

Development of Radiation Safety Training Program for Integrated Molecular Imaging Centre in Kenya

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1. Introduction

The rising incidence of cancer in Kenya has led to increased demand for advanced diagnostic technologies such as Positron Emission Tomography (PET) and Single Photon Emission Computed Tomography (SPECT). These modalities, while essential for modern patient care, expose healthcare personnel to ionizing radiation and require stringent radiation protection measures. Despite regulatory oversight by the Kenya Nuclear Regulatory Authority (KNRA), recent reviews at the Integrated Molecular Imaging Centre (IMIC) have revealed significant deficiencies in structured radiation safety training. This study aims to develop a tailored radiation safety training program that aligns with both KNRA regulations and International Atomic Energy Agency (IAEA) standards.

2. Methods and Materials

The development of a radiation safety training program for nuclear medicine workers at the Integrated Molecular Imaging Centre (IMIC) in Kenya followed a structured qualitative approach, integrating local regulatory review with international benchmarking. The development framework presented in Figure 1 corresponds to Sections 2.1 through 2.4, illustrating the sequential methodology employed.

2.1 Literature Review and Conceptual Framework

A comprehensive review of radiation safety standards from the International Atomic Energy Agency (IAEA), Kenya Nuclear Regulatory Authority (KNRA), and relevant training models from South Korea, South Africa, and the United States was conducted. This formed the foundation for evaluating existing practices and identifying international best practices.

2.2 International Benchmarking

Radiation safety training systems from South Korea (KOFONS and NSSC/KINS), South Africa, and the United States were reviewed. These countries were selected for their structured, accredited training frameworks and emphasis on safety culture, regulatory oversight, and tiered instruction.

2.3 Role and Risk Assessment

IMIC personnel roles were analyzed to determine exposure risk levels. This informed the design of differentiated training modules for new and existing staff, based on their responsibilities and occupational risk.

2.4 Gap Analysis

IMIC's existing training records, SOPs, audit reports, and KNRA compliance findings were assessed against IAEA safety standards (e.g., GSR Part 3, Safety Reports Series No. 20, and Safety Reports Series No. 40). Gaps were identified in training coverage, documentation, frequency, and role-specific content.



Fig. 1. Framework of the Proposed Radiation Safety Training Program

3. Results and Discussions

A comprehensive gap analysis revealed significant shortcomings in the existing radiation safety training framework at the Integrated Molecular Imaging Centre (IMIC). Key findings included the lack of structured and role-specific training modules, irregular training intervals, and inadequate coverage across occupational groups.

International benchmarking against established training systems in South Korea (KOFONS-NSSC/KINS), South Africa, and the United States highlighted several best practices that could be adopted within IMIC. These included:

- Role-specific modular training tailored to staff responsibilities and occupational exposure risks.
- Mandatory annual refresher courses to reinforce knowledge and sustain safety culture.
- Structured evaluation mechanisms, including written assessments and practical drills.
- Integrated quality assurance systems, ensuring continual monitoring and improvement of training effectiveness.

Table 1 summarizes the gaps identified and the proposed improvements.

Table 1. Gaps Identified vs. Proposed Solutions

Current Status at IMIC	IAEA/Benchmark Standards	Proposed Improvements
Training for limited staff	Mandatory training for all Radiation workers	Redesign modules based on roles and risk levels
Irregular training intervals	Annual or more frequent training	Set clear training intervals (annual/quarterly for high-risk staff)
Limited audit activity	Routine audits and feedback loops	Integrate QA and regular feedback mechanisms

Based on these findings and international benchmarking, a modular training program was designed to address identified gaps. Table 2 lists the role-specific training modules proposed

Table 2. Proposed Role-Specific Radiation Safety Training Modules at IMIC

Module Title	Target Group	Duration	Evaluation Method
Basic Radiation Science	All staff	2 hours	MCQ test (pass $\geq$ 80%)
Radiation Monitoring & Dosimetry	All radiation workers	2 hours	Practical + quiz
Contamination Control & Waste Management	Technologists, Cyclotron Operators, RSOs	2 hours	Drill + waste ID quiz
Patient-Centered Radiation Protection	Technologists, Nurses	3 hours	Checklist + plan

4. Conclusions

The findings underscore the urgent need for structured, role-specific, and locally contextualized radiation safety training at IMIC. The proposed framework offers a scalable model for enhancing radiation protection standards and compliance in Kenya's nuclear medicine sector. The adoption of such training programs is essential, not only for protecting healthcare workers and ensuring patient safety, but also for achieving compliance with both national and international regulatory frameworks.

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