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ASSESSMENT OF KNOWLEDGE OF OCCUPATIONAL HEALTH HAZARDS AND SAFETY PRACTICES AMONG RADIOGRAPHERS IN THE GREATER ACCRA REGION, GHANA

BY

FATI IBRAHIM

(10639969)

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DECLARATION

I, Fati Ibrahim declare that this work is a result of my own original research apart from peoples' investigations which have been duly acknowledged and that this dissertation, either in whole or part has not been presented anywhere for a degree.

Fati Ibrahim (Student)	Dr. Uri Selorm Markakpo (Academic Supervisor)
Date	Date

DEDICATION

This work is dedicated to Apreku & Asiedua Ayete Labi for their unfailing support.

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LIST OF ABBREVIATIONS

ALARA:	As Low As Reasonably Achievable
CT:	Computed Tomography
GAEC:	Ghana Atomic Energy Commission
GAR:	Greater Accra Region
GHS:	Ghana Health Service
GSR:	Ghana Society of Radiographers'
HCF:	Healthcare Facility
HCW:	Healthcare Worker
IAEA:	International Atomic Energy Authority
ICRP:	International Committee for Radiation Protection
ILO:	International Labour Organization
MOH:	Ministry of Health
MI:	Medical Imaging
MRI:	Magnetic Resonance Imaging
NIOSH:	National Institute of Occupational safety and Health
NRA:	National Radiation Authority
OHS:	Occupational Health and Safety
QA:	Quality Assurance
RPA:	Radiation Protection Authority
WHO:	World Health Organization

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ABSTRACT

Background: Radiographers render various radiological services to patients and clients. However, while they attend to patients, they are exposed to hazards that could be detrimental to their health and safety. In order to minimize exposure to these hazards and prevent their detrimental effects on radiographers, research documents on knowledge and safety practices among these workers must be available for reference. However, to date there is virtually no study that have investigated the knowledge and safety practices adopted by radiographers in Ghana during work to ensure welfare.

Aim: The study therefore aimed at assessing the knowledge of radiographers about occupational health hazards and safety practices in radiography.

Method: A cross-sectional study approach was adopted in this study. A total of 100 participants were recruited (90% response rate) from various radiology facilities across Greater Accra region. Convenient sampling was used to select three governments and three private owned facilities to observe their safety practices. Questionnaires were administered to obtain data on the study.

Results: From the study, radiographers had good knowledge about occupational health hazards (Score=43, SD=0.4). Generally, radiographers had low potential exposure to Ionizing Radiation (37; 41.1%), processing chemicals (24; 26.7%), patient body fluids (41; 45.6%) and stress due to work overload (25; 27.8%). In as much as radiographers were aware and practiced some safety practices, they fell short of safety practices that involved the input of facility owners and/or regulatory bodies. For instance, 88.9% of the participants agreed they assumed correct posture during work procedures however, close to half (42; 46.7%) of the participants never had safety training in their facilities and over two-thirds of the participants' monitoring dosimeter had not been read and recalibrated for more than 3 months as part of their safety practices. More than two-

thirds (67; 74.4%) of them did not have safety protocols for reporting hazard incidents at their radiologic facility. There was significant relationship between gender, complete immunization of hepatitis B and tetanus, last time of training and lack of sleep due to shift schedule and knowledge of occupational health hazards and safety practices.

Conclusion: Overall, radiographers had good knowledge about occupational health hazards. Radiographers were generally exposed to ionizing radiation (IR), processing chemicals, patient body fluids and stress due to work overload. In as much as radiographers were aware and practiced some safety practices, they fell short of safety practices that involved the input of facility owners and/or regulatory bodies such as complete immunization of hepatitis B and tetanus, safety training and unfavourable work shifts. Finally, significant proportion of female participants had higher knowledge in occupational health hazards and safety practices compared to the male participants.

CHAPTER ONE

INTRODUCTION

1.1 Background

The health of a worker is very important and when impaired it affects the workers' quality of life and hinders work productivity. The main objective of occupational health and safety is to basically prevent hazards. The World Health Organization (WHO) in 2007 endorsed a Global Health of Action on Workers' Health from 2008 to 2017. This action plan involving work place hazard prevention, improved health at work place, service condition and provision of available emergency care in unforeseen situations always, was to provide a guideline for workers' safety at work. In achieving healthy working environment, employers are duty-bound to ensure safety for their workforce (Rosnaer & Markowitz, 2016).

Since 1950, a combined committee of International Labour Organization (ILO) and World Health Organization (WHO) on occupational health (at its maiden gathering in 1950 and reviewed at its twelfth gathering in 1995) have shared a mutual description of occupational health which states that, Occupational health should be geared towards the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations; and involves the prevention amongst workers, of departures from health caused by their working conditions; the protection of workers in their employment from risks resulting from factors adverse to health; the placing and maintenance of the worker in an occupational environment adapted to his physiological and psychological capabilities and, all of which have been summarized as: the adaptation of work to man and of each man to his job (Guidotti, 2012).

Occupational health and safety centered programs aim at fostering safe work environment to protect, employers, and the populace who could be affected by a company's activities. Occupational health is a multidisciplinary area of healthcare incorporating disciplines such as occupational medicine, occupational or industrial hygiene, public health, safety engineering, chemistry, health physics, ergonomics, toxicology, epidemiology, and environmental health (Cantrell, 1950). Workplace occurrences, events or structures that have the likelihood to cause harm (injury or ill health) are termed occupational hazards (Aluko et al., 2016). Bell et al. (2013) stipulate that farmers, contractors, drivers and healthcare providers are the most susceptible to high-risk occupational hazards.

Globally, healthcare workers represent 12% of the total working population (Goniewicz et al, 2010) and perform their duties in settings that could be highly hazardous to their well-being thereby, encountering hazards related to their work activities (Manyele et al., 2008; Nsubuga et al., 2005).

Radiographers, like other HCWs, are exposed to hospital related occupational health hazards such as blood-borne infections (Goniewicz et al., 2010) in addition to harmful doses of radiation. In recent years, medical imaging has gone through drastic transformations from just a simple x-ray machine to more sophisticated procedures such as digital x-ray equipment, multi-detector computed tomography (CT) and magnetic resonance imaging (MRI) which have contributed in revolutionizing clinical medicine practice (Hounsfield, 1980). The advent of these new technologies have several advantages which include improved surgical treatment, shorter hospital stays, elimination of exploratory surgery, improved diagnosis and treatment of medical

conditions, as well as rapid diagnosis of life-threatening vascular conditions such as mesenteric ischemia (Godoy et al., 2010). However, most of these imaging technologies use ionizing radiations which account for the highest man-made source of radiation exposure, and worsened by lack of justification and optimization criteria by both radiological staff and referring clinicians (Lauer MS, 2009; Mettler et al, 2008; Brenner & Hall 2007). The use of heightened doses of medical ionizing radiation by these practitioners can be linked to the inadequate knowledge on radiation hazards and dose limits for the various radiological investigations by practitioners (Yurt,2014; Brown N & Jones L, 2013; Thomas et al, 2006). Assessment of the knowledge of health hazards and safety practices associated with the use of ionizing radiations among radiographers, therefore, would help improve compliance with safety standard measures necessary for reduction of unsafe exposure to harmful radiation and occupational injuries in radiography (Anim-Sampong et al., 2015).

1.2 Problem Statement

Inadequate level of knowledge about occupational health and safety by Health Care Workers (HCWs) in low and middle income countries adversely affect their health and safety culture (Tebeje and Hailu, 2010). A study by Kyei & Antwi (2015) indicates that even though the regulations for the use of ionizing radiation (IR) in medicine have been in existence for years now Ghanaian radiographers' knowledge about them is low thereby hindering adherence to safety measures and increasing the risk of exposure to hazards. The knowledge, awareness and adherence to these regulations are however the keys to reducing the level of exposure to Ionizing radiation (IR) and their adverse health effects (Dewi et al., 2010).

Lack of information and training on occupational hazards and safety increases radiographers' probability of exposure to these hazards at work. Also, lack of training on OHS, and use of protective equipment for radiographers increase their susceptibility to harmful effects of ionizing radiations (Aluko et al., 2016; Lavoie et al., 2010; Mathewos, 2015).

Furthermore, most studies in medical imaging have focused mainly on radiation protection (Breitenstein & Seward, 2001) but not occupational health and safety in general, making it virtually impossible to assess other hazard agents in medical imaging.

Therefore, since institutional health and safety practices stipulate that healthcare facilities should be places for acquiring quality healthcare rather than contracting diseases (Brennan et.al., 1991), assessing the knowledge of occupational hazards and safety practices among radiographers like other healthcare workers would help improve safety standard procedures needed to protect them from work-related injuries as they are forerunners of medical imaging (Anim-Sampong et al., 2015).

1.3 Justification

Globally medical imaging has developed drastically in the last two decades. In Ghana, during this period radiological investigations have advanced from one single slice Computed Tomography (CT) scanner to over twenty multiple slices CT scanners and zero Magnetic Resonance Imaging (MRI) scanner to close to fifteen MRI scanners. This developmental surge has resulted in the increase in activities of radiographers relative to performing diagnostic procedures on patients, with corresponding increase in exposure to occupational hazards.

In view of this, the findings of this study would enhance regular monitoring of radiologic facilities to ensure that structures are put in place to make the facilities user-friendly and safe.

Also, the study findings would contribute to the knowledge of the role ought to be played by radiology managers in ensuring the protection of staff and patients against occupational hazards associated with radiological examinations. The study findings would moreover serve as a guide in establishing standard operating procedures and provision of safety protocols in radiologic facilities. In addition, the study would provide critical knowledge on the need for radiographers to be always abreast with OHS protocols through refresher courses. Lastly, it would increase productivity by reducing man-hours and revenue lost due to occupational injuries.

1.4 Conceptual Framework Narrative

The conceptual framework (Fig 1), describes how certain factors (independent variables) influence the level of knowledge of occupational health and safety practices among Ghanaian radiographers. The level of knowledge of occupational health hazards and safety practices (dependent variables) by radiographers is highly influenced by their demographic characteristics (age, gender, marital status and institution of practice), workload and shift system run. This is because heavy workload and unfavorable shift system may make workers exhausted and stressed up, making it difficult for them to yearn for further training and compliance to safety procedures.

Proper regulation and monitoring by the National Radiation Authority (NRA) coupled with supervision and evaluation of radiological procedures by radiation safety officers/ advisors in imaging facilities cannot be overemphasized. Regular checks by this body will improve the knowledge required to promotes attitudinal changes in radiographers in

order to incorporate radiation safety measures in their practice. The National Radiation Authority (NRA) will also ensure that employers play their role by providing safety devices in medical imaging, thereby leading to increase in radiation protection practices in Ghana whilst the employers will also make sure NRA perform their duty in ensuring radiation safety through regular equipment checks and dosimeter recalibrations.

Availability of safety protocols, guidelines and safety policies in medical imaging will help in structuring standard of operations to guide work of radiographers and instituting a roadmap in reducing occupational injuries and accidents.

Regular training programs in occupational health and safety organized by the employer and other relevant bodies will also go a long way in increasing knowledge level of practitioners in the subject area thereby contributing to attitudinal changes that ensure a reduction in work-related accidents and injuries in imaging facilities across the nation.

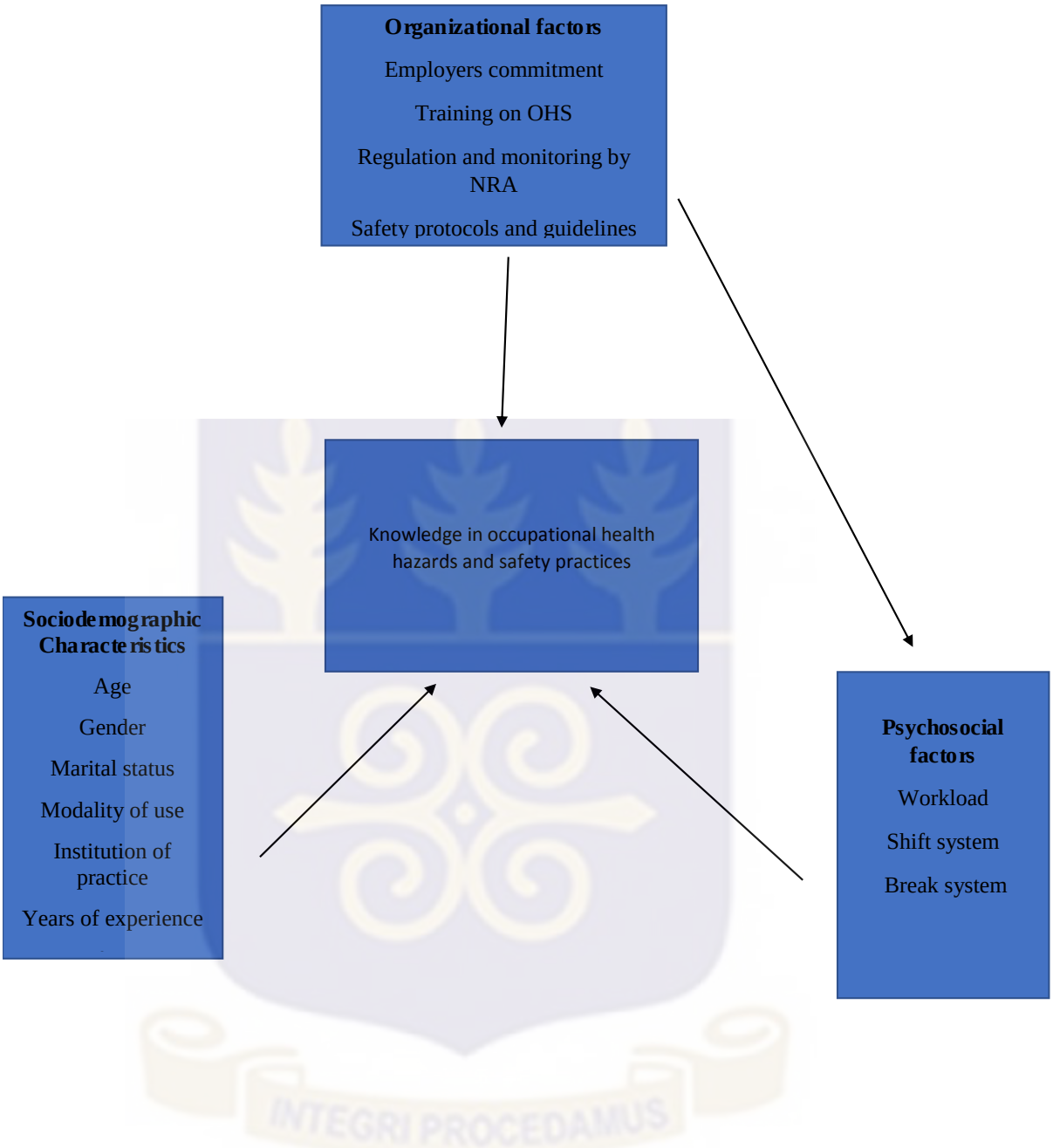

Figure 1: Conceptual framework

1.5 Research Questions

The research was guided by the following questions;

1. What is the knowledge level of radiographers on occupational health hazards associated with their work?
2. What are the OHS hazards that radiographers are exposed to in the course of work?
3. Which safety measures are in place to protect radiographers in their line of duty?

1.6 Study Objectives

1.6.1 General Objectives

•To assess the knowledge of radiographers on occupational health hazards and safety practices in radiography.

1.7 Specific Objectives

To determine the knowledge level of radiographers about occupational health hazards and safety practices related to radiography.

To identify OHS hazards that radiographers are exposed to in the course of radiological procedures.

To assess the safety practices adopted by Radiographers in their line of duty.

CHAPTER TWO

LITERATURE REVIEW

2.1 Occupational Hazards

Globally, over 59 million people are employed by healthcare facilities (HCFs) to offer varying services to clients and patients, and, these facilities have been categorised as hazardous and high-risk workplaces (Pruss A, et al., 1999; Stonerock T, 2004). Like other high-risk workplaces, HCFs are marked by high-level exposure to hazards that remarkably put the health and lives of workers at risk.

Aluko et al. (2016) described hazard as an intrinsic property of a substance, agent, source of energy or situation that has the potential of causing adverse consequences and Risk as the chance that injury to 'life, health, and or the environment' may arise from a hazard. Occupational hazards are agents in the work environment and / or associated with the work that have the potential of causing harm or ill health. Occupational safety is the control of hazards in the workplace to attain a suitable level of risk, while workplace safety generally refers to the process of safe guarding the health and safety of staff while at work, despite their profession (Tziaferi S.G. et al., 2011; Oluwagbemi B, 2011)

An estimated 100,000 workers perished due to work-related illness and an incidence of 400,000 occupational diseases are recorded every year. This high injury and death rates among exposed workers indicate the importance of occupational health and safety (Ajayi et al, 2016; Bell et al, 2013), among workers in numerous occupations due to their exposure to different types and varying degrees of hazards in the workplace. Bell et al. (2013) further stipulated that farmers, contractors, drivers and healthcare providers are the most susceptible to high-risk occupational hazards.

Medical imaging has increased significantly, at a growth of an estimated 20% each year. No other contributor to healthcare costs - including prescription drugs - is growing as rapidly. This upsurge can be attributed to advancement in imaging technology which provides prescribers with clearer images of patient's body and/or modern radiologic equipements which offer prescribers a full view of body organs, that guides in deciding on an appropriate course of treatment (Borase & Deshmukh, 2014). The upsurge in use of medical imaging increases the chance of radiographers being exposed to several occupational hazards related to radiology. Numerous research from sub-Saharan Africa shows that HCWs are often exposed to chemical, biological, physical, and psychosocial occupational hazards (Nsubuga & Jaakkola, 2005; Tinubu et. al,2010). Regularly HCWs encounter patients, exposing them to infectious diseases and therefore, require effective protective measures to reduce their risk. Occupational hazard data among HCWs and their mitigation measures are unavailable in most of sub-Saharan African countries, particularly Ghana. A deeper understanding of the influencing factors of occupational hazards among healthcare workers will positively impact occupational health and safety policy and programs for healthcare workers.

2.2 Occupational Hazards encountered by Radiographers

2.2.1 Biological Hazard

Biological hazards (biohazards) are biological agents that threaten the health of living organisms, especially humans. They include waste of medical origin and/or microorganism samples, virus or toxin that affect human and animal health. Radiographers like other healthcare workers are daily in contact with patients thereby exposing them to various biological hazards such as hepatitis B and HIV through infected aerosols or infected patient body fluids. The WHO stipulates that occupational

exposure accounts for hepatitis B prevalence of 37% among health workers although this condition is preventable with complete immunization. However, not up to one-fifth of health workers in some regions of the world (particularly sub-Saharan Africa and Asia) have been fully immunized**.** Insufficient supply of personal protective equipment (gloves) may lead to reuse increasing the spread of diseases. A study by Reda et al. (2010) in Ethiopia indicates that HCWs have a 29% and 31% lifetime risk of needle stick injury and blood contact respectively with student trainees having a higher probability of injury.

The just ended Ebola outbreak in West Africa resulted in a significant disproportionate morbidity and mortality among healthcare workers. By May, 2015, 0·02% of Guinea's population had died due to Ebola, compared with 1·45% of the country's healthcare workers. In Liberia and Sierra Leone, the differences were more dramatic, with 0·11% and 0·06% of the general population killed by Ebola as against 8·07% of the health-care workers in Liberia, and 6·85% in Sierra Leone (WHO, 2015; World Bank, 2015).

The probability of acquiring a nosocomial infection is high in developing countries like Ghana, where hygiene and safety standards in healthcare centers are below par, communicable diseases are common and health facilities are always overcrowded (Niu, 2010). Studies and focused training to elevate knowledge levels about these hazards and implementation of safety measures associated with them are therefore, vital in reducing their effects to the barest minimum.

2.2.2 Chemical hazard

Chemical hazards that radiographers are exposed to in their course of work comprise chemical preparations, be it in solid, liquid or gas state. They include, cleaning solvents, fumes from welding, carbon monoxide and helium gasses, gasoline, solvents, explosive chemicals and pesticides.

In processing radiographic films, radiographers are exposed to processing solutions made up of chemicals such as glutaraldehyde, hydroquinone, potassium hydroxide, potassium sulphite, sodium, formaldehyde, thiosulphate, acetic acid, aluminium sulphate, ammonium thiosulphate. The above mentioned chemicals increases the likelihood asthma and catarrh development (Cullinen et al.,1992; Trigg et al,1992; Chan-Yeung et al, 1993; Gannon et al.,1995; Di Stefano, et al,1999; Smedley et al.,1999).

Numerous studies (Gordon, 1989; Gannon et al.,1995; Smedley et al.,1999; Wymer et al., 2000) have also brought to light a variety of symptoms noticed among radiographers. These symptoms include upper respiratory tract infections, sore eyes, headache, fatigue, oral ulcers, tight chest, skin rash, dyspnea, chest pain, and heart arrhythmias. However, knowledge of these hazards and effective ventilation in the darkroom using extractors help reduce exposure to chemical hazards in the radiology settings (Hayes and Fitzgerald, 1994; Helen, 2000; Teschke et al.,2002).

Other chemical hazards radiographers are exposed to are contrast agents' spills during preparation and administration and cuts from the metallic crimps of contrast bottles. Others result from inappropriate handling of gas cylinders and lead exposure from broken or torn shielding apparels.

For these reasons, adequate knowledge of the potential of these chemicals to cause harm or injury and safety practices required to minimize their exposure and adverse effects are important to ensure safety of staff and patients (Niu, 2010).

2.2.3 Physical hazard

Common physical hazards in the radiology department includes exposure to noise, ionizing and non-ionizing radiation, temperature, poor illumination, electrical injuries

and fire (Ashton & Gill, 2000). Exposure to these hazards may lead to occupational diseases and injuries resulting in decreased productivity (Hasselhorn et al., 2001).

Ionizing radiation (IR) exposure in HCFs is a life threatening physical hazard resulting in irreversible damages to Radiographers. Medically, IR are used for both diagnostic and therapeutic radiologic purposes such as diagnostic X-ray, fluoroscopy and angiography, a dental radiograph (Abdellah et al., 2015; Abo El-Ata, 2014), and nuclear medicine purposes (Abo El-Ata & Nahmias, 2005). In addition, portable X-ray equipment used in Intensive Care Units, surgical and emergency rooms are hardly assessed for radiation exposures effects on radiographers and other HCWs (NIOSH, 2001). This exposes radiographers to long-term low levels of ionizing radiation. In relation to this, numerous studies have reported the role of low long-term radiation exposure to decreasing hemoglobin and mean corpuscular volume in the blood of radiographers.

The severity of effect of exposure to IR is hinged on the knowledge of radiographers concerning possible life threatening effect of IR and application of radiation safety practices. Well-structured laboratory test of haematological parameters are highly vital, coupled with the accurate wearing of dosimeters by radiographer for dose assessment (Heydarheydari et al., 2016; Shafiee et al., 2016). The International Commission on Radiological Protection (ICRP) endorses a high knowledge of the health effects of ionizing radiation on radiographers, in order to carry out safety precautionary measures needed for protection (ICRP, 2007). In spite of this, most radiologic facilities in Ghana lacked protective measures and equipment (aside from lead aprons) (Emi-Reynolds et.al, 2012). These workers therefore recommend that radiation protection and safety measures should be strengthened coupled with training and awareness programs to safeguard clients and the environment at large.

Other physical hazards that radiographers are exposed to in the hospital environment include excessive noise from sources such as equipment (MRI), monitor alarms, paging systems and telephones. Several departments in the hospital such as surgical ICUs, theatres, MRI units and kitchen exceed recommended levels of noise set by the World Health Organization (WHO) and Environmental Protection Agency. The exposure to the increased sound levels can lead to worsening patient outcomes, stress and fatigue among HCWs (Tainter et al., 2016; Mc Neer et al. 2016). According to the WHO, the recommended noise level for hospital patient rooms at day and night time are 35 dB and 30 dB respectively (Hill & Lavela, 2015). However, most hospitals exceed this WHO set standard (Ryan et al. 2016). With respect to this, numerous studies have reported noise levels 70–90 Db during peak times in hospital environments (Blomkvist et al., 2005; Tijunelis et al.,2005; Vinodhkumaradithyaa et al., 2008). The increased sound levels can adversely affect hearing and equilibrium of individuals exposed.

2.2.4 Psychosocial Hazard

Life and career changes, lack of group cohesion, leadership, demanding roles and task and group conflicts results in emotional fatigue and exhaustion which are common causes of occupational stress. Work-related stress highly influences the psychosocial wellbeing of workers. Numerous reviews have indicated that occupational stress predisposes workers to conditions such as cardiac and mental diseases and musculoskeletal disorders. There exists significant relationship between high job demands, low control, and effort-reward imbalance with factors for mental and physical health problems. This increases significantly, the cost in public healthcare (WHO,2018).

Due to neglect, the Commission for the Social Determinants of Health (2008) recommended the expansion of occupational health and safety remit to incorporate occupational stress and harmful behaviours.

Violence in the HCFs can be hazardous to the psychological wellbeing of HCWs. Violence could take the form of either physical, emotional and/or mental abuse that emanate from colleagues, patients or visitors.

The shift system employed by most HCFs can also be very stressful to HCWs including radiographers and their relations. Working with terminally ill clients always can be very emotionally wearing. Finally, challenges with conflicting roles in the family, as well as from work issues, can cause remarkable stress to radiographers like any other healthcare staff (PSHSA, 2013).

2.3 Organizational Factors

2.3.1 Employers' commitment

The role of employers in minimizing occupational hazards in the radiology unit cannot be overemphasized. In a study conducted by Makanjee, (2006) among 119 radiographers from 11 different facilities revealed that employers and managers must provide a positive working environment for radiographers to perform their duties to improve quality of work. Employers commitment expands from the planning or setting up of the facility. IAEA (2001) stipulates that designing of a protective thickness of radiological walls and other standard protocols are not enough. These should be coupled with taking an interest in the organization of the whole radiologic unit. For instance, radiation protection shouldn't just end with the installation of protective equipment but there must be a clear understanding of its purpose and good practices until it becomes habitual. Level of responsibility should be from the regulatory body, employing authority to radiographers. The employer is responsible for the safety of all staff, clients and people who may be in the range of any radiation exposure from the x-ray equipment. It is therefore important for hospital administrators to set up radiation safety committee with

a designated radiation protection officer who supervises the safety of all radiation area (Manual of Radiation Protection in Hospitals and General Practice, volume 3).

Employers are also to ensure that all persons using ionizing radiation have the appropriate qualifications, authorization, registration and training required to carry out their functions in compliance with regulations (Radiation Protection Manual, 2013).

Employers are also required to appoint a radiation safety committee and officer to perform regular radiation protection surveys (Mann & Williams, 2003). They must also ensure that x-ray equipment is calibrated periodically (APM report, No.38), appropriate PPEs, adequate signage showing areas of high ionizing radiations and important protocols with standard operating procedures in the unit are in place (Hazardous substance Act, 1991). The employer is also expected to have documented processes to explain conventions for patient safety such as patient identification, diagnostic reference levels, referrer, practitioner and radiographer identification, authorization and justification of all exposures (IAEA, 2004a).

2.3.2 Regulation and Monitoring

The World Health Organization (1980) defines quality assurance (QA) programme in diagnostic radiology as a structured effort by the staff operating a facility to ensure that the diagnostic images produced are of appropriately high quality so that they persistently provide sufficient diagnostic information at the least possible cost and with the least possible exposure of client to IR.

Initially in Ghana, Radiation Protection Board was responsible for authorization and inspection of practices through quality control checks using radiation sources and radioactive materials (Radiation Protection Instrument LI 1559, 1993). The PNDC law 308 was a revision of the Atomic Energy Act 204 0f 1963 (Atomic Energy Act

204,1963), which was replaced by the Atomic Energy Act 588 of 2000 (Atomic Energy Act 588,2000). However, prior to the establishment of RPB, the health physics Department of the Ghana Atomic Energy Commission (GAEC) was rendering quality control and other assistance such as environmental monitoring and radiation badges monitoring in Ghana (Emi-Reynolds et al., 1982).

Currently, the Nuclear Regulatory Authority (NRA) which was established in August 2015 through an act of parliament is the independent body responsible for ensuring that, radiation safety requirements in medical facilities are met (Nuclear Regulatory Authority Act, ACT 895). They are mandated to certify qualified organizations and experts to carry out quality assurance for medical facilities.

Radiographic practice establishes a Quality Assurance program, which places emphasis on image quality optimization and client dose reduction. The extent of the quality assurance program is dependent on complication arises from the radiological practices. The elements of the quality assurance program outlined below include a system of checks and procedures to ensure that the aims of the quality assurance program enunciated above are met.

The facility owner must seek the advice of a qualified expert on matters relating to image quality optimization, patient dosimetry and other matters relating to radiation protection as required to ensure optimum quality [IAEA, 2002].

A study by Schandorf and Tetteh in 1998 in Ghana showed that there was no instituted procedure for testing for newly installed X-ray devices. Also periodic performance and routine checks following extensive repairs of faulty devices to ensure self-consistency of equipment performance were not performed. In addition, they stated that there was no convention code on quality assurance schedules for radiological utility in Ghana.

From their study, Schandorf and Tetteh (1998) observed that, human and equipment were two main factors affecting quality assurance programs. Also their study revealed that when quality control of the facility equipment was satisfactory, complications related to images of diagnostic value was an aftermath of human error.

A study by Schandorf et al (1998) revealed that hitherto to their study there was no representative dose data in Ghana. Their study evaluated the doses of radiation to patients in frequently requested examination (chest, skull, abdomen, pelvis and lumbar spine). The mean entrance (skin) dose during the survey for patients close to the standard 70kg weight and 20cm AP trunk thickness were compared with the Commission of European Communities' (CEC) guideline values for the same selected anatomy. The findings showed higher mean dose greater than that set by the CEC and the International Commission on Radiological Protection (ICRP), (1990). This is an indication that doses being received in Ghana are high and above international standards and this thereby increases the possibility of radiation hazard to both radiographers and patients.

2.3.3 Education and training

Ionizing radiation use in clinical medicine is a very important tool in modern medicine. However, this radiation can pose a lot of irreversible biological effects (such as cancer) on people that are likely to be exposed such as radiographers (Persson & Shrader-Frechette, 2001; Karen et al, 2006). Therefore, occupational radiation protection is essential for the wellbeing of radiographers. In ensuring safety from occupational hazards, radiographers must undergo appropriate education and training in relation to their job and equipment used (Rahman et al, 2008). However, most of the training on OHS radiographers receive is during their formal education period with little or no continuous training during practice. This is entreated in a study by conducted amongst

European radiographers which revealed that their education and training in radiation protection was good. However, only 30% of this training was in the course of practice while 70% of the training was during their undergraduate education (European Federation of Radiographer Societies, 2011). In a related study among interventional cardiologists, it was revealed that fellows who had undergone structured occupational hazard training during practice were more knowledgeable about safety procedures such as radiation worker pregnancy policy, importance of an in-house radiation safety officer, proper use of dosimeters and safe levels of radiation exposure (Candice et al., 2010).

In a study by Mojiri & Moghimbeigi, (2011) indicated that more than half of the radiographers who participated in the study had not undergone any form of in service training on OHS and this resulted in low usage of gonadal shielding on patients.

2.4 Sociodemographic factors

In Ghana currently, no research has been done to bring to light the importance of attitudes, beliefs and knowledge in the quality of service provided by radiographers, though an unpublished work has been done by a physical therapist towards Evidence Based Practice (EBP) (Kyei et al., 2015). A study conducted in the United Kingdom indicated that radiographers had less knowledge of EBP than physiotherapist, occupational therapists, dieticians, speech and language therapist and psychologists (Upton, 2006). Anderson et al (2005) also showed that physiotherapists in the united states of America generally held positive attitudes and believes regarding EBP. Other studies largely focused on radiographers' use of evidence and application of literature as a determinant of patient management. In these studies, respondents were divers in expressing whether or not they had knowledge and skills necessary for EBP (Innvaer el al., 2002; Brownson et al., 2009). Also, in a study conducted by Kyei et al (2015), it was

demonstrated clearly that additional studies are required towards the improvement of evidence based practice in Ghana.

A research performed by Anderson et al (2011) to determine the association of radiographers' self-assessed level and use of competencies with some sociodemographic and situational factors. It was found that both the level and use of several competencies differed in line with age, years of experience and institution of practice. Further investigations however revealed that, the above mentioned factors didn't fully influence competency. Accordingly, the authors concluded that a multidimensional situation with other possible factors of importance, for instance the radiographer's educational level may contribute towards the quality of service delivered by the radiographer. A study examined technical knowledge in plain radiography amongst a cohort of radiographers and identified three independently associated factors; Academic degree, Grade point Average and previous refresher course(s) as factors that contributed towards the quality of service delivered by the radiographers (Anderson et al., 2011; Upton, 2006). While no significant role was found for age, sex and work experience, in conformity with the previous report, a significant association was observed between the level of knowledge and job placement (Farajollahi et al., 2014).

2.5 Psychosocial factors

job stress and work and work load is some of the causes of psychosocial hazards among radiographers. The work schedule and daily activities of radiographers coupled with extended working hours usually leave them frustrated. This stress is compounded by other factors such as home management (especially for women). A study conducted in the UK shows that heavy work load and work stress are common causes of psychosocial hazards to radiographers (Verrier & Harvey, 2010).

A study conducted by Ng et al, (2009) showed that 61% of radiographers sampled had experienced workplace violence before with 97% of them suffering from verbal abuse with patients as the main source of abuse. This resulted in increased work dissatisfaction and sick leave, work related stress and depression among the radiographers. The same study also revealed that almost all the radiographers (89%) had not undergone gone any form of training on OHS and thereby were not knowledgeable enough to prevent workplace violence.

2.6 Conclusion

The knowledge of occupational health hazards and safety practices needed to protect the workers from harm by IRs is highly incomplete. Efforts from industry players, management and radiographers will eliminate most preventable hazards. Some safety measures and interventions have been recommended and implemented in some radiologic units both in developed and developing countries. These interventions should, however, be continually evaluated to ensure adherence. Even as radiographers are inclined to provide care for their patients, they are however entitled to a risk-free environment that promotes health. Occupational hazards can be minimized by improving workplace safety through regular focused training, provision of personal protective equipment, regular monitoring and suitable workload and shifts.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This section describes the methodology of the study. It gives descriptions of the study area, study design, study procedures, data collection tools and data analysis. Ethical considerations are also mentioned.

3.2 Study Design

A quantitative cross-sectional study design was employed in this study. Pre-designed questionnaires were administered to certified, practicing radiographers in the Greater Accra Region to assess their knowledge of occupational health hazards and safety practices. Six selected radiologic facilities (three public and three private owned facilities) were observed to assess their safety practices.

3.3 Study area

The study was undertaken at the various radiologic units in the Greater Accra Region.

The Greater Accra Region is the smallest of the 10 administrative regions in terms of land coverage, occupying a total land surface of 3,245 square kilometres or 1.4 per cent of the total land area of Ghana and located geographically on latitude 5° 45' 0.00" N and longitude 0° 00' 0.00" E. It lies in the South East of the country bordered on the north by eastern region, on the south by the Gulf of Guinea, on the east by Volta region and on west by central region. The region is enriched with vast coastal savannah vegetation, a little forest area inland towards the Eastern region, and beautiful stretch of coastline. It is the second most populated region accounting for about 15% of Ghana's total population.

A local government system demarcates the region into16 local government administrative districts (Fig. 2).

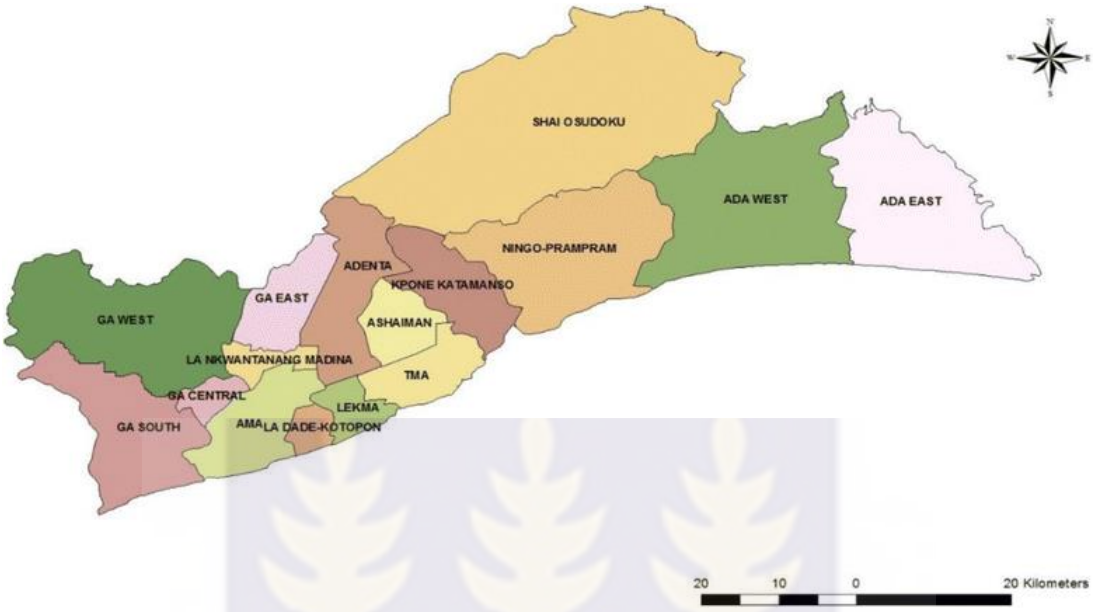

Figure 2: Map of Greater Accra Region showing its sixteen Districts

3.4 Variables of interest

3.4.1 Dependent Variable

The dependent variable of the study is knowledge of occupational health hazards and safety practices amongst radiographers.

3.4.2 Independent Variables

The independent variables that can affect the outcome of the study are;

Sociodemographic factors which include age, sex, marital status, level of education, institution of practice, years of experience and modality of use.

Organizational factors such as employers' commitment, regulation and monitoring by NRA, training on OHS and safety protocols and guidelines.

Psychosocial factors which include work load, shift system and break system.

3.5 Study Population

The study population comprised of all qualified and certified practicing radiographers in the Greater Accra region at the time of the study (100).

3.6. Sample size determination

The sample size was calculated using the formula provided by Yamane (1967). The formula is based on the assumption that a simple random sampling gives every individual an equal chance of being selected with a probability of 0.05 and a confidence interval of 95%.

According to this formula, the sample size:

$$n_{\circ} = \frac{N}{1 + N(e)^2} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where:

n: sample size

N: the study population, N=100

e: precision, 5% (0.05)

According to the database of the Ghana Society of Radiographers, there are currently 100 certified practicing radiographers in the Greater Accra region.

Putting the values above into equation (1), the minimum sample size for necessary for this study is given by

$$n_{\circ} = \frac{100}{1+100(0.05)^2} = 80.0$$

Therefore, the final minimum sample size needed for the study was 80.

Adding a 10% of sample size as security against non-responsive participants' gives

n=80+(10/100×80) =88

3.6.1 Sampling Method

Total population sampling method was employed to recruit all 100 qualified and certified practicing radiographers in the Greater Accra region. Total population sampling aims at examining an entire population with a unique set of characteristics (Laerd, 2012) and this feature fits perfectly with our study as only qualified and certified practicing radiographers in GAR at the time of the study were recruited. The Ghana society of radiographers (GSR) served as the gatekeeper, as their database was used to contact our population of interest.

Convenience sampling technique was used to select six radiological facilities where safety practices of radiographers during working hours were observed. The convenient sampling technique enhanced the selection of facilities that have active radiology departments which are necessary for proper observation of safety practices adopted by radiographers.

3.7 Eligibility Criteria

All qualified, certified and practicing radiographers in the GAR who fit the inclusion criteria, were available at the time of data collection and gave their consent willingly were part of the study.

3.7.1 Inclusion Criteria

All qualified, certified and practicing radiographers in the GAR at the time of the study who agreed to be part of the study.

3.7.2 Exclusion Criteria

Individuals who didn't consent and radiographers who were not practicing at the time of the study.

3.8 Data Collection Tool

A close-ended structured questionnaire (APPENDIX 1) was employed to gather data from the participants. A checklist (APPENDIX 2) served as a guide for documentation of safety practices in selected radiologic units as observed.

3.8.1 Questionnaire

The questionnaire was in four sections. The Section A comprising 8 questions gathered the sociodemographic information of the study participants. Section B comprising 10 statements focused on the respondent's knowledge of occupational health hazards. Section C gathered information concerning occupational hazards encountered by radiographers and Section D comprising 19 questions gathered information about their safety practices. APPENDIX 2 comprising 6 statements was a checklist that assessed selected radiologic facilities' safety practices. Regarding the measurement of the knowledge of the participants, 10 statements on a 5 point Likert Scale with responses ranging from strongly agree to strongly disagree was used. For each statement, the correct response was awarded 5-point score if it was a "strongly agree'' response and 1 point if it was a strongly disagree response. A total score of 10-29 was considered as poor knowledge, a score of 30-39 was considered as moderate knowledge and a score of 40-50 was considered as high knowledge. The questionnaire was pre-tested at the radiology unit of Koforidua regional hospital to ensure its validity.

3.9 Study Procedures

Permission was sought from the GSR to use their database to contact radiographers. The study was explained clearly to the participants. The questionnaires were administered by trained research assistants in the language the participant best understood after their informed consent had been sought. The questions answered were about knowledge

about occupational hazards, hazards encountered at work and safety practices employed by radiographers in their line of work.

3.10 Data Collection Procedure

Questionnaires were administered to participants by the principal investigator and research assistants. Principal investigator self-observed and recorded safety practices of radiographers from the six selected facilities by the use of a checklist as a guide.

3.11 Data Storage and Protection

All data collected on the study were protected against inappropriate use, disclosure, malicious accidental loss or destruction in order to protect the confidentiality of the study participants' data. Data was locked with restricted access on a secure laptop. Routine electronic back up were conducted. There will be an appropriate safe disposal/destruction of data or devices after the completion of the study.

3.12 Quality Control

Data were checked daily to ensure that information was collected and filed properly.

3.12.1 Recruitment and training of research assistants

Four research assistants (radiography interns) were recruited and taken through 3-days training to equip them with the necessary skills needed to assist with the study. The assistants, who comprised radiography interns and have basic knowledge of radiography needed to facilitate accurate data collection, assisted in administering the questionnaires. The research assistants were trained to conform to the ethical guidelines of the study.

3.12.2 Pre-testing of Questionnaire

The questionnaires were pre-tested at the Koforidua regional hospital, as the Radiology department of this facility has similar characteristics as those from which data collection was performed in the substantive study. Pretesting was done to evaluate the research questions and to determine if respondents clearly understood the questions and could provide relevant answers to them. Necessary modifications were made before the commencement of the actual study. Data were checked daily to ensure that all information was properly collected and filed. Double checks were done to ensure that the right information was entered from the questionnaires.

3.13 Data Processing

The questionnaires were coded and entered into Microsoft Excel (version 2010). The data was cleaned, validated and exported to Stata (statistical analysis software) version 15 for analysis.

3.14 Data Analysis

Data from the questionnaires were entered into Microsoft Excel and then transferred to Stata Version 15 for cleaning, merging and analysis. Cleaning of the data was done by running frequencies of the variables. This checked inconsistently coded data. Inconsistency in data coding were double checked with raw data from the questionnaire. Both univariate and multivariate regressions were performed.

Two methods were used for the analysis of the Likert scale responses. Firstly, the answers were coded on a scale from 1 (strongly disagree) to 5 (strongly agree) and analysed categorically. The composite score was calculated for the overall items on the knowledge of radiographers to determine the outcome variable (knowledge of

radiographers of OHS). The minimum score was 10 and the maximum was 50. The composite mean was then calculated using Stata Version 15. The relationship between the outcome variable (knowledge of radiographers of OHS) and independent variables such as sociodemographic characteristics (age, work experience, gender, educational level, etc.) was analyzed initially using the univariate (simple) logistic regression analysis. Multivariate logistic regression analysis was done to exclude high intercorrelated independent variables. A score of less than 30.00 was considered low knowledge, a score of 30-39 was considered as moderate knowledge and a score of 40-50 was considered as high knowledge. A confidence interval of 95% was used to show significant relationship between the dependent and the independent variables.

Logistic regression was used because the outcome variable (knowledge of radiographers of OHS) is a categorical variable and is normally distributed. Normality was determined by using histogram and qladder commands in Stata Version 15. The results were presented in frequencies, mean and percentages.

3.15 Ethical Consideration

Permission was sought from the Ghana Health Service Ethics Review Committee before the commencement of the study. Approval was sought from the Ghana Society of Radiographers (GSR). Additionally, approval was sought from collaborating radiological facilities involved in this study. Participant informed consent was sought before included in the study. All procedures were thoroughly explained, and the confidentiality of all information was assured. Anonymity was ensured by maintaining codes during data entry instead of names, contact numbers and other cues that could lead to the identification of participants.

3.15.1 Description of participants

Qualified, certified and practicing radiographers were recruited for the study. Permission was sought from the Ghana society of radiographers. The aims and objectives of the study were clearly explained to the participants before their informed consent was sought. Data collected from participants were kept confidential and was used only for the purposes of the study. Individuals who wish to opt out of the study were free to do so at any point of the study.

The study participants were assured that all their information would be kept confidential and would not be disclosed to anyone without their permission.

3.15.2 Consenting process

Informed consent was sought from all participants before the start of data collection. The participants consented by signing after they have read the consent form. The consent form had information regarding the study, possible risks/discomfort, possible benefits, confidentiality, data security, plans for records keeping, who to contact for additional information and the rights of the participants.

3.15.3 Privacy and confidentiality

To ensure privacy and confidentiality, questionnaires were coded with respondents' IDs instead of names. Additionally, respondents' names were not mentioned in the report of the study and information gathered on respondents were kept strictly confidential by the principal investigator.

3.15.4 Possible benefits

Findings of the study would help improve the health and safety policies of the Radiographers so as to minimize the occupational hazards, injury and/or disease that

radiographers are exposed to in the course of work. health challenges amongst Radiographers.

3.15.5 Compensation

Study participants were not given any compensation for participating in the study. This was communicated to them prior to commencing the study. However, snacks were given to them after administering the questionnaires as part of good towards maintenance of a health working relationship.

3.15.6 Protocol Amendment

In the event that any section(s) of the protocol had to be changed/amended ethical clearance was sought from the Ghana Health Service Ethics Review Committee before such amendments would be made to the study.

3.15.7 Conflict of interest

There was no conflict of interest.

3.15.8 Possible risk of discomfort

There were no major risks associated with participating in this study. The procedures in this study were mostly non-invasive and did not cause much discomfort to the participants apart from questions on personal matters like age and marital status and time spent in answering questions in the questionnaire which could make them a bit uncomfortable.

3.15.9 Description of the level of research burden

Study participants were requested to answer a questionnaire which took approximately 45 minutes to complete.

3.15.10 Data security

All information obtained was kept in locked files on the computer by the principal investigator with secured passcodes.

3.15.11 Plans for record keeping

The study materials (Questionnaires and informed consent forms) were not labelled with participants' names but rather with a unique identification number for each study participant.

3.15.12 Provision for participants to voluntarily opt out of the study

Participation in this study was entirely voluntary and participants could choose not to answer any or all of the questions. Any study participant who decided to opt out of the study at any point during the study was permitted to do so without any penalty in any way. However, participants were encouraged to fully participate to ensure findings of the study will be a true reflection of the level of knowledge of radiographers about occupational hazards and safety, required or improvement of policy to ensure safety of radiographers and clients during radiologic examination.

3.15.13 Funding

The study was self-funded by the principal investigator.

CHAPTER FOUR

RESULTS

4.0. Introduction

This chapter presents the findings of the study in accordance with the stated objectives and research questions. The chapter is in six sections; sections one, two, three, four and five present the descriptive analysis of the sociodemographic characteristics; knowledge of radiographers in occupational health hazards; occupational health hazards and safety hazards that radiographers are exposed to and the safety practices they adopt in the course of work respectively. Section six presents the relationship between knowledge of occupational health and sociodemographic characteristics, organizational and psychosocial factors.

4.1. Demographic characteristics of participants

Table 4.1 below summarizes the demographic characteristics of participants in the study. A total of 90 participants were surveyed. The mean age was 35.5 (SD=7.5) years while the minimum and maximum ages were 23 years and 59 years respectively. The median years of experience was 8.5 with lower quartile of 5 and upper quartile of 13. Majority 60 (66.7%) of the participants were males. More than half 49 (54.4%) of the participants were married while 41(45.6) were single. Most of the participants 59 (65.6%) had a Bachelor's degree. Over two-thirds of 67 (74.4%) of the participants were working with the Conventional X-Ray modality whilst two thirds 54 (60%) of the participants work in government facilities.

Table 4. 1: Socio-demographic characteristics (n=90)

Sociodemographic Characteristics	Frequency (n)	Percent(%)
Age		
Mean ± SD	35.5 ± 7.54	
21-30	23	25.56
31-40	49	54.44
41-50	14	15.56
51-60	4	4.44
Gender		
Male	60	66.67
Female	30	33.33
Marital status		
Married	41	45.55
Single	49	54.44
Current modality		
Conventional	67	74.44
Non-conventional	23	25.56
Institution of Practice		
Government	54	60
Private	36	40
Level of education		
Certificate/Diploma	23	25.56
Bachelor's degree	59	65.56
Post graduate	8	8.89
Years of work experience		
Median(LQ, UQ)	8.5 (5,13)	
1-5	24	26.67
6-10	31	34.44
11-15	21	23.33
≥ 16	14	15.56

4.2. Assessment of Radiographers' knowledge on occupational health hazards

Table 4.2A and 4.2B presents the overall assessment of the knowledge of radiographers on occupational health hazards. Overall, almost 90% of participants recorded high knowledge in occupational health and safety with a mean score of 43.1 (SD=3.6).

Table 4. 2A: Summary of the results of the assessment of radiographers' knowledge about occupational health hazards and safety practices

Outcome Variable	Observations	Mean	Standard deviation	Min	Max
Knowledge	90	43.1	3.6	32	50

Table 4.2B: Overall assessment of radiographers' knowledge about occupational health hazards and safety practices

Level of knowledge	Frequency	Percentages	Cumulative percentages
Moderate knowledge	10	11.1	11.1
High knowledge	80	88.9	100
Total	90	100	100

Table 4.2C shows the results of the assessment of knowledge of radiographers about occupational health hazards and safety. The results showed that all 90 (100.0%) participants agreed that occupational health and safety is the responsibility and right of both employer and employee. Additionally, all the participants agreed that occupational hazards always relate to the work activities that increase the risk of injury. Furthermore, most 83 (92.2%) of the participants stated they were obliged to report work-related accidents or injuries. However, more than half 48 (53.3%) of the participants were unsure whether a cataract is a common occupational disease among interventional radiographers. Majority 77 (85.5%) also agreed that the most effective accident and disease prevention begins when work processes are still in the design stage. Similarly, most 76 (84.4%) participants agreed that film monitors recording their exposure must always be won. Additionally, more than half, 56 (62.3%) agreed that the limit on an effective dose of ionizing radiation for a radiation worked aged 18 years and above in any calendar year is 20mSV (Table 2B).

4.2C. Assessment of Radiographers' knowledge about occupational hazards and safety practices

Variable	Strongly agreed	Agree	Unsure	Disagree	Strongly disagree
Occupational Health and Safety is the responsibility & right of both employer and employee	87(96.67)	3(3.33)	0 (0.0)	0(0.00)	0.(0.00)
Occupational hazards always relate to the workplace activities that increase the risk of injury and/or disease and rate of accidents.	60(66.67)	30(33.33)	0(0.00)	0(0.00)	0(0.00)
Radiographers are obliged to report work-related accidents/injuries	71(78.89)	12(13.33)	7(7.78)	0(0.00)	0(0.00)
Cataract is a common occupational disease among interventional radiographers	19(21.11)	14(15.56)	48(53.33)	4(4.44)	5(5.56)
The most effective accident and disease prevention begins when work processes are still in the design stage	38(42.22)	39(43.33)	12(13.33)	1(1.11)	0(0.00)
To minimize unnecessary dose, most radiation protection programs issue alerts when radiation badge readings exceed 10% and 30% of the maximum permissible dose.	20(22.22)	28(31.11)	31(34.44)	5(5.56)	6(6.67)
Radiographers must always wear film monitors recording their exposure to radiation	65(72.22)	11(12.22)	6(6.67)	3(3.33)	5(5.56)
The limit on an effective dose of ionizing radiation for a radiation worker aged 18 years and above in any single calendar year is 20Msv	23(25.56)	33(36.67)	29(32.22)	1(1.11)	4(4.44)
Complete hepatitis B and tetanus immunization must be compulsory for all radiographers	65(72.22)	16(17.78)	8(8.89)	1(1.11)	0(0.00)
Radiographers are at high risk of occupational hazards	67(74.44)	20(22.22)	0(0.00)	3(3.33)	0(0.00)

4.3Assessment of occupational health hazards Radiographers have been exposed to

Table 4.3 summarizes the results of the assessment of occupational health hazards that radiographers have been exposed to. Overall, out of the total number of participants who were assessed for exposure to physical occupational health hazards, close to half 37 (41.1%) answered yes to ionizing radiation exposure. In terms of exposure to chemical hazards, more than one-fourth 24 (26.7%) admitted they had been exposed to processing chemicals. Additionally, close to half 41 (45.6%) of the participants who were exposed

to biological hazards had direct contact with the patient's body fluids. Furthermore, a little above one-fourth 25 (27.8%) of the participants who were exposed to psychosocial hazards had stress due to workload.

Table 4. 3: Assessment of occupational health hazards Radiographers have been exposed to

Hazards	Frequency(N=90)	Percent (%)
Physical hazard		
Noise	20	22.2
Inadequate illumination	17	18.9
Ionizing radiation exposure	37	41.1
Fire	5	5.6
Electrical shock	11	12.2
Chemical hazard		
Inhalation of harmful gaseous substance	18	20.0
Exposure to processing chemicals	24	26.7
Exposure to disinfectants	20	22.2
Cuts from broken bottles of contrast media	14	15.6
Lead exposure	14	15.6
Biological hazards		
Needle prick injury	23	25.6
Direct contact with patient body fluids	41	45.6
Occupational infections	26	28.9
Psychosocial hazards		
Physical abuse	9	10.0
Verbal abuse	23	25.6
Lack of sleep due to shift schedules	15	16.7
Stress due to workload	25	27.8
The emotional effect of working with a terminally ill patient	18	20.0

4.4A. Assessment of safety practices known and adopted by Radiographers

Participants were asked to choose from options regarding safety practices they know and adopt to minimize occupational accidents, injury and/or disease. As shown, all 90 (100%) of the participants were aware of safety precautions against occupational hazards. Almost all 87 (96.7%) of the participants adopt handwashing with a bacterial agent as a safety practice, more than two-thirds 69 (76.7%) adopt barrier method,

majority, 87 (96.7%) of the participants use gloves as a safety method while all 90 (100.0%) of them know that lead apparels (aprons) is a safety material against an occupational health hazard. Majority 68 (75.6%) of the participants indicated yes to knowledge of the motorized equipment and use it as a safety measure. A similar trend of observations was recorded for environmental control and safe disposal of sharps. Overall, 6 (6.7%) of the respondents either do not know or do not use radiation monitoring dosimeters as a safety precaution. Additionally, close to one-fourth 21 (23.3%) and more than one-third 31 (34.4%) of the participants were not completely immunized for Hepatitis B and tetanus respectively.

Table 4. 4A: Assessment of safety practices known and adopted by radiographers

Safety Precautions	Frequency(n=90)	Percent (%)
Knowledge of safety precautions		
Yes	90	100.0
No	0	0.0
Safety practices adopted by radiographers		
Hand washing with bactericidal agent		
Yes	87	96.67
No	3	3.33
Barrier method		
Yes	69	76.67
No	21	23.33
Gloves		
Yes	87	96.67
No	3	3.33
Lead Apparel		
Yes	90	100.00
Motorized equipment		
Yes	68	75.56
No	22	24.44
Radiation monitoring dosimeters		
Yes	84	93.33
No	6	6.67
Environmental control e.g. effective waste handling		
Yes	85	94.44
No	5	5.56
Safe disposal of sharps		
Yes	87	96.67
No	3	3.33
Hepatitis B Immunization		
Yes	69	76.67
No	21	23.33
Tetanus Immunization		
Yes	59	65.56
No	31	34.44

4.4B: Assessment of safety practices known and adopted by Radiographers

Table 4.4B is the continuation of the assessment of the safety practices by radiographers.

Overall, more than one-third 36 (40%) of the participants did not know of any

prophylactic treatment and or procedure following exposure. Most 80 (88.9%) of the participants agreed they assume correct posture during procedures. However more than two-third 63 (70.0%) of them never had their radiation monitoring dosimeters read for over 3 months. Furthermore, almost all 80 (88.9%) of the participants said they comply with safety precautions because of personal and patients' safety. However, more than two-thirds 67 (74.4%) of the participants did not have safety protocols for reporting hazard incidents and almost one-third 28 (31.5%) were unsure. As shown, only a little above half 48 (53.3%) of the participants had occupational health and safety training programs attended by participants. In addition, less than one fourth 11 (22.9%) had their last training in less than a month. As shown, more than half 52 (57.8%) of the respondents stated they have in-house radiation protection officers. However, about to one-third 33 (36.7%) of responded their radiation equipment had never under gone quality control/assurance test before.

Table 4.4B: Assessment of safety practices known and adopted by radiographers

Hazards	Frequency(n=90)	Percent (%)
Prophylactic treatment		
Yes	54	60.0
No	36	40.0
Correct body posture		
Yes	80	88.9
No	10	11.1
Last time dosimeter was read		
1-3months	27	30
>3months	63	70
Why is it important to comply with safety precautions		
Hospital policy	2	2.2
Personal and patient safety	88	97.8
Do you have in your facility safety protocols for reporting hazard incidents	23	25.6
Yes	67	74.4
No		
Are OHS training organized in your facility?		
Yes	48	53.3
No	42	46.7
Last time of training		
<1 month	11	22.9
1-6 months	15	31.3
7-12 months	16	33.3
>12 months	6	12.5
Total	**48***	
In-house RPO		
Yes	52	57.78
No	38	42.22
QA/QC of equipment		
Yes	57	63.3
No	33	36.7

*Indicating participants who ticked yes for training

4.5 Assessment of compliance with recommended safety measures and practices by radiation facilities.

Three (3) private and three (3) government facilities were assessed for compliance with standard safety measures and practices and the results are as summarized in table 4.5 below. As shown, generally, all the private and government radiation facilities had visible radiation warning signs and infections control measures being observed by radiographers. In addition, the radiation shielding materials such as aprons and gonadal shields were available and being used by all facilities. However, it was observed that all facilities did not have break periods for radiographers. Additionally, it was noted that radiographers in 2 (66.7%) out of the three government facilities were not wearing their radiation monitoring badges.

Table 4. 5: Compliance with recommended safety measures and practices

Safety Measures	Private Frequency (N=3)	Percent (%)	Public Frequency (N=3)	Percent (%)
Are infection control measures being followed by radiographer?				
Yes	3	100.0	3	100.0
No	0	0.0	0	0.0
Are there radiation warning signs available and visible?				
Yes	3	100.0	3	100.0
No	0	0.0	0	0.0
Are shielding materials (aprons, gonad shields, etc.) available?				
Yes	3	100.0	3	100.0
No	0	0.0	0	0.0
Are shielding materials being used rightly?				
Yes	3	100.0	3	100.0
No	0	0.0	0.0	0.0
Is the facility ergonomically friendly (motorized equipment, chairs, tables, etc.)?				
Yes	3	100.0	3	100.0
No	0	0.0	0	0.0
Are there break periods for radiographer?				
Yes	0	0.0	0.0	0.0
No	3	100.0	3	100.0
Are radiation monitoring badges worn by radiographers				
Yes	3	100.0	2	66.7
No	0	0.0	1	33.3

4.6A Relationship between sociodemographic characteristics and knowledge on occupational health hazards and safety.

A bivariate analysis (Fishers' exact) was performed to examine the relationship between sociodemographic variables and knowledge of occupational health hazards and safety practices. The results (Table 4.5A) revealed that there was no significant association between any of the sociodemographic variables (such as age in years, educational level, years of experience, institution of practice) and knowledge on occupational health hazards and safety practices ($p > 0.05$).

Table 4. 6A: Relationship between knowledge on occupational health hazards and sociodemographic characteristics

Sociodemographic characteristics	Moderate	High	Fishers' exact p-value
Age (Mean ± SD)	34.70 ± 7.85	35.60 ± 7.54	0.737
Gender			0.155
Male	9(15)	51(85)	
Female	1(3.33)	29(96.67)	
Marital status			0.503
Married	6(14.63)	35(85.37)	
Single	4(8.16)	43(91.84)	
Modality			0.733
Conventional	7(10.45)	60(89.55)	
Non-conventional	3(13.04)	20(86.96)	
Institute of Practice			1
Government	6(11.11)	48(88.89)	
Private	4(11.11)	32(88.89)	
Educational level			0.879
Certificate/Diploma	3(13.04)	20(86.96)	
Bachelor	6(10.17)	53(89.83)	
Postgraduate	1(12.5)	7(87.5)	
Years of work experience			0.296
1-5	4(16.67)	20(83.33)	
6-10	2(6.45)	29(93.55)	
11-15	1(4.76)	20(95.24)	
≥ 16	3(21.43)	11(78.57)	

*Statistically significance is set at P-value=0.05

4.6B: Association between knowledge of occupational health hazards and sociodemographic characteristics

Table 4.5B presents the relationship between knowledge of occupational health hazards and the socio-demographic characteristics of the participants. Overall, the simple logistic regression model showed no statistically significant (P > 0.05) relationship between knowledge of occupational health hazards and safety practices and the socio-demographic characteristics. However, after adjusting for confounders, the results showed that female participants (OR=10.01; CI= 1-31.45) had higher odds of having high knowledge compared to the male participants. This association was found to be significant (p=0.05). In addition, 2.90 and 4.00 times higher odds of having high

knowledge of OHS were recorded for participants who had worked for 6-10 years (OR=2.90; CI= 0.48 - 17.38) and 11-15 years (OR=4.00; CI=0.41 - 39) respectively, compared to those who had worked for more than 15 years (OR=0.73; CI=0.14 - 3.89) however, this was found to be not statistically significant (P=0.335). Similar trends were observed for the rest of the independent variables.

Table 4.6B: Association between knowledge of occupational health hazards and sociodemographic characteristics

Sociodemographic characteristics	Unadjusted			Adjusted		
	UOR	95% CI	p-value	AOR	95% CI	p-value
Age	1.02	0.93 - 1.12	0.721	1.22	0.95 - 1.55	0.11
Gender		-	0.130			**0.05***
Male	ref			ref		
Female	5.12	0.62 - 22.45		10.05	1 - 31.45	
Marital status		-	0.337			0.96
Married	ref			ref		
Single	1.93	0.5 - 7.37		0.95	0.14 - 6.58	
Current modality		-	0.733			0.56
Conventional	ref			ref		
Non-conventional	0.78	0.18 - 3.3		0.56	0.08 - 3.99	
Institute practice		-	1.000			0.92
Government	ref			ref		
Non-government	1.00	0.26 - 3.83		0.91	0.18 - 4.69	
Education		-	0.926		-	0.84
Certificate/Diploma	ref	-		ref		
Bachelors	1.33	0.3 - 5.81		1.72	0.27 - 10.81	
Postgraduate	1.05	0.09 - 11.82		1.27	0.05 - 34.46	
Years of work experience			0.335		-	0.12
1-5	ref	-		ref		
6-10	2.90	0.48 - 17.38		1.51	0.16 - 14.29	
11-15	4.00	0.41 - 39		1.19	0.04 - 33.73	
≥ 16	0.73	0.14 - 3.89		0.03	0 - 3.22	

*Statistically significance is set at P-value=0.05 OR=Odds Ratio. CI=confidence interval. Ref= reference category.

4.6.C Relationship between organizational factors and knowledge of occupational health hazards and safety practices.

A bivariate analysis (Fishers' exact) was performed to examine the relationship between sociodemographic variables and knowledge of occupational health hazards and safety

practices. The results (Table 4.6) revealed that there exists a relationship between complete immunization of hepatitis B and tetanus by facility and level of knowledge of occupational health and safety. Among those that recorded high knowledge in occupational health and safety, a significant proportion of them (80%) that had received complete immunization for hepatitis B from their facilities compared to those who had not received full immunization of hepatitis B (p=0.034). Similar trends exist for those that had received complete immunization of tetanus (p= 0.012). Furthermore, the time of last OHS training among radiographers was found to be related to the knowledge of occupational health and safety. Among the participants that had high knowledge, a significant proportion of them were engaged in OHS training in the last 6-12 months (35.6%) compared with those that were engaged in OHS training more than 12 months ago (13.3%).

However, availability of radiation monitoring dosimeters, availability of safety protocol of reporting hazards, in-house RPO and regular QA/QC on radiation equipment were found not to be related to knowledge of occupational health and safety.

Table 4.6C: Relationship between knowledge of occupational health hazards and safety practices and organizational factors

Organizational factors	Knowledge level		
	Moderate	High	Fishers' exact p-value
Radiation monitoring dosimeters			
Yes	9(90)	75(93.75)	0.517
No	1(10)	5(6.25)	
Complete immunization of hepatitis B			
Yes	5(50)	64(80)	**0.034***
No	5(50)	16(20)	
Complete immunization of tetanus			
Yes	3(30)	56(70)	**0.012***
No	7(70)	24(30)	
Last time of radiation monitoring			0.717
3months	2(20)	25(31.25)	
>3months	8(80)	55(68.75)	
Facility has safety protocol for reporting hazard incident			0.693
Yes	3(30)	18(22.5)	
No	7(70)	62(77.50)	
Occupational health and training			0.179
Yes	3(30)	45(56.25)	
No	7(70)	35(43.75)	
Last time of training			**0.02***
< 1 month	3(100)	8(17.78)	
1 - 6months	0(0)	15(33.33)	
6 - 12 months	0(0)	16(35.56)	
>12 months	0(0)	6(13.33)	
In-house RPO			0.089
Yes	3(30)	49(61.25)	
No	7(70)	31(38.75)	
QA_QC procedure			0.086
Yes	9(90)	48(60)	
No	1(10)	32(40)	

*Statistically significance is set at P-value=0.05.

4.6D: Relationship between psychosocial factors and knowledge of occupational health hazards and safety practices.

A bivariate analysis (Fishers' exact) was performed to explore the relationship between psychosocial factors and knowledge of occupational health hazards and safety practices. The results (Table 4.6D) revealed that there was a significant association between lack

of sleep due to shift schedule and knowledge in occupational health and safety practices (p= 0.05). However, there was no significant association between physical abuse, verbal abuse, stress due to work load and emotional effect of working with terminally ill patients and knowledge of occupational health and safety practices.

Table 4.6D: Relationship between psychosocial factors and knowledge of occupational health hazards and safety practices.

Psychosocial factors	Knowledge Level		Fishers' exact p-value
	Moderate	High	
Physical abuse			1
Yes	3(30)	27(33.75)	
No	7(70)	53(66.25)	
Verbal abuse			0.051
Yes	6(60)	68(85)	
No	4(40)	12(15)	
Lack of sleep due to shift schedule			**0.005***
Yes	1(10)	47(58.75)	
No	9(90)	33(41.25)	
Stress due to work load			0.617
Yes	8(80)	70(87.5)	
No	2(20)	10(12.5)	
Emotional effect of working with terminal ill patients			0.617
Yes	6(60)	53(66.25)	
No	4(40)	27(33.75)	

*Statistically significance is set at P-value=0.05

CHAPTER FIVE

DISCUSSION

5.0. Introduction

This chapter presents the findings of the study in relation to the reviewed literature on the research topic. The findings are discussed in accordance with the stated objectives and research questions. The study sought to determine the knowledge of Radiographers about occupational health hazards and safety practices and to establish any relationship between knowledge of occupational health and safety and sociodemographic characteristics of the participants. These are presented as follows:

5.1. Assessment of Radiographers' knowledge on occupational health hazards

The results showed a high knowledge of participants regarding occupational health hazards. This agrees with the findings of other studies (Aluko et al., 2016; Chaundhry et al., 2006; Sweta, & Suresh, 2013). For instance, Aluko et al (2016) recorded high knowledge among all the Nigerian healthcare workers when their knowledge, attitudes and perceptions of occupational hazards and safety practices were assessed. This is an indication that radiographers are not only concerned about rendering services to their clients /patients but also are knowledgeable about their profession to the greatest extent in order to maintain their health.

However more than half of the participants were not sure whether a cataract is a common occupational disease among interventional radiographers or not. This finding is not surprising because there have been different views about the sufficiency of ionizing radiation dose to cause the cataract (Baruch, 2005). A study by Milacic (2009), for instance found that chronic exposure to low doses of ionizing radiation do not cause

occupational radiation cataract as an independent occupational disease but rather this health condition is related to type of radioactive emission, mode and type of radiation, working burden and working conditions as well as type of job when an experimental study involving 3,240 health workers in medical centres of Serbia in the period 1992-2002 was carried out (Milacic, 2009).

Ko et al (2018), on the other hand identified that cataract incidence among interventional cardiology workers was higher than among other non-interventional cardiology or radiology workers when a systematic study was carried out to determine the health effects of occupational radiation exposure among Fluoroscopy-Guided Interventional medical workers. In view of the reports above, the inability of the respondents in this current study to tell whether radiation associated cataract is caused by ionizing radiation exposure or not suggests that they require additional training to improve their knowledge about the adverse effects of hazardous radiation exposure.

5.2. Assessment of occupational health and safety hazards prevalent among radiographers

The results showed that close to half (41.1%) of the participants admitted they had been exposed to ionizing radiation. The current finding agrees with those from a study by Moonga (2016), where the level and risk of exposure to occupational ionizing radiation by radiographers and radiologists at a University Teaching Hospital and Cancer Disease Hospital in Lusaka, Zambia were assessed. Occupational exposures to ionizing radiations by humans have been attributed to a number of factors which include indiscriminate entry of people into radiation rooms during radiological examinations. Lack of safety lights to warn people about ongoing radiological examinations and late detection of radiologic equipment that leaks ionizing radiation in the environment. To

prevent and minimize exposure to ionizing radiations as a result of these occurrences therefore, should be continuous training of radiographers on radiation hazards and safety practices required to prevent their exposure. There should also be constant inspection of radiation equipment for possible defects that can lead to radiation exposure and repair or replace the equipment as soon as the faults are detected. In addition, radiation safety warning lights should be provided in every facility to warn people about the possibility of radiation exposure if they fail to observe the safety practices. Finally, every facility should have a radiation safety officer to ensure the safety of the equipment, the environment and people who may be at risk.

Additionally, more than one-fourth of radiographers reported that they had been exposed to various levels of processing chemicals. This result was similar to the findings obtained by Kakooei (2007), in Iran, a developing country, where chemical systems are still used in processing and developing x-ray films as compared to developing countries. Develop countries now use digital systems which do not involve the use of chemicals in developing x-ray films. Moreover, various imaging centres have started shifting from the use of chemical processing systems to the use of computer and digital radiographic systems in film development and because of this, chemical hazard exposure in radiography would soon be a thing of the past.

Nevertheless, these findings suggest that there should be regular monitoring and evaluation in facilities where chemical systems are still used in processing x-ray films in order to insulate measures necessary to minimize chemical hazard and exposure in radiography.

Further, close to half of the participants who were exposed to biological hazards had direct contact with the patient's body fluids and one-fourth who were exposed to psychosocial hazards had to stress due to workload. This correlates with a similar study carried out in Ghana (Ofori-Manteaw et al., 2015) and Nigeria (Ogenyi et al., 2018). For example the stress, direct contact with bodily fluids, and contrast media splashes were the three most prevalent hazards reported by 121 (87.1%), 78 (56.1%), and 72 (51.8%), respectively when the prevalence of occupational hazards among medical radiation workers in Northern Nigeria was undertaken (Ogenyi et al., 2018). These findings were, however, higher compared to our current results.

5.3. Assessment of safety practices by Radiographers

The results showed that almost all participants adopted hand washing with a bacterial agent as a safety practice. This finding agrees with a previous study where effective hand washing prior to, and after every clinical procedure in preventing cross infection was found (Aluko et al., 2016).

However, close to one-fourth and more than one-third of the participants were not completely immunized for Hepatitis B and tetanus respectively. A similar study in Nigeria found only 64.2% and 87.2 % of the healthcare workforce had completed Hepatitis B and Tetanus immunizations, respectively (Aluko et al., 2016). Meanwhile, health workers are more prone to contracting Hepatitis B infection since they are the risk of getting needle stick injuries (Kashyap, 2018). It is therefore essential that policies are formulated to ensure that all radiation workers are immunized appropriately.

For radiation safety purposes, radiation dosimeters should be read and recalibrated frequently to enable prompt detection and remediation of abnormal environmental

radiation exposures so as to prevent excessive human exposures that could lead to deleterious health conditions (IAEA, 2004b). In addition, about to one-third 33 (36.7%) of responded their radiation equipment had never under gone quality control/assurance test before.

These results may partly be due to the breakdown of the dosimetry equipment at the GAEC, the only public mandatory body for setting radiation standards and monitoring radiation related activities. In addition, these results partly explain why some of the participants responded they had been exposed to radiation hazard and could be at high risk of hazardous radiation exposure and affirms why measures should be put in place by EPA, GAEC and other relevant authorities to improve policies and facilities for best practices by all radiation facilities in the country.

Occupational hazard and safety training focused on radiation safety is essential to instill best practices necessary for prevention of radiation related accidents, injury and diseases among the radiographers, however, just a little above 50% of the participants admitted they had training programs in occupational health and safety.

A similar study in Iran to assess medical radiation workers on the knowledge, attitude and practice necessary to protect them against ionizing radiation hazards found that 78.9%, 70.7% and 32.4% of them had poor radiation protection knowledge, attitude and practice, respectively attributable to lack of effective training. However, considering the enormity of socio-economic repercussions of radiation exposure it is important that the training necessary to minimize accidents, injuries and disease are acquired by radiographers.

Finally, it was observed that all facilities (both government and private) did not have designated break periods for radiographers and this could be the reason for the high

prevalence of stress due to workload. Since stress could lead to accidents injury, disease and death among workers, it is important that anything that could lead to stress among the staff is addressed as soon as possible.

5.4. The relationship between knowledge on occupational health hazards and safety practices and sociodemographic characteristics

The results showed significant relationship between gender and knowledge on occupational health hazards and safety practices. This is in agreement with the results of previous studies (Alavi et al., 2017; Aluko et al., 2016; Tziaferi et al., 2011). Additionally, the unadjusted analysis of the results showed no significant difference in knowledge of occupational health hazards among the unmarried compared to the singles which is contrary to the findings of the study by Tziaferi et al., (2011) that observed a significant relationship between marital status and knowledge of occupational health hazards. Although there was no significant relationship between the knowledge of occupational health hazards among participants of the various categories of years of experience, the odds of having high knowledge was lower for participants with 16 years of experience compared to the 1-5years of experience group. This may be because the radiographers with lower years of experience had not yet lost remembrance of things learned at school compared with those with a lot of experience who might have forgotten what they had learned as a result of lack of enough training on occupational health hazards during their practice as found in this study. Additionally, the lower knowledge among those with a lot of years of experience may be because they thought they were old and have achieved some significant gains in life so their exposure to occupational health hazard might not necessarily have so much effect on them compared to a younger person who is full of years and aspirations.

5.5. The relationship between organizational factors and knowledge on occupational health hazards and safety practices.

The study showed significant association between complete immunization of hepatitis B and tetanus. This is in agreement with a study conducted among health care workers in Pakistan, where close to half participants interviewed had not undergone full immunization of hepatitis B, with awareness and non-availability of vaccine by employer as major reasons for this deficit (Hussain et al., 2010). The above is indicative that employers' commitment in ensuring radiographers' knowledge of occupational health hazards and safety practices is highly integral. Also, this study showed no significant relationship between whether or not radiographers engage in occupational health and safety training and knowledge on occupational health and safety however, the time of last training significantly related to knowledge of occupational health hazards and safety practices of radiographers. This outcome is in agreement with a study conducted by Dong et. al, (2004) where a relation was established between effect of regular training on OHS and good knowledge, leading to better safety practice.

5.6. The relationship between psychosocial factors and knowledge on occupational health hazards and safety practices.

Analysis of the psychosocial factors in relation to the knowledge health and safety practices among the participants using Fishers' exact test revealed that participants that lack sleep due to unfavourable shift schedule were likely to have lower knowledge of occupational health and safety practices. This finding is in agreement with a study conducted among midwives by Mollart et al., (2013) where work schedules had significant impact on burnout levels of midwives leading to occupational injuries. The findings in this study could be as a result of the fact the unfavourable shift schedules

always made it very difficult for such participants participate in OHS training that might be organized by their facilities.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

5.0. Introduction

This chapter is in three sections. Section one presents the conclusion of the study. Section two presents the limitations and section three presents the recommendations of the study and future research.

5.1. Conclusions

Overall, radiographers had good knowledge about occupational health hazards. Radiographers are generally exposed to IR, processing chemicals, patient body fluids and stress due to work overload. In as much as radiographers were aware and practiced some safety practices, they fell short of safety practices that involved the input of facility owners and/or regulatory bodies such as complete immunization of hepatitis B and tetanus, safety training and unfavourable work shifts and this influenced their knowledge of occupational health hazards and safety practices. In addition, significant proportion of female participants had higher knowledge in occupational health hazards and safety practices compared to male participants.

5.2. Limitations to the study

This study has some limitations. The first is recall bias. There could be recall bias since respondents were required to give information on occupational health hazards experienced in the past year. Secondly, since the focus of this study was on radiographers in the Greater Accra Region, the conclusions drawn from this study cannot be generalised. However, the conclusions can be extended to the health facilities

that share similar characteristics. The third is the fact that the data might be subjected to bias by how the questionnaire was structured and the sincerity of respondents' answers. In spite of all these limitations, the internal and external validity of the study was not adversely affected.

5.3. Recommendations and future research

Based on the findings from this research, the following recommendations were made:

1. There should be continuous OHS training for radiographers by facility owners and regulators.
2. There should be regular Quality Control / Quality Assurance of equipment and work environment by facility owners.
3. There should be regular monitoring of film badges by radiation protection regulators.
4. Facility management and regulatory bodies must show commitment towards the safety of radiographers.
5. This current study was a cross-sectional study and could not therefore provide evidence on the temporal relationship or establish causal effects. A future study with an alternative design such as longitudinal study is recommended to achieve those objectives.

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APPENDICES

Appendix 1- Questionnaire

Dear Participant,

We would be very grateful if you would assist to carry out an important study at the School of Public Health in the University of Ghana.

This study is to assess radiographers' knowledge of occupational health hazards and safety practices. The study also aims at identifying militating factors against adherence of safety regulations pertinent to radiography. The study in the end will provide you with some helpful job-related health information to maintain good health.

You can please help us complete this questionnaire by answering a few questions about yourself and knowledge about occupational health and safety. Your participation is vital to the success of this research project.

We would like to assure you that whatever information you give us will be confidential and will be known by only us, the investigators. The information will be reported in statistical summary form only.

Should you have any questions about the study, or problems with questions in this questionnaire, please do not hesitate to contact the Principal Investigator whose contact information is provided below.

Thank you for your willingness to participate in this important research project.

Contact:

Fati Ibrahim (Student)

Phone number: 0242756417

Email: ifatiwill@yahoo.com

SECTION A: (SOCIO – DEMOGRAPHIC DATA OF RESPONDENTS)

1.Code……...

2. Age……..

3. Gender: (1) Male [ ] (2) Female [ ]

4. Marital Status: (1) Single [ ] (2) Married [ ] 5. Current Modality of use: (1) Conventional [ ] (2) Non-conventional [ ]

6. Institute of practice: 1. Government [ ] 2. Private [ ]

7. Years of working experience……..

8. Level of education: 1. Diploma/CERT [ ] 2. Bachelors' degree [ ] 3. Post graduate Degree [ ]

SECTION B

(KNOWLEDGE OF RADIOGRAPHERS IN OCCUPATIONAL HEALTH HAZARDS)

STATEMENT	RESPONSE				
	Strongly agree	**Agree**	**Unsure**	**Disagree**	**Strongly disagree**
9. Occupational Health Safety is the responsibility & right of both employer and employee.					
10. Occupational hazards always relate to the work place activities that increases risk of injury.					
11. Radiographers are obliged to report work-related accidents/injuries.					
12. Cataract is a common occupational disease among interventional radiographers.					
13. The most effective accident and disease prevention begins when work processes are still in the design stage					
14. To minimize unnecessary dose, most radiation protection programs issue alerts when radiation badge readings exceed 10% and 30% of the maximum permissible dose.					
15. Radiographers must always wear film monitors recording their exposure to radiation					
16. The limit on effective dose of ionizing radiation for a radiation worker aged 18 years and above in any single calendar year is 20mSV					
17. Complete hepatitis B and tetanus immunization must be compulsory for all radiographers					
18. Radiographers are at high risk of occupational hazards					

SECTION C: OHS HAZARDS THAT RADIOGRAPHERS ARE EXPOSED TO.

Instruction: Please, tick the appropriate option(s) (You can tick more than one).

19. Which of the following occupational hazards have encountered in your line of work?

(a) Physical hazards	
I. Noise	☐
II. Inadequate illumination	☐
III. Ionizing radiation exposure	☐
IV. Fire	☐
V. Electrical shock	☐
(b) Chemical hazards	
I. Inhalation of harmful gaseous substances	☐
II. Exposure to processing chemicals	☐
III. Exposure to disinfectants	☐
IV. Cuts from broken bottles of contrast media bottles	☐
V. Lead exposure	☐
(c)Biological hazards	
I. Needle prick injury	☐
II. Direct contact with patient body fluids	☐
III. Occupational infections	☐
(d) Psychosocial hazards	
I. Physical abuse	☐
II. Verbal abuse	☐
III. Lack of sleep due to shift schedules	☐
IV. Stress due to work load	☐
V. Emotional effect of working with terminally ill patients	☐

SECTION D: SAFETY PRACTICES

20. Which of the following activities do you use to protect yourselves from radiation hazard?

(1). Collimation [ ] (2). ALARA principle [ ] (3). Correct usage of monitoring badges [ ] (4) recapping needles after use [ ]

21.Are you aware of safety precautions against occupational hazards? 1. Yes [ ] 2. No [ ]

If No, skip questions 18-28.

If yes, which of the following precautions are you aware of and which do you practice?

Precautions	Awareness/ practice	
	Yes	No
22. Hand washing with bactericidal agent		
23. Barrier methods:		
24. Gloves		
25. Lead apparels (apron)		
26. Motorized equipements		
27. Radiation monitoring dosimeters		
28. Environmental control e.g. effective waste handling		
29. Safe disposal of sharps		
30. Complete immunization against: i. Hepatitis B		
ii. Tetanus		
31. Prophylactic treatment and/or procedures		

following exposures		
32. Correct body posture during procedures		

33.When was the last time your radiation monitoring dosimeters read (1) 1-3 month [ ] (2) 3-6months [ ] (3) 6-9months [ ] (4). 9-12 months [ ] (5) > 12months

34. Why is it important to comply with safety precautions? (1). Because it's the hospital policy [ ] (2) For personal and patients' safety [ ] (3). Others (Please specify):_____

35. Do you have in your facilities safety protocols for reporting hazard incidents? (1). Yes [ ] (2). No [ ] (3). Not sure [ ]

36. Are occupational health and training programs organized in your facility? (1). Yes [ ] (2). No [ ]

37. If yes, when was your last training? (1). <1 month [ ] (2). 1-6 months [ ] (3). 6-12 months [ ] (4). >12months

38. Is there an in-house radiation protection officer (RPO) in your facility? (1). Yes [ ] (2). No [ ] (3) Not sure [ ]

39. How often does your equipment undergo Q/A and Q/C procedures? (1). Quarterly [ ] (2). Biannually [ ] (3). Annually [ ] (4). Never [ ] (5). Others [ ]

Appendix 2- OBSERVATIONAL CHECKLIST FOR SAFETY PRACTICES

40. Are infection control measures being followed by radiographer? Yes /No

41. Are there radiation warning signs visible? Yes/No

43. Are shielding materials (aprons, gonad shields, etc.) available? Yes/No

44. Are shielding materials being used rightly? Yes/No

44. Is the facility ergonomically friendly (motorized equipment, chairs, tables, etc.)? Yes/No

45. Are there break periods for radiographer? Yes/No

46. Are radiation monitoring badges worn by radiographers? Yes/No

Appendix 3 - Informed Consent

Title: Occupation hazards knowledge and safety practices among radiographers in the Greater Accra Region.

Principal investigator: Fati Ibrahim

Qualification: BSc Radiography

Address: School of Public Health, University of Ghana, Legon.

General information about the research

Radiographers are exposed to occupational hazards such as infections, ionizing radiation exposure, inhalation of hazardous fumes and abuse from patients.

This research is being conducted to assess the knowledge of radiographers in the Greater Accra region about hazards they are exposed to at work and what safety measures are employed during working. The entire research will take about 9-months to conduct.

Assessing the knowledge of occupational hazards and safety practices among radiographers, therefore, will help improve their awareness of the hazards and compliance with safety standard measures necessary to minimize occupational accidents, injuries and exposure to harmful radiations. Also it will improve policy on radiation safety among staff and patients.

The study is purely an academic exercise and it forms part of the researcher's work towards the award of a Master of Public Health Degree.

Possible risk of discomfort

There are no major risks associated with participating in this study. The procedures in this study are mostly non-invasive and will not cause much discomfort to the participants apart from questions on personal matters like age and marital status and

time spent in answering questions on the questionnaire which can make you a bit uncomfortable.

Description of level of research burden

Study participants would be requested to answer a questionnaire.

Possible benefits

Findings of the study will inform the health and safety policies of the Radiographers and other stakeholders to minimize the occupational health challenges amongst Radiographers.

Confidentiality

Confidentiality will be assured. The study participants will be assured that all their information will be confidential and will not be disclosed to anyone without their permission.

Data security

All information obtained, will be kept in locked files on computer by the principal investigator with secured pass codes.

Plans for record keeping

The study materials (Questionnaires and informed consents) will not be labeled with participants' names but rather with a unique identification number for each study participant.

Person responsible and phone number

The person responsible for the data storage will be

Fati Ibrahim (Student)

School of Public Health, University of Ghana, Legon.

Mobile number: 0242756417.

Email address: ifatiwill@yahoo.com

Voluntary participation and the right to leave the research

Participating in this study is entirely voluntary. Declining to enter the study or answer a question will have no negative consequences.

Contacts for additional information

Please call the person responsible for this study, Fati Ibrahim, on 0242756417 if you have questions about the study. If you have any questions about your rights as a research participant or feel you have not been treated fairly, you may contact any of the following:

- GHS/ Ethical Review Committee Administrator, Hannah Frimpong (mobile: 0507041223)
- School of Public health, University of Ghana, Legon

for further clarification or redress.

Your rights as a participant

This research has been reviewed and approved by the Ghana Health Service Ethical Review Board. If you have any further questions about your rights as a research participant, you may contact the chairman of the Board.

Consent Form

The above document describing the benefits, risks and the procedures involved in the dissertation titled ("Assessment of knowledge of occupational health hazards and safety practices among radiographers in the Greater Accra region, Ghana") has been read and explained to me. I have been given the opportunity to ask questions and all the questions that I have asked about the research have been answered to my satisfaction. I agree to participate as a volunteer.

....

Date Signature or Thumbprint of Participant

If volunteers cannot read the form themselves, a witness must sign here:

I was present while the benefits, risks and procedures involved in the study were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research.

....

Date Signature of witness

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above individual.

....

Date Signature of persons who obtained consent

Appendix 4 - Curriculum Vitae

P.O Box AN 19669,

Accra-North.

Phone Number: 0242756417

Email: ifatiwill@yahoo.com

Personal detail: Principal Investigator

My Profile:

I am presently pursuing a Master of Public Health (MPH) degree at the School of Public Health, University of Ghana. I am at the Department of Biological, Environmental and Occupational Health.

I hold a Bachelor of Science (BSc) degree in Diagnostic Radiography (2010) from the university of Ghana.

I currently work as a Radiographer at the Korle-bu Teaching Hospital. I am also the general secretary for the Society of Radiographers' (GSR), the sole umbrella body for all radiographers, radiotherapists and sonographers in Ghana.