THE RELATIONSHIP BETWEEN SAFETY MANAGEMENT PRACTICE AND RADIATION SAFETY AWARENESS AMONG EMPLOYEES IN UUM UNIVERSITY HEALTH CENTRE

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ABSTRACT

Safety awareness programs have been conducted comprehensively and actively in order to inspire employees' engagement and commitment towards safety issues even though from time to time it has been reported that the number of incidents and accidents at the manufacturing firms is keep-on increasing. Furthermore in terms of radiation safety awareness, failure to reduce occupational exposure due to inadequate of knowledge, attitude and action towards ionizing radiation may result in cumulative radiation damage not only in Radiology Professionals but also the other citizens as well. The study was conducted in order to determine the relationship between safety management practice and radiation safety awareness in UUM University Health Centre. In addition, the study was done quantitatively by distributing questionnaires to all employees of University Health Centre. The data from 57 respondents were collected and then analyzed by using SPSS Version 24.0. The findings showed that safety management practice has strong correlation with radiation safety awareness. All these results and findings would provide fruitful guidance for scholars and practitioners in identifying "rooms for improvement" especially in radiation safety awareness campaign.

Key words: safety management practice, radiation safety awareness. X-ray, ionizing radiation and employees.

ABSTRAK

Program kesedaran keselamatan sentiasa dijalankan secara komprehensif dan aktif bagi menggalakkan penyertaan dan komitmen pekerja terhadap isu-isu keselamatan walaupun kejadian insiden dan kemalangan yang dilaporkan dalam sektor perkilangan adalah meningkat dari masa ke semasa. Selanjutnya dalam konteks kesedaran keselamatan radiasi, kegagalan mengurangkan dos sinaran pekerjaan akibat kurangnya pengetahuan, sikap dan amaln akan mengakibatkan kemusnahan radiasi secara kumulatif bukan sahaja kepada Pekerja Sinaran tetapi juga orang awam yang lain. Kajian ini dibuat bagi mengkaji hubungan di antara amalan pengurusan keselamatan dan kesedaran keselamatan radiasi di Pusat Kesihatan Universiti UUM. Kajian telah dijalankan secara kuantitatif dengan mengedarkan borang kajiselidik kepada semua kakitangan Pusat Kesihatan Universiti UUM. Data daripada 57 responden dikumpul dan dianalisa menggunakan SPSS Versi 24.0. Hasil analisa menunjukkan amalan pengurusan keselamatan mempunyai hubungan yang kuat dengan kesedaran keselamatan radiasi. Semua keputusan dan dapatan akan dapat membekalkan panduan yang berguna untuk pengkaji dan pengamal keselamatan dan kesihatan pekerjaan di dalam mengenalpasti ruang-ruang untuk penambahbaikan terutamanya di dalam kempen kesedaran keselamatan radiasi.

Kata kunci: amalan pengurusan keselamatan, kesedaran keselamatan radiasi, X-ray, radiasi mengion dan pekerja.

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LIST OF ABBREVIATIONS

AELA	Atomic Energy Licensing Act
AELB	Atomic Energy Licensing Board
ALARA	As Low As Reasonably Achievable
BBS	Behavior Based Safety
CME	Continuous Medical Education
CT	Computed Radiography
DNA	Deoxyribonucleic Acid
DOSH	Department of Occupational Safety and Health
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
MDUUM	*Medical Diagnostic* Universiti Utara Malaysia
MOH	Ministry of Health
MPD	Maximum Permissible Dose
NDT	Non-Destructive Testing
OSH	Occupational Safety and Health
OSHA	Occupational Safety and Health Act
PKUUUM	Pusat Kesihatan Universiti, Universiti Utara Malaysia
PPE	Personnel Protective Equipment
UUM	Universiti Utara Malaysia
QAP	Quality Assurance Program
RP	Radiographers' Compliance
RPC	Radiation Protection Culture
RPO	Radiation Protection Officer
SBU	Strategic Business Unit
SMS	Short Message Service
SOP	Standard Operating Procedure
SPSS	Statistical Package for Social Science

CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

Occupational safety, health and welfare are the essential subjects about people at work in the organization. According to Shariff (2005), some of the purposes of occupational safety and health are to ensure the health of the employees to be fit physically, mentally as well as socially and safe against any risk, work hazard or illness. In Malaysia, work place accident is one of the factors which contributes to mortality rate and the number of those who are suffering of work related hazards such as cancer, chemical burns, loss of limbs and bodily handicapped is increasing annually. In addition, accidents in workplace which happen for number of reasons may produce the outcomes of minor injuries, damages to properties or even in certain cases may end up with major injuries or deaths (Zakaria, Mansor, & Abdullah, 2012).

According to Occupational Accidents Statistics by Sectors until October 2016 which includes manufacturing, mining and quarrying, construction, agriculture, forestry, logging and fishing, utility, transport, storage and communication, wholesale and retail trade, hotel and restaurant, financial, insurance, real estate and business services, public services and statutory bodies, the manufacturing sector has the highest number of death which is 39. In terms of Non-Permanent Disability, manufacturing sector is still leading the figures which is 1751. In addition, for Permanent Disability, the value is 61 which have been contributed by manufacturing sector also (DOSH, 2016).

One of the theories which is associated with factors that causes the accident is the Domino Theory which was formulated by H.W Heinrich in 1959. The theory explains the roles of ancestry and social surrounding, mistake of the person, the unsafe act and physical hazard, the accident and the casualty (Stranks, 1994). By practice, accidents can be controlled, minimized or controlled at any workplace and at any time. In order to achieve the goals of safety management, basic awareness on safety including radiation safety and safety management practice have to be present in the mind and attitude of the employers, employees and public as well (Shariff, 2000).

According to World Health Organization (2008) as cited by Alotaibi, Abdulsalam, Bakir and Mohammed (2015), more than 3600 million of X-ray examinations are being done, 37 million nuclear medicine procedures (scintigraphy) are being performed and 7.5 million radiotheraphy are being carried out every year globally. The use of ionizing radiation has continuously undoubtedly increased along with the advances in medicine as well as diagnostic imaging modalities since the discovery of X-rays in 1895 by the German Physicists, Wilhem Conrad Roentgen (Jang & Jeong, 2016). According to Bennet (1991) as cited by Amin, Rifiar, Razak and Lawai (2012) have shown that 90% of the public exposure around the world comes from medical exposures. In Malaysia, the medical exposures to the public members are being controlled by acts as well as regulations which have been adopted from the International Commission on Radiological Protection (ICRP) and International Atomic Energy Agency (IAEA). Furthermore, the basic radiation safety standard is gazetted as Act 304, Atomic Energy Licensing Act 1984 (AELA 1984) in which the regulations are being enforced to ensure the radiation protection for public members from ionizing exposures.

In modern medicine, ionizing radiation is intensively being used in diagnosing and treating human diseases such as cancer and at the same time contributes vast of innovations to medical advancement. Ionizing radiation such as X-ray in medical imaging is one of the influential diagnostic tools in the discipline of medicine. No doubt, radiation which is widely used in Diagnostic Imaging Department has hazardous effects on biological system. In the process of using the ionizing radiation, the exposure to radiation healthcare employees increases daily and therefore failure to decrease occupational exposure will have effect on cumulative radiation damage not only in radiology employees, healthcare workers but also in all citizens. According to Dehghani, Ranjbarian, Mohammad, Soleiman and Ahangar (2014), radiation exposure from medical procedures has become threat to health affecting millions of people globally. Cancer, genetically determined ill health, abnormalities development and degenerative sickness are some of the results of being excessive exposed to ionizing radiation (Carlton & Adler, 2012; Brent, 2009). According to Dellie, Admassie and Ewnety (2014), it is now believed that radiation exposure has a linear relationship with cancer development.

While the benefits of medical imaging far outweigh the risks, ionizing radiation can be hazardous when managed improperly. Every individual who is working in the Medical Imaging Department specifically as well as healthcare or medical care premises is responsible for following radiation safety policies and procedures. Moreover, not only do these procedures protect patients, they also protect the healthcare professionals who work with ionizing radiation devices such as medical imaging and radiation therapy equipment.

Radiation safety awareness and protection of patients as well as the staffs have become rudimentary roles and responsibilities in diagnostic imaging since the discovery of X-rays and the first reports of radiation injury was in 1896 (Hrabak, Marko, & Kralik, 2008). According to Act 304 AELA, the use of all forms of radioactive materials or an irradiating gadgets which produce radiation for the beneficial use both in the industry as well the medical field needs to have an approved license from the Malaysian Atomic Energy Licensing Board (AELB) and the Ministry of Health (MOH) for the purposes to make sure all the activities involved are being managed safely and not to harm the employees, public members, properties and environment as well.

1.2 BACKGROUND OF THE STUDY

In Malaysia, radiation industries in which the employees are using radiation sources as part of their jobs are only small-sized organizations and according to Noriah (2008) in 2007, there were about 1,800 different workplaces used ionizing radiation in which 15,000 radiation workers involved from 3 categories officially classified as medical, industry and Non-Destructive Testing (NDT). In medical sectors, the three medical specialties which have contributed to the annual radiation doses are diagnostic radiology, radiotheraphy and nuclear medicine as well (Shah, Begum, Nasreen, & Khan, 2007). In addition, according to Noriah (2008) also, 51% came from the medical sector, 43% from industrial and the other 6% form the Non-Destructive (NDT) field. However, the Industrial Radiographers were among the most highly exposed group as compared to others since their nature of jobs and the high energy used in radiographic procedures (Noriah, 2004 and Noriah, 2006).

Even though it is believed that the exposures being received by Medical Radiographers as well as other medical personnel are low, the effects are still there waiting to be burst such as cataract development, cancers and brain tumors even though the incidents are delayed. Moreover, studies have shown that Nurses who are working in the radiology premises for instance have 40% higher possibilities of developing cataract (Shah, 2016).

In UUM University Health Centre, radiological investigations which are some of the most important clinical procedures in order to justify and quantify the diagnosis are being performed in Diagnostic Imaging (X-ray) Unit. In order to justify the roles of radiological investigations, according to Arslanoglu, Bilgin, Kubali, Ceyhan, Ilhan and Maral (2007) radiological examinations have an important roles in the diagnosis and treatment of disease even though radiation has been proven to have biological effects on living creatures. The Diagnostic Imaging (X-ray) Unit is operating by 1 Senior Diagnostic Radiographer, 2 Time Scale Diagnostic Radiographers and 1 Operational Assistant. In addition the 3 Radiographers are officially trained with at least the Diploma level in Radiographic Study and refresher courses such as CME (Continuous Medical Education) are required to be attended by them annually for continual licensing purposes as well as to enhance clinical competencies.

In terms of job expansion, job enlargement and job enrichment, the other medical personnel in UUM University Health Centre still have the relationship with the Diagnostic Imaging (X-ray) Unit. The jobs that have been designed are requesting for patients' appointment, becoming chaperon, assisting the patients, giving certain emergency treatment, retrieving X-ray images and patients' clinical data, discussing the X-ray images interpretations and other clinical works which have to be done in the

suite. No doubt, every staff in UUM University Health Centre still has the relationship in his or her job designation and as a result of that every personnel will have a risk to be exposed by the X-ray directly or indirectly. According to Mojiri and Moghimbeigi (2011), occupational radiation protection is essential not only for all individual who are working in the diagnostic imaging suites permanently but also for individual who may in a radiation surrounding even though the frequency is occasional.

1.3 ORGANIZATIONAL BACKGROUND

Historically, UUM University Health Centre (formerly known as Student Health Centre) began operating in 1986 on the campus of *Bandar Darulaman, Jitra Kedah* and had been moved to the Campus of *Sintok* in 1990. During that time, the services were Out Patient and Dental Unit only. However, in 1994 the services had been expanded into comprehensive medical care such as Medical, Dental, New Students Health Examinations, Diagnostic Laboratory, Pharmacy, X-ray and Trauma/Emergency services. In 1998, UUM University Health Centre was incorporated into Strategic Business Unit (SBU) for the purpose to generate income for UUM University Health Centre particularly and to the university in general. Meanwhile, the planning of having another Strategic Business Unit (SBU) had already begun in the year 2009. At last, another Strategic Business Unit formerly known as *Medical Diagnostic* Universiti Utara Malaysia (MDUUM) was established in 2010 and consisted of Administrative Unit, Diagnostic Laboratory Unit and Diagnostic Imaging (X-ray) Unit.

Now, UUM University Health Centre is one of the departments under the Chancellery Department. However, the operational and financial management have being

administered independently in order to make the service running smoothly as well as cutting certain bureaucratic procedures.

The core businesses of UUM University Health Centre are slightly different from public/government and private healthcare premises since the objectives are to serve the university community with medical and healthcare services. However, with the process of transforming into effective Strategic Business Unit (SBU), UUM University Health Centre have expanded the services into public segmentations especially the neighborhood region such as *Changloon, Bukit Kayu Hitam* and some parts of the District of Kubang *Pasu*. Furthermore, the Vision, Mission, Philosophy and Client's Charter of UUM University Health Center are as in Figure 1.1:

VISION	Creating university community with healthy mental, physical strength and become productive human race and nation.
MISSION	Become a centre of excellence for the delivery of health services to the university community through healthy overall comprehensive health services and quality.
OBJECTIVES	• To provide an efficient treatment to the campus and surrounding community. • Detecting illness of patients and provide treatment. • Prevention and control of disease in the campus and the surrounding area. • Ensure the campus clean and away from disease symptoms. Increasing knowledge of the overall health of the campus community.

PHILOSOPHY	Caring, Teamwork and Professionalism

CLIENT'S CHARTER	• Patients given quality treatment.
	• Clients are treated with courtesy, considerate, respectful, honest, polite and giving.
	• Patients were given a clear explanation of the procedure and the proposed treatment including risks and other options.
	  • Honorary patients will be maintained during treatment.
	  • All the information is on the patient and the treatment will be kept confidential and will only be revealed to certain parties with its consent subject to the law.

Figure 1.1: Vision, Mission, Objectives, Philosophy and Client's Charter of UUM University Health Centre

In terms of the governance, UUM University Health Centre has five major disciplines which are Medical, Dental, Administration, Public Health and Medical Diagnostic Universiti Utara Malaysia (MDUUM). All the departments/sections have been operating according to the structure and the services chart as Figure 1.2:

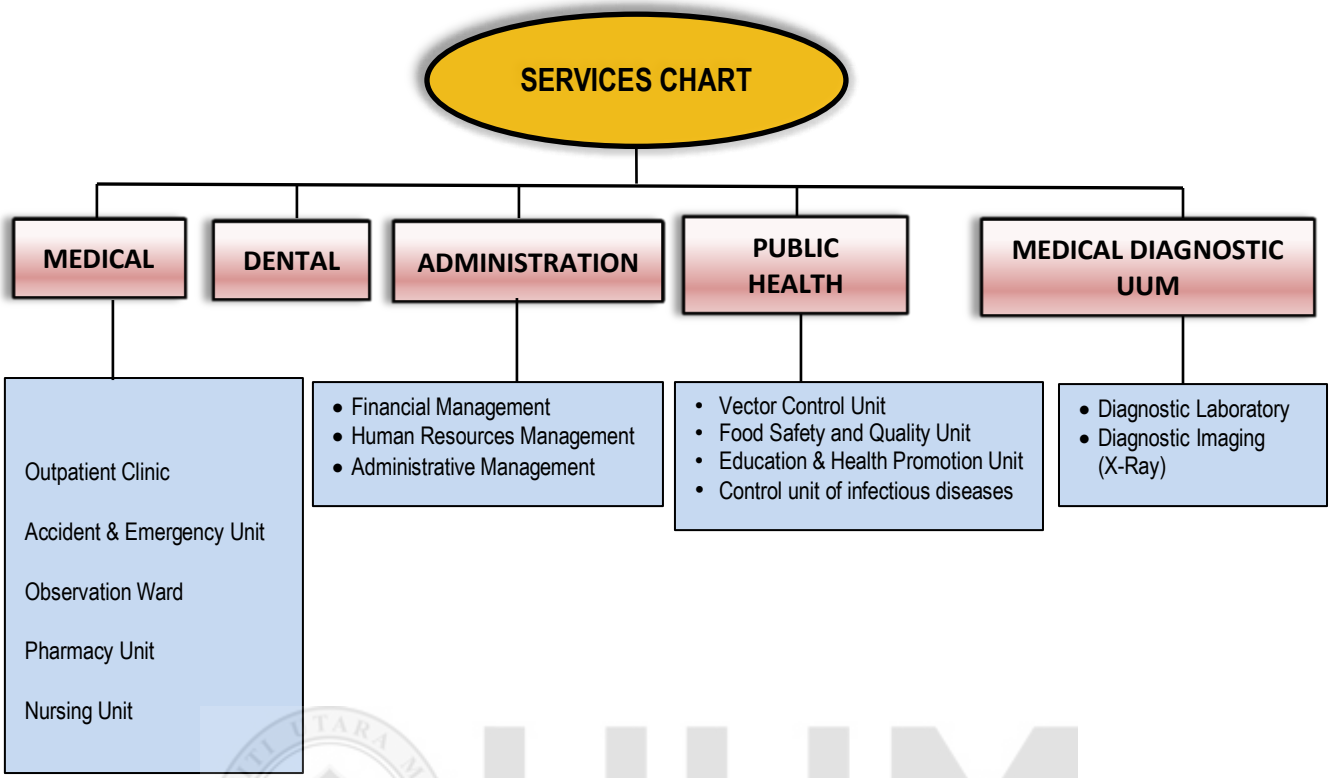

Figure 1.2: Services chart of UUM University Health Centre

University Health Centre has 62 personnel which are ranging from many hierarchies of positions that have their roles and responsibilities in associated of the designations. Each of the staffs is the important asset to UUM University Health Centre from the perspective of Human Resource Management because they are the characters that make the world in University Health Centre goes round. The Figure 1.3 shows the Organizational and services chart of UUM University Health Centre:

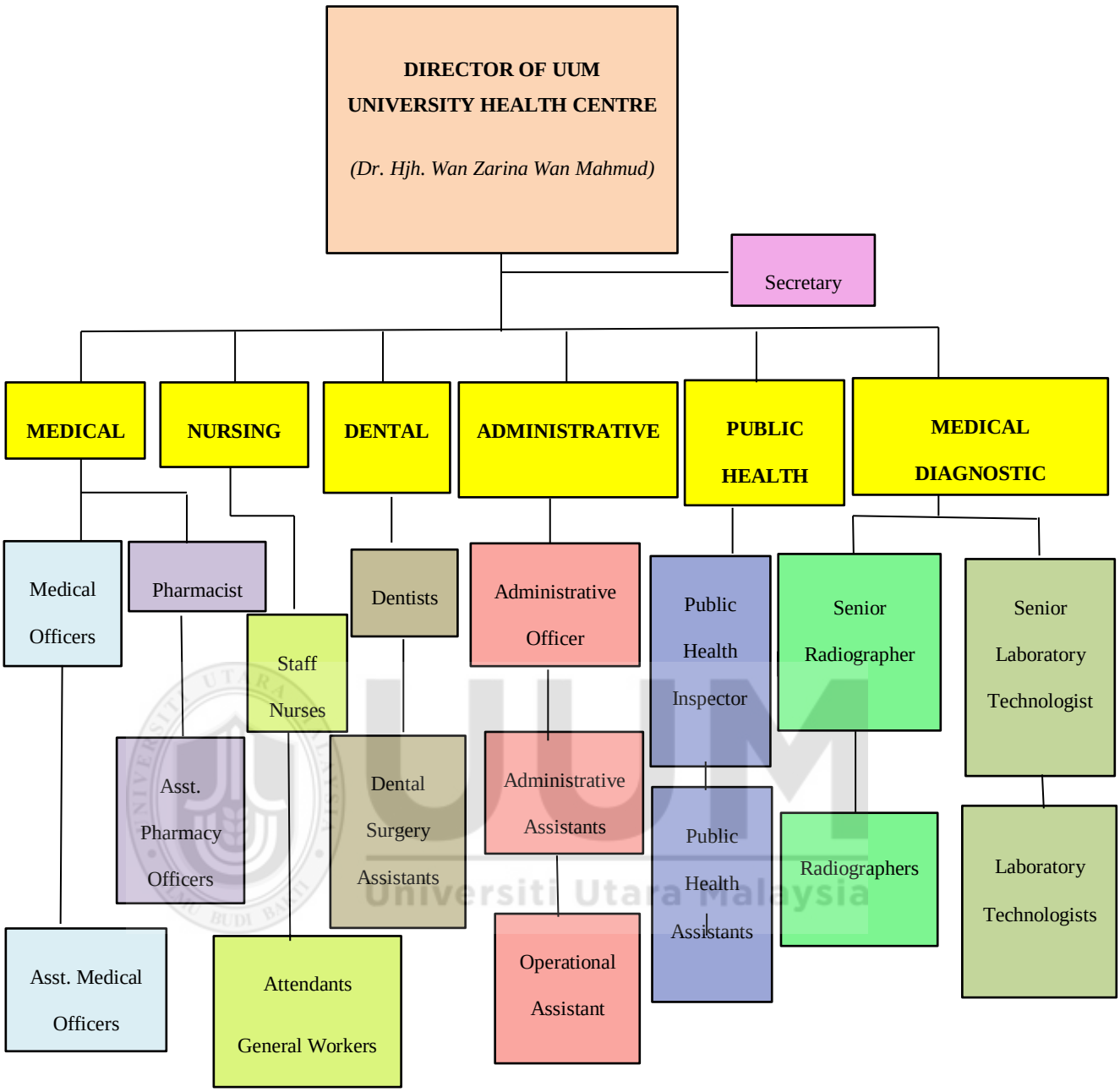

Figure 1.3: Organizational and services chart of UUM University Health Centre

1.4 PROBLEM STATEMENT

The exposure to ionizing radiation from medical procedures has become a public as well as scholars concern and as a result has become public and scientific discussions. The term 'radiation' means a wide spectrum of different types of energy including X-ray in which most of them have been suspected to cause illnesses to human health (Bobrow, 1993). As claimed by Kew, Zahiah, Syed Zulkifli, Noraidatulakma and Hatta (2012), the extensive or obiquitous use of ionizing radiation has triggered greater disturbance regarding the risks of diagnostic radiation exposures.

According to Yucel, Karakas, Bulbul, Kocar, Duman and Onut (2009), there are two types of radiation effects on human health which are the stochastic and deterministic effects. Stochastic effect is an-independent-dose effect which can cause critical sickness such as cancer whereas deterministic effect or dependent-dose-effect is the effect in which is immediate such as nausea, skin burn and acute radiation syndrome. However, the possibility that radiation exposure from radiological procedures can increase the occurrence of cancer is still controversial (Kew *et al.,* 2012).

Any staff if being assigned to work in UUM University Health Centre especially in Diagnostic Imaging (X-ray) Unit and other unit as well should pose adequate knowledge and awareness on radiation safety. The justification for the characteristic is because patient safety is the top priority in any medical examination or intervention (Kew *et al.,* 2012). Moreover, the knowledge and awareness on radiation safety will shape the concern, attitude and action of the affected individual when dealing with X-ray patients and procedures. Although there are many studies that have been

performed regarding this topic, the significant of the study are the recommendations which can be proposed to the staffs in improving the level of knowledge, awareness and practice of radiation protection as well as strengthening the regulations and activities of Radiation Safety Committee in UUM University Health Centre. According to Yurt, Cavusoglu, and Gunay (2014), it has been acknowledged that most of the healthcare personnel often do not have adequate knowledge about the risks of ionizing radiations and the preventive procedures which can be executed to mitigate the risks. Despite the awareness of health risks which are related to medical, radiation exposures, there is always poor knowledge transfer to the non-radiological medical groups (Kew *et al.*, 2012).

Based from the interview with UUM University Health Centre Director, Dr. Hajah Wan Zarina binti Wan Mahmud, she did mention that the radiation safety awareness was still not achieve to the required standard. Then, she suggested to conduct a radiation safety awareness study to getting indicators from the UUM University Health Centre's employees. Furthermore, there was no study or survey had been conducted which involved UUM University Health Centre since its establishment. By conducting this survey, its results and findings will provide the information of radiation safety awareness among UUM University Health Centre's employees. In addition, by using the results and findings, training will be planned and executed for preventive programs.

1.5 RESEARCH OBJECTIVES

The major objective of this research is to study the safety management practice in UUM University Health Centre and its correlation towards radiation safety awareness. Therefore the objectives which have been formulated are:

1.5.1 To determine safety management practice among the employees in UUM University Health Centre.

1.5.2 To determine radiation safety awareness among the employees in UUM University Health Centre.

1.5.3 To determine the relationship between safety management practice and radiation safety awareness among the employees in UUM University Health Centre.

1.6 RESEARCH QUESTIONS

The research questions are the foundational core of this research project which are emphasizing on the study, determining the methodology and showing all steps of inquiry, analysis and reporting. In the context of this research, they will provide bigger view on the correlation of the safety management practices towards radiation safety awareness. Hence, from the independent variable and dependent variable, the Research Questions (RQs) that have been developed in this study are:

RQ1: What is the level of safety management practices in UUM University Health Centre?

RQ2: What is the level of radiation safety awareness in UUM University Health Centre?

RQ3: Is there any correlation between safety management practice and radiation safety awareness in UUM University Health Centre?

1.7 SIGNIFICANCE OF THE STUDY

The aim of this research is to collect usable data from the related respondents and as a result of that, the root causes and their associates related to safety management practice and radiation safety awareness can be identified. The hazardous effects to human beings of ionizing radiation used in diagnostic radiology, radiotheraphy and nuclear medicine are well studied and hence it is extremely essential to understand and apply the proper established radiation protection and safety rules in order to minimize radiation exposure to workers (Sayed & Mahmood, 2016). Moreover, the staff awareness on radiation safety is vary depending on the attitude, logistics and surrounded culture even though many studies have shown that the degree of alertness have increased globally. In the study which has been carried in two Malaysian local universities in which the respondents are final year students who are studying nuclear science course, the findings have shown that most of them have adequate knowledge on the subject of radiation safety as well as the department and the associated employees have

implemented good operational of radiation protection procedures (Sayed & Mahmood, 2016).

By conducting this quantitative research, both the problems in safety management practice as well as radiation safety awareness can be recognized in such a way whether they can contribute to medical industry. As a result, the degree of quality which is associated to radiation safety awareness can be classified as prognosis and it could assist the management of UUM University Health Centre in improving the awareness among the employees.

The results and findings from this research in which the independent variables are the six dimensions of safety management practice consisting of management commitment, safety training, workers' involvement, safety communication and feedback, safety rules and procedures and safety promotion policies will guide the management of UUM University Health Centre to fortify the employees' views about occupational safety and health. Furthermore, practical information will be provided with related to occupational safety and health issues, areas which need to be improved, loopholes and plan of actions which can improve the level of implementation of safety management practice and radiation safety awareness.

The radiological and non-radiological staffs' perception, opinion and action about ionizing radiation as well as radiological protection can be obtained in order to propose set of recommendations for radiation safety both for the employees as well as the patients. In addition, the findings and results of this study can guide the UUM University Health Centre Occupational Safety and Health (OSH) Committee in order to

develop Radiation Protection Culture (RPC) which enables the reduction of radiation dose, fortifies radiation risk awareness, minimize unsafe practices and improve the quality of radiation programs. According to Ploussi and Efstathopoulos (2016), Radiation Protection Culture (RPC) is a term which describes about the combination of behaviors, beliefs, practices and regulations among the practitioners, staffs and patients regarding to radiation protection. The formation of Radiation Protection Culture (RPC) needs Continuous Medical Education (CME) among practitioners and staffs, successful communication among all the stakeholders and execution of Quality Assurance Program (QAP).

Another significant is the findings and outcomes will strengthen the both the implementation and enforcement of radiation protection in UUM University Health Centre and thus the level of radiation safety awareness among employees can be enhanced. Moreover, the successful of radiation safety awareness will promote UUM University Healthy Centre specifically and Universiti Utara Malaysia generally in the field of radiation safety even though Universiti Utara Malaysia does not have Medical and Health Science Faculty.

In summary, the study will provide important information and facts for future researchers on safety management practice and radiation safety awareness. Further comparable studies are advisable to be conducted in other countries in which the level of understanding and practicing radiation safety awareness may different. Moreover, other sectors which are using ionizing radiation such as veterinary, industrial, oil and gas, food safety, airport security checkpoints or even nuclear plants can conduct the research for the purpose to enhance the reliability of the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

A literature review is a process which requires the identification of published or unpublished works from the secondary data resources on the area of interest and the assessment of the publications towards the study (Sekaran and Bougie, 2013). Therefore, the literature review in this chapter will deliberate about the safety management practice, radiation safety awareness and other related empirical research which will explain in detail the correlation of safety management practice towards radiation safety awareness.

2.2 SAFETY MANAGEMENT PRACTICES

Safety at work is one of the most vital and critical issues in many organizations due to the fact that accidents and injuries in the workplace can give the impacts to the organization financially and non-financially (Subramaniam, Shamsudin, Zin, Ramalu, & Hassan, 2016). Managing Occupational Safety and Health (OSH) at the work place is a job scope which needs a higher degree of concern, responsibility, commitment and efforts rather than just a day to day routine activities in order to ensure compliance with all the legal. According to Bahari (2000), university is not an industry in which the management of OSH is only striving for the safety and health for both students and employees but also a place where the best practices are tested, documented, replicated, adopted and cultivated.

Rapid technological advancement in the last decades with Computed Tomography (CT) Scan have pushed the diagnostic imaging professionals to keep in touch with increasingly complicated technologies for the purposes to gain the maximum benefits of improving images acquisition and thus enhance the quality of the radiological examinations. Although X-ray examinations in medical imaging is very clinically vital, it is estimated that 20% of the investigations are not beneficial and thus the unnecessary exposed to ionizing radiations have contributed to 100 - 250 cancer each year in the United Kingdom according to Quinn, Cooper, Davies-Colley, Rutherford, and Williamson (1997) as cited by Yurt *et al.*, (2014). Furthermore, the challenges in fulfilling the basic responsibilities of radiation safety during this period such as enforcing radiation protection policies and management of risks have become critical issues (Frush, Denham, Goske, Brink, Morion, Mills, Butler, McCullough & Miller, 2012).

Every Diagnostic Imaging (X-ray) Department/Unit undoubtedly has potential to produce hazardous effects which are associated with ionizing radiations and thus awareness and knowledge of application protection guidelines and instruments among radiographers have played important roles to safe working (Mojiri & Moghimbeigi, 2011). In addition as studied by Dehghani *et al.,* (2014), the use and manipulating of ionizing radiation in medical sectors will continue to increase at an exponential rate due to many reasons.

As stated by Shah *et al.,* (2007), the other aspect of radiation protection awareness is the careful justification and optimization at different levels of radiological investigations in

medicine in order to minimize radiation doses to the patients as well as the personnel. In other words, the benefits have to be out weight the risks whenever radiological examinations are needed.

Safety management system is the part and parcel of organization's management system which includes the health and safety work organization and its policy, the planning procedures for accident and ill health prevention, the operational and business management strategies and lastly the implementations and resources in order to develop, practice, review and sustain the occupational safety and health policies. According to Wachter and Yorio (2014), safety management system or behavior-based system mechanisms is often adopted by the organization in order to manage the safety functions for the purpose to beat the output excellence. In addition, Zohar (1980) stated that safety climate is term which explains about workers' realization on how safety management practices are being practiced in the workplace at a specific period of time (Byrom & Corbridge, 1997). The measurement of safety climate can produce "early warning" of potential safety system negligence. (Cooper & Philips, 2004).

In the terms of the healthcare suite environment, according to Berwick, Godfrey, and Roessner (1990), hospitals which execute quality improvement methods have shown their new degrees of efficiency, patient satisfaction, safety workplace, clinical effectives with minimum defects and profitability as well. Safety management is the most important interest for those who are working with radiation (Jeong & Jang, 2016). As a result of that, unnecessary exposure to radiation is the impact from carelessness due to insufficient of knowledge, extremely confident in working with radiation and the

attitude of underestimate the radiation risks. According to Luntsi, Ajikolo, Flavious, Nelson, Nwobi, Hassan, and Malgwi (2016), studies have found that most people overestimate the risk of industrial radiation and underestimate the risk of medical radiation.

According to Vinodkumar and Bhasi (2010), safety management practices are the principles, strategies, mechanisms and programs executed by an organization for the purpose of ensuring the safety of the employees. Furthermore, as tested by Vinodkumar and Bhasi (2010), in which the root source of the questionnaires were replicated from Zohar (1980), Coyle, Sleeman and Adams (1995), Williamson, Raliegh, Morrice and Wettenhall (1997), Cheyne, Cox, Oliver, and Tomas (1998), Cox and Cheyne (2000), Flin, Mearns, O'Connor, and Bryden (2000), Neal, Griffin and Hart (2000), Varonen and Matilda (2000), Glendon and Litherland (2001) and Vredenburgh (2002), the six dimensions of safety management practice is management commitment, safety training, employees' involvement, safety communication and feedback, safety rules and procedures and safety promotion policies.

2.2.1 MANAGEMENT COMMITMENT

As cited by Ismail, Ahmad, Janipha, and Ismail (2011), the literature reviews have emphasized management commitment from many angles as follows:

- giving full assistance in terms of time spending in the field of safety representative (Jaselskis, 1996).

- is associated with the existence of policies, standards, activities, resources, objectives and analysis (Smallwood, 1996).
- is influenced by its comprehensive and serious engagement (Wong, 1996).
- exhibiting the importance of leadership and resources in order to execute any improvement strategies which are associated with safety management practice (Cooper, 2000).
- practicing management by walking around the plant in order to ensure and share with the employees about safe work practice (Lack, 2002).
- quantifying the degrees of management commitment which are related to the recognition of the safety programs and the involvement towards safety process (Molenaar, 2002).

Vredenburgh (2002), claimed that the commitment from management can be displayed through job training programs, the participation of management in safety committee, adopted the effects of safety in employees' job descriptions and revising the standard operating procedures. In other words, according to Ismail *et al.*, (2011) and supported by Vredenburgh (2002), the considerations that have to taking into the account of management commitment are contribution, appearance, support, showing the examples, confession, trustworthy, supervision and having optimistic attitude.

2.2.2 SAFETY TRAINING

Safety training is a vital component in developing outstanding job (Stewart, 2002). In addition, a comprehensive well-designed and organized training programs should focus safety work practices and be acquired from an authentic assessment as according to Vredenburgh (2002). Health and safety training is a remarkable hallmark of the accident prevention process (Stranks, 1994). Moreover Vredenburgh (2002), also stated that safety training will contribute to the proactive attitude and action for making accidents more foreseeable. According to Cohen and Jensen (1984) as cited by Vredenburgh (2002), safety training should be followed with a program which were associated with objectives-setting and the feedbacks of performance.

Some of the benefits of safety training as according to Stranks (1994) are:

- create confident in trainees that they can gain different types of skills through applications and trainings.
- ensure better safety performance and enthusiasm
- produce in greater incomes and productivity
- produce in basic mental security and greater commitment at work

Frequency, new workers, particular job safety, effectiveness of the safety procedures and performance stipulation are some of the aspects of the safety training which need to be considered as emphasized by Ismail *et al.,* (2011).

2.2.3 EMPLOYEE'S INVOLVEMENT

Employees' involvement has been reported as a fact which can solve something conclusively in the discipline of safety management as stated by Dedobbeleer and Beland (1991), Rundmo (1994), Shannon, Walters, Lewchulk, Richardson, Moran, Haines, and Verma (1996), Lee (1998) and Cox and Cheyne (2000). Hence, employees' involvement is reflected as a management practice and is quantified using elements which are related to safety committee consisting of workers' representatives, participation of employees in safety related decision makings and pointing out safety issues and seeking advice with employees about safety circumstances (Vinodkumar & Bhasi, 2010). In addition, according to Ashforf and Humphrey (1995) as cited by Wachter and Yorio (2014), involvement of the workers means putting the efforts which include the "hands, head and heart" of workers in active condition and higher level of job productivity.

2.2.4 SAFETY COMMUNICATION AND FEEDBACK

According to Subramaniam *et al.,* (2016), workers should be motivated to express their responses and reactions on safety issues to the management and propose steps in how to improvise the operating procedures as well as activities in order to make them safer. Moreover, the scope and effects of communication and feedback will be more effective and practical if the two-way communication is being practiced (Vinodkumar & Bhasi, 2010).

The study will measure the dimension by using the items which are hazard reporting protocols, transparent policy for safety matters, communication about safety objectives inside the organization which involves the management and employees and chances to discuss safety issues in the meetings.

2.2.5 SAFETY RULES AND PROCEDURES

Safety Rules and Procedures according Lu and Yang (2011) as cited by Subramaniam *et al.*, (2016), mean the level in which an organization develops a clear vision and mission, roles and responsibilities, objectives, configures standards of behaviors amongst workers and institutes safety systems in order to put in right employees' safety behaviors. The information technology is commenced in order to increase the productivity while safety rules and procedures are initiated for the purpose to accomplish safety objectives (Hu, Griffin, & Bertulet, 2016). A proper documented safety rules and procedures and the enforcement by the higher level of management such as the operational, business and strategic which include the supervisors and managers can undoubtedly enhance the safety behaviors of the employees (Glendon & Litherland, 2001). Moreover, Cox and Cheyne (2000) and Mearns, Whitaker, and Finn (2003) did include safety rules and behaviors as an aspect in their offshore researches and displayed that it does have important correlation with accident rates as cited by Vinodkumar and Bhasi (2010).

2.2.6 SAFETY PROMOTION POLICIES

The development of safety promotion policies are essential in creating strong safety culture in an organization. Studies have shown that workplace accidents and casualties can be decreased by the rewarding contributions of safety promotion policies (Ali, Abdullah, & Subramaniam, 2009; Vinodkumar & Bhasi, 2010). Moreover, Zohar and Luria (2005) stated that safety promotion policies will contribute a strong culture for safety and can direct to minimize number of injuries in hospitals. According to Subramaniam *et al.,* (2016), safety promotion policies can foster and persuade employees to work safely and not creating harms to other parties. One of the approaches that can be used in implementing safety management practices in healthcare suites is giving reward such as recognition, time off, training and education and prizes without having extra budget. Studies have shown that safety issues reported by workers have major influence on the accident prevention mechanisms at the workplace (Barach & Small, 2000; Chen & Lai, 2014).

2.3 RADIATION SAFETY AWARENESS

The term radiation safety as defined by Gonzalez (2011) is used comprehensively justify whatever being done in order to prevent or minimize the injury, damage or risk from radiation exposure. Moreover the term exposure is used to show the condition of being exposed to radiation harm either those delivering exact dose or those delivering actual risk. According to Gonzalez (2011) also, in 1957 Taylor who was one of the earlier initiators in the field of radiation safety declared that:

"Radiation protection is not only a matter of science. It is a problem of philosophy, and morality, and the utmost wisdom."

As defined by Noriah (2008), radiation safety is comprehensively depended on a whole set of regulations and acts, the enforcement agencies, safety culture and training which contribute to the regulatory control of the occupational exposures and prevention the disposal of radioactive materials into the environment. The radiation safety awareness culture of any organization can be explained by the attitudes, behavior and actions of the organization's stakeholders towards radiation safety (Cole, Chapple, Thurston, Rogers, Murray, Riley, Bradley, & Reay, 2016). In order to achieve and maintain a good radiation safety culture, holistic and continuous efforts have to integrate at all levels of working practices.

2.3.1 THE PRODUCTION OF X-RAYS

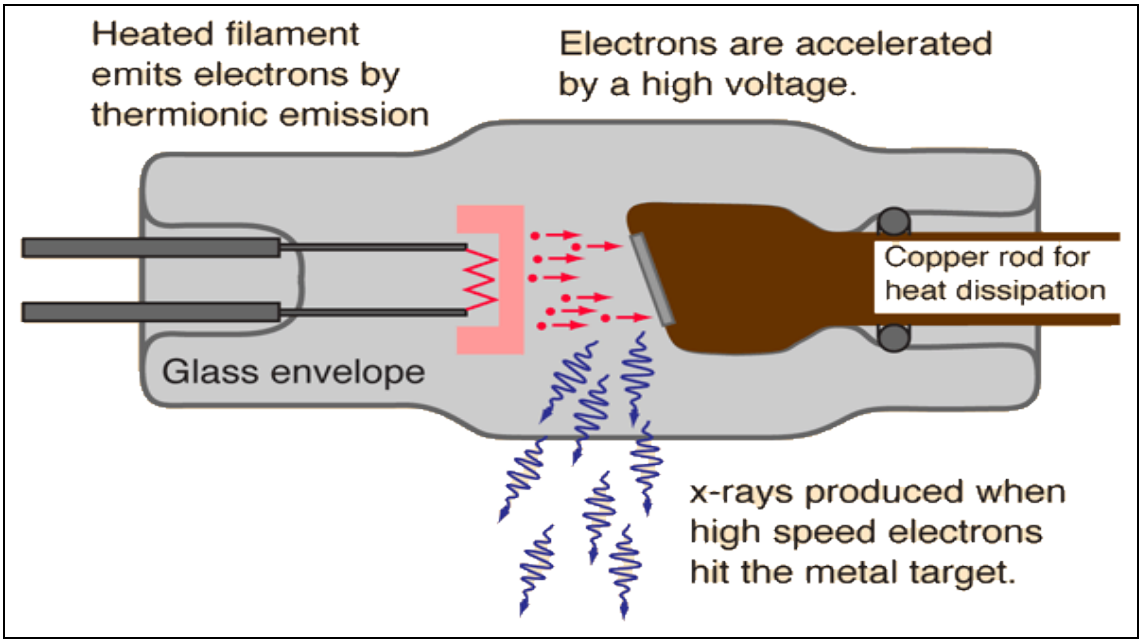

Figure 2.1: The Production of X-rays

Source: Adopted from Veterinary Medical Centre of Long Island, 2010

X-rays are produced when electrons hit a metal target usually made by copper or tungsten. The electrons are accelerated from the heated filament by a high voltage towards the metal target. As a result, the X-rays are produced when the electrons strike with the atoms as well as the nuclei of the metal target. Hence, all the points which are being discussed are illustrated in Figure 2.1. According to Malaysian Institute of Technology Nuclear Research (2004), the X-rays which are being used in hospitals or clinics can be best classified as sources of artificial radiation. In other words, the root source of X-rays comes from electricity.

2.3.2 BASIC INFORMATION ON IONIZING RADIATION

Radiation is a type of energy which being produced from a source and spread through space either as waves or particles. Moreover, some radiation such as from the fluorescent lamps are visible whereas others such as from microwaves and X-rays are invisible. Certain radiation such as X-rays could ionize atoms or in other words remove electrons from the atoms as they pass through the subject and the ability is called ionizing radiation. The X-rays can penetrate deep into the human body and the penetration level is influenced by the accelerated voltage (Juri, Ali, & Kastor, 2011).

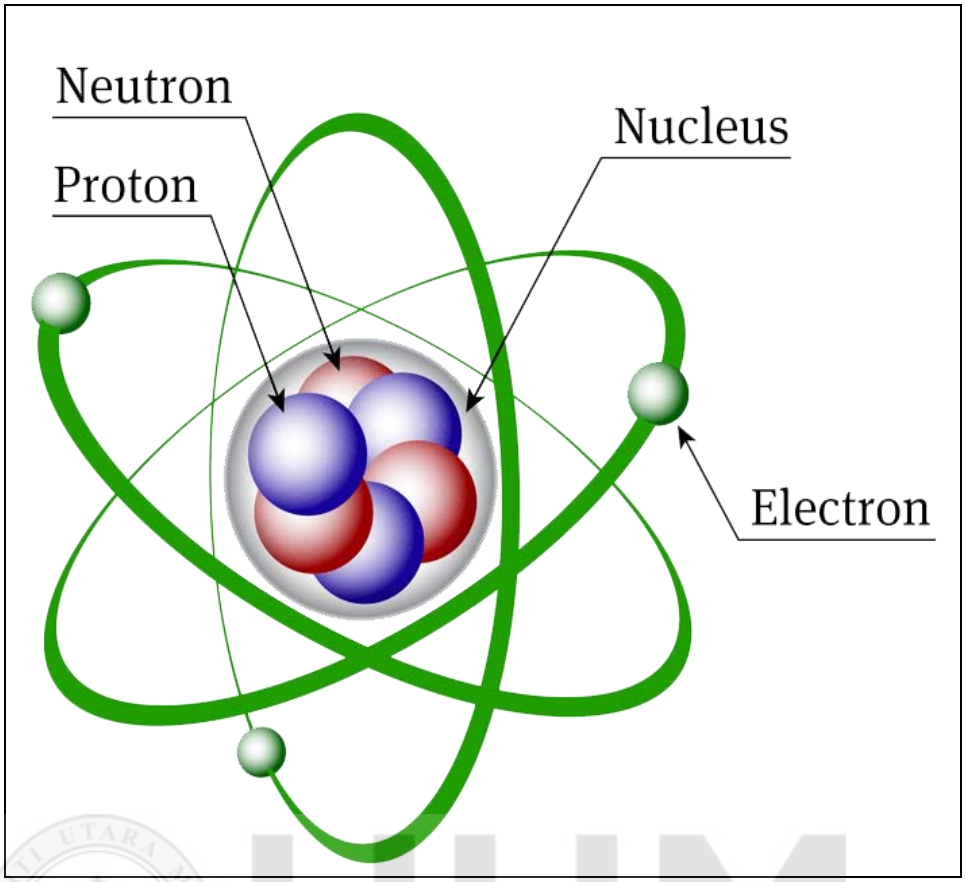

Figure 2.2: Atomic Structure

Source: Adopted from Bahari & Yusof, 2007

Atoms consist of electrons which are surrounded with a nucleus which contains of protons and neutrons. Neutrons are neutral whereas protons and electrons are electrically charged. Protons do have a relative charge of +1, while electrons do have a relative charge of -1. Moreover, the number of protons in an atom is called atomic number. All of the points which are being discussed are as in the Figure 2.2.

2.3.3 RADIATION HAZARDS AND BIOLOGICAL EFFECTS OF IONIZING RADIATION ON HUMAN BEING

Injury to living tissues which is caused by ionizing radiation are the results of emitting of energy to both the atoms and molecules in the cellular structure. According to Malaysian Nuclear Agency (2006), there are two types of biological effects if an individual were exposed to radiation. The first one is somatic effect in which the cells inside the body will damage and are observable. Secondly, the genetic effect that occurs in the reproductive cells such as damage of the chromosomes and may be inherited. In somatic effect, the first classification is deterministic effect which refers to physical injury that may be observed after being exposed to exposures in associated with certain threshold value. However the second classification is stochastic effect with has no threshold value and may lead to genetic effect.

The System International (S.I) unit for either exposed or absorbed dose for radiation is Sievert (Sv). The International Commission on Radiological Protection (ICRP) has recommended that the Maximum Permissible Dose (MPD) for general public is 1miliSievert (mSv). Furthermore, the annual Maximum Permissible Dose is 20mSv for radiation workers and will be decreased to 2mSv during pregnancy. Acute exposure is the exposure which is relatively high dose that can occur during radiological accident and may result in deterministic and early effect (Malaysian Nuclear Agency, 2006). In order to illustrate the incident, Table 2.1 shows The symptom caused by acute exposure:

Table 2.1: The symptom caused by acute exposure

Source: Adopted from Malaysian Nuclear Agency, 2006

Severity	***Symptom***	***Characteristics***	***Remarks***
Fatal	*Prodromal Syndrome*	*- "Nausea, vomiting, diarrhea, loss of appetite and headache".* *- "Severity is dependent on the radiation dose been exposed".* *"Existence of latent period".*	*"Threshold level less than 1Sv".*
	Bone Marrow/Haematopoietic Syndrome	*- "Damage to blood system and stem cell; resulting in the reduction of the number of blood cell".*	*"Threshold level, 1v. Probability of death begin with whole body dose of 2Sv".*
	Gastrointestinal Syndrome	*- "Immediate effect- it causes all symptoms of prodromal syndrome and severity of gastrointestinal pain".* *- "Damage to gastrointestinal system".*	*"Threshold level between 4-5Sv".*

	Central Nervous System	*- "Death due to damage to central nervous system".* *- "Victim suffers motor in coordination, hyper-excitation and coma".* *- "Death within 2-3 days".*	*"Threshold level more than 50Sv".*
Non-fatal	*Skin Burn*	*-"Similar to sun burn".*	*"Threshold level 3-8Sv".*
		- "Second degree burn that will leave permanent scars".	*"Threshold level 10Sv".*
		- "Severe injury".	*"Threshold level 50Sv".*
	Hair Loss (Epilation)	*- "Regrowth as white and coarse hairs".*	*"Threshold level" 3-4Sv.*
		- "Permanent hair loss".	*"Threshold 7Sv".*
	Infertility	*-"Temporary infertility, 1-3 years".*	*"Threshold 1.5-2Sv".*
		- "Permanent infertility".	*"Threshold 5-*

			6Sv".
	Blindness	*- "Opacification of eye lens".*	*"Threshold level 0.2-0.5Sv".*
		- "Cataract"	*"Threshold level 2-10 Sv".*

According to Bushberg (2017), some of the factors which have influence on radiation effects are the amount of dose received, rapidity of the dose received, size of the area been exposed on human being, degree of tissues sensitivity to radiation, the existence of genetic abnormalities which can effect DNA repair, the individual age at the time being exposed and the individual general status of health.

2.3.4 RADIATION SAFETY PRINCIPLES

Ionizing radiation is a radiation which has stronger kinetic energy that can explicit the electrons from their orbits and as a result the atoms will be ionized. Moreover, the reaction can modify the chemical bonding and may result in chemical reactive ionization. Depending on the degrees of exposure, radiation can cause health risks such as somatic effect and genetic effect. In other words, radiation can damage human body cells, increase the risks of getting cancer or genetic mutation that can be inherited to the next generation. If the dose being received is extremely higher, the individual who is being exposed may die in several weeks.

Radiation safety or radiological protection is the science and practice to protect public members as well as the environment from the risks and hazards of ionizing radiation. It is believed that the risks of cancer are increasing statistically even though at the lower radiation exposure in which the period of exposure is gradually longer (Sapiin, 2014).

Malaysian Nuclear Agency (2006) has stated that the objectives of radiation safety are to protect human being and the environment from unnecessary radiation exposure without eradicating the benefits of ionizing radiation, to prevent the existence of deterministic effects by minimizing doses to individuals below the logical threshold and to reduce the induction process of stochastic effect.

The three basic factors in dose limitation which are justification of practice, optimization of protection and safety through the ALARA (As Low as Reasonably Achievable) Principle and controlling the dose limit are essential to be implemented comprehensively in achieving the output of radiation safety. Another practices are shielding the patients and wearing the PPE (Personnel Protective Equipment) while performing the radiological investigations for medical and dental purposes (Juri *et al.*, 2011).

2.3.5 LEGISLATURE

According to Cambridge Dictionary (2017), legislature means *"the group of people in a country or part of the country who have the power to make and change laws"*. As stated in International Atomic Energy Agency (IAEA), it is the roles and responsibilities of the government at present to develop, maintain and enforce the legal blueprint for

radiological safety (Ng, Ng, & Mishar, 2016) and each country should establish an independent regulatory agency in order to regulate all the *"radiation-related activities"*. In general, the roles of the regulatory body as indicated by IAEA (2014) are:

- "*Establishing requirement for the application of the principles of radiation protection as specified in IAEA Fundamental Safety Principles for exposure situations, and establishing or adopting regulations and guides for protection and safety";*
- *"Establishing a regulatory system for protection and safety";*
- *"Adopting a graded approach to the implementation of the system of protection and safety, such that the application of regulatory requirement is commensurate with the radiation risks associated with exposure situation";*
- *"Ensuring the application requirements for education, training qualification and competence in protection and safety of all persons engaged in activities relevant to protection and safety";*
- *"Ensuring the mechanisms are in place for the timely dissemination of information to relevant parties, such as the suppliers and users of the sources, on lessons learned for protection and safety regulatory experience and operating experience, and from incidents and accidents and the related findings. The mechanisms established shall appropriate, be used to provide relevant information to other relevant organizations at the national and international level";*
- *"In conjunction with other competent authorities, adopting other specific requirements for acceptance and for performance, by regulation or by the application of published standards, for any manufactured or constructed source,*

device, equipment, or facility that when in use, has implications for protection and safety";

- *"Establishing mechanisms for communication and discussion that involve professional and constructive interactions with other relevant parties for all protection and safety related issues";*
- *"Establishing, implementing, assessing and striving to continually improve a management system that is aligned with the goals of a regulatory body and that contribute to the achievement of those goals".*

According to tradition as mentioned by Ng *et al.*, (2016), legislations which are associated with radiation safety in healthcare suites have been enforced by the government agency responsible for health such as in Malaysia, Singapore, Thailand and The Philippines. In addition, in Malaysia the Ministry of Health has been given the legalized authority in order to supervise the use of ionizing radiation in medicine as well as to oversee the radiation exposure levels.

2.3.5.1 ATOMIC ENERGY LICENSING 1984 (ACT 304)

From the legal perspective, this act was originated from the Radioactive Substances Act 1968 (Act 250) which was not holistic enough to cover the enforcement of radiation safety since the sources of ionizing radiation were ranging from radioactive materials as well as irradiating apparatus. Then in 1984, the Atomic Energy Licensing Act (AELA) 304, was enacted in order to control and regulate the use of atomic energy in education, industry as well as medicine in Malaysia and the Atomic Energy Licensing Board (AELB) is the responsible department which regulating, safeguarding and monitoring

the ionizing radiation activities as well as programs in Malaysia (Bahari, 2000 and Noriah, 2014). However, the Ministry of Health is the authorized legal agency which regulates, monitors and enforces the use of ionizing radiation in medical field. In addition, the act also discusses about the roles and responsibilities of employers as well as employees towards radiation safety.

2.3.5.2 OCCUPATIONAL SAFETY AND HEALTH ACT 1994 (ACT 514)

Moreover in 1994, the Occupational Safety and Health Act 514 (OSHA) was gazetted in Parliament for the purposes to complement or replace other existing regulations and acts in managing occupational safety and health including AELA and unlike AELA, the Department of Occupational Safety and Health is the enforcement department which has an authority to enforce all safety and health activities at the workplace including the universities. In other words, the introduction of the Occupational Safety and Health Act 1994 ensured those who are involved in radiation activities have to comply with all the regulations as being enforced in order to achieve the *"Win-win Situation"* to the shareholder, stakeholder, worker and customer as well.

Other hallmark is to avoid litigation due to improper practice of radiation safety procedures. Both Acts which are AELA and OSHA are needed and enforced strictly to be implemented in ensuring safety and health in the workplace.

2.3.6 RADIATION SAFETY AWARENESS DIMENSIONS

Working with radiation in certain cases can be hazardous jobs to safety and health of an employee if when prevention procedures are not followed, protective measures are not implemented and safe working practices are not enforced due to poor management or insufficient of knowledge, training, accountability and responsibility (Noriah, 2011). Hence, knowledge, attitude and action are the dimensions of radiation safety awareness in this study.

2.3.6.1 KNOWLEDGE

Lack of knowledge towards laws and regulations towards occupational safety and health at workplace can have major contribution to the rate of accidents. Moreover, adequate knowledge can produce employees who are very discipline and always alert on the importance of working in a safe behavior (Cooper & Philips, 2004). Furthermore, proper knowledge and awareness with are associated with radiation hazards and radiation protection are compulsory for health professionals especially the radiology personnel (Subedi, Suwal, & Pant, 2014)

2.3.6.2 ATTITUDE

In order to initiate radiation protection culture which is included radiation safety awareness, the combination of attitudes, beliefs, practices and regulations among all the parties involved such as the professionals, employees, patients and public members towards the issue is very essential (Plousi & Efstathopoulos, 2016).

2.3.6.3 ACTION

According Sharma, Singh, Goel and Satani (2016), the degree of awareness related with radiation protection affects employees' behavior since their actions will not be practically safe thus will result to adverse impacts due to lacks of information.

2.4 EMPERICAL STUDIES ON SAFETY MANAGEMENT PRACTICE TOWARDS RADIATION SAFETY AWARENESS

In terms of the study of safety management practice which is related to safety behavior, there are various studies which have conducted such as DePasquale and Geller (1999), Vredenburgh (2002) and Vinodkumar and Bhasi (2010). According to DePasquale and Geller (1999), an organization which has a low rate of workplace accidents was due to several contributing factors which were the involvement of management in occupational safety and health programs, new recruits safety training, continuous safety training for existing employees and effective safety communication between the hierarchies of the employers as well as the employees. The safety management practice which is fully support by the workers will develop a good safe workplace environment (Vinodkumar & Bhasi, 2010). In hospital environment as studied by Vredenburgh (2002), the dimensions in safety management practice which were the employees' engagement, safety training, selection, reward system, the commitment from management and safety communication and feedback played important roles in shaping the safe work environment.

For an empirical study which is related to radiation safety awareness, a meta-analysis which was conducted by Sarman and Che Hassan (2016) among dental practitioners, radiographers and other radiation workers of hospital settings worldwide from 27 studies that were published from the search engine and databases from 2009 to 2016, the findings have shown that knowledge, work site and years of practice which can be concluded including the safety management practice and inspection of the equipment has a strong relationship with Radiographers' Compliance (RP) which can assumed as parts of radiation safety awareness.

Another radiation safety awareness study in which the awareness and knowledge about radiation protection among radiology professional in the Radiology Department, East Java Indonesia had been assessed was conducted. In addition, the findings could be noted that radiation protection has direct relationship with the general awareness and knowledge about ionizing radiation doses as well as the side effects (Elnari, Noor, & Yuniewati, 2016).

2.5 SUMMARY

In a nutshell, it is right to say that the perceived behavioral controls which are related to management commitment, safety training, employees' involvement, safety communication and feedback, safety rules and procedures and safety promotion policies will determine the level of radiation safety awareness among Radiology Professionals, Non-Radiology Professionals as well as the patients in healthcare suites specifically in UUM University Health Centre and other healthcare suites in general.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This section will describe the process on how the sample been determined, how the survey been performed and its content, how the survey been managed and to whom, who had responded to the survey, and how the data analysis been administered.

According to Puvenesvary, Rahim, Naidu, Badzis, Nayan and Aziz (2011), a research design is a plan or set of proposals which demonstrate how it is expected to perform. At a philosophical level, the choice of a specific research method will give justified and understandable acceptance (Kler, 2010). Descriptive study or quantitative research has been choosing as a research design. In addition, descriptive study is a research study which explains briefly the variables in a situation of interest to the researcher (Sekaran & Bougie, 2013). Moreover, descriptive studies are often designed to collect data that describe the characteristics of persons, events, or situations. It is right to say that descriptive studies are usually the best approaches in gathering information which will demonstrate relationships and describe the world as it exists. These types of studies are often performed before an experiment in order to gain specific things that can manipulate the results and can be included into the experiment. According to Bickman and Rog (1998), descriptive studies can provide the answers the questions such as “what is” or “what was” while experiments can typically answer “why” or “how.”

3.2 CONCEPTUAL FRAMEWORK

Conceptual model is a theoretical structure of assumptions, principles, and rules that integrates altogether the ideas comprising a broad concept. Furthermore it can navigate research by providing a visual representation of theoretical constructs (and variables) of interest. Designing a conceptual model will begin with conducting a comprehensive review of the literatures, searching peer-reviewed journal articles, books/monographs, conference papers, and other related references.

The study conducted by Vinodkumar and Bhasi (2010) is used as a reference and became the foundation in developing the conceptual framework for this research. Vinodkumar and Bhasi (2010) developed three variables which are safety management practices (independent variable), determinant of safety performance (mediator) and components of safety performance (dependent variable). In addition, safety management practices can influence the development of safety environment in organization as concluded by Vinodkumar and Bhasi (2010) and there were some efforts to identify certain safety management practices which could determine safety performance. Figure 3.1 exhibits the conceptual framework which was developed by Vinodkumar and Bhasi (2010).

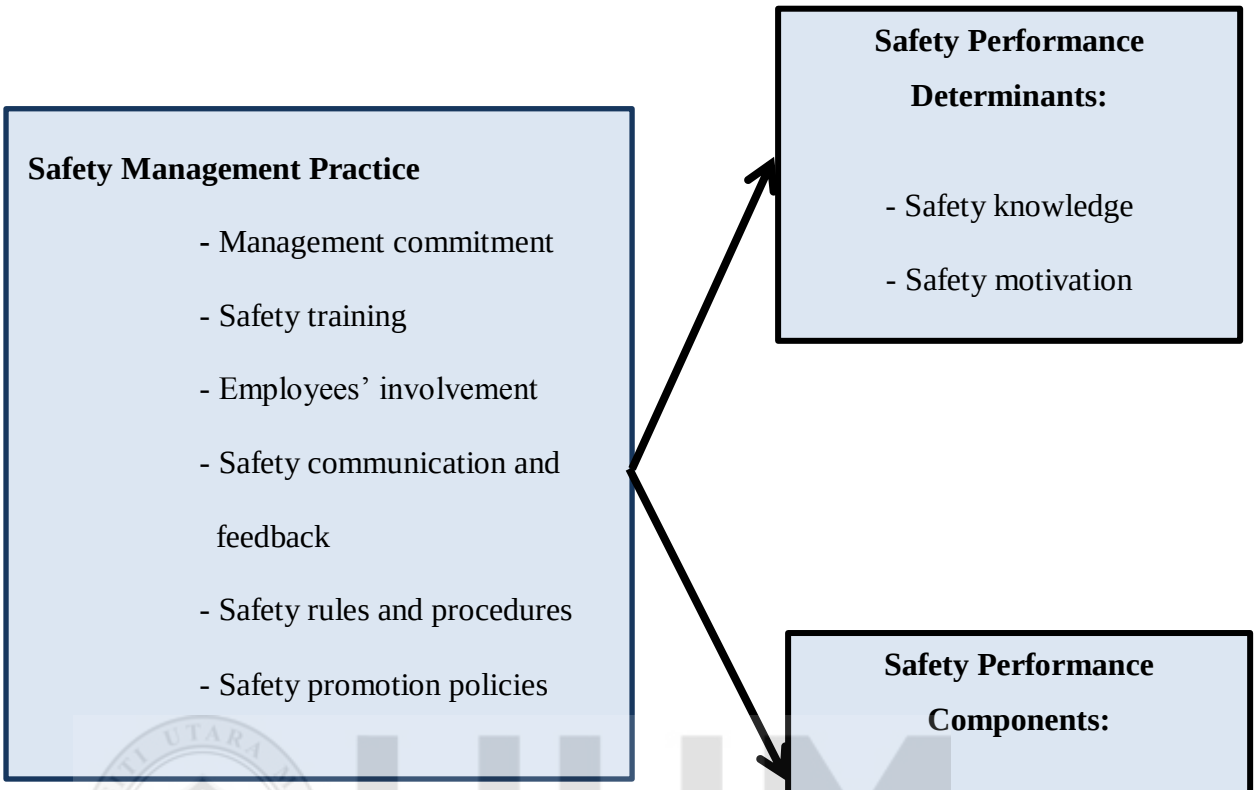

Figure 3.1: Model tested by Vinodkumar and Bhasi (2010)

However in this research, a conceptual framework that has two variables namely safety management practice as independent variable and radiation safety awareness as dependent variable. The conceptual framework for this study is as in Figure 3.2:

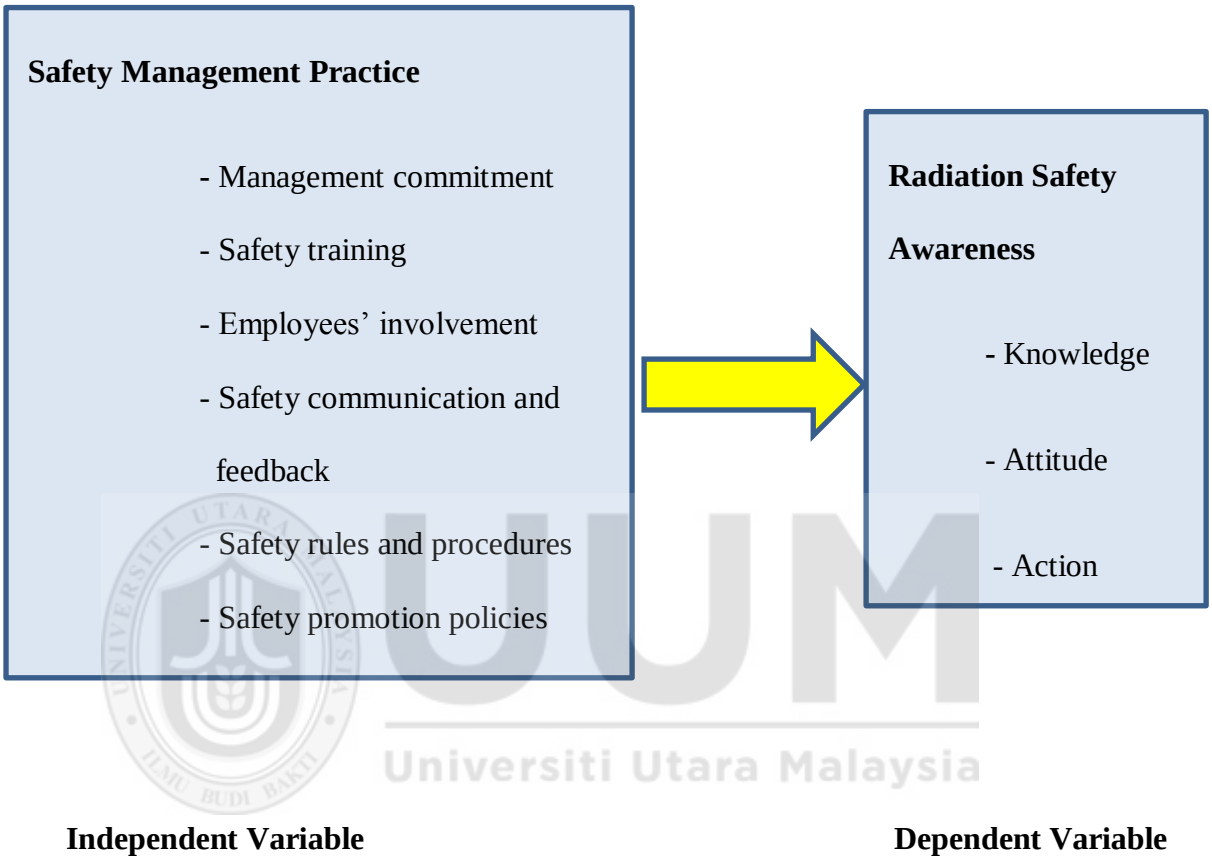

Figure 3.2: Research conceptual framework

3.3 HYPOTHESIS

Based on the literature review which has been discussed and the conceptual framework that has been developed, the hypothesis which can be formulated is:

H: Safety management practice has strong correlation with radiation safety awareness in UUM University Health Centre.

3.4 RESEARCH DESIGN

The main objective of this research is to determine the employees' perception on safety management practice and its correlation towards radiation safety awareness. Hence, the independent variable which is the safety management practice was used in order to measure the level of correlation towards radiation safety awareness which is the dependent variable. The study has been conducted by using quantitative method in which the self-administered questionnaire been used for the purpose to get the essential data. Moreover the questionnaire has been developed from the replication of previous studies which are on the same subject.

The second step is conducting the pilot test which the amount was 45 out of the population which was 61. The respondents were asked to fill-up the questionnaire during their free time and return the questionnaire after three days. The third step is

conducting the final research in which 61 sets of questionnaire were distributed among the employees and the instruction to them as similar when conducting the pilot test.

3.5 INSTRUMENTATION AND MEASUREMENT

The study used questionnaire mechanism in order to collect data from the respondents. Thirteen (13) pages of the questionnaire were divided into three main sections and the medium of languages that were English and *Bahasa Melayu*. It was decided to give the questions both in English and *Bahasa Melay*u since the respondents have different level of understanding in English which is undoubtedly been influenced by the level of education. Moreover the type of the questionnaire was self-administered and all the questions were closed-ended. The contents of the questionnaire were discussed with the supervisors of this research project and the Medical Doctor from UUM University Health Centre who is the licensee as well as a consultant of an X-ray operation. Furthermore, he is also a Radiation Protection Officer (RPO) in UUM University Health Centre. After taking into account every item in detail, necessary changes were executed such as simplifying, rewording and replacing some of the questions.

The first section of the questionnaire was section A which focused on the demography of the respondents. The questions were the classifications of the occupations, age group, sex, level of education and years of service in *PKUUUM* (UUM University Health Centre).

The second section of the questionnaire was about the six dimensions of the safety management practice which were management commitment, safety training,

employees' involvement, safety communication and feedback, safety rules and procedures and safety promotion policies. The questions were prepared based on the revision of related literature and theory. Moreover, all the 57 questions were adapted from Vredenburgh (2002), Glendon and Litherland (2001), Cheyne (2000), Varonen and Mattila (2000), Flin *et al.* (2000), Cheyne *et al*. (1998), Williamson *et al*. (1997), Coyle *et al*. (1995) and Zohar (1980). All these instruments were adapated and tested by Vinodkumar and Bhasi (2010) in their research on organizational safety management practices in petrochemical industry in Kerala, a state in the southern part of India. Hence, the section B contained of:

i) Management commitment – 9 items

ii) Safety training – 6 items

iii) Employees' involvement – 5 items

iv) Safety communication and feedback – 5 items

v) Safety rules and procedures – 5 items

vi) Safety promotion policies – 5 items

For the dependent variable which was the radiation safety awareness, three major dimensions were emphasized which were knowledge, attitude and action. In measuring the dimension of knowledge, the instruments from Alotaibi, Abdulsalam, Bakir and Mohammad (2015) were adapted. For the second dimension which was the attitude, the instruments from Abdellah, Attia, Fouad, and Abdel-Halim (2015) and Jeong and Jang (2016) were adapted. For the last dimension in this dependent variable which was action, the instruments from Yurt *et al*., (2014) and Abdellah *et al.*, (2015) were also adapted. Thus, the section C consisted of:

i) Knowledge – 5 items

ii) Attitude – 6 items

iii) Action – 6 items

The thirteen pages of questionnaire had provided space beside the every statement to make the preference in the 5-point Likert Scale. According to Geller, Roberts and Glimore (1996), Likert Scale is one of the types of responses and usually utilizes in questionnaire survey most extensively used scale in questionnaire based studies. Hence, the scale is as in the Table 3.1:

Table 3.1: Five-point Likert Scale

Judgement	**Scale**
Strongly Disagree	1
Disagree	2
Partially Agree	3
Agree	4
Strongly Agree	5

3.6 SAMPLING PROCEDURE AND DATA COLLECTION

The population of the study is all the employees in UUM University Health Centre in which the total amount is 61. According to the *"Table for Determining Size from a Given Population"* prepared by Krejcie and Morgan (1970), the minimum sample size for this study is 52. Table 3.2 displays the number of questionnaires which have been distributed to the respondents as well as the numbers that have been returned back to the researcher. The response percentage rate was 93.44% and the unreturned questionnaires in which the percentage rate was 6.56%. In addition, some of the factors which might contribute to the number of unreturned questionnaires were time constraint, lack of support by the respondents, lack of teamwork's spirit and others.

Table 3.2: Number of questionnaires distributed and returned

Item	Quantity
Questionnaires Distributed	61
Questionnaires Returned	57

3.7 PILOT STUDIES

According to Borg & Gall (1979), a pilot study in performing a research needs to be done in order to measure the level of clarity of the questions as well as to recognize

areas which have problems and need to be rectified. Hence, a pilot study was organized for the purpose to test the reliability of the questions before the real data collection would be conducted.

In this pilot study, 45 employees from UUM University Health Centre involved and the data collected were analyzed using Statistical Package for Social Science (SPSS) version 24.0. The objectives of this pilot study are to inspect the reliability of the instruments as well as to evaluate the understanding of the respondents towards the questions which have been asked.

The ability of the instrument to gain a consistent and stable measurement is the meaning of instrument reliability. Moreover, these measurements can be obtained from the result of internal consistency measured using Cronbach's Alpha Value in which the Cronbach's Alpha Value will show a strong relationship for both of the items. Reliability is defined by the coefficient of reliability (Alpha) between the values of 0.00 to 1.00. Therefore, if the reliability is higher, the reliability of the test is better. By referring the Table 3.3, the tested Cronbach's Alpha Value of the pilot study were listed according to the dimensions of the variables. From the table, all the dimensions of the independent and dependent variables showed the value of above 0.6 and therefore the reliability of the test is better (Hair, Anderson, Babin and Black, 2009). From the pilot test that had been done, the Cronbach's Alpha Value for all the 57 questions which were consisted of Independent Variable section and Dependent Variable section was 0.933 even though the Cronbach's Alpha Value for employees' involvement was only 0.417 .

Table 3.3: Tested Alpha Cronbach's value for pilot study

Item	Dimension of Variable	Cronbach's Alpha Value
Management commitment	Independent	0.816
Safety training	Independent	0.798
Employees' involvement	Independent	0.417
Safety communication and feedback	Independent	0.765
Safety rules and procedures	Independent	0.706
Safety promotion policies	Independent	0.804
Radiation safety awareness	Dependent	0.875
All variables	Independent and Dependent	0.933

3.8 SUMMARY

The pilot study was based on the sets of 45 questionnaires which had been collected from the respondents. The employees' perception on safety management practice and its influences towards radiation safety awareness had been verified in UUM University Health Centre. The SPSS software version 24.0 was used in order to analyze the assessment data, reliability test and Cronbach's Alpha Value in order to cease the findings. In addition, the Cronbach's Alpha Value for all the items of questionnaire was 0.933 which indicates that the internal consistency of the defined scale was strong.

CHAPTER FOUR

RESULT AND ANALYSIS

4.1 INTRODUCTION

This chapter will disclose the results as well as findings of the study. The questionnaires which had been distributed among the UUM University Health Centre were then collected and analyzed statistically using the Statistical Package for Social Science (SPSS) Version 24.0. The gathered data then analyzed with descriptive frequency analysis for demographic of respondents, reliability analysis, descriptive analysis of variables, correlation and regression analysis.

4.2 DATA ANALYSIS

First, the demographic data of the respondents were examined by using the protocol of descriptive statistics of frequency analysis in order to obtain the results of demographic facts of the respondents. Next, the data analysis process began with the reliability analysis for the purpose to measure the reliability of variables which are safety management practice and radiation safety awareness. Furthermore, in order to further the analysis, descriptive statistics of variables, correlation and regression analysis were applied.

4.3 RESPONSE RATE

A total number of 61 questionnaires were distributed to the respondents. However at the end of the survey period, a total number of 57 questionnaires were returned in which the percentage is 93.44%. In addition, some of the factors which might contribute to the number of unreturned questionnaires were time constraint, lack of support by the respondents, lack of teamwork's spirit and others. During the analysis, a total amount of 12 items are recoded since they were negative statements in which the rating have to be changed from 1to 5, 2 to 4, 3 to 3, 4 to 2 and 5 to 1. Another important thing that can be noticed was that there was no item with null data.

4.4 DISTRIBUTION OF FREQUENCY ANALYSIS

Based on the demographic items provided inside the questionnaire which were classification of the occupations, age, gender, level of education and years of service in UUM University Health Centre, all the items were analyzed using descriptive frequency analysis.

4.4.1 PROFILE OF RESPONDENTS

By using the descriptive frequency analysis, the respondents' profiles were analyzed. Table 4.1 as in the next page presents the detailed descriptive statistics of the respondents' characteristics.

Table 4.1: Demographic characteristics of the respondents (N=57)

Descriptive	Frequency	(%)
Classifications of Occupations		
- Management and Professional	7	12.3
- Support	50	87.7
Age		
- 20-30 years	14	24.6
- 31-40 years	33	57.9
- 41-50 years	7	12.3
- 51-60 years	3	5.3
Sex		
- Male	16	28.1
- Female	41	71.9
Level of Education		
- Secondary School	9	15.8
- Professional Certificate	5	8.8
- Diploma	33	57.9
- First Degree	9	15.8
- Master Degree	1	1.8
Years of Service in PKUUUM		
- 1-5 years	14	24.6

- 6-10 years	29	50.9
- 11-15 years	9	15.8
- 16-20 years	4	7.0
- More than 21 years	1	1.8

The first data been analyzed was classification of occupations in which the classification are the Management and Professional and the Support Group. The personnel who were classified in the Management and Professional Group are Medical Doctors, Dentists and Administrative Officers represent 12.3% out of the total respondents in which the frequency was 7. However, those who were in the support Group such as the Radiographers, Staff Nurses, Assistant Medical Officers, Medical Laboratory Technologists, Assistant Pharmacy Officers, Assistant Environmental Officers, Dental Surgery Assistants, Public Health Assistants, Administrative Assistants, Nurse Aides, Drivers and General Assistants represented 87.7 % out of the total respondents in which the frequency was 50.

In terms of age of the respondents, most of the respondents were at the age of 31-40 years old that are 57.9% in which the frequency was 33. The second biggest of age of the respondents was at the age of 20-30 years old in which it represented 24.6% and the frequency was 14. The third biggest group of respondents in which the amount was 7 were at the age of 41-50 years old and the percentage was 12.3%. The least respondents were presented by the 51-60 years old group in which percentage was 5.3% and the frequency number was 3.

By looking at the gender of the respondents, most of the respondents were female in which the percentage was 71.9% and the frequency was 41. In addition, all types of designations in UUM University Health Centre were conquered by the female staffs. The second group was the male which represented 26.3% and the frequency was 16.

The third item was the level of education in which majority of the respondents had Diploma in which the percentage was 57.9% and the frequency was 33. In fact, in the healthcare suites such UUM University Health Centre which provide healthcare services, paramedics who are hired such as Radiographers, Staff Nurses, Assistant Medical Officers, Medical Laboratory Technologists, Assistant Pharmacy Officers and Assistant Environmental Officers need to have at least Diploma in the relevant subspecialties. The First Degree group which represented 15.8% in which the amount was 9 comes from the occupation of Medical Officer, Dentist and Administrative Officer. The similar percentage which was 15.8% and the frequency was 9 were contributed from the Secondary School group. The Professional Certificate Group which consisted of Dental Surgery Assistant and Public Health Assistant represented 8.8% in which the frequency was 5. The Master Degree group which consisted of Specialist Medical Officer represented the least in which the percentage is 1.8% and the frequency was 1.

The final data in the demographic profile of the respondents was the years of service in *PKUUUM* (*Pusat Kesihatan Universiti UUM* / UUM University Health Centre). It showed that majority of the respondents were in the range of 6-10 years in which the percentage was 50.9% and the frequency was 29. For the second highest was in the range between 1-5 years in which the percentage was 24.6% and the frequency was 14.

The third highest was the range of 11-15 years in which the percentage was 15.8% and the frequncy was 9. For the respondents who were in the range of 16-20 years, the percentage was 7.0% and the frequency was 4. Finally, the least group was in the range of more than 21 years in which the percentage was 1.8% and the frequency was 1.

4.5 RELIABILITY ANALYSIS OF QUESTIONNAIRE ITEMS

Based on the principle, a measurement procedure which is stable should come out with the results which are the same or approximately similar if the same individual and condition are used. Reliability indicates the amount observed in the variance score against the actual variance score. Furthermore, the internal consistency reliability used in SPSS determines the performance of the items on the test measure the same construct or idea. Therefore in this research, the reliability coefficient called Cronbach's Alpha (α) (Cronbach, 1951). Furthermore, according to Nunally (1978) and DeVellis (2003), a Cronbach Alpha Value of 0.70 and above indicates that the internal consistency of the defined scale is strong. On the other hand, the Cronbach Alpha Value which is 0.60 and above is considered significant (Hair, Anderson, Babin & Black, 2009). Therefore, Table 4.1 shows the reliability test of the two variables in this study which are safety management practice and radiation safety awareness. The Cronbach's Alpha Value which was 0.841 indicates it had good internal consistency on the data reliability.

Table 4.2: The Reliability Test of all variables

Cronbach's Alpha Value	N of items
0.841	57

In order to check the reliability further, the variables in the study were tested by the six dimensions of safety management practice and radiation safety awareness.

Table 4.3: The Reliability Test of each variable

No.	Safety Dimensions	No. of Items	Cronbach's Alpha Value
1.	Management commitment	9	0.830
2.	Safety training	6	0.850
3.	Employees' involvement	5	0.600
4.	Safety communication and feedback	5	0.820
5.	Safety rules and procedures	5	0.740

6.	Safety promotion policies	5	0.870
7.	Radiation safety awareness	17	0.931

The results of the Cronbach's Alpha Value in Table 4.2 demonstrated by SPSS indicate that the highest value which been achieved was on Radiation Safety Awareness ($\alpha = 0.931$) and the lowest was Employees' Involvement ($\alpha = 0.600$). Moreover, based on the Table 4.2, the overall individual of Cronbach's Alpha Value in this study was proven significant as it showed good internal consistency reliability which benchmarked the Cronbach's Alpha Value which is above 0.60 (Hair *et al*., 2009) .

4.6 ANSWERING THE RESEARCH QUESTIONS

In order to answer the first Research Question number one (1) on the level of safety management practices in UUM University Health Centre, the Mean Statistics Test was carried out in answering the question. The data then been analyzed by using SPSS program Version 24.0 and the classification of mean is described as in the Table 4.4:

Table 4.4: Classification of Mean

Range of Mean	Description
1.00 – 1.80	Very Low
1.81 – 2.60	Low
2.61 – 3.40	Moderate
3.41 – 4.20	High
4.21 – 5.00	Very High

Source: Veloo & Rahman, 2012

Table 4.4 describes on the mean statistics of the Independent Variable as well as Dependent Variable for comparison. The data showed that the mean value between value between safety management practice and radiation safety awareness were between 3.4772 – 3.9454. Therefore, radiation safety awareness scored higher mean value at 3.8318 as compared to 3.7913 for safety management practice. Furthermore, the standard deviation score for safety management practice was 0.57441 and radiation safety awareness was 0.56306.

Table 4.5: Mean Statistics for safety management practice and radiation safety awareness

Variable	N	Mean	Standard Deviation
Safety management practice	57	3.7913	0.57441
Radiation safety awareness	57	3.8318	0.56306

In order to answer Research Question number two (2) on the level on the level of radiation safety awareness in UUM University Health Centre, the results of Mean statistic of radiation safety awareness as in Table 4.6 can display the answer.

Table 4.6: Mean Statistics for radiation safety awareness

Variable	N	Mean	Standard Deviation
Radiation safety awareness	57	3.8318	0.56306

The results indicated that radiation safety awareness had higher mean value of 3.8318 (high). These results proved that the respondents had good attitude and proactive behavior towards radiation safety awareness in the workplace. Majority of the respondents had higher tendency to perform their jobs' descriptions in a safe manner, use the PPE effectively, obey the exact safety rules and procedures, ensure the maximum level of safety and is always on the right track according to Standard Operating Procedures (SOPs).

Overall, the higher standard deviation score for radiation safety awareness was 0.56306. Therefore, the results indicated that there was relativity among all the respondents towards radiation safety awareness.

4.7 CORRELATION TEST

According to Pallant (2007), Correlation Analysis is done in order to "determine the strength and the directions of the linear relationship between the two variables". In

order to answer the Research Question number three (3) whether there is a strong correlation between safety management practices and radiation safety awareness in UUM University Health Centre, the Correlation Test was used and the Range of Correlation and the Description as in Table 4.7:

Table 4.7: Table of Correlation

Range of Correlation	**Description**
0.91 – 1.00	Very Strong
0.71 – 0.90	Strong
0.51 – 0.70	Moderate
0.31 – 0.50	Weak
0.01 – 0.30	Very Weak
0.00	No Correlation

Source: Chua, 2006

Based on Table 4.7 from Chua (2006), the Analysis Result of Pearson Correlation between safety management practice in which the dimensions were management commitment, safety training, employees' involvement, safety communication and feedback, safety rules and procedures and safety promotion policies as well as radiation safety awareness are shown in Table 4.8. It displayed a strong correlation at $r = 0.751$.

Table 4.8: Correlation Analysis of safety management practice and radiation safety awareness

		Safety Management Practice	**Radiation Safety Awareness**
Safety management practice	Pearson Correlation	1	0.751**
	Sig. (2-tailed)		0.000
	N	57	57
Radiation safety awareness	Pearson Correlation	0.751**	1
	Sig. (2-tailed)	0.000	
	N	57	57

** Correlation is significance at the 0.01 level (2-tailed)

4.8 MULTIPLE REGRESSION ANALYSIS

From the Multiple Regression Analysis as in Table 4.10, it can be concluded that 68.40% of the items and dimensions inside the independent variable were associated with the dependent variable.

Table 4.9: Model summary of Multiple Regression Analysis

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.827[a]	.684	.646	5.69208

a. Predictors: (Constant): Safety management practice

b. Dependent Variable: Radiation safety awareness

4.9 OTHER ANALYSIS RESULTS

4.9.1 Descriptive differences between classifications of occupations towards radiation safety awareness using T-Test

Table 4.10: Descriptive differences between classifications of occupations towards radiation safety awareness using T-test

Group Statistics					
Radiation Safety Awareness	**Classifications of Occupations**	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
	Management and Professional	7	70.5714	5.02849	1.90059
	Support	50	64.3800	9.83930	1.39149

	Levene's Test for Equality of Variances	
	F	Sig
Radiation Safety Awareness Equal variance assumed	6.765	0.012

P < 0.05 = Accepted

The findings from Table 4.10 showed that the differences between classifications of occupations had significant effect towards radiation safety awareness since $p < 0.05$.

4.9.2 Descriptive differences between sex towards radiation safety awareness using T-Test

Table 4.11: Descriptive differences between sex towards radiation safety awareness using T-test

Group Statistics					
Radiation Safety Awareness	**Sex**	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
	Male	16	64.815	10.45128	2.61282
	Female	41	65.2683	9.34084	1.45879

	Levene's Test for Equality of Variances	
	F	**Sig**
Radiation Safety Awareness **Equal variance assumed**	1.247	0.269

P > 0.05 = Rejected

The findings from Table 4.11 showed that the differences between sex did not have significant effect towards radiation safety awareness since p > 0.05.

4.9.3 Descriptive differences among ages towards radiation safety awareness using ANOVA Test

Table 4.12: Descriptive differences among ages towards radiation safety awareness using ANOVA Test

ANOVA					
Radiation Safety Awareness					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	40.591	3	13.530	0.141	0.935
Within Groups	5090.286	53	96.043		
Total	5130.877	56			

P > 0.05 = Rejected

The findings from Table 4.12 showed that the differences among ages did not have significant effect towards radiation safety awareness since $p > 0.05$.

4.9.4 Descriptive differences among level of education towards radiation safety awareness using ANOVA Test

Table 4.13: Descriptive differences among level of education towards radiation safety awareness using ANOVA Test

ANOVA					
Radiation Safety Awareness					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	794.219	4	198.555	2.381	0.063
Within Groups	4336.659	52	83.397		
Total	5130.877	56			

P > 0.05 = Rejected

The findings from Table 4.13 showed that the differences among level of education did not have significant effect towards radiation safety awareness since p > 0.05.

4.9.5 Descriptive differences among years of service in *PKUUUM* towards radiation safety awareness using ANOVA Test

Table 4.14: Descriptive differences among years of service in *PKUUUM* towards radiation safety awareness using ANOVA Test

ANOVA					
Radiation Safety Awareness					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	356.492	4	89.123	0.971	0.432
Within Groups	4774.385	52	91.815		
Total	5130.877	56			

P > 0.05 = Rejected

The findings from Table 4.12 showed that the differences among years of service in *PKUUUM* did not have significant effect towards radiation safety awareness since p > 0.05.

4.10 SUMMARY OF HYPHOTHESIS TEST RESULTS AND TEST METHODS

The summary of the hypothesis test result and test method are as in the Table 4.14:

Table 4.15: Summary of hypothesis test method and result

Hypothesis	Test Method	Result
H: Safety management practice has strong correlation with radiation safety in UUM University Health Centre.	Pearson Correlation Sig. (2 tailed) 0.751** 0.000	Accepted/Strong

** Correlation is significance at the 0.01 level (2-tailed)

From the table, the H hypothesis which stated that safety management practice has strong correlation with radiation safety awareness in UUM University Health Centre was accepted. The level of correlation of safety management practice towards radiation safety awareness was at strong level with r = 0.751. In terms of Regression Analysis, the result of 68.40% indicated that all the items and dimension inside safety management practice would have influences on radiation safety awareness. Lastly, it is right to say that safety management practice when being executed will have strong impacts to radiation safety awareness in healthcare suites. In terms demography of the respondents, the differences between classifications of occupations which were Management and Professional and Support as well did have significant effect towards radiation safety awareness in which the p value (0.012) was less than 0.05.

4.11 SUMMARY

The study was conducted among 57 respondents in UUM University Health Centre and the percentage of response rate was 93.44%. The Cronbach's Alpha Value for all variables was 0.841. Therefore, the Cronbach's Alpha Value in this study was acceptable and showed good internal consistency reliability as per reference value of above 0.60. In addition, it can be concluded that there was a strong relationship between the independent variable (safety management practice) and dependent variable (radiation safety awareness) with a score of r = 0.751.

CHAPTER FIVE

DISCUSSION AND RECOMMENDATIONS

5.1 INTRODUCTION

In this chapter, the summary of the research that was conducted and the data which were gained from the research will be discussed. In addition, the objective of this study is to analyze the relationship between safety management practice (management commitment, safety training, employees' involvement, safety communication and feedback, safety rules and procedures and safety promotion policies) towards radiation safety awareness in UUM University Health Centre. Therefore, the outcomes and findings of the research may guide UUM University Health Centre specifically and other healthcare suites generally in enhancing the level of safety management practice as well as radiation safety awareness at its organizations.

Most of the literature reviews have emphasized that majority of the previous studies on radiation safety awareness are on the organizations as well as the employees only. In addition, most of the studies that have been conducted have shown that there are lots of "rooms for improvement" especially on the knowledge, attitude and action of the practitioners which are needed to be upgraded. Even though ionizing radiation has been used widely in medical sectors almost hundreds of years, yet there is still lacking of proactive knowledge, attitude and action. No doubt, all the initiatives need lots of management commitment, safety training, employees' involvement, safety communication and feedback, safety rules and procedures and safety promotion policies

through the platform of Occupational Safety and Health Committee of an organization. Higher level of employees' involvement is very essential the in making the workplace safe by integrating the knowledge, attitude and action towards occupational safety and health including radiation safety awareness.

In the study that was conducted in which the independent variable was safety management practice (management commitment, safety training, employees' involvement, safety communication and feedback, safety rules and procedures and safety promotion policies) whereas the dependent variable was radiation safety awareness. Moreover the respondents which involved 57 personnel were authentic from UUM University Health Centre.

It is right to say that safety communication and feedback, safety promotion policies and employees' involvement have strong influence towards radiation safety awareness. In addition, employees who are having good communication skill, committed and seriously taking part in Occupational Safety and Health Committee and proactive are viable in changing their knowledge, attitude and action towards radiation safety awareness.

5.2 DISCUSSING THE RESEARCH QUESTIONS

RQ1: What is the level of safety management practice in UUM University Health Centre?

In answering the question, the results showed that the mean value was 3.7913 (Table 4.5) which indicated a high level of data consistency. In fact, UUM University Health Centre is one of the eldest departments in UUM since it began the operation in *Bandar Darulaman* in 1986 and moved to *Sintok* in 1990. In more than thirty years of operation UUM University Health Centre has undergone certain accreditations such as the ISO 9001, 5S, *Anugerah Kecemerlangan Universiti,* Occupational Safety and Health Audit. No doubt, all these accreditations have shaped UUM University Health Centre to have higher level of implementation of safety management practice which includes management commitment, safety training, employees' involvement, safety communication and feedback, safety rules and procedures and safety promotion policies.

In terms of management commitment, the employees are really appreciated and recognized the efforts and commitment being made the management in making the workplace safe. According to Ismail *et al.*, (2011), the management commitment is the key entity in making the safety culture can be achieved.

From the perspective of safety training, the employees who are the important asset of an organization are really understand and appreciate the initiatives for providing occupational safety and health training in which the impacts will beneficial both the employers and the employees.

From the dimension of employees' involvement, the personnel in UUM University Health Centre have been given full support in executing the occupational safety and health protocols, policies as well as procedures. According to Ashforth and Humprey

(1995), employees' involvement will involve the "hands, head and heart" in order to contribute for safer workplace.

Furthermore for safety communication and feedback, the findings demonstrated that the communication between employers and employees regarding the occupational safety and health issues have never having obstacles.

For safety rules and procedures, all the Standard Operating Procedures (SOPs) as well as Occupational Safety and Health protocols have been executed strictly and comprehensively with regular audits been conducted. According to Hu *et al.*, (2016) as quoted by Mashi, Subramaniam, and Johari (2017), safety rules and procedures are implemented in an organization in order to achieve safety objectives.

The dimension of safety promotion policies indicated that incentives and rewards for reporting safety hazards are still relevant among the employees. Moreover, many mechanisms and methods are being used widely in order to implement recognition and incentive programs for the purpose to convince safety performance (Minter, 2003).

RQ2: What is the level of radiation safety awareness in UUM University Health Centre?

The mean value of 3.8318 (Table 4.5) for the radiation safety awareness (Dependent Variable) indicated that a high level of data consistency as according to Veloo and Rahman (2012). In UUM University Health Centre, knowledge about ionizing radiation and its effects to human life is something in which the management and the practitioners are very concerned with.

The attitude towards radiation safety awareness is very positive since all the staffs will be exposed to the effects of radiation and how to handle and mitigate them effectively. Furthermore, the Radiology Professionals such as the Medical Officer in-charge who is acted as the License Holder as well as the Radiation Protection Officer is very particular on the subject of radiation safety. No doubt, the Radiographers have performed their roles and responsibilities effectively in educating Non-radiology Professionals about the risks of ionizing radiation through the social media such as in the website, visual posters and information in the Diagnostic Imaging Unit and with their professional practices.

Since all the policies and procedures which are associated with radiation safety are authentically based on Atomic Energy Licensing Act (Act 304), all the practice towards the use of ionizing radiation have to be professional in producing quality images for interpreting as well as minimizing the radiation doses for staffs and the patients. Moreover, wearing relevance Personal Protective Equipment (PPE) has become a must for every radiation personnel, Since Diagnostic Imaging Unit is a licensed premise in using ionizing radiation, regular inspections and audits have been conducted by Malaysian Nuclear Agency and Ministry of Health (MOH).

RQ3: Is there any correlation between safety management practices and radiation safety awareness in UUM University Health Centre?

There was strong correlation between safety management practice (management commitment, safety training, employees' involvement, safety communication and feedback, safety rules and procedures and safety promotion policies) and radiation

safety awareness at the r value was 0.751. As according to Chua (2006), the value of r = 0.751 indicates that the correlation is strong.

5.3 IMPLICATIONS TO THE ORGANIZATION

The findings and results of this research will have practical implications which include the personnel and the organization as well. From the perspective of human resource and attitude, the findings propose that the employees who are low on competency can be trained in order to enhance the knowledge, attitude and skill to be more efficient.

UUM University Health Centre should conduct more workshops, clinical attachments, short-term refresher courses, preparation and distribution of pamphlets and posters on the effects of ionizing radiation. Furthermore, social media such as website, instagram, facebook and others can be manipulated for the purposes to improve and alert the knowledge on radiation safety awareness among employees.

In order to improve the knowledge, attitude and action towards radiation safety awareness among UUM University Health Centre including the Radiology Professionals as well as Non-radiology Professionals, the recommendations are:

i) Increase the supervisions and audits from authorized bodies such as the UUM Occupational Safety and Health Committee, Department of Occupational Safety and Health (DOSH), Malaysian Nuclear Agency and Ministry of Health.

ii) Substitute old and worn out gadgets as well equipment with the new and advanced ones

iii) Execute training courses, workshops and clinical attachments for preventive mechanisms.

iv) Always be alert that all the policies and procedures has to be compliance with Atomic Licensing Act 1984 (Act 304).

In conclusion, it can be said that the radiation safety culture is needed to be promoted in UUM University Health Centre in order to make the employees be more radiation safety committed to themselves, patients, stakeholders and organization.

5.4 LIMITATION OF THE STUDY

Since the research was a self-administered questionnaire based study, respondents could answer some of the questions after assessing the correct answers from many sources such as social media and other references such as text book, journal etc. Another limitation is the population size of respondents in which the sample was 57 out of 61 populations that will not provide further insight into the main issue since larger population will end up with wider opinions and perspectives.

The last limitation which can be discussed is different demographic characteristics which can influence the data collection since this was a cross-sectional study. It is right to say that different nations will probably have different opinions towards certain issues.

5.5 RECOMMENDATIONS FOR FUTURE STUDIES

Due to the fact that the research main objective was to determine the relationship between safety management practice and radiation safety awareness, the target of the respondents should those who are at the higher level risks of exposing to ionizing radiation such as the Radiographers even though the number of them is less than 5 personnel. In addition, a qualitative method can be executed in order to gain as many information and facts as it can.

An effective structured communication of framework should be developed for the purposes to obtain higher efficiency data collection and employees' participations such as using social media liked whatsapp, e-mails, survey websites, instagram, Short Message System (SMS) and other modalities within a longer period of time frame.

5.6 CONCLUSION

In conclusion, the safety management practice (management commitment, safety training, employees' involvement, safety communication and feedback, safety rules and procedures and safety promotion policies) has strong correlation at the value of r = 0.751 with radiation safety awareness.

No doubt, the employees as well as the employers together with the Occupational Safety and Health Committee have more roles and responsibilities in ensuring the assigned jobs' performances to be at the expected quality standards including on the knowledge, attitude and action on radiation safety subject even though safety management practice does have strong correlation with radiation safety awareness. It can be concluded that to maintain the quality of safety management practice as well as radiation safety awareness being executed needs lots of efforts, resources and enforcement.

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SURVEY QUESTIONNAIRE, ENGLISH AND MALAY LANGUAGE VERSION

COLLEGE OF BUSINESS
UNIVERSITI UTARA MALAYSIA

Dear Sir/Madam**,**

I am Ruzaidi bin Ramli, a Master of Science (Management) student from Universiti Utara Malaysia (Matric No.: 818217), currently conducting research entitled **"The Relationship between Safety Management Practice and Radiation Safety Awareness Among Employees in UUM University Health Centre"** under the supervision of Associate Professor Dr. Fadzli Shah bin Abd. Aziz and Mr. Fadzil bin Mohd Husin. In endeavoring to conduct this research data will be collected from UUM University Health Centre's employees.

Fortunately you have been nominated to take part in this research and may I ask that you kindly complete the questionnaire enclosed. I assure you that it would not take longer than 30 minutes as your cooperation will contribute to improving the standard of safety in UUM University Health Centre.

All data provided will be treated as confidential and will only be used for this academic research.

Thank you for your cooperation.

Yours sincerely,

Ruzaidi bin Ramli
College of Business
Universiti Utara Malaysia
06010 UUM Sintok
Kedah
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QUESTIONNAIRE / *KAJI SELIDIK*

THE RELATIONSHIP BETWEEN SAFETY MANAGEMENT PRACTICE AND RADIATION SAFETY AWARENESS AMONG EMPLOYEES IN UUM UNIVERSITY HEALTH CENTRE

HUBUNGAN ANTARA AMALAN PENGURUSAN KESELAMATAN DAN KESEDARAN TERHADAP KESELAMATAN RADIASI DI KALANGAN STAF PUSAT KESIHATAN UNIVERSITI UUM

PART A: DEMOGRAPHY OF RESPONDENT / *DEMOGRAFI RESPONDEN*

Please tick (√) the appropriate answer. / *Mohon tandakan (√) pada jawapan yang sesuai.*

1. What is your classification of occupation? *Apakah kategori pekerjaan anda?*
   ( ) Management and Professional / *Pengurusan dan Profesional*
   ( ) Support / *Pelaksana*

2. Which age do you belong? / *Yang manakah kategori umur anda?*
   ( ) 20 – 30
   ( ) 31 – 40
   ( ) 41 – 50
   ( ) 51 – 60

3. Sex / *Jantina:*
   ( ) Male / *Laki-laki*
   ( ) Female / *Perempuan*

4. Level of education / *Tahap pendidikan:*
   ( ) Secondary School / *Sekolah Menengah*
   ( ) Professional Certificate / *Sijil Profesional*
   ( ) Diploma / *Diploma*
   ( ) First Degree / *Ijazah Pertama*
   ( ) Master Degree / *Ijazah Sarjana*

5. Years of service in UUM University Health Centre / *Jumlah tahun perkhidmatan di Pusat Kesihatan Universiti UUM:*
   ( ) 1 – 5 years / *1-5 tahun*
   ( ) 6 – 10 years / *6-10 tahun*
   ( ) 11 – 15 years / *11-15 tahun*
   ( ) 16 – 20 years / *16-20 tahun*
   ( ) More than 21 years / *Lebih daripada 21 tahun*

PART B: SAFETY MANAGEMENT PRACTICE / *AMALAN PENGURUSAN KESELAMATAN*

Instruction / Arahan:

Mark (√) in the related spaces. / *Tandakan (√) pada ruang berkaitan.*

Legend / *Legenda*:

Judgement	Rating
Strongly Disagree / *Sangat Tidak Bersetuju*	1
Disagree / *Tidak Bersetuju*	2
Partially Agree / *Bersetuju Sebahagian*	3
Agree / *Bersetuju*	4
Strongly Agree / *Sangat Bersetuju*	5

1) Management Commitment / *Komitmen Pihak Pengurusan*

No.	Statement	1	2	3	4	5
1.	Safety is given the high priority by the management. *Keselamatan dalam pekerjaan diberi keutamaan tinggi oleh pihak pengurusan.*					
2.	Safety rules and procedures are strictly followed by the management. *Peraturan dan prosedur keselamatan dalam pekerjaan dilaksanakan sepenuhnya oleh pihak pengurusan.*					
3.	Corrective action is always taken when the management is told about unsafe practices. *Langkah penambahbaikan selalunya dilaksanakan oleh pihak pengurusan apabila dimaklumkan mengenai amalan-amalan pekerjaan yang tidak selamat.*					

*4.	In my workplace, Supervisors / Heads of Units do not show interest in the safety of workers. *Di tempat kerja saya, Penyelia-penyelia / Ketua-ketua Unit tidak menunjukkan minat terhadap keselamatan para pekerja.*					
5.	The management considers safety to be equally important as services. *Pihak pengurusan menganggap keselamatan dalam pekerjaan adalah sama pentingnya dengan perkhidmatan*.					
*6.	Members of the management do not attend Occupational Safety and Health Meetings. *Ahli-ahli daripada kalangan pihak pengurusan tidak menghadiri Mesyuarat Keselamatan dan Kesihatan Pekerjaan.*					
*7.	I feel that the management is willing to compromise on safety for improving the services. *Saya merasakan bahawa pihak pengurusan sanggup berkompromi dalam aspek keselamatan pekerjaan demi meningkatkan perkhidmatan*.					
8.	When near-miss accidents are reported, my management acts quickly to solve the problems. *Bilamana kemalangan yang hampir berlaku dilaporkan, pihak pengurusan akan bertindak segera untuk menyelesaikan masalah tersebut.*					
9.	My department provides sufficient Personal Protective Equipment (PPE) for the workers. *Jabatan saya menyediakan Alat Pelindung Peribadi (PPE) yang mencukupi untuk para pekerja.*					

2) Safety Training / *Latihan Keselamatan*

No.	Statement	1	2	3	4	5
1.	My department gives comprehensive training to the employees on workplace safety and health issues. *Jabatan saya menyediakan latihan yang menyeluruh kepada pekerja mengenai isu-isu keselamatan dan kesihatan pekerjaan.*					
2.	Newly recruits are trained adequately to learn safety rules and procedures. *Pekerja-pekerja baru telah dilatih secukupnya dalam mempelajari peraturan dan prosedur keselamatan dalam pekerjaan.*					
3.	Safety issues are given high priority in training programmes. *Isu-isu keselamatan dalam pekerjaan diberi keutamaan dalam program-program latihan.*					
*4.	I am not adequately trained to respond to emergency situations in my workplace. *Saya tidak dilatih secukupnya untuk bertindak balas terhadap situasi kecemasan di tempat kerja saya.*					
5.	The management encourages the employees to attend Occupational Safety and Health training programmes. *Pihak pengurusan menggalakkan para pekerja untuk mengikuti program-program latihan Keselamatan dan Kesihatan Pekerjaan.*					
6.	Safety training given to me is adequate to enable to assess hazards in the workplace. *Latihan keselamatan pekerjaan yang diberikan kepada saya adalah mencukupi untuk saya menilai bahaya-bahaya di tempat kerja.*					

3) Employees' Involvement / *Penglibatan Para Pekerja*

No.	Statement	1	2	3	4	5
1.	The management always welcomes opinion from employees before making final decisions on safety related matters. *Pihak pengurusan sentiasa mengalu-alukan pendapat dari pihak pekerja sebelum membuat keputusan muktamad berkenaan perkara-perkara yang berkaitan keselamatan pekerjaan.*					
2.	My department has Safety and Health Committees consisting of representatives from management and employees. *Jabatan saya mempunyai Jawatankuasa Keselamatan dan Kesihatan Pekerjaan yang terdiri daripada pihak pengurusan dan pekerja.*					
3.	The management promotes employees involvement in safety related matters. *Pihak pengurusan menggalakkan penglibatan pihak pekerja dalam perkara-perkara yang berkaitan keselamatan pekerjaan.*					
4.	The management consults with employees regularly about workplace safety and health issues. *Pihak pengurusan kerap berbincang dengan para pekerja mengenai isu-isu keselamatan dan kesihatan pekerjaan.*					
*5.	Employees do not sincerely participate in identifying safety problems. *Para pekerja adalah tidak sepenuh hati melibatkan diri dalam mengenalpasti masalah-masalah keselamatan pekerjaan.*					

4) <u>Safety Communication and Feedback / *Komunikasi Keselamatan dan Maklumbalas*</u>

No.	Statement	1	2	3	4	5
*1.	My department does not have a hazard reporting system in which employees can communicate hazard information before hazard occurs. *Jabatan saya tidak mempunyai sistem pelaporan di mana para pekerja dapat menyalurkan maklumat berkenaan sesuatu bahaya di tempat kerja sebelum ia berlaku.*					
2.	The management operates an open door policy on safety and health issues. *Pihak pengurusan mengamalkan polisi pintu terbuka berkenaan isu-isu keselamatan dan kesihatan pekerjaan.*					
3.	There is sufficient opportunity to discuss and deal with safety and health issues in the meetings. *Terdapat peluang yang secukupnya untuk berbincang dan menangani isu-isu keselamatan dan kesihatan pekerjaan di dalam mesyuarat.*					
*4.	The targets and goals for safety performance in my organization are not clear to the employees. *Sasaran dan matlamat prestasi keselamatan pekerjaan di dalam jabatan saya adalah tidak jelas kepada para pekerja.*					
5.	There is an open communication about occupational safety and health issues in the workplace. *Terdapat komunikasi secara terbuka berkenaan isu-isu keselamatan dan kesihatan pekerjaan di tempat kerja saya.*					

5) Safety Rules and Procedures / *Peraturan dan Prosedur Keselamatan*

No.	Statement	1	2	3	4	5
1.	The safety rules and procedures followed in my department are sufficient to prevent incidents from occurring. *Peraturan dan prosedur keselamatan pekerjaan di dalam jabatan ini adalah mencukupi untuk mencegah kejadian tidak diiingini daripada berlaku.*					
*2.	The facilities which are provided by the Occupational Safety and Health Committee are not adequate to meet the needs of the organization. *Kemudahan-kemudahan yang disediakan oleh Jawatankuasa Keselamatan dan Kesihatan Pekerjaan adalah tidak mencukupi untuk keperluan organisasi ini*.					
3.	My Heads of Units and Top Management Officers always try to enforce safe working procedures. *Ketua-ketua Unit dan Pegawai-pegawai Pengurusan Atasan sentiasa menguatkuasakan prosedur pekerjaan yang selamat.*					
4.	Safety inspections are carried out regularly. *Pemeriksaan keselamatan pekerjaan kerap dilaksanakan.*					
5.	The safety procedures and practices in this organization are useful and effective. *Prosedur dan amalan keselamatan pekerjaan dalam organisasi ini boleh digunapakai dan berkesan.*					

6) **Safety Promotion Policies / *Polisi Galakan Keselamatan***

No.	Statement	1	2	3	4	5
1.	In my department, safe conduct is considered as a positive factor for job promotion. *Dalam jabatan saya, perlakuan selamat dalam pekerjaan dianggap faktor positif untuk kenaikan pangkat.*					
2.	In my department, employees are rewarded for reporting safety hazards (thanked, cash or other rewards, recognition in newsletter, etc.). *Dalam jabatan saya, para pekerja diberi ganjaran kerana melaporkan bahaya-bahaya keselamatan dalam pekerjaan (diberi penghargaan, wang tunai atau ganjaran-ganjaran lain, pengiktirafan dalam buletin jabatan dan sebagainya).*					
3.	In my department, Occupational Safety and Health Week celebration and other safety promotional activities arranged by the management are very effective in creating safety awareness among workers. *Sambutan Minggu Keselamatan dan Kesihatan Pekerjaan dan aktiviti-aktiviti promosi keselamatan pekerjaan yang lain yang diaturkan oleh pihak pengurusan adalah amat berkesan dalam mewujudkan kesedaran keselamatan dalam pekerjaan di kalangan pekerja.*					
4.	There is an existence of very healthy competition among employees to find out and report unsafe conditions and acts. *Terdapatnya persaingan yang sangat sihat di kalangan pekerja dalam mencari dan seterusnya melaporkan keadaan dan tindakan yang tidak selamat dalam pekerjaan.*					

*5.	The Head of Unit becomes very unhappy and angry when employees find out and report unsafe conditions and acts in the unit. *Ketua Unit berasa sangat tidak berpuas hati dan marah apabila para pekerja menemukan dan melaporkan keadaan serta tindakan yang tidak selamat di unit berkenaan.*					

PART C: RADIATION SAFETY AWARENESS / *KESEDARAN KESELAMATAN RADIASI*

Knowledge, Attitude and Action / *Pengetahuan, Sikap dan Tindakan*

No.	Statement	1	2	3	4	5
1.	The knowledge of ionizing radiation dose of common radiological investigation in medical practice is important. *Pengetahuan mengenai dos radiasi mengion untuk pemeriksaan radiologi biasa di dalam bidang perubatan adalah penting.*					
*2.	Lectures, workshops and clinical attachments would not help the most to raise the understanding of awareness on radiation safety. *Syarahan, bengkel dan penempatan klinikal tidak membantu dalam meningkatkan kefahaman mengenai kesedaran keselamatan radiasi.*					
3.	ALARA (As Low as Reasonably Achievable) principle is one of the practices in order to minimize radiation dose and at the same time optimizes the quality of X-ray image. *Prinsip* ALARA (As Low as Reasonably Achievable*) adalah salah satu praktis dalam meminimakan dos radiasi dan pada masa yang sama mengoptimakan kualiti imej X-ray.*					

4.	The policies and procedures which are associated with radiation safety in my department are purely based on Atomic Energy Licensing Act 1984 (Act 304). *Semua polisi dan prosedur berkaitan keselamatan radiasi di jabatan saya adalah berdasarkan kepada Akta Perlesenan Tenaga Atom 1984 (Akta 304).*					
5.	Lead apron, lead gown, gonad shield, thyroid shield and lead glass goggles are some of the Personal Protective Equipment (PPE) which are being used in Diagnostic Imaging Unit / Department. *Apron getah berplumbum, gaun getah berplumbum, perisai gonad, perisai tiroid dan* goggle *kaca berplumbum adalah sebahagian daripada Alat Pelindung Peribadi* (PPE) *yang digunakan di Unit / Jabatan Pengimejan Diagnostik.*					
*6.	I believe that all the policies and procedures on radiation safety awareness in my department are not clear and difficult to understand. *Saya percaya semua polisi dan prosedur kesedaran keselamatan radiasi di jabatan saya adalah tidak jelas dan sukar difahami.*					
7.	I feel anxiety over risks of radiation exposure. *Saya berasa bimbang mengenai risiko-risiko dedahan radiasi.*					
8.	I know whom to contact if I have questions about radiation safety precautions which are needed for employees and patients. *Saya tahu kepada siapa perlu berhubung jika saya mempunyai soalan-soalan mengenai langkah-langkah keselamatan radiasi yang perlu untuk pekerja dan juga pesakit.*					
9.	I feel I can clearly explain the radiation safety precautions needed to the patients. *Saya berasa saya boleh menerangkan secara jelas tentang langkah-langkah keselamatan radiasi kepada pesakit*.					

10.	I feel safe when caring for patients needing radiation safety precautions. *Saya berasa selamat semasa memberi perkhidmatan kepada pesakit yang memerlukan langkah-langkah keselamatan radiasi.*					
11.	I feel confident about the steps which I need to take when caring for patient needing radiation safety precaution. *Saya berasa yakin mengenai langkah-langkah yang perlu diambil semasa memberi perkhidmatan kepada pesakit yang memerlukan penjagaan keselamatan radiasi.*					
12.	Radiological examinations should be justified by doctors is the practice for radiological examinations in patients with the possibility of being pregnant. *Pemeriksaan radiologi yang melibatkan pesakit yang disyaki mengandung perlu dirujukkan terlebih dahulu kepada doktor untuk justifikasi.*					
*13.	Any individual can enter the X-ray room freely. *Sesiapa sahaja boleh masuk ke bilik X-ray sesuka hati.*					
14.	Personal Protective Equipment (PPE) needs to be worn by related staff when performing X-ray examinations. *Alat Pelindung Peribadi* (PPE) *perlu dipakai oleh kakitangan berkaitan semasa menjalankan pemeriksaan X-ray.*					
15.	When performing the X-ray examinations, the related staff needs to increase the distance from the X-ray source. *Semasa menjalankan pemeriksaan X-ray, kakitangan berkaitan perlu menjarakkan diri daripada sumber X-ray.*					
16.	X-ray exposure time needs to be minimized in order to decrease radiation dose to patients and the staffs. *Masa dedahan X-ray perlu diminimumkan bagi mengurangkan dos radiasi kepada pesakit dan kakitangan.*					

17.	Radiation Protection Policies in my department are compliance with Atomic Energy Licensing Act 1984 (Act 304). *Polisi Perlindungan Radiasi di jabatan saya adalah menepati keperluan Akta Perlesenan Tenaga Atom 1984 (Akta 304).*					

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- End of the questionnaire. Thank you for your valuable time-