

## **The Peoples' Perception of the Health Effects of Human Exposure to Ionizing Radiation from Diagnostic Medical Imaging**

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**Abstract:** This study was carried out to examine the peoples' perception of the health effect of human exposure to ionizing radiation from diagnostic medical imaging in some selected hospitals and diagnostic centers in Ibadan and Ibarapa areas of Oyo State, Nigeria. The survey research method was adopted for this study. Data were collected from medical professionals (i.e. Medical Doctors, Radiologists, and radiographers) and the patients that have been exposed to radiation from Medical Diagnostic Imaging with the aid of well-structured questionnaires. A total number of two hundred (200) questionnaires were distributed but only one hundred and ninety seven (197) were returned and these later formed the basis of data analysis which were classified and tabulated with percentages. The result revealed that medical Diagnostic imaging is highly essential in diagnostic and treatment of ailment as it creates visual representation of the interior of the body. However, patients are not aware of the effects of these radiations that exposure to ionizing radiation can result to cancer. On the basis of these findings, among others, it was recommended that pregnant women should avoid CT scan at the early stage because radiation damages the cell by damaging DNA molecules. Moreover, Ultrasounds, MRI are useful alternatives to CTs, X-rays and Nuclear Medicine, (Kwan Hoong 2003).

**Keywords:** Health Effect, Medical Diagnostic Imaging, Human Exposure, Ionizing Radiation.

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Date of Submission: 10-05-2018

Date of acceptance: 28-05-2018

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### **I. Introduction**

Medical imaging is the visualization of body parts, tissues or organs, for use in clinical diagnosis, treatment and disease monitoring. It is the technique and art of creation of visual presentation of the interior of a body for clinical analysis and medical intervention (Schofeld, 2011). The medical imaging machine and other equipment have become a gateway to health. In many cases, the patient endures the radiating of her body so that the machine may light up the cancer, heart tumor, blockage, or various other ailments. One result of the new non-invasive imaging technologies in the area of medicine is the capability of turning a person inside out. It conjures up foreboding visions of an all-powerful observe who has instant visual access to the anatomy, biochemistry and physiology of a patient (Wilson, 2002). While doctors have always used technological tools, the power and possibilities of seeing inside the living human body through radiation, ultrasound and magnetic resonance gives a divine authority that exceeds historical precedent, and paradoxically, makes them less germane to the patient/doctor relationship.

The patient's role in diagnosis of disease traditionally have been one of the acquiescent contributor – a data provider – but now it may be even less relevant to his diagnosis. Traditionally, a patient described her symptoms, disrobed and submitted to a physical exam (Wall, 1997). With technologies that can peer behind skin through bones into body organs and even brains, a patient can literally observe reproduction of his disease. Previously, a doctor might feel a lump or diagnose a clogged artery based on the patient's symptoms, but now disease posses for the camera. There are few places to hide. A doctor shows the patient an MRI of her right breast and circles in red the whitish mass identified as cancer. The tumor that might kill her in six to eight months appear as a mall twinkle on a computer monitor (Smith, 2009)

Ionizing radiation is a radiation that composed of particles that individually carry enough kinetic energy to liberate an electron from atom or molecules. The most commonly forms of ionizing radiation are x-ray and gamma-rays (Smith, 2009). Medical imaging that used radiation necessary for accurate diagnosis of disease and injury because they provide important information about the patient health to the doctor. The benefits of medical imaging greatly have potential small risk of harm from the amount of radiation used. The effects of low doses of radiation used in diagnostic imaging are not known but high doses of radiation are linked to an

increased risk of cancer and other ailment. (Feeney, 1996) Medical Diagnostic Imaging is essential for the diagnosis and provide important information to aid in determining the appropriate treatment of different types of diseases. Imaging plays an important and critical role in the evaluation of patient with different ailments. (Roobottom, 2004). This study was carried out to demonstrate that exposure to moderate or doses radiation increases the risk of cancer in most organs.

Physician and patient have become increasingly aware of the potential risks of radiation exposure from medical diagnostic imaging over the past several years. Small but real risks of cancer and other radiation induced disease in the case of medical imaging must be balanced against potential benefit of improved diagnostic accuracy (Hayles, 2002).

Studies of radiology have established radiation as a risk factor for thyroid cancer, particularly from early life exposure. About 0.62 mSv (20%) of the global annual per caput effective radiation dose came from diagnostic medical radiation for the period of 1997-2007, increased from 0.4mSv for the years 1991 – 1996 (Schonfeld, 2011). Medical x-rays constitute the most common type of diagnostic medical exposures worldwide, but their contribution to the cumulative effective dose is relatively low, whereas computed tomography scans account for 7.9% of diagnostic radiology examinations but 47% of the collective effective dose from diagnostic radiation procedures in part the world. (Smith, 1995)

## II. Common Types Of Medical Imaging

**X-Rays:** These are a types of radiation, similar to light and microwaves. However, unlike light, x-rays penetrate the body to create a 2 dimensional image (picture). An X-ray machine is much like a camera but uses x-rays to expose the film. X-rays of the abdomen (which will expose the uterus i.e. womb to radiation are usually avoided in pregnancy.

**Nuclear Medicine:** The recorded radiation emitted from within the body rather than generated by an external source in nuclear medicine as is the case with x-rays. Nuclear medicine studies can identify medical problems at an earlier stage than other diagnostic test in some diseases. It involves Inhaling, injecting or swallowing a radioactive 'tracer'. The gamma rays emitted by this material are used by the scanner to show images of bones and organs. Radioactive material may cause allergic of injection-site reactions in some people.

**Ultrasound:** Ultrasound uses high frequency sound waves to produce moving images onto a screen of the inside of the body, including organs soft tissues, bones and an unborn baby.

The ultrasound scanner transmits high-frequency sound waves into a body by use of probe or transducer. The waves penetrate into the body and bounce off organs. The return wave vibrates the transducer, the transducer turns the vibrations into electrical pulses that are sent to ultrasonic scanner and are transformed into an image. Ultrasound has no bio-effects and it has become a popular image technique. The risk involved are:

- Use of a special probe (e.g. for the oesophagus, rectum or vagina is required in some ultrasound).
- Special preparation may be required before the procedure (e.g. a full bladder or fasting).
- Quality and interpretation of the image highly depends on the skill of the person doing the scan. (Brody. et al., 2007)

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### Typical Doses from Medical Procedure Involving Radiation

Radiation dose can be estimated for some common diagnostic X-ray and nuclear medicine studies. It is important to note that there are only typical values. Radiation doses differ for each person because of differences in X-ray machines and their setting determine the amount of radioactive material given in a nuclear medicine procedure, and the patient's metabolism (Adam, 2008).

### **Biological Effects of Ionizing Radiation**

Deterministic effects, such as cell killing, can be more immediate and have a threshold above which severity increases with radiation doses (Brenner et al., 2003). Radiation damages the cell by damaging DNA molecules directly through ionizing effects on DNA molecules or indirectly through free radical formation. Radiation may not cause any outward signs of injury in the short term, the effects may appear much later in life (Amis et al., 2007). Exposure to radiation i.e. stochastic effects can result in hereditary effects and cancer. Estimate cancer risks associated with diagnostic x-rays using epidemiological tools is difficult because of extrapolation to low radiation doses (Brenner et al., 2001).

Radiation induced malformations during pregnancy are important illustrations of deterministic effect. Exposure between the 8<sup>th</sup> and 15<sup>th</sup> week can lead to malformations of the forebrain, resulting in mental retardation. Pregnant women should avoid all ionizing radiation if possible, since X-rays to one site on the body provide some scatter dose to the foetus (Brody et al., 2007)

### **PURPOSE OF THE STUDY**

The main purpose of this study was to find out peoples' perception of the health effects of human exposure to ionizing radiation from diagnostic medical imaging. Specifically the study found out whether:

1. Medical imaging is essential in diagnosis and treatment of ailment
2. People are aware but neglect the effects of exposure to radiation
3. Exposure to radiation result to cancer
4. pregnant women at the early stage should avoid CT scan or not
5. radiation damages the cell by damaging DNA molecules or not

### **RESEARCH QUESTIONST**

The followings questions were raised to serve as guide for this study

1. Is medical Imaging highly essential in diagnosis and treatment of ailment?
2. Are people aware but neglect the negative effects of exposure to radiation?
3. Can exposure to radiation result to cancer?
4. Should pregnant women at the early stage avoid CT scan?
5. Does radiation damage the cell by damaging DNA molecules?

### **III. Methodology**

The survey research method is adopted for this study. A sample survey is defined by (Esan, 1998) as a mini census conducted on a carefully chosen sample from a population to obtain some method, "attempts to determine the incidence, distribution and interrelation among variables ad well as focuses on vital facts, beliefs, opinions, attitudes and behavior from sample drawn". It involves instrumentation by way of producing interview schedules or questionnaires, which are then administered on every unit of the sample.

(Sobowale, 1983), posited that survey method is the best way for studying the attitudes, behavioral pattern and census of people, he further asserted that this method assists "to standardize the researcher's questions in addition to guaranteeing as much as possible uniformity of answers from respondents and facilitate easy coding".

The instrument used in collecting data was questionnaires along with oral interviews. Two hundred (200) questionnaires were distributed to the respondents out of which 197 were properly completed and returned representing 98 percent response rate. The sample size is made up of 197 respondents and comprises of Ibadan and the three local government areas in Ibarapa.

### **IV. Data Analysis And Result**

The data was analyzed using simple frequencies and percentages.

The results is presented by answering the research questions

1. Research question 1. Is medical Imaging highly essential in diagnosis and treatment of ailment? Table 1 presents the answer.

**Table 1: Essentiality of Medical Imaging diagnosis of Treatment of Aliments**

Perception of People	Frequency	Percentage
Positive Feeling	186	94.42
Negative Feeling	03	1.52
No Feeling	08	4.06
TOTAL	197	100

Source: Field Survey, 2014

Table 1 above shows that 186 respondents (94.42%) believed and agreed that medical imaging is highly essential in diagnosis and treatment of ailment because it create the visual representation of the interior of the body. 03 respondents (1.52%) agreed that medical imaging is not essential and 08 respondents (4.06%) are neutral.

This table shows that majority of the respondents agreed that medical imaging is highly essential in diagnosis and treatment of ailment.

Research question 2. Are people aware but neglect the negative effects of exposure to radiation?

**Table 2: People are Aware but Neglect the Effects of Exposure to Radiation**

Perception of People	Frequency	Percentage
Yes	16	8.12
No	181	91.88
TOTAL	197	100

Source field survey, 2014

From table 2 above, it was observed that 16 respondents (8.12%) respondents that people are aware but neglect the exposure to radiation effect. 181 respondents (91.88%) disagreed that people are aware but neglect the effect because if one have the awareness of these effects, it cannot be neglected.

These results showed that majority of the respondents were not aware of the effects of exposure to radiation.

5 Research question 3. Can exposure to radiation result to cancer?

**Table 3: Exposure to Radiation can result to Cancer**

Effects	Frequency	Percentage
Yes	162	82.23
No	35	17.77
TOTAL	197	100

Source: Field survey, 2014

Table 3 above shows that 162 respondents (82.23%) which represents majority of the people agreed that exposure to radiation can result to cancer. 35 respondents (17.77%) disagreed that exposure to radiation can result to cancer. The result showed that largest number of the respondents agreed that exposure to radiation can result to cancer.

Research question 4. Should pregnant women at the early stage avoid CT scan?

**Table 4: Pregnant Women at the Early Stage should Avoid CT Scan**

Effects	Frequency	Percentage
Positive	71	36.04
Negative	126	63.96
TOTAL	197	100

Source: Field survey, 2014

From Table 4 above, it was observed that 126 respondents (63.99%) don't see anything wrong in early exposure of pregnant women to CT scan while (36.04%) believed that pregnant women at the early stage should avoid CT scan.

This showed that most of the respondents do not belief that pregnant women should avoid CT scan at the early stage.

Research question 5. Does radiation damage the cell by damaging DNA molecules?

**Table 5: Radiation Damages the Cell by Damaging DNA Molecules**

<b>Effects</b>	<b>Frequency</b>	<b>Percentage</b>
Positive	149	75.63
Negative	48	24.37
TOTAL	197	100

Source: Field survey, 2014

Table 5 showed that 149 (75.63%) respondents, said that radiation damages the cell by damaging DNA molecules in which most of them were radiotherapists, medical doctors and audiographers. 48 respondents (24.37%) disagreed that radiation damages the cell by damaging DNA molecules and some of this respondents were the patients. This means that large number of the respondents agreed that radiation damages the cells by damaging DNA molecules.

## V. Discussion

From table 1, it is observed that, largest number of people believed that Medical Diagnostic Imaging is highly essential in diagnosis and treatment of ailment as it create visual representation of the interior of the body. This result is in line with (Roobottom, 2004) who asserted that medical diagnostic imaging is essential for the diagnosis and provides important information to aid in determining the appropriate treatment of different types.

Tables 2 shows that patients are not aware of the effects of exposure to radiation only the medical professional have the awareness. This is in diverse with (Hayles, 2002) who believed that physicians and patients have become increasingly aware of the potential risk of radiation exposure from medical diagnostic imaging over the past several years.

Table 3 revealed that most of the respondents believed that exposure to radiation can result to cancer. This result is in line (Brenner et al. 2001) that asserted that exposure to radiation can result in hereditary effects and cancer.

Table 4 shows that largest number of respondents don't see anything wrong in pregnant women been exposed to CT scan at the early stage while very few agreed that the pregnant women should avoid CT scan at the early stage. This result is not in line with (Brody et al. 2007) who revealed that pregnant women should avoid all ionizing radiation if possible because exposure between 8<sup>th</sup> and 15<sup>th</sup> week can lead to malformations of the forebrain, resulting in mental retardation.

Table 5 shows that majority of the respondents believed that radiation damages the cell by damaging DNA molecules. This result corresponded with (Amis et al. 2007) who said that radiation damages DNA molecules inside the cell directly through ionizing radiation.

## VI. Conclusion And Recommendation

It can be concluded from the discussion of this study that most people are not aware of the consequence and effects associated with radiation emitted from Medical Diagnostics Imaging. The people that have the awareness of the consequences and effect were the medical professionals e.g. audiographer, radiologist, medical doctor and laboratory technicians.

Also it is observed that human exposure to medical diagnostic imaging procedures that uses ionizing radiation can result to cancer. So, multiple scans should be avoided to minimize radiation risk.

### Recommendation

- I recommend that there should be public awareness as regards the risk in human exposure to medical diagnostic imaging.
- Ultrasound and Magnetic Resonance Imaging should be an alternative to CTs, X-rays and Nuclear medicine because these use no ionizing radiation.
- Your imaging provider should provide you with information about how to reduce radiation doses.
- Further research should be carried out on the consequences and effects of human exposure medical diagnostic imaging.

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