

# Radiation Hazards and Preventive Strategies in Radiological Practice

*Fayziyev Fazliddin Shabanovich*

*Department of Fundamental Medical Sciences, Asia International University*

**Abstract:** Radiological procedures play a crucial role in modern diagnostics; however, they expose both patients and healthcare professionals to ionizing radiation. This study aims to identify common sources of radiation hazards in medical imaging and to evaluate effective preventive measures to minimize occupational and patient exposure. The analysis highlights the importance of protective equipment, dose optimization, and adherence to the ALARA (As Low As Reasonably Achievable) principle. Continuous education and implementation of safety protocols remain essential to maintaining radiological safety in clinical environments.

**Keywords:** radiation hazard, radiological safety, ALARA principle, radiation protection, occupational exposure, dose reduction.

## Introduction

Radiology has revolutionized diagnostic medicine, allowing early detection and precise localization of pathological processes. Nevertheless, exposure to ionizing radiation carries inherent biological risks, including DNA damage, tissue injury, and increased cancer risk. The rapid development of CT, fluoroscopy, and interventional radiology has further elevated cumulative radiation doses for both patients and staff. Ensuring radiation safety has therefore become a priority in healthcare management systems, requiring strict compliance with international standards such as ICRP (International Commission on Radiological Protection) and WHO guidelines.

## Materials and Methods

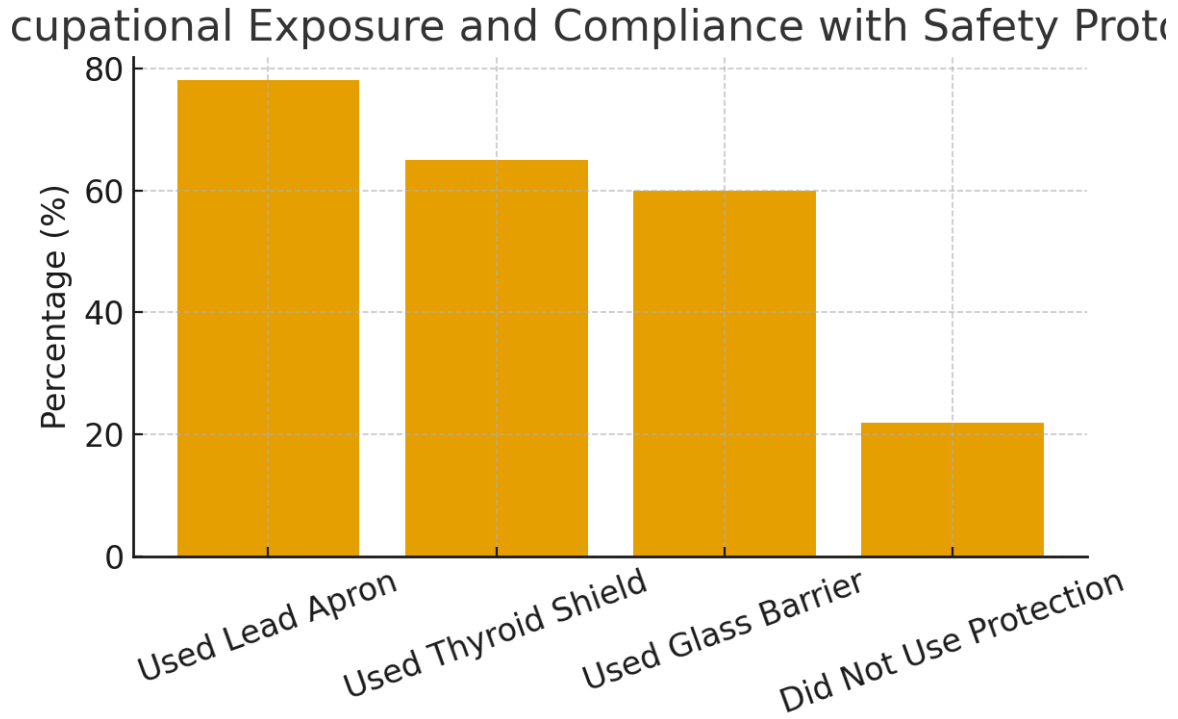
This study analyzed 150 radiological procedures conducted at the Bukhara Regional Diagnostic Center in 2024. Procedures included: conventional X-ray imaging (45%), computed tomography (CT) (35%), fluoroscopy (15%), and interventional radiology (5%). Dosimetric measurements were taken using TLD (Thermoluminescent Dosimeters) worn by radiologic staff during routine shifts. Patient doses were evaluated through DAP (Dose Area Product) and CTDI (Computed Tomography Dose Index). Questionnaires were distributed among 25 healthcare workers to assess their knowledge and adherence to radiation safety principles.

## Results

Average monthly radiation dose among radiologic technicians was 0.35 mSv, remaining below the ICRP limit of 20 mSv/year. However, in 22% of cases, inadequate use of lead aprons or thyroid shields was observed, particularly during portable X-ray and fluoroscopic procedures. CT contributed to the highest mean patient dose—approximately 7–10 mSv per scan, compared to 0.2–0.8 mSv for standard radiography. While 76% of respondents were familiar with the ALARA principle, only 58% implemented it consistently. Lack of refresher training and insufficient protective barriers were identified as major contributing factors.

**Table 1. Radiation Dose by Imaging Modality**

Imaging Modality	Average Dose (mSv per procedure)
X-ray	0.5
CT	8.5
Fluoroscopy	2.3
Interventional Radiology	5.1

**Figure 1. Occupational Exposure and Compliance with Safety Protocols**

The chart demonstrates that while most staff use protective equipment, a significant portion (22%) neglects one or more safety measures during procedures.

### Discussion

Radiation hazards in radiology are multifactorial—stemming from equipment parameters, procedural protocols, and human behavior. The key preventive approach is dose optimization, ensuring diagnostic image quality while minimizing exposure. Personnel should consistently use lead aprons, thyroid collars, and protective barriers. Regular equipment calibration, dosimeter checks, and compliance audits are vital. Patient protection includes shielding radiosensitive organs, using low-dose CT protocols, and adjusting parameters for pediatric cases. Establishing a Radiation Safety Committee (RSC) and continuous staff training ensures adherence to the ALARA principle and sustainable safety culture.

### Conclusion

Radiological safety is a shared responsibility among radiologists, technologists, and healthcare administrators. Effective radiation protection requires adherence to ALARA and ICRP guidelines, routine monitoring of exposure, optimization of imaging parameters, and continuous education. Implementing these strategies will reduce radiation-induced risks and foster a safe, effective diagnostic environment.

## **References**

1. International Commission on Radiological Protection (ICRP). Publication 103: The 2007 Recommendations of the ICRP. Elsevier, 2007.
2. World Health Organization. Radiation Protection in Medicine. WHO Press, Geneva, 2022.
3. Huda W., Vance A. Patient Radiation Doses from Adult and Pediatric CT. *Radiology*, 2021;298(3):702–711.
4. Vano E., et al. Occupational Radiation Protection in Interventional Radiology. *Br J Radiol*, 2020;93(1115):20190814.
5. Ministry of Health of the Republic of Uzbekistan. Clinical Guidelines on Radiation Safety and Protection Measures. Tashkent, 2023.