the African Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology. To enhance the effectiveness of these capacity building efforts, Member States may consider the development of clear policies for the evaluation of the training and competencies, and subsequent formal recognition and registration of clinically qualified medical physicists.

REFERENCES

1. MORRIS, P., PERKINS, A., Diagnostic imaging, The Lancet 379 (2012) 1525–1533; DENDY, P., RINGERTZ, H., Serious deficiencies in numbers of medical physics experts in diagnostic radiology, Eur Radiol. 12 8 (2002) 2125; THOMADSEN, B., The shortage of radiotherapy physicists. J Am Coll Radiol. 1 4 (2004) 280–282

2. European Union Council Directive 2013/59/EURATOM
Available at: eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2014:013:0001:0073:EN:PDF

3. Act No. 7 of 2010 on the Regulations of Nuclear and Radioactive Activities, and the associated Resolution No. 1326 of 2011 on the issuing of executive regulations of nuclear and radioactive activities of Act No. 7 of 2010, Egypt

4. Code of Practice for Users of Medical X-Ray Equipment (revised in January 2015). Department of Health, Directorate for Radiation Control, South Africa

5. Requirements for Licence Holders with Respect to Quality Control Tests for Diagnostic X-Ray Imaging Systems (modified in April 2015). Department of Health, Directorate for Radiation Control, South Africa

6. Radiation Protection and Safety of Radiation Sources: International Basic Safety *Standards* (IAEA Safety Standards Series No. GSR Part 3, Vienna, 2014) — Jointly sponsored by EC, FAO, IAEA, ILO, OECD/NEA, PAHO, UNEP and WHO
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IAEA, Vienna International Centre, PO Box 100, 1400 Vienna, Austria
Email: info@iaea.org • Telephone: +43 (1) 2600-0 • Facsimile +43 (1) 2600-7