



TOWARDS DEVELOPING A RADIATION PROTECTION CULTURE IN DIAGNOSTIC RADIOGRAPHY IN NIGERIA: A PILOT SURVEY

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ABSTRACT

Background: Effective utility of Radiation Protection (RP) is premised on the adoption of its practice as a culture. There have been concerns for the observed poor adherence to radiation protection guidelines in diagnostic radiology service delivery in Nigeria.

Objective: This study sought to identify reasons for this position and explore the challenges militating against development of a radiation protection culture among medical radiation workers in the country.

Materials and Methods: Self-study questionnaires were used to access information on familiarity with and knowledge of the 'as low as reasonably achievable' (ALARA) principle and the National Commission for Radiological Protection (NCRP) guidelines, attitudes, procedures and techniques in radiation protection and dose optimization, individual participation, methods and challenges of optimization and protection, quality of personnel, legislation and level of training received on radiation protection by radiation users from practicing radiographers and radiologists in Nigeria. Information obtained from the responses was organized and presented in simple percentages.

Result: While all respondents claimed familiarity with ALARA and NCRP guidelines for radiation protection, 76% were not usually involved in radiation protection. Reasons for this ranged from workload, unavailability of protection equipment and personnel. Findings generally reflect a poor RP culture deriving from poor practitioner attitudes, lack of equipment for RP, inadequate funding, a lack of sustained interest, inaccessible legislation and poor regulator monitoring. At least 87% of respondents felt that regular monitoring of protection protocols would compel them to adopt RP practice as a routine.

Conclusion: The findings are suggestive of a need for attitudinal change among radiation users and regulators as a first step towards adopting a radiation protection culture in Nigeria.

KEYWORDS: Radiation, Protection, Culture, Nigeria, Radiographers, Radiologists

INTRODUCTION

The effect of ionizing radiation on biological tissues has been identified since the discovery of x-rays in 1895. Evidence from atomic bomb survivors, early radiologists, radium industry workers, miners among other groups confirms that ionizing radiation no matter how small has potential to cause damage to biological tissues (Omar *et al.*, 2015).

Medical use is up to date, the most common source of ionizing radiation injury (Donya *et al.*, 2014). The increasing application of ionizing radiation in the medical practice makes it necessary to find a compromise position between minimizing radiation dose and optimizing image quality. Dose auditing has therefore become crucial to the practice of diagnostic radiology across the world.

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The intention is to keep radiation doses to patients undergoing diagnostic x-ray examination as *low as reasonable achievable* – ALARA (ICRP, 1977, ICRP, 1991) while maximizing the benefits accruing from its use. Several international organizations have provided series of documents on radiation safety standards and recommendations for patient and occupational radiation protection in diagnostic radiology (ICRU, 1996; CEC, 1999; IAEA, 2002).

Radiation Protection (RP) seeks to establish appropriate level of protection for people and the environment against the detrimental effects of radiation exposure without unduly limiting the desirable benefits obtainable from such exposure. The need for implementation of the ALARA principles as well as justification, optimization and dose limitation principles has been stressed by various authors and regulatory agencies (ICRU, 1996; IAEA, 2002; NNRA, 2003).

In Nigeria, the Nigerian Nuclear Regulatory Authority (NNRA), monitors and regulates the use of ionizing radiation, issues authorization to facilities that meet regulatory requirements and imposes penalties on offenders. However, sparse dose studies, lack of dosimetry equipment, lack of diagnostic reference levels, poor quality assurance/quality control measures and lack of any optimization protocols as well as poor knowledge base of radiation workers have been observed in the country (Achuka *et al.*, 2021). Although the use of ionizing radiation is regulated by NNRA, radiation protection of patient is a collective effort involving the radiation worker, regulating agencies and management of facilities using radiation and nuclear sources.

Studies have highlighted concerns about poor adherence to radiation protection guidelines in diagnostic radiology service delivery in Nigeria (Yusuf *et al.*, 2020; Emmanuel *et al.*, 2022). This present study sought to identify reasons for the poor compliance with radiation safety regulations and explore the challenges militating against development of a radiation protection culture among medical radiation users in the country.

MATERIALS AND METHODS

From a rough estimate of 1000 radiographers and radiologists in Nigeria, an appropriate sample size was calculated at the 95% confidence interval and a confidence level of ± 10 , using the Creative Research System's sample size calculator. A total of 230 structured, self-administered questionnaires were issued to practicing radiographers and radiologists in

public and private clinics in Nigeria. The questionnaire fielded questions designed to access information on the respondents' familiarity with the 'as low as reasonably achievable' (ALARA) and the National Council for Radiological Protection (NCRP) radiation protection guidelines and legislation. It also sought responses on the individual respondent's professional knowledge as well as attitudes to radiation protection issues.

The prevailing RP procedures and techniques in radiation protection with respect to patient dose/image quality optimization, individual participation, methods used, challenges of optimization and protection, the quality of personnel with respect to the level of training received by the respondent on RP and available local legislation, were also covered in the questions. The questionnaire was tested for validity by first administering same on diagnostic radiology personnel with not less than five (5) years of practice. Questionnaires were finally administered online through e-mails and in hard copies. Respondents were expected to fill in answers that best applied to their circumstances. Returned questionnaires were collated and organized.

DISCUSSION

Of the 230 questionnaires sent out, a total of 155 (67.0%) were completed and returned. This was far above the sample size of 88 obtained from the sample size calculator. The constitution of the sampled population by profession was made up of Radiologists (35.0%) and Radiographers (65.0%) drawn from 24% private and 76% public health establishments, respectively. The obtained responses indicate that while all respondents claimed familiarity with ALARA and NCRP guidelines for radiation protection, less than 50% were familiar with other RP agencies, locally or globally (Figure 1). The deleterious effects of ionizing radiation place a demand on operators and users to conscientiously seek to optimize its use in order to minimize damage to biological tissues. Radiation protection of staff and patients in diagnostic radiology depends on several factors ranging from the status of the equipment in use to the knowledge, attitude and commitment of medical radiation workers and commitment of regulatory and monitoring agencies.

The results of the current study reveal that although all respondents claimed familiarity with radiation protection guidelines, theoretical familiarity was not translated to practice. There was evidence of low level interest and poor attitudes to radiation protection by medical radiation workers. Of the 155 responses received, 119 or 76% were not usually involved in radiation protection during their work (Figure 2).

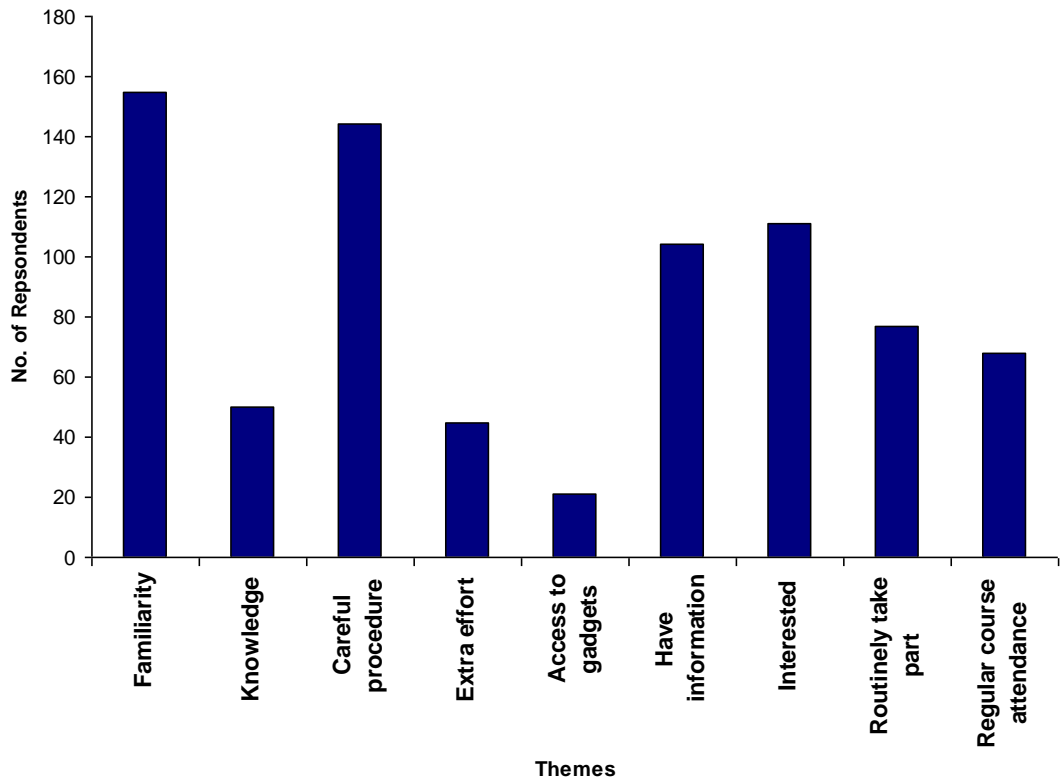


Figure 1: Distribution of responses to the themes covered in the questionnaire.

Figure 2 reveals that only 50 of the 155 respondents had some knowledge of RP procedures outside the RP component of the choice of radiographic technique and collimation of x-ray beam. We also observed low radiation protection course attendance by practitioners. Whether this was due to unavailability of such courses, lack of interest on the part of respondents or due to lack of conference /training funds, is a subject to be investigated. A greater percentage (76.8%) of respondents was not usually involved in radiation protection of patients in the course of their work (Figure 2). This is a cause for concern as the situation suggests a lack of ownership of RP by practitioners. Studies have reported good

radiation protection and monitoring of staff in southwest Nigeria (Ibitoye *et al.*, 2011; Adejumo *et al.*, 2012). However, poor regulatory control of radiological equipment in Nigeria has also been reported (Emmanuel *et al.*, 2022). Whether this suggests that radiation workers are more concerned with their individual protection than with protection as part of their practice is a matter to be further examined. The foregone reflects relatively poor attitude towards RP. RP practise is mostly due to personal interest and effort (Figure 2) rather than any planned institutional approach.

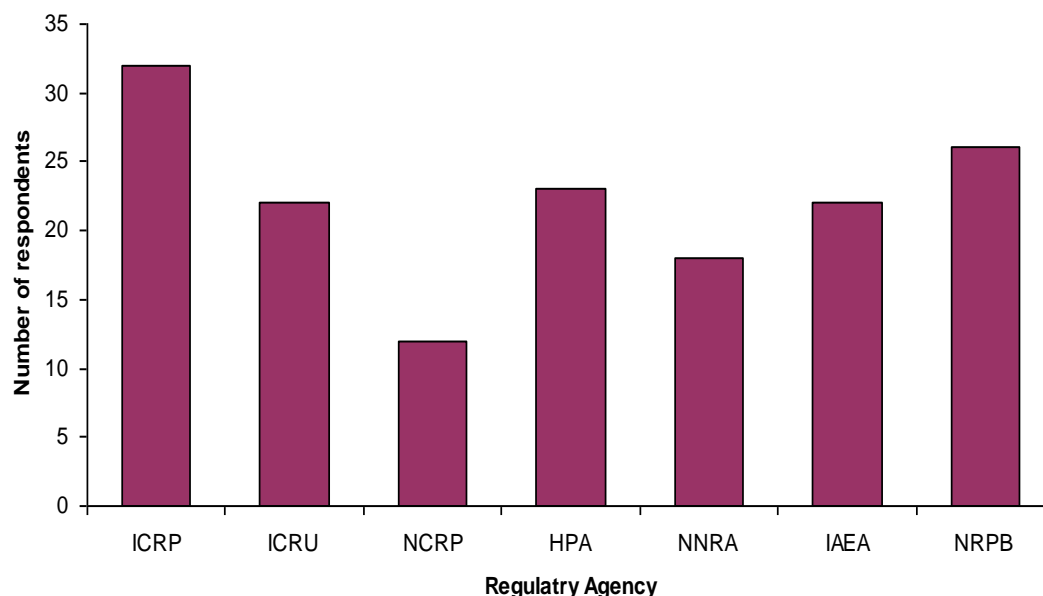
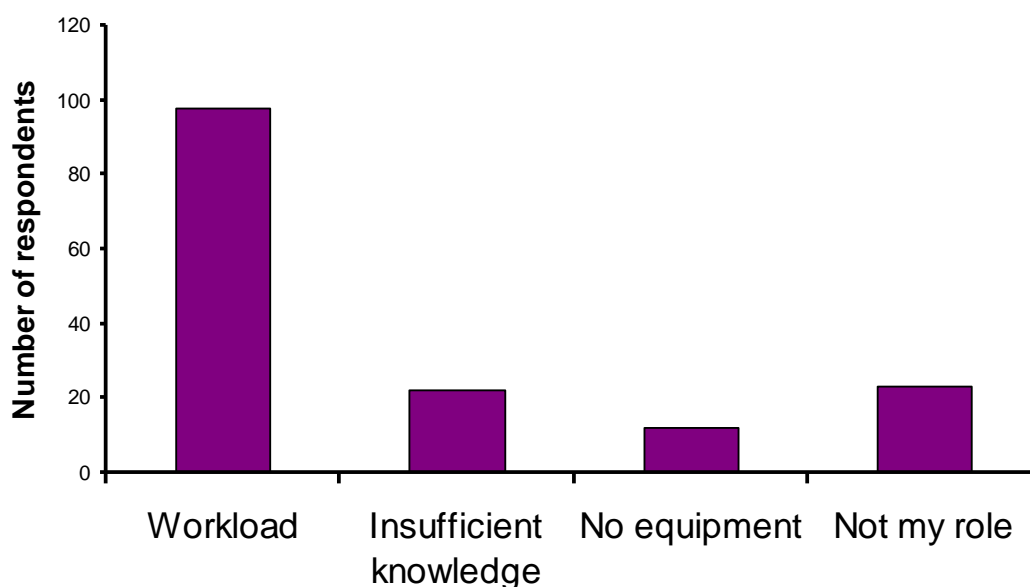


Figure 2: Respondents familiarity with the roles of regulator agencies

Reasons for this ranged from workload (65.0%), unavailability of protection equipment (19.3%), insufficient knowledge (25.8%) and poor attitude towards radiation protection (Figure 3).



As a culture, RP is not ingrained in the sub consciousness of practitioners. It is still far from a philosophy among the respondents. Reasons advanced for the poor radiation protection attitudes were attributed to issues like heavy workload due to low staff strength, low self confidence due to poor knowledge base and lack of radiation protection equipment and personnel. It may be right to conclude that the respondents' reaction to high workloads was

to focus on achieving the task with little attention to the details of how it is achieved. Radiation protection is obviously not perceived as role by some radiation workers (Figure 3). Figure 3: Factors affecting involvement in radiation protection Less than 5.0% of the respondents rated the RP culture in the country as excellent. Approximately 40.0% of the respondents would give RP culture a rating of good to excellent (Figure 4).

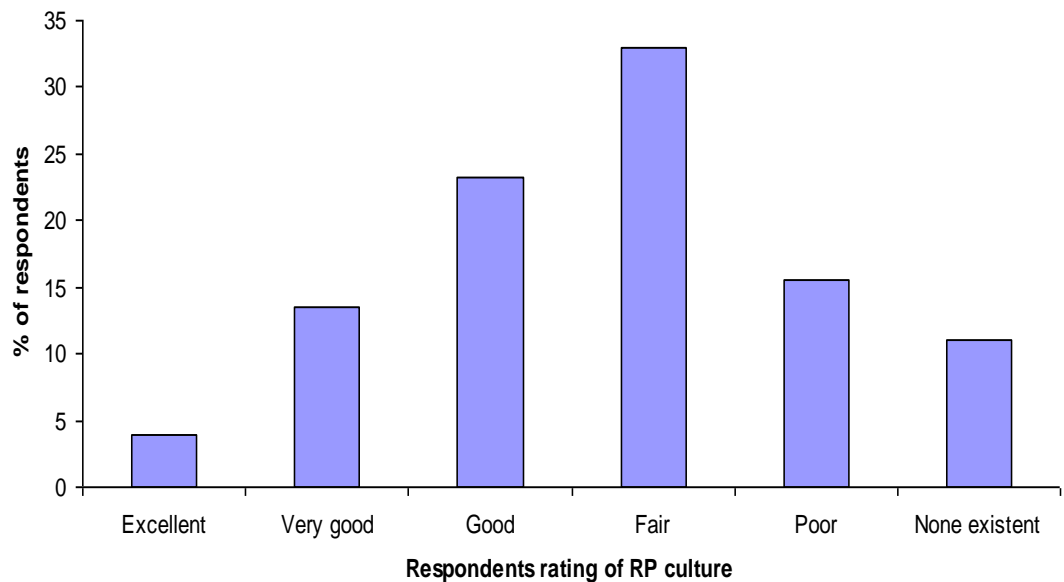


Figure 4: Respondents rating of RP culture

The above would certainly affect radiation protection implementation and could be a reflection of practitioner level of RP acculturation. These may also account for the reasons (Figure 5) for the rating of RP culture in the Country (Figure 4).

Poor funding, lack of regulation and monitoring, absence of requisite equipment and the regulators approach were cited as the major reasons for the rating (Figure 5).

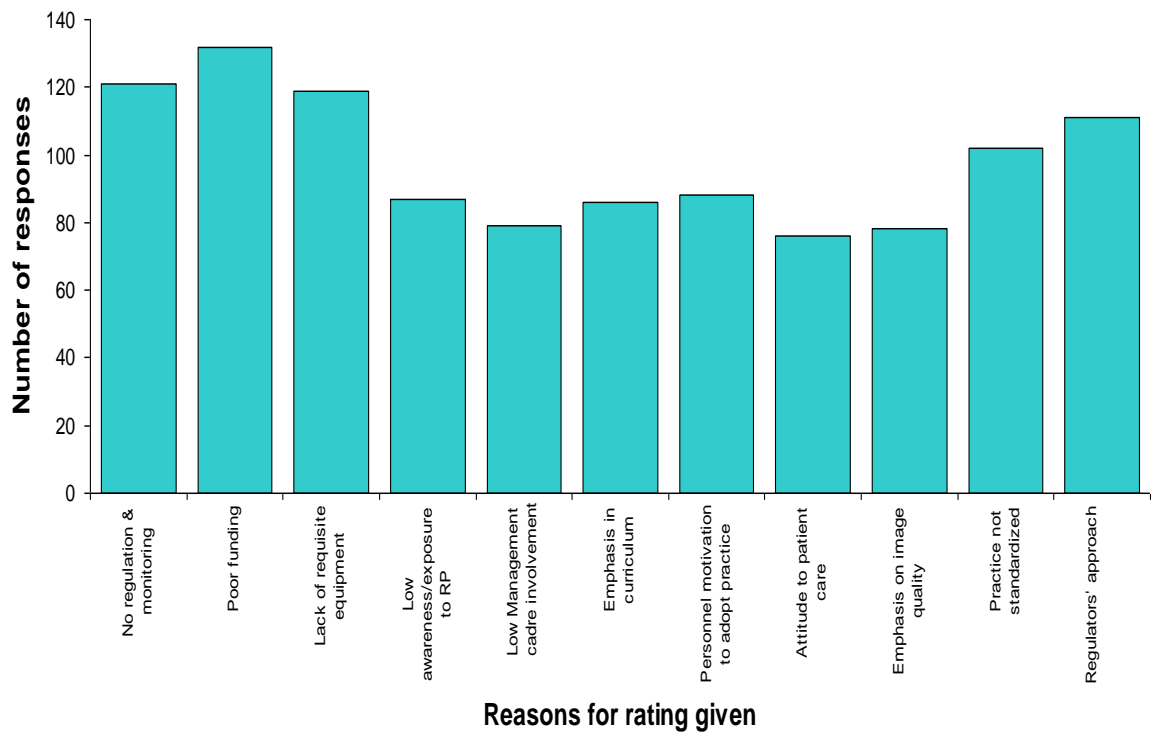


Figure 5: Respondents reasons for the rating of RP culture

At least 96.0% and 87.0% of respondents, respectively, felt that investment in funds and regular monitoring of protection protocols would compel them to adopt and implement RP practice routinely. Other recommendations by respondents were training and education of radiation workers (64.5%), individual commitment (74.0%), supply of radiation protection and monitoring equipment (70.9%), recruitment of specialized personnel (70.9%) among others (Figure

3). At least 92.0% of respondents identified careful procedure as a prevailing RP practise in the respective facilities surveyed.

In Figure 6, respondents recommended monitoring and enforcement, investment in funds equipment procurement and availability, reduced workload, training and education as well as greater individual commitment as steps towards developing an RP culture in Nigeria.

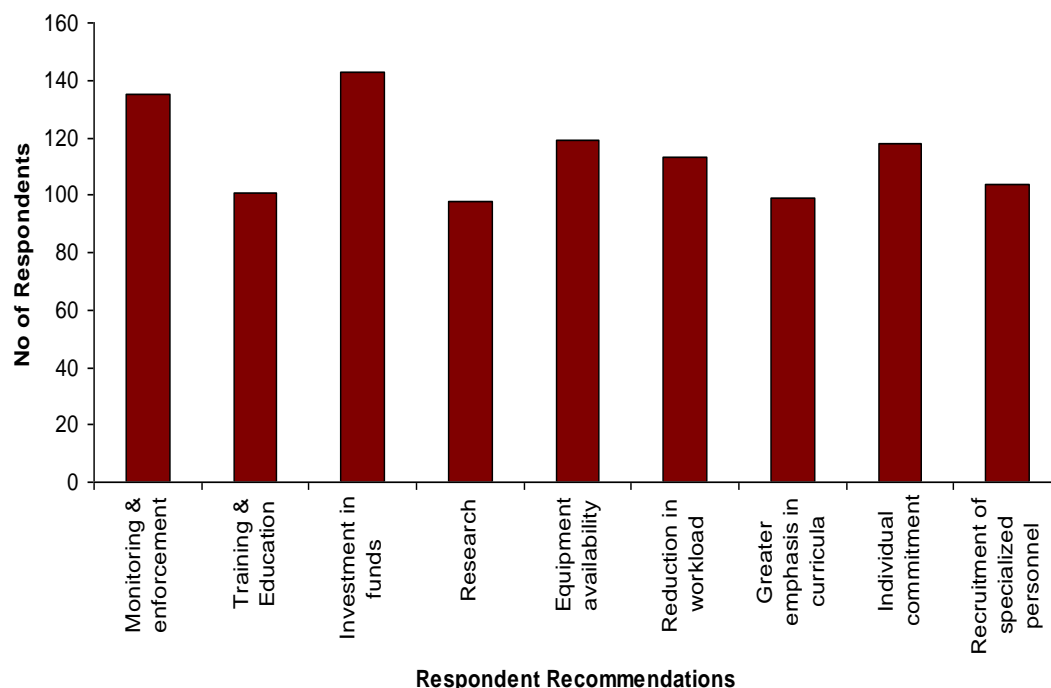


Figure 6: Recommendations towards developing or improving the radiation protection culture

Developing a radiation protection culture in diagnostic radiology service in Nigeria requires the implementation of various measures (Figure 6). These include continuous monitoring, enforcement and evaluation of practice to meet standard guidelines by the country's regulating agency (NNRA). The regulator would have to make both itself and its guidelines become commonplace in the face of the apparent lack of awareness of its presence and role in RP in Nigeria.

In addition to the above, findings show that reduced workload perhaps by improved staffing and recruitment of specialized radiation protection personnel in addition to investment in funds, training and education of radiation workers as well as encouraging research and implementation of research findings (Figure 3) were recommended as ways of achieving a better RP presence. In all these, attitudinal change among radiation users would be the first step towards adopting radiation protection as a culture in Nigeria. The urgent pursuit of these steps would position the Nigerian diagnostic radiology sector in line with global developments and practices.

CONCLUSION

The findings of our study show that radiation protection as a culture is non-existent. There is low interests and poor attitudes, low knowledge base, lack of RP equipment, poor staffing and high workload among others on the one hand and ineffective monitoring and enforcement by the country's watchdog. Continuous professional development programmes in radiation protection for Radiographers/Radiologists, attitudinal change, interest in patient wellbeing by radiation users is essential. Effective legislation, development of radiation protection protocols and diagnostic reference levels, training and education of radiation users, monitoring and enforcement of radiation protection culture by NNRA is recommended. Commitment from regulators and practitioners will form the driving force towards developing a radiation protection culture in Nigeria.

CONFLICT OF INTEREST: None declared

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