

Evaluation of the Level of Knowledge of Prescribers of X-Ray Examinations in Terms of Radiation Protection in the University Hospitals of Ouagadougou in Burkina Faso in 2024

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ABSTRACT

The advantages of using X-ray ionizing radiation for diagnosis and therapeutic monitoring in the medical field are no longer in dispute. However, improper application of these X-rays can lead to radiation-induced damage, hence the need to always respect radiation protection by justifying all X-ray examinations. The objective of our study is to assess the level of knowledge about radiation protection of X-ray examiners in the university hospitals of the city of Ouagadougou. It is an analytical descriptive study combining two approaches, a quantitative approach and a qualitative approach based on a questionnaire developed in accordance with data from the literature. It was of interest to the prescribing doctors of the University Hospitals of the city of Ouagadougou between the period from August 1, 2024 to January 15, 2025. The results showed that general practitioners were the most representative with 34.3%. The CHU-YO was the most represented structure with 45.45%. Prescribers with less than 5 years of experience were in the majority, 62.9%. Those that took into account the benefit/risk ratio were only about 22%. 28% had average knowledge of radiation protection objectives. About 85% of prescribers have never received training on the justification of X-ray examinations, which translates into a poor level of overall knowledge of radiation protection with a rate of 42.65%. In short, we note that efforts still need to be made in terms of training on radiation protection for prescribers in order to enable them to have a good control of radiation protection in order to further reduce radiation-induced damage.

Keywords: Knowledge of Prescribers; Justification; radiation protection; X-rays, Ouagadougou University Hospital.

1. INTRODUCTION

The discovery of X-rays by the German researcher, physicist Wilhelm Rontgen, revolutionized medicine in general and today gave birth to a new science, medical imaging. She is composed of several exploration modalities [1,2] including radiology, which is the X-ray modality. If the use of these X-rays is not well controlled, it can cause damage to both the patient and the worker and even to the environment [3]. Radiation protection, which is the set of measures to ensure the protection of man and his environment against the harmful effects of ionizing radiation, have been developed. It is governed by regulations with standards both at the international level [4] than national [5]. This regulation is based on a key element which is the principle of ALARA "As Low As Reasonably Achievable". This is based on 03 fundamental principles, namely, the justification of the examination, the optimization and the limitation of the dose. However, health professionals, particularly prescribing physicians and radiology practitioners, do not always respect these fundamental principles, which leads to inappropriate exposure to X-ray ionizing radiation and even radiation-induced damage that can range from simple inflammatory dermatitis to cancer. The prescribing physician then plays an important role in the application of radiation protection, but he can also be an obstacle if he does not have sufficient knowledge of radiation protection to judge the appropriateness of a request for an X-ray examination. In the Central African Republic, Kouandongui et al., in their study on "prescribers' knowledge of patient radiation protection", found that 83.9% of prescribers did not know that CT scans were more irradiating than standard radiography [6]. Closer to home, precisely in Togo, Adambounou et al., found in their study on the "Knowledge and attitudes of Togolese medical prescribers on medical irradiation of pregnancy" that about 25% of gynecologists did not know that MRI was not irradiating and 22.8% of them did not know that CT scan was irradiating [7]. Radiation protection is therefore a major public health issue, particularly in the context of the growing use of ionizing X-rays

with the significant reinforcement of the technical platform in equipment producing X-rays in the University Hospital Centers "CHU" of the city of Ouagadougou.

The objective of this study is to assess the level of knowledge of prescribers in terms of radiation protection in the university hospitals of the city of Ouagadougou. A proper application of radiation protection in this environment requires compliance with the principle of justification, the responsibility for which is shared between the radiologist and the prescribing physician. Indeed, this principle requires that before each request for an X-ray examination, the prescribing physician evaluates the benefit/risk ratio of this exposure to X-rays.

2. MATERIAL AND METHOD

This is an analytical descriptive study combining two approaches, a quantitative approach and a qualitative approach based on a questionnaire developed in accordance with data from the literature. It concerned the 04 University Hospital Centers "CHU" of the city of Ouagadougou, namely the CHU-Yalgado OUEDRAOGO, the CHU of Bogodogo, the CHU of Tengandogo and the CHU Pédiatrique Charles de Gaulle and covered the period from August 01, 2024 to January 15, 2025.

Our study population consists of all health workers authorized to prescribe medical examinations. We have general practitioners, doctors in specialization, specialist doctors as well as interns and externs of hospitals, who have officiated in one of the University Hospitals of Ouagadougou during our study period and who have agreed to participate in the study. The questionnaire is composed of several questions that deal with several themes.

The first theme concerns the social demographic parameters of prescribers. Namely the participation rate, the sex ratio, the distribution of prescribers according to qualification.

The second theme deals with the prescribing habits of practitioners: whether they prescribed radiation examinations frequently. If they took into account the benefit-risk ratio of X-rays when ordering an X-ray examination and if they informed the patient of the dangers of X-rays. The third theme evaluates the knowledge of practitioners concerning all radiation protection measures and the risks of radiation-induced pathology on radiology staff due to the performance of an irradiating examination. The last theme concerns the continuing training of prescribers in radiation protection, as well as the existence of a practical guide on radiation protection for imaging examinations in the University Hospitals of Ouagadougou. The data collection was carried out by us, from an individual survey sheet developed for this purpose to concern them in this study. The questionnaire was self-administered online using the Kobotoolbox application. The data was processed and analyzed using Excel 2024 and Kobotoolbox software.

3. RESULTS

143 prescribers out of 167 prescribers surveyed agreed to participate in the study, i.e. a participation rate of 85.62%. This rate was divided as 65% of men against 35% of women, i.e. a sex ratio of 1.86.

Table 1: Profile of the prescribers surveyed

Practitioner Qualification	Frequency	Percentage (%)
Doctoral student	11	7,7
General practitioner	49	34,3
IDH	10	7
Nurse	8	5,6
Specialist Physician	8	5,6
Specialist	6	4,2
Health Attaché	5	3,5
Internal	18	12,6
External	23	16
Other	5	3,5
Total	143	100

Table 2: Distribution of prescribers by university hospital of origin

Activity Service	Actual	Percentage
CHU-YO	65	45,45
CHU-BOGODOGO	36	25,17
CHU-TENGADOGO	27	18,88
CHUP-CDG	15	10,5
Total	143	100

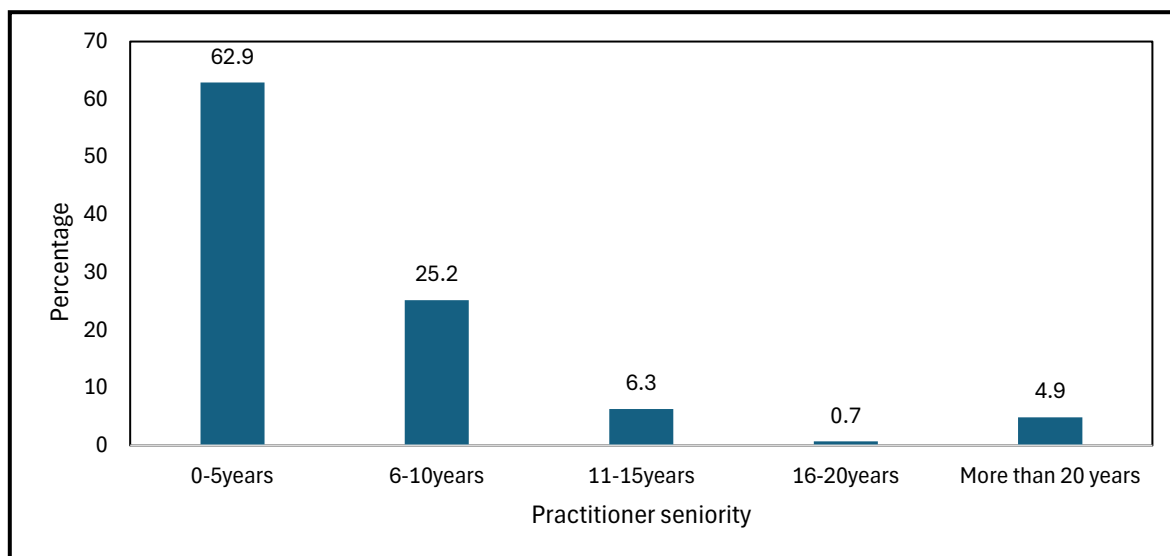


Figure 1: Distribution of prescribers by years of service



Figure 2: Proportion of prescribers taking into account the benefit/risk ratio before prescribing an X-ray examination

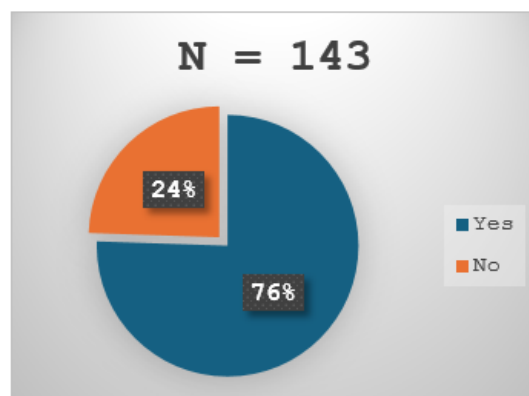


Figure 3: Proportion of prescribers informing patients of the risks of x-rays

Table 3: Assessment of the level of knowledge on the definition of radiation protection

Definition	Actual	Percentage
Good	63	44,1
Medium	53	37,1
Insufficient	27	18,9
Total	143	100

Table 4: Prescribers' knowledge of radiation protection objectives

Objectives	Frequency	Percentage
Good	78	54,5
Medium	40	28
Insufficient	23	16,1
Bad	2	1,4
Total	143	100

Table 5: Assessment of prescribers' knowledge of the principles of radiation protection

Principles	Actual	Percentage
Good	49	34,3
Medium	35	24,5
Insufficient	42	29,4
Bad	17	11,9
Total	143	100

Table 6: Prescribers' knowledge of the risks associated with exposure to X-rays

Risks	Actual	Percentage
Good	76	53,1
Medium	53	37,1
Insufficient	12	8,4
Bad	2	1,4
Total	143	100

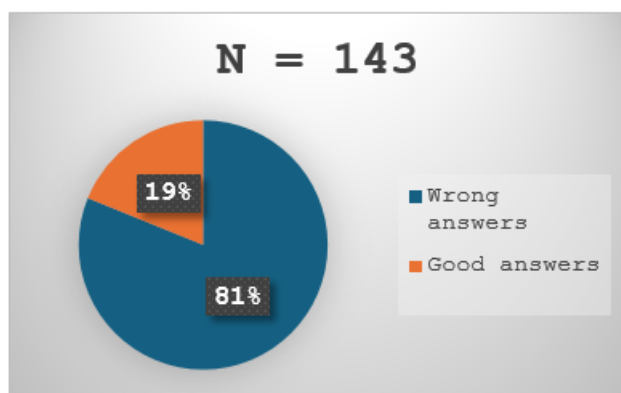


Figure 4: Prescribers' knowledge of how X-ray risks arise

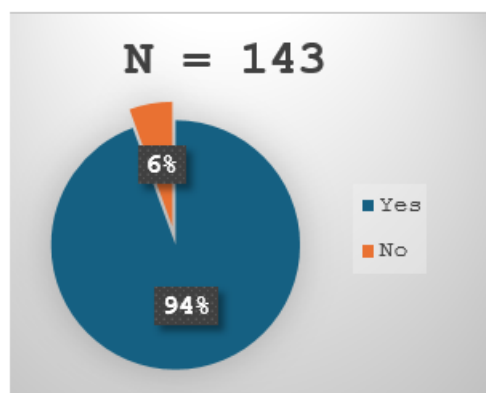


Figure 5: Assessment of prescribers' knowledge of the risk of radiation-induced cancer

Table 7: Prescribers' level of knowledge of the persons concerned by radiation protection

Level	Actual	Percentage
Good	23	16,1
Medium	34	23,8
Insufficient	72	50,3
Total	143	100



Figure 6: Respondents' knowledge of the role of the prescriber in radiation protection

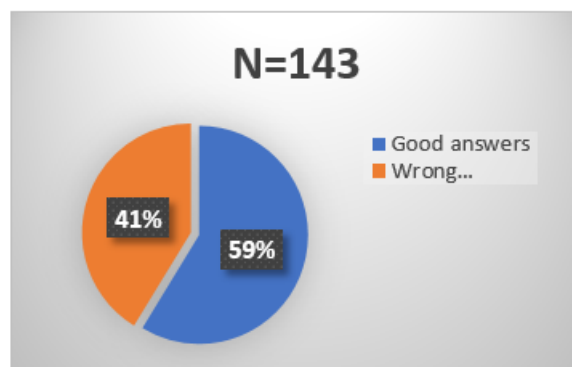


Figure 7: Prescribers' knowledge of the role of the radiologist in radiation protection

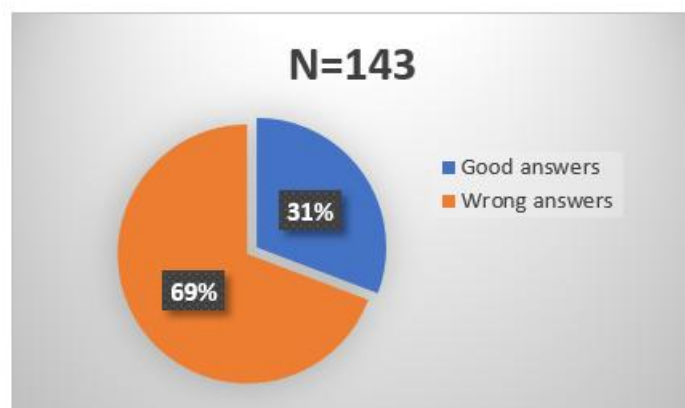


Figure 8: Prescribers' knowledge of the role of the medical imaging technician in radiation protection

Table 8: Prescribers' knowledge of personal X-ray protection in medical imaging

Personal protection	Actual	Percentage
Good	47	32,9
Bad	54	37,8
Insufficient	32	22,4
Medium	10	7
Total	143	100

Table 9 : Prescribers' knowledge of collective X-ray protection in medical imaging

Personal protection	Actual	Percentage
Insufficient	51	35,7
Medium	43	30
Bad	30	21
Good	19	13,3
Total	143	100

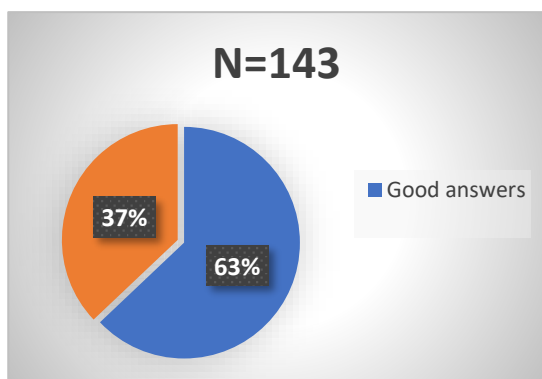


Figure 9: Prescribers' knowledge of medical imaging techniques using X-rays

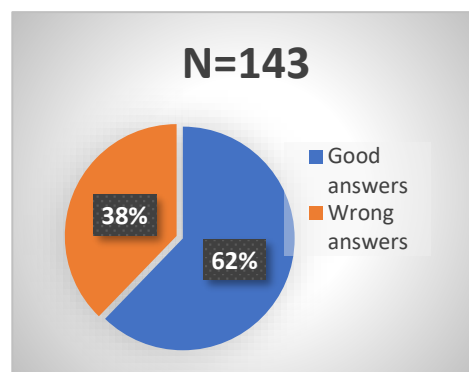


Figure 10: Prescribers' knowledge of the profession and the role of the Competent Person in Radiation Protection "PCR"

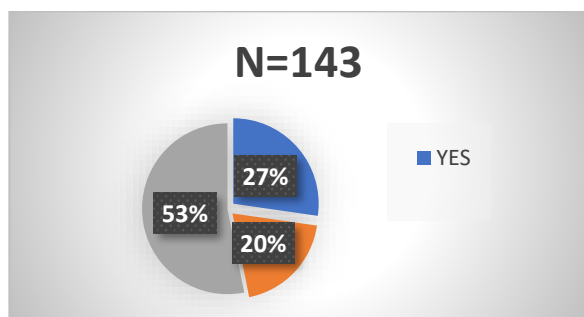


Figure 11: Prescribers' knowledge of the presence of a PCR in their university hospital

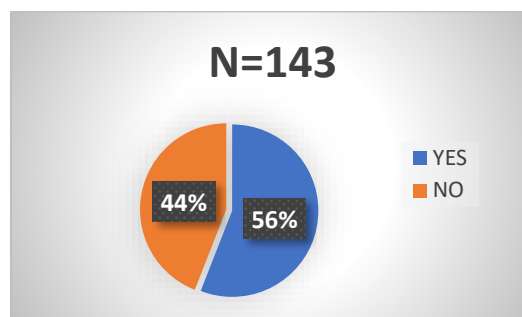


Figure 12: Proportion of prescribers who have or have not received academic training on radiation protection

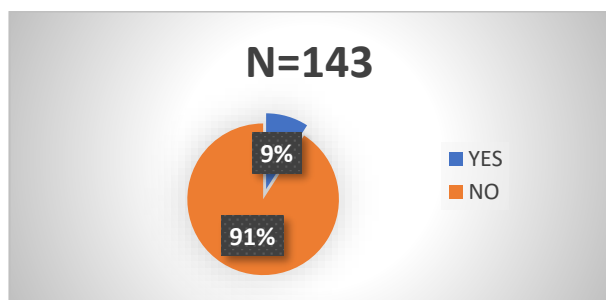


Figure 13: Proportion of prescribers who have received training in radiation protection in a medical setting in the last three years

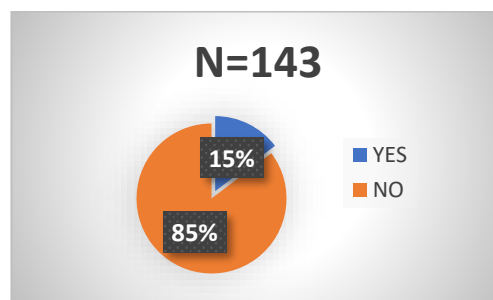


Figure 14: Proportion of prescribers who have received training on the principle of justification

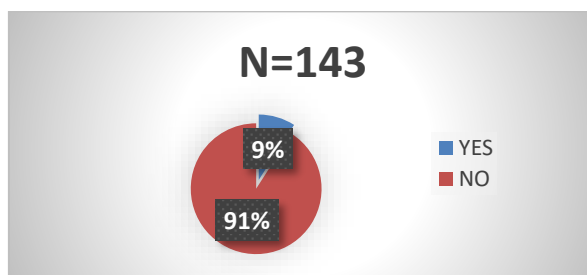


Figure 15: Proportion of prescribers with a radiation safety guide in their department

Table 10: Distribution of prescribers according to their overall level of radiation protection

Overall level of radiation protection	Frequency	Percentage
Good	25	17.49
Medium	57	39.86
Bad	61	42.65

4. DISCUSSION

In our study, the male sex was the most represented in 65% of cases among prescribers characterized by a sex ratio of 1.86.

These results are in line with those of Bangré in Ouagadougou in 2024(8), Sangaré in Ouagadougou in 2021 [8,9] and Kouandongui in the Central African Republic in 2019 [10] were all predominantly male in 68.94%, 65.12% and 72% of cases, respectively. On the other hand, Akanni et al in 2020 in Benin [11] were predominantly female in 61.54% of cases. This male predominance could be explained by the socio-cultural constraints that influenced girls' academic and university choices. The long duration of medical studies could have a negative impact on family life, especially for women.

Among prescribers, general practitioners and interns were the most represented with 34.3% and 12.6% respectively. In their 2017 study, Nikiema et al [12] predominantly found a composition of 57.72% of doctors in specialisation. Sangaré in Ouagadougou in 2021 with a rate of 37.2% of doctors in specialization.

The majority of prescribers, i.e. 56%, had less than 5 years of seniority. Those with a seniority of between 5 and 10 years had 25.2%. Our results are similar to those of Kouandongui in the Central African Republic in 2019 [13] found that 67.6% of them had less than 10 years of experience. Sangaré in Ouagadougou in 2021 also found that most of its study population totaled less than 10 years of study, i.e. 58.34% [9]. Three-quarters (3/4) or 75.5% of prescribers said they considered the benefit/risk ratio before ordering X-ray medical imaging tests. Our results are similar to those of Bangré et al in 2024 who found a rate of 76.52% in their study [8]. They are close to those of Nikiema et al, who in their research study among prescribers in 2017 in Burkina Faso, found that 82.92% of respondents took into account the benefit-risk ratio [12]. Our figures are also close to those found in 2011 in France by Gervaise et al [14] among whom 70% of practitioners said they took into account the risks associated with X-rays when prescribing. On the other hand, 24.5% did not take into account this benefit/risk ratio, even though it is strongly recommended before each prescription. Also, of the prescribers surveyed, only 22.4% of them said that they informed patients of the probable risks of exposure to X-ray ionizing radiation when prescribing medical imaging examinations. Our results are consistent with those of Gervaise et al, which were found in France in 2011, where only 25% of prescribers informed the patient [14]. On the other hand, they differ from those of Bangré et al, who found that 37.12% of the prescribers surveyed informed their patients of the risks involved. In Bobo, Burkina Faso, in 2017, Nikiema et al found a rate of 60%. The same is true for Kouandongui et al in 2019 in the Central African Republic with a rate of 57.4% [6]. Only 44.1% of the people surveyed in our study had a good knowledge of the definition of radiation protection. Hammami et al found a similar score of about 43.83% in their study on the evaluation of the radiation protection practices and knowledge of cardiologists in Tunisia in 2021 [15]. 40 out of 143, i.e. 28% of the prescribers surveyed, had an average level of knowledge of the objectives of radiation protection. Our results differ from those of Bangré et al, who found in their study that about 58% of prescribers had an average level of knowledge of the objectives of radiation protection. This fundamental difference between our 02 studies could be explained by the quality of the survey staff. Indeed, in our study, the majority of prescribers are already active agents, whereas in the study by Bangré et al, the majority sample was composed of hospital interns.

Only 34.3% of our study population had a good level of knowledge about the fundamentals of radiation protection. This low level was also noted by Bangré et al with a rate of 16%. The same is true for Nikiema et al in 2017 in Bobo-Dioulasso found in their study that 17.89% had a good knowledge of the principles of radiation protection. These results could be explained by the lack of continuing education on radiation protection for the benefit of prescribers of medical examinations.

116 prescribers out of 143 in our sample, i.e. 82.1%, have a poor knowledge of the effects related to X-ray ionizing radiation. Our results corroborate those of Yao et al, who found in a study that only 11.4% of the staff of the Abidjan cardiology unit had a good knowledge of the issue. [16] This low level of knowledge can be explained by the lack of continuous training of prescribers on radiation protection, which could enable these agents to differentiate between a deterministic effect or immediate effect resulting from overexposure to X-rays and a stochastic effect resulting from the accumulation of radiation doses that could lead to the appearance of cancer. In our study, more than half (53.1%) of prescribers had a good level of knowledge about the existence of radiation-induced cancer. Bangré et al found in their study in 2024 that 80.30% of prescribers had knowledge about radioactive cancer, while this knowledge was good for 74.51% of exposed staff. Their results are similar to those of Nikiema et al in 2017 in Bobo-Dioulasso, who found in their study that the majority of prescribers (83.73%) were informed of the existence of the risk of radiation-induced cancer.

51.7% of respondents are aware of the role of the prescribing physician in terms of radiation protection, 58.7% for the attributes of the radiologist in terms of radiation protection, on the other hand, only 31.5% are aware of the role of the medical imaging technician in compliance with radiation protection. Similarly, only 14.7% of prescribers are aware of the services that deal with radiation protection issues at national and international level.

In general, prescribers do not have a good knowledge of the means of anti-X-ray protection. Indeed, our study showed that 37.8% of prescribers have a poor knowledge of personal protective equipment and 35.7% of this same population have insufficient knowledge of collective anti-X-ray protection equipment. Bangré et al found in 2024 in their study on the evaluation of the knowledge of radiation protection prescribers, a poor level of knowledge of around 52%. The non-availability of protective equipment in radiology rooms could explain the low level of knowledge of stakeholders on the issue. Indeed, Marzouk et al in Tunisia in their work had found that 60.3% of doctors had never worn a dosimeter due to non-availability [17]. In the Sangaré study in Ouagadougou, 88.30% of the exposed staff did not respond that the department did not have a dosimeter or a thyroid cover.

53 out of 143 prescribers, i.e. 37.1%, had a poor knowledge of imaging techniques using X-ray ionizing radiation. Indeed, the majority of these prescribers thought that radiography was the most irradiating technique in 86.8% of cases. Magnetic resonance imaging (MRI) in 71.3% of cases and ultrasound in 11.7% of cases were considered irradiating techniques. Our results are consistent with those of Nikiema et al in Bobo-Dioulasso in 2017, who found in their study that radiography was considered by prescribers to be the most irradiating imaging technique in 86.99%, followed by computed tomography (73.17%). They differ from those of Bangré et al, who found in their study that the majority of prescribers, i.e. 67.42%, had a poor knowledge of irradiating techniques. MRI is a non-irradiating technique, but in our study 71.3% of prescribers had stated that MRI was an irradiating imaging technique. This finding was noted in other studies such as that of Bangré et al in 71.97% of cases. Borgen et al in 2014 in Norway [18], Moifo et al in 2017 in Cameroon found lower rates than our study in 10.5% and 41.1% respectively and Dango in Burkina Faso in 2020 which also found a lower rate of 43.83%. However, scintigraphy was considered by almost all prescribers to be a non-irradiating technique. This could be explained by the fact that it is a rare technique in Burkina Faso. Indeed, the country has only one nuclear medicine department, namely that of the Yalgado Ouedraogo University Hospital. This low knowledge of imaging techniques could be linked to a lack of knowledge and training on the methods of image acquisition in the field of medical imaging.

81.1% of the investigations were aware of the existence of a competent person in radiation protection, but only 61.5% of them knew the exact role of PCR. While it is true that the main role of PCR is to ensure safe, effective and reassuring exposure to ionizing X-ray radiation in health facilities, it is clear that there are no officially named PCRs in almost all university hospitals in the city of Ouagadougou. Indeed, only 27.3% of the surveys claimed to be aware of the existence of a PCR in their hospital.

More than half, or 55.9%, of the prescribers surveyed said that they had never benefited from a course on radiation protection during their academic studies. Almost all, or 90.9%, of prescribers said they had never been trained on radiation protection in the last 03 years. Our results corroborate those of Bangré et al who found in their study that 89.39% of prescribers had never received training on radiation protection. They can also be superimposed on those found by Nikiema et al in 2017 in Bobo-Dioulasso, which found that only 9.02% of prescribers had claimed to have benefited from specific training in radiation protection. These figures are significantly higher than those of Kouandongui who found in the Central African Republic in 2019 that only 3% had already received training in radiation protection of the patient. On the other hand, our figures differ from those found by Sangaré in 2020 in Ouagadougou, where 48.83% of respondents said they had received training on radiation protection beyond the training, 91% of our prescribers surveyed said they did not have a guide on radiation protection in their departments.

5. CONCLUSION

Some medical imaging techniques such as CT scans are based on X-ray ionizing radiation, which can cause harmful effects on human and environmental health. The prescription of these types of examinations requires a good mastery of radiation protection, in particular the principle of justification. However, our study on the assessment of the level of knowledge of prescribers in radiation protection in the university hospitals of Ouagadougou in Burkina Faso in 2024 showed overall, a lack of knowledge of prescribing medical staff on radiation protection in general and in particular the justification for examinations. This can be explained by the lack of continuing education in the field for the benefit of these X-ray examiners. Good control of radiation protection by health professionals is therefore necessary to reduce the health risks associated with radiation.

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