# Analysis and Investigate the effect of Radiation on professional workers in Radiology and Imaging Department

**BY**

**Md. Asif Rahman**

**162-19-1894**

**Samia Ahmed**

**162-19-1904**

**Mohamed Abdi Hassan**

**163-19-1917**

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Supervised By

**Professor Dr. A.K.M. Fazlul Haque**

Associate Dean, Faculty of Engineering

Daffodil International University


**DAFFODIL INTERNATIONAL UNIVERSITY**

**DHAKA-1207, BANGLADESH**

## APPROVAL

This thesis titled **"Analysis and Investigate the effect of Radiation on professional workers in Radiology and Imaging Department"** submitted by Md. Asif Rahman, Samia Ahmed, Mohamed Abdi Hassan to the Department of Electronics and Telecommunication Engineering (ETE), Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the bachelor degree in Electronics and Telecommunication Engineering and approved as to its style and contents.

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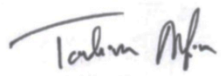

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Daffodil International University

**Dr. Saeed Mahmud Ullah** — **External Examiner**
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Department of Electrical and Electronics Engineering
University of Dhaka

## DECLARATION

We hereby declare that this research is our own work and effort under the supervision of **Dr. A.K.M. Fazlul Haque, Professor and Associate Dean, Faculty of Engineering.** Daffodil International University, Dhaka. It has not been submitted anywhere for any award. Where other sources of information have been used, they have been acknowledged.

**Supervised By:**

**Prof. Dr. A.K.M. Fazlul Haque,**

Professor & Associate Dean

Faculty of Engineering
Daffodil International University

**Submitted By:**

Md. Asif Rahman

162-19-1894

Samia Ahmed

162-19-1904

Mohamed Abdi Hassan

163-19-1917

Department of ETE

Daffodil International University

## DEDICATION

This thesis is wholeheartedly committed to our dearest guardians, who have been our source of motivation and gave us strength when we thought of surrendering, who consistently provide their ethical, spiritual, feeling and financial support.

## ACKNOWLEDGEMENT

First and foremost, we would like to express and convey our gratitude to the Almighty Allah, for his blessing approval, protection, mental power and wisdom in all aspect of our life, and all applause to Allah of Complete this thesis.

The real sprit of achieving a goal is through the way of excellence and austere discipline. we would have never succeeded in completing our task without the cooperation, encouragement and help provided by various personalities.

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Md. Asif Rahman

Samia Ahmed

Mohamed Abdi Hassan

## ABSTRACT

This research work presents the analysis of the radiation exposure level of workers in the department of X-Ray, CT scan, and MRI. The information was gathered from that particular department and it was investigated and compared with the standard radiation dose level that is verified worldwide by the International Committee on radiological protection (ICRP). In which the reason for this thesis is to define the impact of worker's radiation level and how the results of radiation to the people groups in the hospitals and close by just as states some careful steps because of tipsiness for a specific circumstance. This works described appropriation and patterns of doses which came word related radiation exposure among radiologists from some chose diagnostics in Dhaka Bangladesh, where multi-month portion estimations were gathered for a time of half year. A transportable situation radiation screen (thermo luminescent dosimeters) was utilized to measure the level of radiation in work environments in certain departments that manage radiation of diagnostic situated in various places of the city. An aggregate of 57 radiation workers was observed. The average estimated radiation doses of the workers are 0.02 to 7.75 mSv. Among these, workers in the radiology division got the highest assessed doses. The investigation shapes the exposures phase of more extensive, complete, and increasingly normal observing of word related radiation introductions and long haul examinations concerning its gathering designs, which could frame the premise of future records on the hindering impacts of radiation, normal for labors who works in radiation fields. The ionizing hazard has very much impactful on people regular life. Different types of cancers arise to emerge because of obvious radiation exposure to ionizing radiation like X-beams. This thesis work is not only for occupational workers, but it also for the general peoples who visited there for health issues or diagnostic issues. Finally, we can say that this exposure increased sometimes unintentionally or sometimes having a lack of knowledge. The occupational workers have to very much sincere and well known about the exposure. They must have to maintain the safety and all precautions for the patients also for themselves.

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# Analysis and Investigate the effect of Radiation on professional workers in Radiology and Imaging Department

## CHAPTER 1

## INTRODUCTION

### 1.1 OVERVIEW

Clinical imaging is the primary wellspring of artificial first acquaintance of radiation. However, the patients have no knowledge about radiation hazard when they are having any diagnostic examine. This analysis provides an outline of distributed writing with an emphasis on diagnostic patients fair and square of consciousness of radiation hazard from all medical imaging.

140 articles distinguished and screened for qualification, 24 fundamentally evaluated and 4 examinations remembered for combination. All examinations exhibited that patients have lack of knowledge about radiation exposure and featured an absence of correspondence between social insurance experts and patients with regard to emission hazard.

The short-range and long-range effects of radiation handle a number of issue to raise public concern about both. In fact the most important area is that the current situation is that radiation can be isolated by the average person. Besides the effect of the introduction of radiation to understand the difference between ionizing radiation and non-ionizing radiation will probably not appear for months or decades.[2]

Specialists related to this test include the investigation of radiation levels and the effects of X-beams in the clinical field. This exploration works basically established on my survey and information investigation utilizing the information gathered as verified from the clinical and/or paramedical staff at some specific hospitals of Dhaka city.

## 1.2 PROBLEM OVERVIEW

Almost every walk of people together with those who are privileged, does not have proper understanding and knowledge about the destructive effect of ionizing energy**.** The present situation is that emission to ionizing energy, despite how small, it brings the possibility of loss as the amount of destruction is comparable to the amount deposited.[3] The damage done by ionizing radiations depends both on the measure of material included and the energy deposited. Ionizing radiation harm increments as the measure of radiation stored increases and decreases if it is spread throughout a greater amount of material. The possible portion can be thought of as the normal full body portion which would have the same impact as the exact unstable portion. The viable portion is estimated in units of Sievert (Sv) or millisieverts (mSv).[4]

## 1.3 AIMS AND OBJECTIVE

This analysis is made arrangements for enlightening the people on the effects of ionizing radiation. The objectives of this hypothesis are looking at the radiation level among the word related workers of the radiology division of picked from Labaid Hospital and Ibn Sina Hospital, Dhaka city Bangladesh.

- To know the exact volume of exposure within the body of the professionals.
- To specified the measure of radiation unusual by the workers and relate it to the universal acknowledged of radiation (for example 20mSv).
- Verify the radiation hazard for every employee separately.
- To reach conclusion and important proposal that would be of extraordinary help to the occupational professionals and the patients those visit the radiation division.

## 1.4 LIMITATION

The analysis is defined to knowledge of ionizing exposure for the professional employee of some clinics and Hospitals in Dhaka city, Bangladesh. Survey has done on those hospitals and collect data from the relevant department. So result is depended on specific hospitals workers and the important thing is the working years of workers. Some worker might be work for 10 year, some are 5 years or some might be recently joined. This will be very the result. Those workers work

there for long time, their radiation does are higher, and who are recently join their radiation does are lower. The research had done on the X-Ray, CT scan, MRI and some other department. Radiation dose can be very in between these departments .X-Ray could have higher dose. MRI could be lower.

## 1.5 JUSTIFICATION

According to the ICRP recommendations, when exposure, or the issues involved in the potential radiation exposure, radiation damage should be clearly considered. Loss should not be limited to radiation; this includes other losses and costs. A lot of the time, the amount of radiation damage tends to be much higher. Involved in a practice exceeding the level of radiological protection. To find the best available alternatives usually work outside the responsibility of radiological protection organization ".[5]

To be sure the above endeavor of overcoming an issue, this exploration isn't completely liberated from clear and inactive constraints simply like any ordinary examination, along these lines this exploration is viewed as of significant concerning the near investigation on word related specialists in lethal impact of ionizing radiation on individual by estimating the portion of every laborer utilizing thermo luminescent dosimeter (TLD).[2]

## 1.6 MOTIVATION

Clinical imaging is the most widely recognized utilization of X-beams today, including single picture indicative assessments, for example, a X-beam picture of a messed up arm, the lungs, a tooth at the dental specialist, or mammography screening. In the event that patient have a cancer, heart disease, emphysema, or liver masses, CT outputs can discover it or help any radiologist with seeing any changes. They show inward wounds and dying, for example, those brought about by a car accident. They can help find a tumor, blood clump, overabundance liquid, or contamination.

On the other hand, MRI utilizes a solid attractive field and radio waves to make nitty pictures of the organs and tissues inside the body. Since its development, specialists and analysts keep on refining MRI strategies to aid clinical systems and examination. The advancement of MRI upset medication. This article describe MRI checks, how they work, and how specialists use them.[6]

## 1.7 ABOUT RESEARCH

In this analysis the purpose was dealing with the related investigate of radiation level on professional workers. In various department of specific hospitals in Dhaka city those deals with the radiation, in chapter one discussed has done about general introduction, statement of the problems, aims and objective, limitation, justification, and general motivation. In chapter two it will discuss about the review of the discovery and history of radiation, radiation and radioactivity, production of x-rays from x-rays machine, properties of x-rays, wavelength and intensity, biological effect, whole body radiation, radiation and risk, typical exposure level during x-rays examination, use of radiation in medical imaging, radiation protection, radiology workers, brief explanation of brain, brain tumors, courses of brain tumors, types of brain tumors, symptoms of brain tumors, diagnosed of brain tumors, treatment of brain, treatment method, treatment by using x-ray, treatment computed tomography (CT), uses of MRI, chest x-ray, and its types and some application of these imaging system. In chapter 3 it will discuss about the material used and the methodology, after that in next chapter which is four it will analysis the data tables which has been surveyed, calculation of the result, percentage and graphs. And in final chapter is represent some recommendation, summary, conclusion, and lastly references.[2]

# CHAPTER 2

## 2.1 RELATED WORKS AND CONTRIBUTIONS

G.K Korir, J.S Wambani and I.K Korir has gave us the related addition of this work. The employees who have admitted to help in making the research to have good result by the analysis the dose among them. The aggregate of 367 clinical radiation laborers were checked in which the information was gathered for the time of one year to the diverse gathering of clinical radiation laborers in Kenya, in light of their matured and gender orientation to locate the level of dosed by the clinical specialists.[7]

Another paper by Giri, Dhiraj Giri, V. Krishna Murthy they have talked about on related exposure just as the general hazard to people in general and individual's meeting the radiology department in emergency clinics in which they did a trial by estimating the radiation room of 13, x-beam and 2, fluoroscopy room in kathmandu city, nepal utilizing a compact estimating instrument LB 12 RAT 0/F[8]. Additionally M.Ramos, A Montoro, M Algeria, S Ferer, J.F Borquinero, R Tortosa, R Miro, G Verdu, P. Rodriguez, LL Burrios, JI Villaescusa joined and talked about on organic and physical techniques for chance estimation in interventional radiology; inconvenient impact of immediate and dispersed radiation which experience in deterministic impact radio-demits, matured, skin, waterfalls, telanglectasia in nasal area, hand depilation malignancy rate. They utilized the procedure by proposing gathering of six interventional radiologists at the emergency hospitals.[9] Alessandra Quaito, Vincinzo Di Lecce, Rita Dario, Jessica Uva, Politacnico di Bari, Dias. Likewise gives their commitment in the field of designing they proposed counterfeit optical radiation (AOR) exposure they developed the individual dosimeter for (AOR) discovery, in which the framework can be utilized for assessing the AOR, yet in addition giving the common and fake wellspring of radiation. What's more, they focused on the hazard level related to each light radiation striking the administrator's retina[10].

### 2.1.1 DISCOVERY/HISTORY OF RADIATION

The primary target of this epitomize work is to describe the historical backdrop of the revelation and advancement of radiotherapy, after some time. There are three key achievements throughout the entire existence of radiotherapy, in particular the revelation of X-beams, the disclosure of characteristic radioactivity, and the creation of counterfeit radioactive components. These three recorded references, alongside the top to bottom information on the nuclear and atomic structure, where the names of Niles Bohr and Ernest Rutherford are unavoidable[11]. During the assessment of standard, the general little has been to depend on hazard appraises that have little changes of under evaluating the results of radiation introduction. It is imperative to understand that a large portion of the impacts saw in human populace have happened at high dosages and portion rate. The data accumulated from those populaces must be downsized to low portion and low rates to gauges the hazard that happens in word related setting[12]. After the revelations of x-beam in 1895 and radioactivity in 1896 x-beam gadgets and radioactive material were applied in physic, science and medication. In the good old days the client of x-beams were unconscious that huge radiation does could cause genuine organic impacts.[13]

## 2.2 RADIATION AND RADIOACTIVITY

Our life has developed in a circumstance loaded up with radiation. The powers at work in radiation are uncovered after looking at the structure of particles. If the comparison an atom with human hair, then atom consider the million times thinner than human hair and are made out of considerably littler particles – some of which are electrically charged.

Molecules structure the fundamental structure squares of all issue. As it were, all issue on the planet starts with particles – they are components like oxygen, hydrogen, and carbon. A particle comprises of a core – comprised of protons and neutrons that are kept together by atomic powers and electrons that are in circle around the core. The atom conveys a positive charge, protons contains positive charge, and neutrons don't convey a charge. The electrons, which convey a negative charge, move around the core in shells. The negative electrons are pulled in to the positive core as a result of the electrical power. This is the manner by which the atoms remain together.[14]

There are three significant sorts of regular radioactivity.[2]

- Alpha Radiation
- Beta Radiation
- Gamma Radiation

The sources emit the energy and it travel through space and possibly ready to enter different material light radio and microwave are kind of radiation that are called non-ionizing radiation. Radiation is vitality that movements through space as molecule or wave. Radiation is energy, for example, heat light, solid microwaves, radio wave, x-beam and radar. Radiation is all over, it is the air that inhaled the drinkable water and the eatable food.[15]

## 2.3 SOURCE OF RADIATION

Foundation radiation is surrounding all of us the time. Its greater part shapes normally from minerals. These radioactive minerals are in the ground, soil, water, and even our bodies. Foundation radiation can likewise originate from space and the sun. Different sources are man-made, for example, x-beams, radiation treatment to treat malignant growth, and electrical cables.

Here are some types of sources:

- Radio antennas
- Radiation nuclei reactor
- Radiation come from sun
- Microwave oven
- X-ray machine

## 2.4 TYPES OF RADIATION

Radiation is energy as scheme of particles. There are two types of radiation

- non-ionizing
- ionizing
- which will be described in below

## 2.5 Ionizing radiation

Ionizing radiation is the progression of power as nuclear and subatomic particles or electromagnetic waves that is fit for liberating electrons from an atom, making the molecule become charged (or ionized). Ionizing radiation incorporates the more powerful finish of the electromagnetic range (X-beams and gamma beams) and subatomic particles, for example, electrons, neutrons, and alpha particles.[16]

### 2.5.1 Benefits of Ionizing radiation

Diagnostic and restorative clinical utilizations of ionizing radiation go from straightforward strategies like taking a chest x-beam to the unpredictable regimens used to treat a brain tumor. Every applications benefits patient. The analytic uses of ionizing radiation are ordered under two fundamental headings: radiology and neuro medication. In radiology, the radiation directed is outer to the patient; in neuro medication, it is inside. Ionizing radiation applied for restorative designs is likewise commonly grouped into classifications depending on whether the wellspring of the radiation is outside or interior to the patient. These regions are called radiation oncology and teletherapy (outer sources), brachytherapy (interior), and restorative neuro medication.

For a molecule to ionized, it must both have a sufficiently high energy and cooperate with atom of an objective. Generally, photons and particles with energies over a couple of electron volt (ev) are ionizing:

- Alpha particles
- Beta particles
- Gamma ray
- X-ray radiation and
- Neutron

### 2.5.2 NON IONIZING RADIATION

Non-ionizing radiation is in the scope of 0 Hz to 1015 Hz. While, ionizing radiation is in the scope of 1016 Hz up to 1026 Hz. Non-ionizing radiation originates from incredibly low recurrence (ELF), low recurrence (VLF), radio waves, microwaves, infrared radiation and noticeable light. Progressions in advancement and industry have improved human life. In any case, introduction to electromagnetic fields (EMFs) by using electrical machines, contraptions, present day instruments,

electrical links and concentrated contraptions has occurred as a result of these mechanical headways and is achieving a hazard to run of the mill lives. The closest quick and so close innovations in our regular day to day existence is a cell phone.

### 2.5.3 HARMS OF NON-IONIZING RADIATION

Human everyday life consistently revealed by a similar kind of non-ionizing radiation source. Electrical also, electronic hardware when all is said in done, for example, cordless telephones, cell, microwaves, PCs, computer games, TVs and others can make non-ionizing radiation; a low recurrence radiation.[17], [18]

Tumor advancement by hazard to radiofrequency electromagnetic fields below exposure limits for peoples. A persistent, interminable, presentation to a comprehensive arrangement of balanced radiofrequency electromagnetic fields (RF-EMF) stacks all species and gatherings through the globe. There is still long haul impact of interminable presentation to low-level recurrence. EMFs Radiofrequency fields in the frequency go 300 MHz to 300 GHz is broadly utilized in protection, industry, medication, electrical cables, and specialized gadgets and general customer item and is inciting danger to ordinary lives. For businesses, non-atomic ventures created all the more ionizing radiation in examination with atomic businesses as those non-atomic ventures get utilizes more on foundation radiation, cosmic beams.[19], [20]

## 2.6 MEASUREMENT OF RADIATION

Estimating radiation is very hard and uses a few units. Researchers measure the measure of radiation being transmitted in the customary unit called the curie (ci) or the SI unit called the Becquerel (Bq). Their unit expresses the quantity of deterioration or separate of a component) every second as the component attempts to arrive at a stable or non-radioactive. One Bq is equivalent to one dis reconciliation for each second and one Ci is equivalent to 37 billion Bq.[2]

When estimating the measure of the radiation that an individual is exposed to the measure of vitality consumed by the body tissue two-unit is utilized. The traditional Roentgen (or transmitted)

ingested portion (rad) and the SI dark (GY) 1Gy=100rad. In the event that the researcher is estimating an individual natural danger of enduring wellbeing impact of radiation, the units of estimating are the regular between equal man (rem) or the SI Sievert (Sv). 1Sv=100 rem.[2], [15]

## 2.7 X-RAY

X-radiation is a type of electromagnetic radiation. Most X-beams have a frequency in the scope of 0.01 to 10 nanometers, comparing to frequencies in the range 30 Peta hertz to 30 exa hertz (3×1016 Hz to 3×1019 Hz) and energies in the range 100 eV to 100 keV. X-beam frequencies are shorter than those of UV beams and commonly longer than those of gamma beams. In numerous dialects, X-radiation is alluded to with terms meaning Roentgen radiation, after Wilhelm Roentgen, who is typically credited as its pioneer, and who had named it X-radiation to connote an obscure kind of radiation. Spelling of X-ray(s) in the English language incorporates the variations x-ray(s), x-ray(s) and X-ray(s).

## 2.8 PRODUCTION OF AN X-RAY FROM X-RAY MACHINE

Radiation producers produce X-beams by the acceleration of electrons through an electrical voltage potential and halting them in an objective. Numerous devices that utilization a high voltage and the resources of electrons produce X-beams as an undesirable result of gadget activity. These are called coincidental X-beams. Most X-beam gadgets discharge electrons from a cathode, quicken them with a voltage and permit them to hit an anode, which emanates X-beam photons. These X-beam photons can be sorted as Bremsstrahlung or Characteristic.[21]

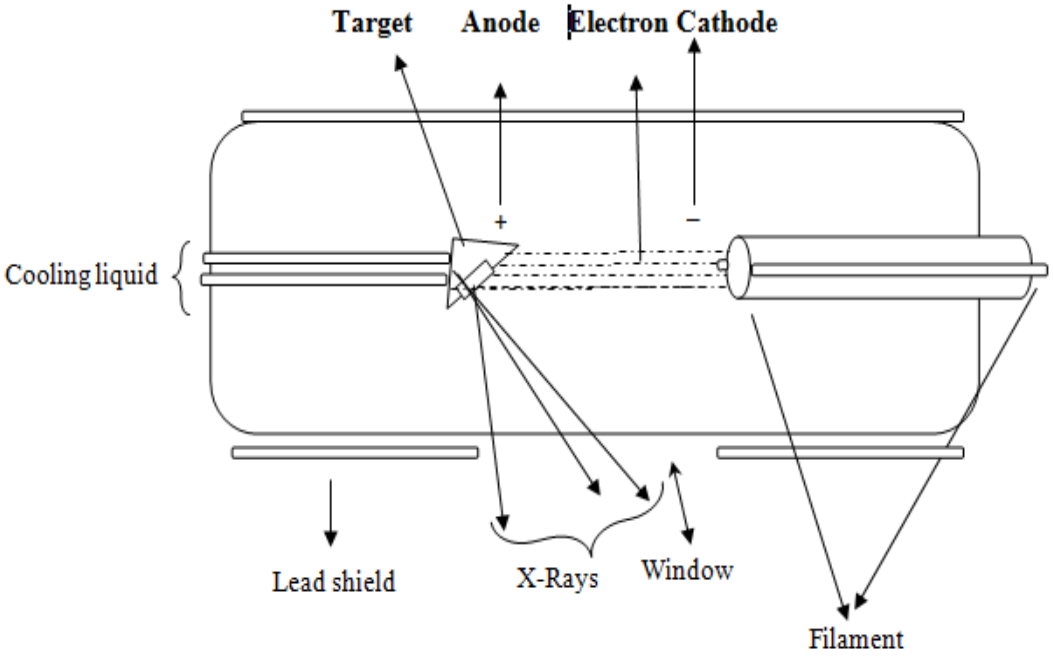



Figure 2.1: Working Diagram of X-Ray Machine

## 2.9 PROPERTIES OF X-RAY

Roentgen researches the properties of the x-radiation in detail. He found that numerous substances which were dark to noticeable or bright beams were Transparent to the x-beams. The level of straightforwardness anyway varied for various substances. In this way paper was seen as finished straightforward.[2], [15]

The X-Rays properties are given below:

- They have a shorter frequency of the electromagnetic range.
- Requires high voltage to deliver X-Rays.
- They are utilized to catch the human skeleton absconds.
- They travel in a straight line and don't convey an electric accuse of them.
- They are equipped for going in a vacuum.[22]

## 2.10 Types of X-Rays

Clinical science perceives various sorts of X-Rays. A couple of significant sorts of X-Rays are given in the focuses underneath.

- Standard Computed Tomography
- Kidney, Ureter, and Bladder X-beam
- Teeth and bones X-beams
- Chest X-beams
- Lungs X-beams
- Mid-region X-beams[22]

## 2.11 X-Rays Uses

Since the revelation of X-radiation, they are utilized in different fields and for different purposes. Some key employments of X-Ray are given beneath.

- Clinical Science
- Security
- Stargazing
- Industry
- Reclamation[22]

## 2.12 TYPICAL EXPOSURE LEVEL DURING X-RAY EXAMINATION

An individual located four feet from the patient's bed at the time the radiographic utilizing 14x7 picture receptor is made may normally get about 0.010 milligrams, to get 500miligram, one would have at that separation for 50,000 x-beam introduction. An individual found four feet from a patient experiencing fluoroscopy may regularly get about 0.50milligram every moment while the machine is "on to get 500milligram one would need to be in the area for 15-20 hours quickly with separation, the further, one is from the patient during the genuine x-beam assessment, the smaller the exposure. [2], [15]

## 2.13 TREATMENT BY USING X-RAY RADIATION

Outer Radiation originates from huge machine normally, outside radiation treatment gave 5 days every week for half a month the treatment plan relies upon the sort and size of the tumor and the age of the patient. Gives the all-out dosages of radiation over an all-encompassing period help to ensure solid tissue in the zone of the tumor. Outer might be coordinated just to the tumor and the tissue near it or less frequently to the whole mind. At the point when the entire cerebrum is dealt with, the patient regularly got an additional near radiation to the territory of the tumor. This lift can emerge out of outside radiation or from an implant.[2], [15]

## 2.14 Computed Tomography Scan (CT scan)

Computed Tomography (CT) of the body employments advanced x-beam innovation to help

Distinguish an assortment of diseases and conditions. CT examining is quick, easy, and noninvasive and exact. In crisis cases, it can expose inside wounds and draining rapidly enough to help spar lives.[23]

## 2.15 Some common uses of the procedure

CT imaging is:

- One of the quickest and most precise instruments for inspecting the chest, mid-region and pelvis since it gives nitty gritty, cross-sectional perspectives on a wide range of tissue.

- Used to inspect patients with wounds from injury, for example, an engine vehicle accident.
- Performed on patients with intense indications, for example, chest or stomach agony or trouble breathing.
- Regularly the best strategy for recognizing cancer in the chest, mid-region, and pelvis, for example, lymphoma and tumors of the lung, liver, kidney, ovary and pancreas. It's viewed as the best technique since the picture permits a doctor to affirm the nearness of a tumor, measure its size, distinguish its exact area and decide the degree of its inclusion with other close by tissue.[23]

In child patients, CT imaging used to evaluate:

- lymphoma
- neuroblastoma
- kidney tumors
- congenital malformations of the heart, kidneys and blood vessels
- cystic fibrosis
- complications of acute appendicitis
- complications of pneumonia[23]

Radiologists and radiation oncologists often use the CT examination to:

- Rapidly recognize wounds to the lungs, heart and vessels, liver, spleen, kidneys, gut or other interior organs in instances of injury.
- Control biopsies and different methodology, for example, abscess drainages and insignificantly intrusive tumor medicines.
- Plan for and survey the consequences of medical procedure, for example, organ transplants or gastric detour.
- stage, design and appropriately control radiation medicines for tumors just as screen reaction to chemotherapy
- measure bone mineral thickness for the location of osteoporosis.[23]

## 2.16 Radiation Doses from CT Scans

Different measures are utilized to portray the radiation portion conveyed by CT filtering, the most significant being assimilated portion, successful portion, and CT portion record (or CTDI). The assimilated portion is the vitality consumed per unit of mass and is estimated in grays (Gy). One gray equivalents 1 joule of radiation energy consumed per kilogram. The organ portion will to a great extent decide the degree of hazard to that organ from the radiation. The powerful portion, communicated in Sieverts (Sv), is utilized for portion disseminations that are not homogeneous, it is intended to be relative to a nonexclusive gauge of the total harm to the patient's reasons for the

radiation presentation. The successful portion takes into consideration an unpleasant correlation between various CT situations however gives just an inexact gauge of the genuine hazard. For hazard estimation, the organ portion is the favored amount.

The radiation doses to specific organs from some random CT study rely upon various elements. The most significant is the number of sweeps, the cylinder current and filtering time in milliseconds (mAs), the size of the patient, the pivotal filter extend, the sweep pitch (the level of cover between neighboring CT cuts), the cylinder voltage in the kilovolt tops (kVp), and the particular plan of the scanner being utilized.[24]

## 2.17 Benefits & Risks

## Benefits

- CT examination is effortless, non-invasive, and precise.
- A significant favorable position of CT is its capacity to picture bone, delicate tissue, and veins all at the equivalent time.
- Dissimilar to regular x-beams, CT checking gives extremely point by point pictures of numerous kinds of tissue as well as the lungs, bones, and vein.
- CT assessments are quick and basic; in crisis cases, they can uncover inner wounds and drain rapidly enough to help spare live.
- CT has been demonstrated to be a practical imaging apparatus for a wide scope of clinical issues.
- CT imaging gives ongoing imaging, making it a decent instrument for directing insignificantly intrusive.
- techniques, for example, needle biopsies and needle aspiration of numerous territories of the body, especially the lungs, midsection, pelvis, and bones.[23]

## Risks

There is no conclusive evidence that radiation at restricted amounts passed on by a CT channel causes disease. Huge populace examines have indicated a slight increment in malignancy from a lot bigger measures of radiation.

- The compelling radiation portion for this methodology fluctuates. See the Radiation Dose in X-Ray and CT Exams page for more data about the radiation portion.

- Women should to consistently tell their primary care physician and x-beam or CT technologist if there is an opportunity they are pregnant. See the Safety in X-beam, Interventional Radiology and Nuclear Medicine Procedures page for more data about pregnancy and x-beams.

- CT checking is, by and large, not suggested for pregnant ladies except if medicinally essential.[23]

- There is a little hazard that the difference medium can influence your kidneys. Your radiographer checks your latest blood test results before your sweep to ensure your kidneys are functioning admirably.[25]

## 2.18 Limitations of CT Scanning

Delicate tissue subtleties in territories, for example, the brain, inner pelvic organs, and joints can frequently be better assessed with magnetic reverberation imaging (MRI). In pregnant ladies, while CT can be performed securely, other imaging tests not including radiation, for example, ultrasound or MRIs, are favored yet just on the off chance that they are probably going to be comparable to CT in diagnosing your condition. An individual who is exceptionally huge may not fit into the opening of a regular CT scanner or might be over as far as possible—typically 450 pounds—for the moving table.[23]

## 2.19 Positron emission tomography (PET) or PET-CT scan

A PET output is utilized from the outset to discover progressively about a tumor while a patient is accepting treatment. It might likewise be utilized if the tumor returns after treatment. A PET output is typically joined with a CT scanning, called a PET-CT scan. However, we may hear our doctor recommends this methodology similarly as a PET scan. A PET scan is an approach to make pictures of organs and tissues inside the body utilizing different substances, for example, sugars or proteins. A modest quantity of a radioactive substance is infused into the patient's body.[25]

## 2.20 Lowering Radiation from CT Scans

By taking this step, it may reduce radiation from CT scans:

- Altering the scanning based on the size and weight of the patient or the body part being examined.
- Putting resources into CT scanners with the most recent equipment and programming instruments that limit radiation introduction.
- In Radiation Exposure Registry, at present being developed, will give benchmarks to deciding the ideal degree of radiation for every CT test.
- In a Blue Cross Blue Shield quality improvement investigation of some emergency clinics and imaging rehearses, called the Advanced Cardiovascular Imaging Consortium, in Cardiac Computed Tomography group diminished the normal CT radiation presentation by 43 percent.
- Using MRI or ultrasound, if either is viewed as a successful other option.[26]

## 2.21 Magnetic resonance imaging (MRI)

An MRI utilizes magnetic fields, not x-beams, to deliver itemized pictures of the body. The X-ray can be utilized to quantify the tumor's size. An exceptional color called a differentiation medium is given before the scan to make a clear picture. This color can be infused into a patient's vein or given as a pill or fluid to swallow. X-rays make more definite pictures than CT filters and are the suggested method to analyze a brain tumor. The aftereffects of a neuro-assessment, done by the internist or nervous system specialist, figure out which kind of MRI to utilize.[27]

## 2.22 BRAIN TUMORS

Human body is comprised of kinds of cells. Each sort of cell has exceptional capacities. Most cells in the body develop and separate in a methodical manner to frame new cells as they expected to keep the body healthy and working appropriately. At the point when cells lose the capacity to control their division regularly and with no organization. To additional phones structure the mass of tissue called a tumor. Every year in excess of 16,000 peoples discover they have a brain tumor, the tumor can be start or threatening. [2]

There are two kinds of brain tumors:

- Primary brain tumors, which start and tend to stay in the brain
- Metastatic brain tumors, which begin as cancer[28]

| BENIGN TUMORS | MALIGNANT TUMORS |
|---|---|
| Slow growing | Usually rapid growing |
| Distinct borders | Life threatening |
| Rarely spread | Invade brain tissue |
| Can usually be removed | |

## 2.23 Brain tumor post-treatment MRI

The imaging of essential and metastatic brain tumors is intricate and depends heavily on advanced magnetic resonance imaging (MRI). Usage of these propelled imaging strategies is basic in helping clinicians decide tumor reaction after the inception of treatment. Numerous choices are at present accessible to treat cerebrum tumors, and each can altogether modify the brain tumor appearance on post-treatment imaging. Also, there are a few normal and remarkable treatment-related difficulties that are essential to distinguish on standard post-treatment imaging.[29]

## 2.24 Benefits and Risks of MRI

### Benefits:

A MRI scanner can be utilized to take pictures of any piece of the body (e.g., head, joints, mid-region, legs, and so forth.), in any imaging course. X-ray gives preferred delicate tissue differentiate over CT and can separate better between fat, water, muscle, and other delicate tissue than (CT is typically better at imaging bones). These pictures give data to doctors and can be valuable in diagnosing a wide assortment of sicknesses and conditions.[30]

### Risks:

MR pictures are made without utilizing any ionizing radiation, so patients are not presented to the hurtful impacts of ionizing radiation. In any case, while there are no realized physical dangers from a brief exposure to the MR condition, the MR condition includes a solid, static attractive field, an attractive field that changes with time (beat angle field), and radiofrequency energy, every one of which conveys explicit security concerns:

- The solid, static magnetic field will pull in magnetic articles and may make harm the scanner or injury to the patient or clinical experts if those items become shots. Cautious screening of individuals and articles entering the MR condition is basic to guarantee nothing enters the magnet region that may turn into a shot.

- The magnetic fields that change with time make uproarious thumping noise which may harmful to hear if sufficient ear assurance isn't utilized. They may likewise cause fringe muscle or nerve incitement that may feel like a jerking sensation.

- The radiofrequency energy utilized during the MRI output could prompt warming of the body. The potential for warming is more prominent during long MRI assessments.[30]

# CHAPTER 3

## MATERIALS AND METHODOLOGY

### 3.1 INTRODUCTION

In this analysis utilization of the quantitative strategy in gathering the information from some various hospital in Dhaka city Bangladesh which incorporates radiology department, CT scan department, MRI department, cardiology department, urology department, and neuro medicine department were altogether gathered and examined utilizing diagrams and charts to know the retaining portion from each work that manages radiation in the above departments where the material and a few inquiries will be utilized.

### 3.2 Materials and Method

This overview has been completed by the estimation of the compelling portion due to spilled and dissipated radiation from some radiology in selected hospital. Dose was measured by term luminescent dosimeter badge (TLD Badge).

The TLD badge is the equipment that can be utilized in radiation checking, similar to the next type of device in old day "film type" x-beam identifications which should be supplanted each month and are prepared physically, the Thermo luminescent Dosimeter identification gives the comfort of a multi-month utilization. Every one bit of identification includes four components for radiation discovering: Two components are lithium bromide Li2B4O7: Cu radiation reaction trademark near human tissue and the other two components are Calcium Sulfate CaSo4: Tm, which are very delicate for radiation detection.

The TLD doesn't have a substantial weight. Which causes it to be cut effectively to dress during the administrations. Each TLD allowed a coded for simple ID and following. A staff they helpful to get definite reports from the completely customized perusing by the TLD and announcing strategy performed by a TLD Automatic Reader. The TLD Reader is set up with a microcomputer that controls self-checking capacities to give them a huge sum exact outcomes.

The TLD contains fluoride components and is cut to each set up that is liable for communicating with radiation. A TLD was utilized to process the radiation signals. Furthermore, the gadget that will take the radiation estimation scope of 0.05 mSv - 10 Sv. The alignment factor RCF utilized was 0.020 NC/μSv for the radiation wherein the staffs that served in the clinical field had the option to uncover, as decided to utilize the maker's guidance manual and suggestions in the International Atomic Energy Commission (IAEC) Standard.

Estimations were performed during the daytime, regular working hours of the chosen hospitals which were five hours of the day from 8 AM to 1 PM morning movement, and 6 days out of each week. Estimations were done by TLD badge and measure the approximate value of radiation level on each worker. Before the machines were turned on, the background radiation was estimated to completely chosen hospitals. In this manner, after the exposure to the radiation, the drop out radiation was estimated in the control board and patient holding up the region. And some of data were collected from the online sources. Then the main purpose was verified of all the data and try to get an average value.

## 3.3 METHODOLOGY

The method can be directed for all intents and purposes or by survey. Accordingly, this research thesis was directed through the inquiry. S M Abdus Sobhan Electroclinical Engineer radiology expert in Ibn sina Hospital was asked about the inquiry illuminated regarding the survey are as per the following:

Q1. How many workers do you have in the x-ray unit in the radiology department?

Answer: We have 19 workers.

Q2. What is the nature of their work?

Answer: Some of the workers are x-ray technicians while some are radiologist. Each has specific work.

Q3. How does each conduct his work?

Answer: Therefore, the work of x-ray technicians and radiologist are fully detail explain in chapter two.

Q4. How does x-ray machine produce X-Ray:

Answer: x-ray is produce from the x-ray machine by the process modern x-ray tube. And the fully detail of x-ray production is also in chapter one.

Q5. Does x-ray have the side effect?

Answer: Yes, it has negative effects.

Q6. What is the side effect of the x-ray?

Answer: the effects of x-ray are many but few of them are it course brain cancer, skin bone, blood disorder damage different kinds of tissue etc.

Q7. How can we protect ourselves from the x-rays exposure?

Answer: using of some radiation protection materials which is monitoring devices such as; TLD, blue box and by using time distance and shielding procedure.

Q8. What is the example of diseases or illness that can be kill by using X-Ray.

Answer: Brain tumor is an example. an x-ray can be used in some instances to kill affected cells tissue.

Q9. Can x-ray also used to treat or kill the illness in the human body?

Answer: Yes, it can be used to kill diseases in the human body

Q10. What is the maximum permissible limit of x-ray exposure to workers?

Answer: The international commission for radiation protection (ICRP) allowed the standard maximum exposure of 20msv for workers in radiation environment.

Q11. What are the differences between acute and chronic radiation dose?

Answer: Intense radiation for the most part alludes to an enormous number of portions of radiation got by the people in a brief timeframe. Chronic dose refuses to the combined of little dosages accepting by the individual which would rehash itself over a prolonged stretch of time of periods, for instance, 20 rem every week consistently for quite a long while consumed by the 0ccupational laborers. This infers portion for radiation security purposes that any radiation dose, either intense or interminable, may cause deferred impacts. In any case, just enormous intense portions cause early impacts; yet then again ceaseless dosages inside the staff's portion limits don't cause early

impacts. Since the National Radiological Commission limits gave by staff would not allow huge intense doses, worry with word related radiation hazard is essentially centered on controlling ceaseless introduction for which conceivable deferred impacts, for example, malignant growth, are of concern.

# CHAPTER 4

## RESULT AND DISCUSSION

### 4.1 RESULT

The tables below give details on how the data have collected and calculated to find the estimated value to each staff using TLD to monitor the record of radiation dose in mSV and calculate the total days and estimated exposed dose per year and lastly compare the result with the international accepted dose approved by international commission for radiation protection (ICRP).

**TABLE 4.1** describe the TLD and the period of data collected from the Hospitals

| | | Session 1 | | Session 2 | | Session 3 | |
|---|---|---|---|---|---|---|---|
| Employee ID NO: | TLD ID | Issued January | Returned March | Issued March | Returned May | Issued May | Returned June |
| 101 | 100201 | 60 | | 60 | | 60 | |
| 102 | 100202 | 60 | | 60 | | 60 | |
| 103 | 100203 | 60 | | 60 | | 60 | |
| 104 | 100204 | 60 | | 60 | | 60 | |
| 105 | 100205 | 60 | | 60 | | 60 | |
| 106 | 100206 | 60 | | 60 | | 60 | |
| 107 | 100207 | 60 | | 60 | | 60 | |
| 108 | 100208 | 60 | | 60 | | 60 | |
| 109 | 100209 | 60 | | 60 | | 60 | |
| 110 | 100210 | 60 | | 60 | | 60 | |
| 111 | 100211 | 60 | | 60 | | 60 | |
| 112 | 100212 | 60 | | 60 | | 60 | |
| 113 | 100213 | 60 | | 60 | | 60 | |
| 114 | 100214 | 60 | | 60 | | 60 | |
| 115 | 100215 | 60 | | 60 | | 60 | |

## 4.2 CALCULATION OF RESULT

Have the total dose and to calculate the estimate exposure dose per year;

Let A = estimate dose per year

B = total dose

C = total days

For total days per year = 365 days

This formula used $A = \frac{365 \text{ days} \times \text{total dose}}{\text{Total days}}$

$$A = \frac{365 \text{ days} \times B}{C}$$

**(I)** Employee ID = 101

TLD ID = 100201

Total dose = 0.86

Total days = 180 days

$$A = \frac{365 \times 0.86}{180} = 1.74\text{mSv}$$

**(II)** Employee ID = 102

TLD ID= 10202

Total dose = 0.88

Total days = 180 days

$$A = \frac{365 \times 0.88}{180} = 1.78\text{mSv}$$

**(III)** Employee ID = 103

TLD ID = 100203

Total dose = 0.97

Total days = 180 days

$$A = \frac{365 \times 0.97}{180} = 1.97\text{mSv}$$

**(IV)** Employee ID = 104

TLD ID = 100204

Total dose = 1.34

Total days = 180 days

$$A = \frac{365 \times 1.34}{180} = 2.72\text{mSv}$$

**(V)** Employee ID= 105

TLD ID = 100205

Total dose = 2.14

Total days = 180 days

$$A = \frac{365 \times 2.14}{180} = 4.34\text{mSv}$$

**(VI)** Employee ID = 106

TLD ID = 100206

Total dose =1.32

Total days = 180 days

$$X = \frac{365 \times 1.32}{180} = 2.68\text{mSv}$$

**(VII)** Employee ID = 107

TLD ID = 100207

Total dose = 1.51

Total days 180 days

$$X = \frac{365 \times 1.51}{180} = 3.06\text{mSv}$$

**(VIII)** Employee ID = 108

TLD ID = 100208

Total dose = 0.96

Total days = 180 days

$X=\frac{365 \times 0.96}{180} = 1.95mSv$

**(IX)** Employee ID = 109

TLD ID = 100209

Total dose = 1.36

Total days = 180 days

$X=\frac{365 \times 1.36}{180} = 2.76mSv$

**(X)** Employee ID = 110

TLD ID = 100210

Total dose = 1.77

Total days = 180 days

$X=\frac{365 \times 1.77}{180} = 3.59mSv$

**(XI)** Employee ID = 111

TLD ID = 100211

Total dose = 2.3

Total days = 180 days

$X=\frac{365 \times 2.3}{180} = 4.66mSv$

**(XII)** Employee ID = 112

TLD ID = 100212

Total dose =0.77

Total days 180 days

$$X = \frac{365 \times 0.77}{180} = 1.56\text{mSv}$$

**(XIII)** Employee ID = 113

TLD ID = 100213

Total dose = 0.86

Total days = 180 days

$$X = \frac{365 \times 0.86}{180} = 1.74\text{mSv}$$

**(XIV)** Employee ID = 114

TLD ID = 100214

Total dose = 2.14

Total days = 180 days

$$X = \frac{365 \times 2.14}{180} = 4.34\text{mSv}$$

**(XV)** Employee ID = 115

TLD ID = 100215

Total dose = 1.06

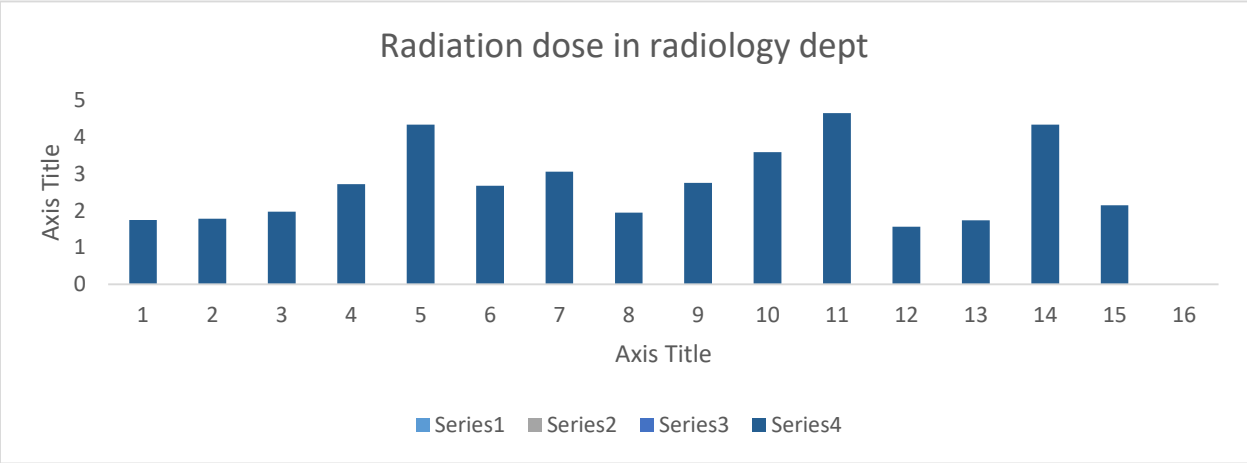
Total days = 180 days

$$X = \frac{365 \times 1.06}{180} = 2.15\text{mSv}$$

**TABLE 4.2** described the amount of dose by radiology department worker and the estimated dose per year been calculated

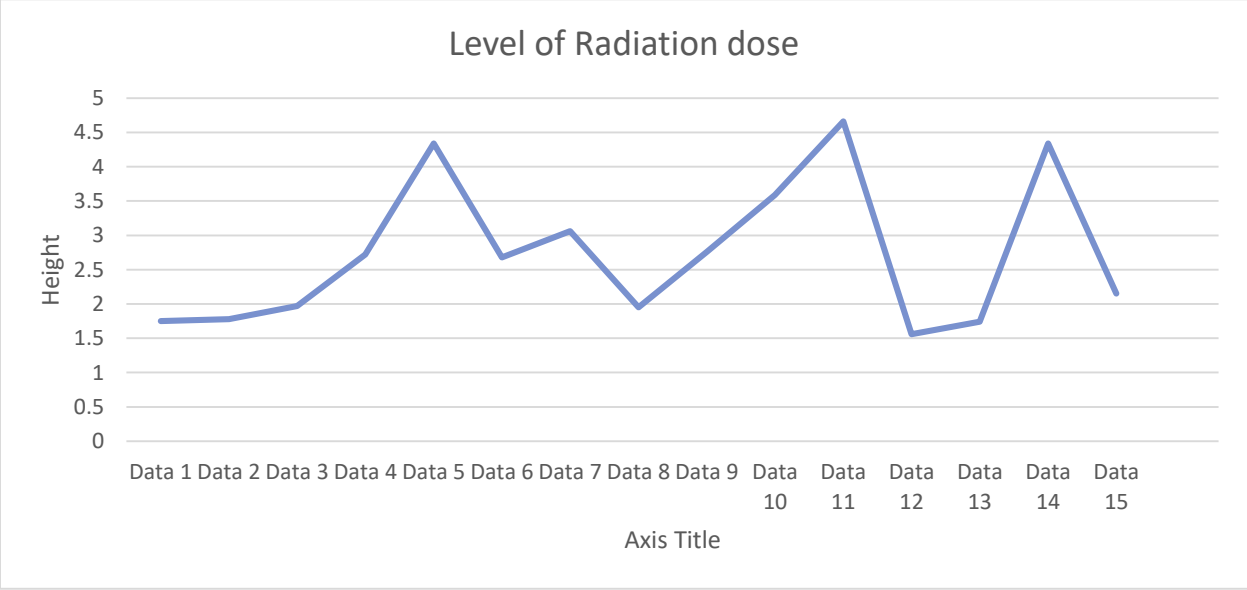
| | Period 1 | Period 2 | Period 3 | | |
|---|---|---|---|---|---|
| Total days | Dose mSV | Dose mSV | Dose mSV | Total dose mSV | Estimate dose per year mSV |
| 180 | 0.33 | 0.32 | 0.21 | 0.86 | 1.74 |
| 180 | 0.26 | 0.22 | 0.40 | 0.88 | 1.78 |
| 180 | 0.40 | 0.31 | 0.26 | 0.97 | 1.97 |
| 180 | 0.13 | 0.27 | 0.84 | 1.34 | 2.72 |
| 180 | 0.60 | 0.34 | 1.2 | 2.14 | 4.34 |
| 180 | 0.71 | 0.27 | 0.34 | 1.32 | 2.68 |
| 180 | 0.19 | 0.36 | 0.96 | 1.51 | 3.06 |
| 180 | 0.26 | 0.29 | 0.41 | 0.96 | 1.95 |
| 180 | 0.27 | 0.25 | 0.84 | 1.36 | 2.76 |
| 180 | 0.32 | 0.84 | 0.61 | 1.77 | 3.59 |
| 180 | 1.19 | 0.89 | 0.27 | 2.3 | 4.66 |
| 180 | 0.26 | 0.17 | 0.34 | 0.77 | 1.56 |
| 180 | 0.39 | 0.26 | 0.21 | 0.86 | 1.74 |
| 180 | 0.81 | 0.62 | 0.71 | 2.14 | 4.34 |
| 180 | 0.26 | 0.26 | 0.54 | 1.06 | 2.15 |

From these estimate chart has made to evaluate the data. From the chart it can find out the pick value and the bottom. In below it is a bar chart which contains data what we take from X-Ray department.




Graph 4.1: the level of radiation dose by the radiology department staff

This is the line chart which contains data what we take from X-Ray department worker. We take 15 peoples data from Radiology department. In above page we configure the bar chart value, now we configure the line chart and then we can saw the pick value.



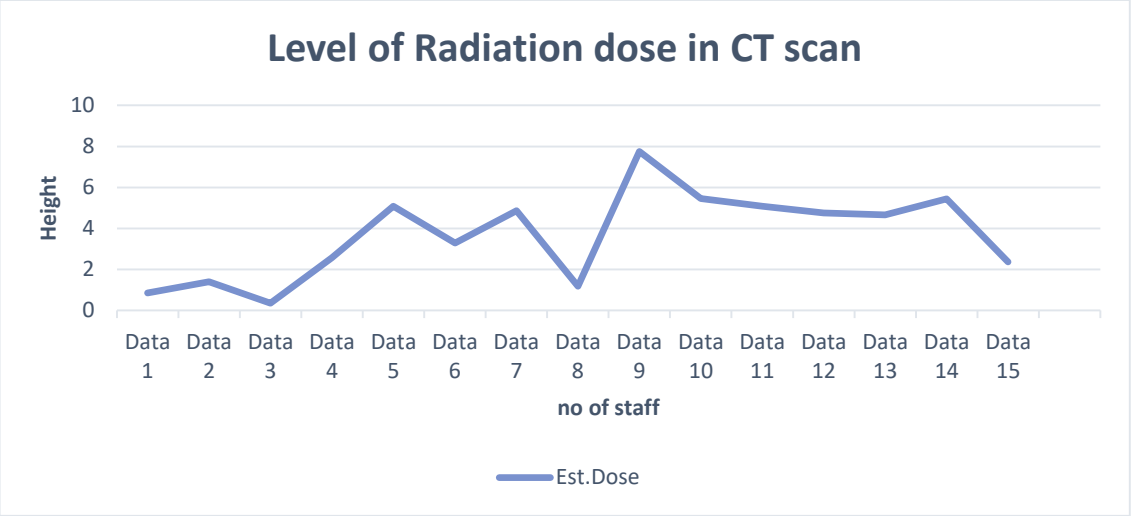

Graph 4.2: showing the exposed dose by the Radiology Department data

CT Scan Department staff data and the calculation is the same procedure with the above department in which the table contain the following data below.

**Table 4.3** total doses calculated and estimated in mSV from the above department

| | Period 1 | Period 2 | Period 3 | | |
|---|---|---|---|---|---|
| Total days | Dose MSV | Dose MSV | Dose MSV | Total dose MSV | Estimate dose per year MSV |
| 180 | 0.14 | 0.21 | 0.07 | 0.42 | 0.85 |
| 180 | 0.10 | 0.25 | 0.21 | 0.56 | 1.4 |
| 180 | 0.00 | 0.02 | 0.17 | 0.19 | 0.36 |
| 180 | 0.17 | 0.13 | 1.00 | 1.27 | 2.58 |
| 180 | 0.31 | 1.50 | 0.7 | 2.51 | 5.09 |
| 180 | 0.42 | 0.19 | 1.01 | 1.62 | 3.29 |
| 180 | 1.2 | 0.78 | 0.42 | 2.4 | 4.87 |
| 180 | 0.03 | 0.21 | 0.34 | 0.58 | 1.18 |
| 180 | 2.07 | 0.72 | 1.03 | 3.82 | 7.75 |
| 180 | 0.97 | 0.72 | 1.01 | 2.7 | 5.46 |
| 180 | 1.5 | 0.29 | 0.72 | 2.51 | 5.09 |
| 180 | 0.57 | 0.82 | 0.95 | 2.34 | 4.75 |
| 180 | 0.32 | 0.71 | 1.27 | 2.3 | 4.66 |
| 180 | 1.70 | 0.92 | 0.07 | 2.69 | 5.45 |
| 180 | 0.25 | 0.50 | 0.42 | 1.17 | 2.37 |

From these value here its make a line chart, and it can see that the pick value is 7.75mSv. We also take the 15 peoples data from CT scan department. From the calculation we found that employee no 9 contain the highest value 7.75mSv. In below we configure the graph and easily can found the pick value.




No of staff in CT scan

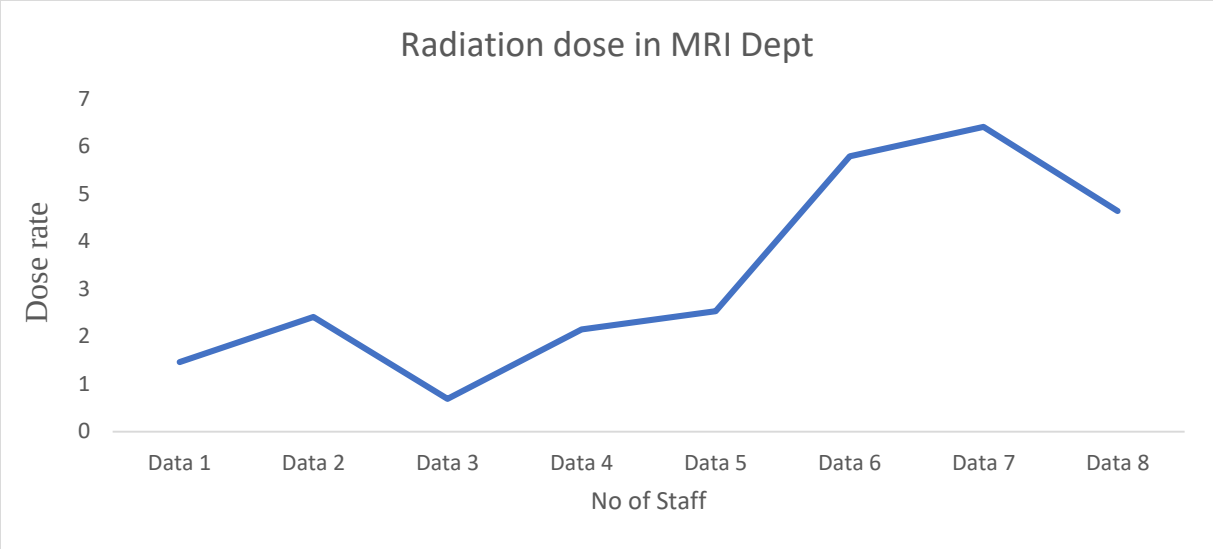
Graph 4.3: showing the exposed dose by the above data from CT Scan Department

MRI Department staff data and the calculation is the same procedure with the above department in which the table contain the following data below

**Table 4.4** total doses calculated and estimated in mSV from the above department

| | Period 1 | Period 2 | Period 3 | | |
|---|---|---|---|---|---|
| Total days | Dose MSV | Dose MSV | Dose MSV | Total dose MSV | Estimate dose per year MSV |
| 180 | 0.17 | 0.21 | 0.34 | 0.72 | 1.46 |
| 180 | 0.57 | 0.17 | 0.45 | 1.14 | 2.41 |
| 180 | 0.00 | 0.12 | 0.27 | 0.34 | 0.69 |
| 180 | 0.57 | 0.32 | 0.17 | 1.06 | 2.15 |
| 180 | 0.25 | 0.50 | 0.50 | 1.25 | 2.53 |
| 180 | 0.71 | 0.95 | 1.2 | 2.80 | 5.79 |
| 180 | 1.04 | 0.78 | 1.34 | 3.16 | 6.47 |
| 180 | 0.87 | 0.90 | 0.52 | 2.29 | 4.64 |

In the MRI department, survey has done on 8 employees. Table show their estimate dose per year. Based on these value the line chart and the pick value is 6.47mSv were configured. In MRI department employee no 7 contain the highest value.



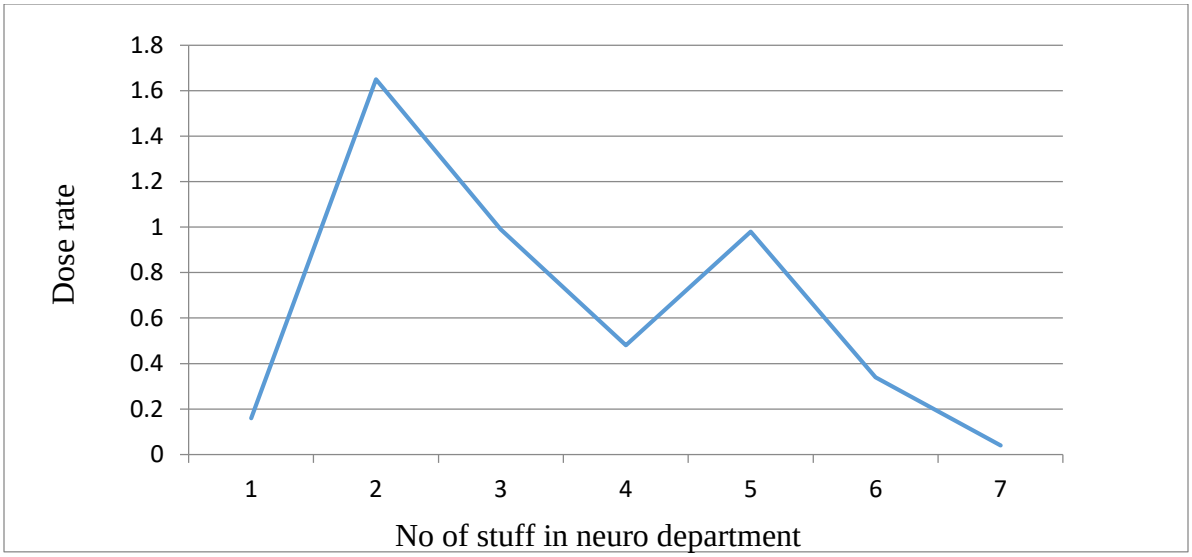

Graph 4.4: showing the exposed dose rate by the above data from MRI department

Nuclear medicine Department staff data and the calculation is the same procedure with the above department in which the table contain the following data below

**Table 4.5** total doses calculated and estimated in mSV from the above department

| | Period 1 | Period 2 | Period 3 | | |
|---|---|---|---|---|---|
| Total days | Dose MSV | Dose MSV | Dose MSV | Total dose MSV | Estimate dose per year MSV |
| 180 | 0.04 | 0.07 | 0.12 | 0.23 | 0.47 |
| 180 | 0.42 | 0.7 | 0.02 | 1.14 | 2.31 |
| 180 | 0.54 | 0.02 | 0.41 | 0.97 | 1.97 |
| 180 | 0.07 | 0.07 | 0.02 | 0.16 | 0.32 |
| 180 | 0.1 | 0.23 | 0.41 | 0.74 | 1.50 |
| 180 | 0.00 | 0.02 | 0.00 | 0.02 | 0.04 |
| 180 | 0.2 | 0.07 | 0.32 | 0.59 | 1.19 |

In the neuro medicine department, survey on 7 employees. From the table get their estimate dose per year. Based on these value we configure the line chart and the pick value is 2.31 mSv. Radiation level in neuro medicine department is lower that X-Ray or CT scan department.



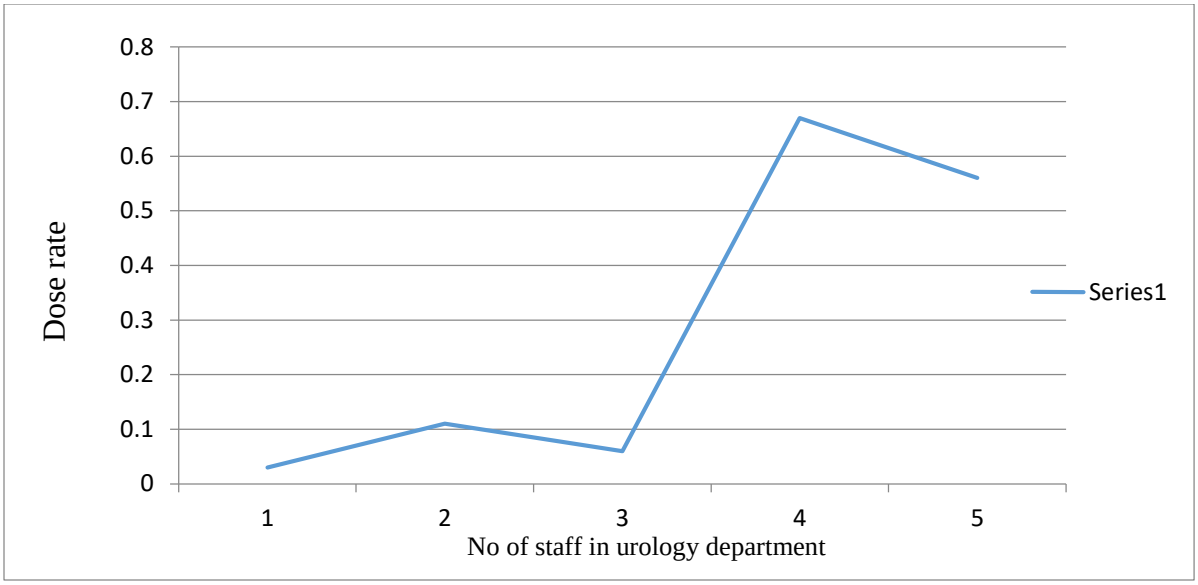

Graph 4.5: showing the exposed dose rate by the above data from nuclear medicine department

Urology Department staff data and the calculation is the same procedure with the above department in which the table contain the following data below.

**Table 4.6** total doses calculated and estimated in mSV from the above department

| | Period 1 | Period 2 | Period 3 | | |
|---|---|---|---|---|---|
| Total days | Dose MSV | Dose MSV | Dose MSV | Total dose MSV | Estimate dose per year MSV |
| 180 | 0.01 | 0.00 | 0.03 | 0.04 | 0.08 |
| 180 | 0.02 | 0.05 | 0.09 | 0.16 | 0.32 |
| 180 | 0.00 | 0.00 | 0.06 | 0.06 | 0.101 |
| 180 | 0.1 | 0.17 | 0.02 | 0.29 | 0.59 |
| 180 | 0.27 | 0.09 | 0.10 | 0.46 | 0.93 |
| 180 | 0.13 | 0.2 | 0.11 | 0.44 | 0.89 |

In the Urology department, survey done on 6 employees. From the table get their estimate dose per year. Based on these value configure the line chart were configured. In urology department contain very much low radiation level.



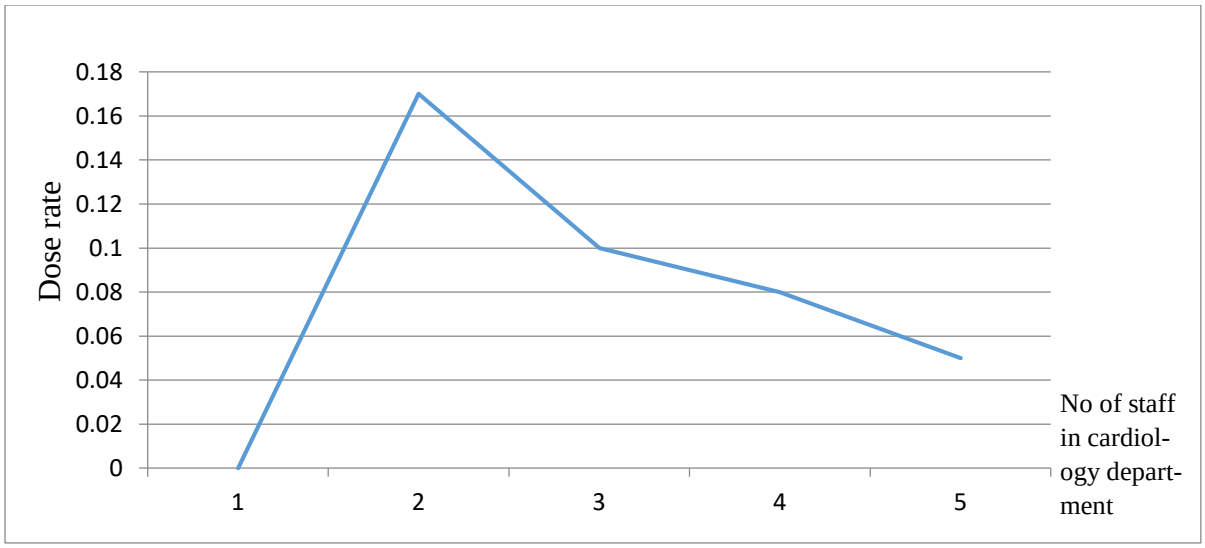

Graph 4.6: showing the exposed dose rate of the workers in urology department

Cardiology Department staff data and the calculation procedure is the same with the above department in which the table contain the following data below

**Table 4.7** total doses calculated and estimated in mSV from the above department

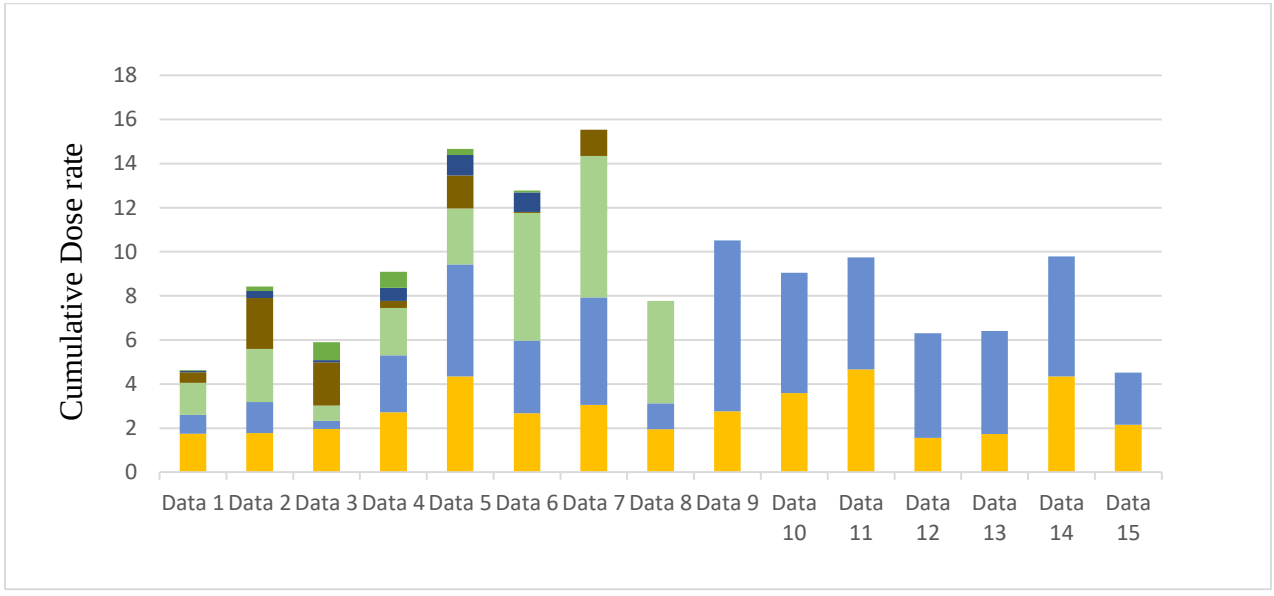
| | Period 1 | Period 2 | Period 3 | | |
|---|---|---|---|---|---|
| Total days | Dose MSV | Dose MSV | Dose MSV | Total dose MSV | Estimate dose per year MSV |
| 180 | 0.00 | 0.01 | 0.00 | 0.01 | 0.02 |
| 180 | 0.00 | 0.07 | 0.03 | 0.10 | 0.20 |
| 180 | 0.07 | 0.1 | 0.13 | 0.4 | 0.81 |
| 180 | 0.2 | 0.07 | 0.09 | 0.36 | 0.73 |
| 180 | 0.7 | 0.07 | 0.00 | 0.14 | 0.28 |
| 180 | 0.01 | 0.00 | 0.03 | 0.04 | 0.08 |

Line chart based on evaluate values of the staff under cardiology department. We work on 7 employes in the cardiology department. In that department they working mainly on ECG, EGO, ETT. That particular test working based on signaling. The exposure of radiation is very low.




Graph 4.7 showing the exposed dose rate by the staff under cardiology dept.

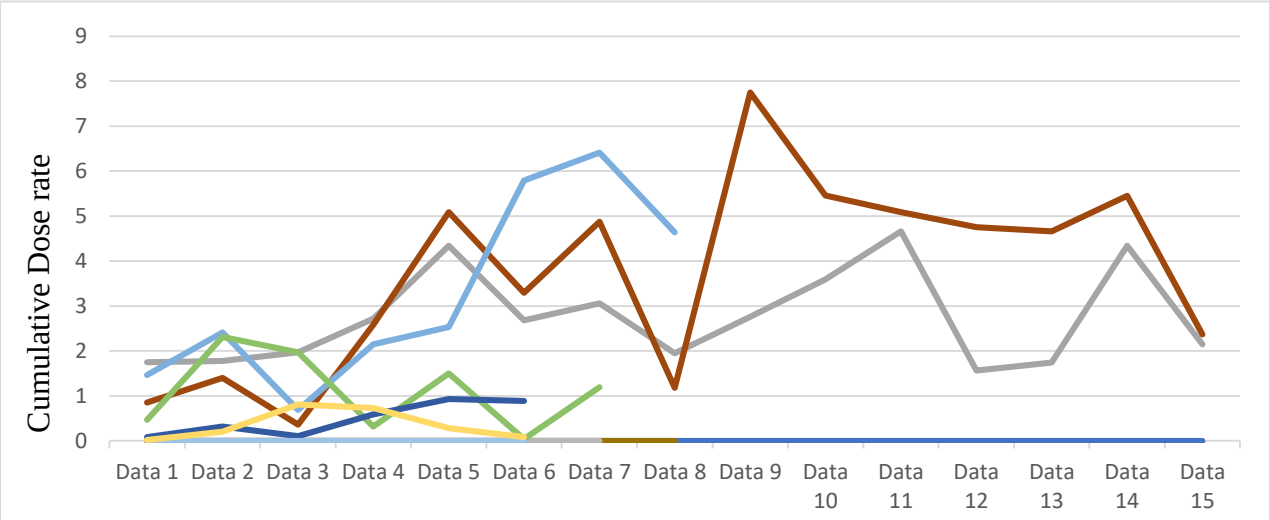
There the configuration of the chart based on overall exposed dose rate by the all six departments surveyed. In here we took all the data from these 6 department and combined the values. In below we configure the bar graph of the combination data.




Total number of stuff dealing with radiation

Graph 4.8 is the overall level of the exposed dose rate by different departments which vary by the use of series.

In here we took all the data from these 6 department and combined the values. In below we configure the line graph of the combination data




Graph 4.9 showing the cumulative exposed dose to the Staffs by the above data

### 4.3 PERCENTAGE

The highest admissible hazard limit for diagnostic labors by the international commission for radiation protection (ICRP) permitted standard highest exposure is 20mSv for workers in radiation environment. From the estimated portion of hazard per year shows in the table above. The maximum estimated dose exposure per year among all the workers in all departments is 7.75mSv. That is the maximum percentage is given as;

$$\text{Max} = \frac{7.75\text{mSv}}{20\text{mVs}} \times 100\% = 38.75\%$$

Then the lowest calculated dose exposure per year is 0.02mSv. Whereas the minimum percentage is given as

$$\text{Min} = \frac{0.02\text{mSv}}{20\text{mVs}} \times 100\% = 0.10\%$$

The average estimated dose exposure per year is

$$\text{Ave} = \frac{(7.75+0.02)\ \text{mSv}}{2} = 3.885\text{mSv}$$

Then the average percentage is given as

$$\text{Ave} = \frac{3.885\text{mSv}}{20\text{mSv}} \times 100\% = 19.43\%$$

That 19.43% is an average level of the medical labors that work with radiation in chosen hospitals, from the doing without the word related staffs in the emergency diagnostics in Dhaka city don't surpass the assessed portion that worldwide commission on radiological assurance (ICRP) endorsed by the word related specialist. That each staff won't surpass the portion pace of 20mSV, this suggests the staffs under these offices dependent on the above outcome are often keep on keeping up by continuing utilizing safety rules and measures for living in radiation territory so that to maintain a strategic distance from the radiation introduction from their specializations.

### 4.4 ANALYSIS & DISCUSSION

In there all the radiation workers including radiologists, radiographers, darkroom professionals, experts, radiation oncologists, inhabitants from the start with the assistant specialists were questionnaires who represent the hospitals. With their assist the estimation of the radiation level of workers had taken.

The appropriation of workers by their ages, the radiation workforce were maximum numbers in the age group of 25-40. The dissemination of personnel by their job duration, the maximum number is 15 years. The total is different because some workers were doing the job from the 10 or 15 years, some of recently joined that’s why the exposure level was different. In the inquiry concerning the consciousness of exposure rate and information rate yet the greater part of them don't have any thought regarding as far as possible. From the survey, they told the vast majority of the emergency clinics utilizing manual film processors yet they are utilizing auto processor. Almost all the radiation workers have not received any kind of training about radiation exposure or safety. Most

of the radiation worked placed radiation as their higher priority. The government is providing a radiation hazard allowance. From the survey, it was found that most of the fresher or the young radiation technologist only are aware of the radiation and they are trying to maintain safety from radiation dose. As per this exploration, the occupational workers are absorbing a limited quantity of radiation which correlation with different elements they in danger at some point or another it will influence the works. Additionally, numerous elements assumed a significant job in flowing radiation harm to the person that is various sorts of Physical, Chemical, and Biological impacts which are for the most part because of the ionization and excitation of the particles or muscles of the substances. The progressions created in the structure of the substances because of this impact are fundamental irreversible and ere is known as radiation harm. Assurance in radiology is intended to accomplish two closures, first to restrain the introduction of the patient to the base level that will deliver a palatable outcome and besides to secure every other individual especially the word related specialists to the valuable pillar, dispersed, and spillage radiation. The degree of getting influenced by ionizing radiation relies upon the individual's entrance to the radiation, his/her financial standard just as his/her mindfulness on the best way to ensure him/herself against such radiation.

## 4.5 Summary

The most dangerous reason for the harmful effects of radiation on the human body is to live near the source of radiation. There is no life insurance for any specific disease in our country, such as cancer, child malformations and more. X-rays were discovered by the German physicist Wilhelm Roentgen in 1895. The potential life force created by X-rays is applied between the cathode and the anode. Specifically about the cathode at the time of surrendering half of this exchanging current (AC) potential to the anode, the electrons are pulled forward and form an X-beam with oscillation as described last. Furthermore, when light emits through radiation problems, it causes ionization and excitation of particles and atoms in the medium, which are related to composite and natural changes, which include whole body radiation, transformation, chromosome breakdown, suspension of cell division, and small activities. In particles, designing materials include damage to late effects and so on and finally, measures against ionizing radiation include column filtration, shaft,

matrix, gonad shading, and the use of covers. Radioactivity when indeterminate atomic cores suddenly disintegrate into frame cores with high solidity. The process of degradation is called radioactivity. Radiation: The arrival of vital energy and molecules during the decay process.

## 4.6 Suggestions and Recommendations

The investigation of patient's portion during imaging techniques is not the same as different investigations of portion estimation since radiation originates from a turning X-beam tube which uncovered radiation from various edges to the patients. CT dosimeters likewise contains some interesting boundaries. This investigation was begun with customary portion estimation strategies utilizing TL chips. During the assessment time frame, just the radiation portions at the checking locale were thought of and the radiation portion encompassing the filtering area was dismissed which was not immaterial by any stretch of the imagination. Some suggestions for further study on the radiation dose measurement are as follows:

- An enormous number of TL chips should to be utilized in a sheet to gauge the patient portion during imaging system. If there should be an occurrence of chest and midsection filter checking length is around 60 cm yet in present investigation the length of each sheet was 45 cm. So that, to gauge radiation portion at the examining area, length of each sheet ought to be in any event 60 cm and to quantify radiation portion including the encompassing district of examining locale, length of each sheet ought to be 100 cm.

- Utilization of body apparition is the most ideal approach to contemplate radiation portion during imaging system. This technique gives the most precise estimation of successful portion just as the hazard estimation.

- A various procedure or formula of calculation should be used to compare dose of patients.

Proposals to decrease tolerant portion for operators and emergency hospitals experts for imaging methodology are as per the following:

- As the patient portion relies upon the various boundaries, for example, tube current, tube voltage, exposure time and so forth so proper utilization of imaging protocol is significant.

- Filter utilized in the middle of X-beam cylinder and patient ought to be changed inside three months. All medical clinic specialists don't know about this.

- Different protecting materials should be utilized appropriately and in a normal manner.

# CHAPTER 5

## CONCLUSION

## 5.1 Conclusion

Radiation is a piece of our common habitat. The absorbed portion from these normal sources is exceptionally low. Radiation uncovered on the patient during clinical analytic test is perhaps the biggest benefactor to the radiation in human body. Despite the fact that it is extremely unlikely to differ the advantages of clinical symptomatic techniques by utilizing radiation, related wellbeing dangers are likewise accessible here. So the most ideal route is to find a way to limit the patient portion. Despite the fact that as far as possible are not common for restoratively important tests or techniques and there is no trade off in the nature of picture in examining, the drawn out impacts of ionizing radiation can be serious. The radiologists should be prepared in the subject of radiation, portion, and their health impacts, so as to stop pointless as less introduction of patients during radiological analytic systems now it is normal that the radiation presentation portion is carefully observed and the device settings just as the protecting materials are analyzed every now and then to maintain a strategic distance from superfluous introduction. Study on the risk, security and anticipation of ionizing radiation is significant. It is known to all that prevention is better than cure. Since it is extremely unlikely to maintain a strategic distance from the ionizing radiation in clinical demonstrative tests, thus, it is the high an ideal opportunity to gauge the overall estimation of dangers and advantages of radiation introductions during clinical analytic tests. Minimization of dangers and intensification of advantages ought to mean of every indicative technique just as x-beam, x-ray CT imaging strategy.

## 5.2 Future Work

This thesis work is the main investigation on imaging machine. The point of the investigation was to quantify the patient portion during radiation imaging systems like x-ray, CT scan, MRI and thus decide the health hazard extraordinarily disease danger of the patients who experience the x-beam and CT innovation. Tolerant portion of imaging strategies in various nations and various emergency clinics are not same at all since it relies upon the cylinder current, tube voltage, checking

time and furthermore explicit plan of the scanner and so on. Thus, it is the interest of time to measure patient dose of imaging technique in regard of Bangladesh in various ways.

Further works on dose measurement should be as follows:

- We will work on various types of X-Ray like chest x-ray, abdominal x-ray, dental x-ray, bone x-ray etc.
- At least 10 types of CT imaging with 20 patients of each kind should be gathered.
- Examination of patient's portion for CT imaging for various CT filtering.
- Separate study for various kind of CT is required so that the estimation of cancer risk be easier.
- Broadly works on the MRI field.

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