

## SIIC099

### A STUDY ON THE IMPORTANCE OF PERSONAL PROTECTIVE EQUIPMENT (PPE) USE IN OCCUPATIONAL RADIATION PROTECTION

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#### **Abstract:**

Radiation safety and precaution become a responsibility for everyone to produce a safe radiation environment and to guarantee no human injuries and exposure occur. It should be a common-sense for every individual who works under a radiation environment to fully implement the usage of PPE to prevent the risk of being exposed accidentally to primary radiation or scattered radiation. However, it was found that there are several studies had discussed on the PPE among radiation workers happened to have lack of knowledge and awareness on the importance of PPE. Therefore, a study on the importance of PPE in occupational radiation protection is conducted by accumulating information and findings from the past study, as a systematic review. A case study was also conducted where a set of questionnaires of 29 designated question was distributed to 81 respondents working under a radiation-related environment. As a result, 82 articles were retrieved from seven databases. Of these, only 16 articles were eligible and included. From review towards radiation safety and awareness among workers, it can be seen that most of the studies have an average response with respondent not fully aware of it. In contrast, results from the case study show that the respondents were more aware of the radiation safety in their workplace with 96.3 % understands the radiation safety procedures when performing work. Furthermore, 78.3% know that there have been appropriate safety measures taken in their workplace to protect the worker from exposure. The significant percentage of 83.9% respondents are confident that the provided PPE are able to protect themselves. Therefore, awareness among workers should be emphasized more, and it is recommended that there should be more program like safety campaign and safety talk to be implemented to stress on the importance of personal protective equipment (PPE) in occupational radiation protection.

#### **Keywords:**

Radiology, radiation protection, radiation risk, ALARA, PPE.

#### **Objectives:**

According to the problem statement above, there are a few objectives of this study which are:

- To study on the importance of Personal Protection Equipment (PPE) used for ionizing radiation protection by collecting journals article
- To gather related information and findings from the past research on the importance of the personal protective equipment (PPE), the needs of implementation, maintenance, quality assurance and quality control, enforcement and legislation, and more.
- To review the past study and findings comparatively by using systematic review method.
- To conduct a case study to identify the awareness among radiation workers regarding the implementation and importance of PPE and analyze by using simple descriptive analysis with Statistical Package for Social Sciences (SPSS).

### ***Methodology:***

Several electronic databases were searched comprehensively related to radiation such as Academia, Core, Elsevier, Science Direct, Research Gate, Crossmark, PubMed, and Science Research and Publishing (SCIRP). The studies included are those published in English from 2009 and above, with suitable research and data collection. The findings of these articles was based on a strategy that started with a selection of keywords whereby the words “radiology”, “oncology”, “radiation protection”, “radiation risk”, “radiation dose exposure”, “ALARA” and “PPE” were used to identify articles related to the importance of PPE used for ionizing radiation protection. The collected journal is then sorted out by fulfilling a few criteria such as the journal chosen should not be more than 10 years of publication and all journals is based in English. Literature review will be conducted systematically by reviewing the collected journals. Table 2 shows the criterion selection for the collected journals.

Table 2: Table of Criterion Selection

	Accepted Criteria	Rejected Criteria
Objective	Related	Non-Related
Language	English	Non-English
Years Published	<10 years	>10 years
Others	Non-duplicated journals	Duplicated Journals
	Full text journals	Non-full journals

### ***Results:***

#### ***Findings on Enforcement and Legislations***

Studies were conducted in the city of Iraq, Qatar and worldwide. The study of [20], used systematic review to develop the peer-reviewed literature worldwide on compliance with indoor tanning legislation. Effect of IT legislation was described as studies documenting the change in occurrence and frequency of IT due to the introduction of IT laws restricting access for young people [20]. According to [21] study, The study method uses TLD-100 to be made from LiF elements assembled in bar-coded cards to measure the cumulative radiation doses from each monitor at the workplace, using various areas inside each radiation workplace (Portable X-ray users or / and radiation source location). Based on the data obtained,

the regulatory law stressed licensees to provide the radiation staff with systems for the individual dose monitoring. However, particularly for large organizations that require complicated and overlapping processes, it is expensive while the NRW issue clearly stands out. They are still quite concerned about the adequacy of the radiation safety for them. Studies from the city of Iraq in Kurdistan and Duhok [22] and [23] has different perspective on the enforcement and legislation view. Duhok was found to be based on a survey conducted by calculating the appropriate treatment due to leaked and distributed radiation from diagnostic X-ray rooms in seven randomly chosen public hospitals in Duhok Governorate, Kurdistan Province, Iraq. The result of the study indicates that X-ray parameters (kVp & mAs) have been increased with more X-ray penetration in X-ray rooms and dosimeters found in both monitored and unregulated areas. This implies that X-ray photons are penetrated into these hospitals' testing rooms because of ineffectiveness of the room walls or doors. In conclusion, it was found that the standards of radiation safety are ignored in most Duhok governorate hospitals. In comparison, the study of [22] has more positive outcome compare to the other studies

### ***Findings on Education and Training***

The studies that focused on the training and education found by few researches such as [24], [15],[7]and [25] has different point of view for each studies where from each journal they use different study method and the results obtained are different from each outcomes. Based on the summarization of data collected in Table 4 found in appendix ,according to [7] the study was a cross-sectional study that aims to measure the amount of receiving radiation of radiology staffs in Imam Reza Hospital of Kermanshah in 2013. From the study, results of this study showed that in none of unites, the receiving radiation did not exceed the threshold. This is beneficial to the radiology staffs in Imam Reza Hospital as the higher authorities has provided sufficient training and education to their staffs. Similarly, to the study of [24], an important result was that qualified residents more often used their dosimeter badge for monitoring than those who did not undergo instruction. An overview of the services considered to be most useful for learning good practices in radiation safety among residents. Other than that, study of [25] did a research on the medical staff working in catheterization laboratory where they used a method of systematic review on reviewing the efficiency of radiation protection (RP) training in minimizing the radiation dose to both medical staff and patient. The results show that the systematic review has made proof that training on radiation safety results in a greater reduction in exposure for medical workers and patients. On the other hand, the study from [15] ,made a research on the present opinion of the European Gastrointestinal Endoscopy Society (ESGE) on radiation safety for endoscopic procedures. The result of their point of view is that the higher authorities have emphasized more on the importance of educating and preparing doctors, medical physicists, maintenance engineers and other assistant staff involved in exposure to medical radiation to minimize the dose of radiation in patients. It was recommended that those who are related with the radiology sector should undergo education and safety training after qualification. Overall, all studies have great findings and it can be used as a lesson or reference for future researchers.

### ***Findings on Awareness among workers***

The study from Faggioni and Kasim are similar as they distributed a set of questionnaires to their targeted respondents. According to Faggioni's study, the questionnaire was distributed to 159 young doctors and students. Basically, the study method begins with a questionnaire consisting of 16 multiples choice questions divided into three separate sections which is demographic data, awareness about radiation protection issues, and knowledge about radiation dose levels of common radiological examinations. After the data was collected, it was found that the result shows an at least a good knowledge of radiation protection issues more frequently than radiology residents and radiography students (94.4% vs 55% and 35.7%, respectively). However, the knowledge on the essential radiation protection topics was low among the medical students. This proof that there was not enough awareness among the medical students during

that time. On the other hand, the study of Booshehri used cross-sectional performed on 102 medical dentists of Yazd city. Like the study of Faggioni, 89% of dentists had poor and 11% had moderate awareness about radiation protection techniques. The knowledge of dentists about radiation protection techniques was very poor and they should implement recent and appropriate radiation protection techniques and guidelines. It can be seen that most of the studies are not fully aware on the safety among workers as the result from each studies only show average respond. Awareness among workers should be emphasize more and it is recommended that there should be more program such as safety campaign, safety talk and more to be implemented.

### ***Findings of Quality assurance and Quality control (QA & QC) of PPE***

Quality assurance program should be implemented in all radiation facilities included diagnostic radiology facility. This program consists of planned and systematic actions providing assurance that the facility will produce consistently great safety precaution as well as the quality images with minimal exposure. Table 6 shows the summarization of various studies regarding on the quality assurance and control (QA & QC) of PPE. There are four studies from different researches using different method to collect data on the quality assurance and quality control of PPE. One example from (Almalki et al, 2017), they used systematic review method utilizing four electronic database which are, Pub-med, Science Direct, Medline and CINAHL using the keywords “radiology” and “indicators” for the services quality in radiology department. Different perspective on the study of (Dumonceau et al, 2012) is that gather their data by forming subgroup where each charged with a series of clearly defined key questions. The committee chair worked with subgroup speakers to identify pertinent search terms that always included, as a minimum, “radiation” and words pertinent to specific key questions. Results obtained and it was suggested that commissioning of the fluoroscopy units should be performed in the framework of the acceptance testing of X-ray systems before their first use with a patient. The accountable authorities of the installation are responsible for the implementation of quality control.

### ***Conclusion:***

In this study, the type of methods used are systematic review and case. By looking on the perspective of Stefano, the evaluation of resources was found to be most helpful for learning good radiation safety practices among residents as they made a research at an academic hospital. Overall, the most of the findings were beneficial to this project as many data and information were obtained. For future references, it is recommended that other researches should widen the scope of the study and to collect data from many other databases not limited only from the Internet but also from other materials such as books