CHAPTER ONE
INTRODUCTION

In modern society, telecommunication has played a significant role in the development of many nations culturally, socially and especially economically. Similarly, telecommunication plays an important role in the world's economy. Worldwide telecommunication industry's revenue will grow from $2.2 trillion in 2015 to $2.4 trillion in 2019; a combined average growth rate of 2.3 percent, according to a new report (Internet World Stats, 2017). For effective and efficient deployment, use and growth of the telecom-services, service providers must deploy, erect and install in and around the country telecommunication masts, towers and base stations to disseminate and disperse information and data services to end-users of these services. In a recent statement, Bashir Gwandu, the acting Executive Vice Chairman of Nigerian Communications Commission (NCC) pointed out that "We cannot have telecommunication services without putting telecommunication masts and towers around the country because we don't have infrastructure in place like other countries, we don't have fibre and wired lines across the country" (*Next* Newspaper, 2011).

The provision and erection of these towers (masts) within the country; which are a *sine qua non* for availability of telecommunication services including internet for fast-tracking business and government cum social services, is not without some issues and concerns from a wide range of quarters. Apart from the legal and administrative issues arising from control over its erection, the presence of the telecommunication mast has engendered serious issues bothering on health, business and environmental concerns. These concerns are even more complicated in developing countries like Nigeria with limited technical and scientific capabilities to regulate and/or mitigate possible health hazards associated with ultra-violet emissions or radiations from the telecommunication masts (Edewor & Imhonopi, 2013; Husain, Gwary, Yusuf & Yusuf, 2017).

The health risks most times are not unconnected with the indiscriminate erection of the telecommunication masts in especially residential areas, and perhaps, without strict compliance with standard regulations guiding such activities by the telecommunication service providers. Given the current global interests, concerns, and increased advocacies for environmental

sustainability, espoused in the 2000-2015 Millennium Development Goals and the current 2015-2035 Sustainable Development Goals, the issue of Environmental Sustainability ranks tops as it is a concern for both the developed Western countries and the developing countries. Scientific evidence has documented some dire consequences of exposure to ultraviolet emissions either from the sun or other electromagnetic objects capable of emitting radiation substances. Such consequences include cancers and other health challenges (Akintonwa, Busari, Awodele & Olayemi, 2009). Though opinions on the health hazardous effect of dappling telecommunication masts in particular are polarized, there is a high possibility that human exposure to a certain degree of radiation is a serious health risk (Levins, O'Meara, Ruhotina, Smith & Delaney, 2015). It therefore became germane to ascertain the perception of residents in South-South Nigeria on the health risks of dappling telecommunication masts situated in their areas.

1.1. Background to the Study

According to Akintowa *et al.* (2009), more than 100 years ago, scientists discovered that many elements commonly found on earth occur in different configurations at the most basic (atom) level. These various configurations (called isotopes) have identical chemical properties, but different physical properties. In particular, some isotopes (known as radioisotopes) are radioactive, meaning that they emit energy in several different forms. This energy emission is what we call radiation (Akpolile & Osalor, 2014).

Radiation is energy given off by matter in the form of rays or high-speed particles. All matter is composed of atoms. Atoms are made up of various parts; the nucleus contains minute particles called protons and neutrons, and the atom's outer shell contains other particles called electrons. The nucleus carries a positive electrical charge, while the electrons carry a negative electrical charge. These forces within the atom, Osibanjo (2009) explains, work toward a strong, stable balance by getting rid of excess atomic energy (radioactivity). In that process, unstable nuclei may emit a quantity of energy, and this spontaneous emission resulting in radiation. Radiation, therefore, takes place when the atomic nucleus of an unstable atom decays and starts releasing ionizing particles, known as ionizing radiation. When these particles come into contact with organic material, such as human tissue, they will damage them if levels are high enough, causing

burns and cancer. Scientific evidence shows that ionizing radiation can be fatal for humans (Akin & Adeniji, 2014; Levins *et al.,* 2015).

Over time, we have come to think of radiation in terms of its biological effect on living cells. For low levels of radiation exposure, these biological effects are so small that they may not even be detectable. In addition, the human body has defence mechanisms against many types of damage induced by radiation (Akintonwa *et al.,* 2009). Consequently, radiation may have one of three biological effects, with distinct outcomes for living cells:

(1) Injured or damaged cells repair themselves, resulting in no residual damage;

(2) cells die, much like millions of body cells do every day, being replaced through normal biological processes; or

(3) Cells incorrectly repair themselves, resulting in a biophysical change.

The exact effect depends on the specific type and intensity of the radiation exposure. In general, however, a 3-millirem exposure imposes the same chance of death. And all these are a possible occurrence with dappling telecommunication masts (Levins *et al.,* 2015).

The associations between radiation exposure and cancer are mostly based on populations exposed to relatively high levels of ionizing radiation (e.g., Japanese atomic bomb survivors and recipients of selected diagnostic or therapeutic medical procedures). Cancers associated with high dose exposure include leukemia, breast, bladder, colon, liver, lung, esophagus, ovarian, multiple myeloma, and stomach cancers. Literature from the U.S. Department of Health and Human Services (2004) also suggests a possible association between ionizing radiation exposure and prostate, nasal cavity/sinus, pharyngeal and laryngeal, and pancreatic cancers.

Those cancers that may develop as a result of radiation exposure are indistinguishable from those that occur naturally or as a result of exposure to other chemical carcinogens. Furthermore, Eriksson-Backa (2014) observes that evidence from literature indicates that other chemical and physical hazards and lifestyle factors (e.g., smoking, alcohol consumption, and diet) significantly contribute to many of these same diseases.

Although radiation may cause cancer at high doses and high dose rates, public health data do not absolutely establish the occurrence of cancer following exposure to low doses and dose rates below about 10,000 mrem (100 mSv). Studies of occupational workers who are chronically exposed to low levels of radiation above normal background have shown no adverse biological effects. Even so, the radiation protection community conservatively assumes that any amount of radiation may pose some risk for causing cancer and hereditary effect, and that the risk is higher for higher radiation exposures (Gazmararian *et al.*, 1999).

A linear no-threshold (LNT) dose-response relationship is used to describe the relationship between radiation dose and the occurrence of cancer. This dose-response model suggests that any increase in dose, no matter how small, results in an incremental increase in risk. The U.S. Nuclear Regulatory Commission (NRC) accepts the LNT hypothesis as a conservative model for estimating radiation risk (Ifc, 2007).

According to Taylor and Todd, (1995), although many radioactive materials are silver-coloured, metallic solids in their pure state, they can vary in color and exist in different physical states, including liquids and gases. They are also physically indistinguishable from other (nonradioactive) metals. In addition, ionizing radiation is not detectable by one's senses. It cannot be seen, heard, smelled, tasted, or felt. For these reasons, simple visual inspection is insufficient to identify radioactive materials, and radiation sources can be virtually impossible to recognize without special markings. To address these problems, scientists (Wilson, Mood & Nordstron, 2010) have developed the following four major different but interrelated units for measuring radioactivity, exposure, absorbed dose, and dose equivalent. These can be remembered by the mnemonic **R-E-A-D**, as follows, with both common (British, e.g., Ci) and international (metric, e.g., Bq) units in use:

- Radioactivity refers to the amount of ionizing radiation released by a material. Whether it emits alpha or beta particles, gamma rays, x-rays, or neutrons, a quantity of radioactive material is expressed in terms of its radioactivity (or simply its activity), which represents how many atoms in the material decay in a given time period. The units of measure for radioactivity are the curie (Ci) and becquerel (Bq).

- Exposure describes the amount of radiation traveling through the air. Many radiation monitors measure exposure. The units for exposure are the roentgen (R) and coulomb/kilogram (C/kg).

- Absorbed dose describes the amount of radiation absorbed by an object or person (that is, the amount of energy that radioactive sources deposit in materials through which they pass). The units for absorbed dose are the radiation absorbed dose (rad) and gray (Gy).

- Dose equivalent (or effective dose) combines the amount of radiation absorbed and the medical effects of that type of radiation. For beta and gamma radiation, the dose equivalent is the same as the absorbed dose. By contrast, the dose equivalent is larger than the absorbed dose for alpha and neutron radiation, because these types of radiation are more damaging to the human body. Units for dose equivalent are the roentgen equivalent man (rem) and sievert (Sv), and biological dose equivalents are commonly measured in 1/1000th of a rem (known as a millirem or mrem).

Because radiation from nuclear material is strictly regulated, humans seldom experience large doses (~50 rem) of radiation. Nonetheless, lower doses can still damage or alter the genetic code (DNA) of irradiated cells. Moreover, high radiation doses (particularly over a short period of time) have a tendency to kill cells. In fact, high doses can sometimes kill so many cells that tissues and organs are damaged immediately. This, in turn, may cause a rapid whole-body response, which is often called “acute radiation syndrome” (WHO, 2014).

In general, the higher the radiation dose, the sooner the effects will appear, and the higher the probability of death. (The time between radiation exposure and cancer occurrence, for example, is known as the “latent period”). This syndrome was observed in many atomic bomb survivors in 1945, as well as emergency workers who responded to the Chernobyl nuclear power plant accident in 1986. Approximately 134 plant workers and firefighters battling the fire at the Chernobyl power plant received high radiation doses of 70,000 to 1,340,000 mrem (700 to 13,400 mSv) and suffered acute radiation sickness. Of those 134, 28 died from the radiation injuries that they sustained (Levins *et al*., 2015).

Although radiation affects different people in different ways, it is generally believed that humans exposed to about 500 rem of radiation all at once will likely die without medical treatment. Similarly, a single dose of 100 rem may cause a person to experience nausea or skin reddening (although recovery is likely), and about 25 rem can cause temporary sterility in men. However, if these doses are spread out over time, instead of being delivered all at once, their effects tend to be less severe (Levins *et al*., 2015).

1.1.1. Telecommunication Mast Concerns

Telecommunication firms like MTN, GLO, AIRTEL and ETISALAT among others pay so much money to people per month to just erect their masts behind their houses. Depending on your power of negotiation and location, telecommunication companies could approach lessors to put up their masts on some unused space on their land and such lessors will earn between N250, 000 – N350, 000 per month. Such a lessor does not have to do anything than allow them to put up their mast around his/her house to earn such a huge amount.

The construction, erection and deployment of telecommunication masts and towers have raised various issues, concerns and misgivings ranging from health, business, environmental, land use and planning and public safety. There are concerns about potentially negative impacts on both the social (e.g. health) and physical (e.g. aesthetics) aspects of base stations and masts. The public's perceptions of the problems revolve around issues such as health risks, mast density, location, mast height, plus the difficulty of camouflaging the masts.

Many commentators (such as Donati, 2003) have raised the question of the health and safety implications of erection of cellular masts and other communication gadgets near residential properties and areas of mass concentration of people like schools, hospitals, stadiums and residential communities. Sometime in 2004, chairman of the Nigeria Nuclear Medical Council, Professor Bola Osijo, warned that erection of telecommunication masts in residential areas was capable of causing cancer and other chronic diseases. He had disclosed then that about 50,000 Nigerians were being diagnosed with cancer yearly before the advent of the telecommunications masts, and reasoned that the influx of the masts by the telecommunications industry and their erection in residential areas could increase cases of the cancer disease. She warned that should

nothing be done to prevent indiscriminate erection of telecoms masts, more Nigerians will be afflicted with the scourge.

The World Health Organization Health (2012) sees communication as critical in managing the health of any society as it plays a vital role in increasing the awareness of the people on the health situations around which goes a long way in determining the state of their health. In its exhaustive document, the WHO (2012) outlines communication actions geared towards health literacy while at the same time underscoring the need for it to be included in policy documents of countries. The essence, it contends, was to ensure successful communication for behavioural impact. Communication for behavioural impact is a planned framework and implementation method for communication based on behavioural models and theories as well as practices to achieve behavioural results in public health programme (WHO, 2012).

Communication is expected to focus on the risky aspects of outbreaks, to be proactive, definitive towards health education, health promotion and health literacy (Carpenter, 2010). Levels of communications expected to drive the dynamics towards behavioural change include intrapersonal, interpersonal, group, organizational and social communications with the media agents providing relevance for all levels. Information is expected to align with these principles in design and execution when it deals with diseases (Dominck, 2012).

One issue of grave health concern that requires adequate health literacy is that of dealing with dappling telecommunication masts that litter the landscape of Nigeria. Base stations and cellular telephone masts form part of the infrastructure required for an effective communication system. Recently in Nigeria, there was a reported dispute between the state and federal authorities and telecommunication service providers as to which agency/level of the government is responsible for the control of erection of mast and regulation of environmental standard in telecomm industry (Husain, Gwary, Yusuf & Yusuf, 2017). The media also reported a rift between the National Environmental Standards and Regulations Enforcement Agency (NESREA) and the Nigeria Communications Commission (NCC), two federal agencies, on the power and degree of involvement in the regulation and control of masts and telecommunication towers location in Nigeria. All these are issues of concern militating against the growth and development of a

viable telecommunication industry in Nigeria. This does not preclude the almost near ignorance of what residents around these masts know of the working of the masts and attendant health concerns. Thus, there is the need to identify these areas of divergence with a view to ascertaining what the people know (Akin & Adeniji, 2014).

Thus, the general rule is that telecommunication towers above 25 meters in height would not be permitted within residential areas. However, the Commission may permit towers above 25 meters height, and in such case, the towers must be placed at a minimum of 5 meters distance to the nearest demised property, excluding the fence. While according to NESREA 2011 regulations document, the distance of foot of masts to a building should be 10 metres, to a fence should be 12 metres and a generating set should be 8 metres away from building (Akin & Adeniji, 2014).

Telecommunication requires equipment and devices that transfer (transmitters) and receive (receivers) information using electronic codes which rely on radio frequency. Advancement in telecommunication allowed for enhanced radio frequency coding which facilitated Internet and Ethernet communication technology. The recent advancement in radio frequency coding allowed for internet telephony and tele-conferencing (Alabi, 1996). Developing countries and countries with economies in transition are undergoing rapid advancement in information and communication technology (ICT) to bridge the digital gaps through the introduction of global system of mobile communication (GSM) (Osibanjo, 2009).

Although there have been no conclusive evidence in stamping a negative tag on these telecommunication masts, concerns have been raised about the health and safety of erection of cellular mast and other communication gadgets near residential properties and areas of mass concentration of people like schools, hospitals, stadium and residential communities.

However, there is no scientific evidence to back this up, even as major operators in the industry have debunked such claims and even spiral the growth of constructing more masts and getting them closer to homes than ever before (Levins *et al.,* 2015). Contentions, are, however, that if the maintained ones pose no threat, what about the un-maintained ones?

Aside the ones identified above, some environmentalists had identified some problems that may not be scientific but worth giving attention to. These include fear of physical injuries arising from defects in construction, installation and maintenance of these masts; falling masts on houses and other personal properties and public utilities; attraction for thunder lightning and the ground which becomes potent for discharge electrical charges; allurement to children and adults alike. Other concerns, which had been dealt with were danger to aircrafts; impact on visual amenities of the area (visual pollution); environmental sustainability and compatibility and the unproven notion that proximity of telecom masts to a residential property adversely affects the market value of such property to the detriment of the owner (Levins *et al.*, 2015). If these are strong as they contend, why the ceaseless erection of masts at even choice properties?

The anxiety raised by these concerns brings to fore the need to evaluate the extent of literacy available to the residents in our environment. In fact there is the need to strike a workable and an equitable balance between the economic realities of development of Telecom infrastructures and the need to protect citizens' health and physical environment of the country (Levins *et al.*, 2015).

The Niger Delta is the delta of the Niger River sitting directly on the Bight of Biafra side of the Gulf of Guinea on the Atlantic Ocean in Nigeria (Hogan, 2013). It is a very densely populated region sometimes called the Oil Rivers because it was once a major producer of palm oil. The area was the British Oil Rivers Protectorate from 1885 until 1893, when it was expanded and became the Niger Coast Protectorate. The delta is a petroleum-rich region, and has been the centre of international controversy over pollution, corruption (notably by the Abacha regime), and human rights violations (Hogan, 2015).

The Niger Delta, as now defined officially by the Nigerian government, extends over about 70, 000 km2 (27,000 sq mi) and makes up 7.5% of Nigeria's land mass. Historically and cartographically, it consists of present-day Bayelsa, Delta, and Rivers States. In 2000, however, Obasanjo's regime included Abia, Akwa-Ibom, Cross River State, Edo, Imo and Ondo States in the region. Some 31 million people of more than 40 ethnic groups including the Bini, Efik, Esan, Ibibio, Igbo, Annang, Oron, Ijaw, Itsekiri, Isoko, Urhobo, Ukwuani, Kalabari, Okrika and Ogoni,

are among the inhabitants of the political Niger Delta, speaking about 250 different dialects (NNDC, 2004).

The Niger Delta, and the "South-South Zone", which includes Akwa Ibom State, Bayelsa State, Cross River State, Delta State, Edo State and Rivers State are two different entities. While the Niger Delta is the oil-producing region of Nigeria, the South South is a geo-political zone. The Niger Delta separates the Bight of Benin from the Bight of Biafra within the larger Gulf of Guinea (NDDC, 2004).

1.2. Statement of the Problem

With the advent of the global system on mobile (GSM) telephony in Nigeria, several challenges have been thrust forth especially with the attendant economic ties. One of the identifiable marks that define the GSM surge in the country is the avalanche of telecommunication masts that apparently dot every inch of the landscape. This has elicited divergent concerns from different stakeholders with some observing that the masts pose great health risk and others suggesting that they do not. The proponents of the limited hazards to health by the telecommunication masts contend that such fears about mobile phone masts, power cables, and communication equipment in general are perpetuated by sensationalist newspapers and are often misguided (Grasso, 2008; Ifc, 2007; Cherry, 2000; Bond & Wang, 2005;Otubu, 2012; Hamblin & Wood, 2002). The opponents (such as Osibanjo, 2009) on the contrary argue that there are specific aspects of the electromagnetic spectrum that are harmful (eg. ultraviolet rays, gamma radiation, extended exposure to x-rays), and much of the rest is safe and has no effect on our health. Although, their arguments point to the fact that extent of health risk associated with telecommunication masts rays are much at a minimal level compared with the ultraviolet rays from the sun, there still exist possibilities for health risks as a result of exposure to radiation masts rays (Hamblin & Wood, 2002).

Therefore, the need exists to determine how people feel about dappling telecommunication masts in the neighbourhood and the challenges radiation from telecommunication masts pose to humans within the vicinity where these masts are erected. The inherent issues of interest here then are, whether radiation from telecommunication masts is a threat to human life, if individuals

are aware of the risks associated with dappling telecommunication masts and also their perception of it. This consideration made a research of this nature germane.

1.3. Purpose of the Study

This work explored the health risks perception among residents living within range of telecommunication masts in the South-South geopolitical zone of Nigeria. Consequent on this, the study examined the extent of health risk knowledge available to the residents. It sought to determine whether the residents are aware of the attendant health risks associated with radiation emitted by telecommunication masts in their locality. And also to ascertain if they take health action to guard against potential health condition from exposure to radiation from the masts. In more precise terms, the study pursued the following objectives:

i. To determine the extent of the residents' awareness of health risks associated with radiation that comes from dappling telecommunication masts;
ii. To determine the extent of their knowledge of health risks associated with radiation that comes from dappling telecommunication masts;
iii. To find out the residents' source of information on health risks associated with radiation that comes from dappling telecommunication masts;
iv. To ascertain their level of practice of precautionary measures against the health risks associated with radiation that comes from dappling telecommunication masts;
v. To ascertain demographic variables that influence knowledge and compliance in regard to health risks associated with radiation that comes from dappling telecommunication masts.

1.4. Research Questions

In view of the foregoing research objectives, the following research questions were formulated to guide the study:

1. What is the level of awareness among residents in South-South Nigeria regarding the health risks associated with radiation that comes from dappling telecommunication masts?
2. What is the residents' extent of knowledge of the risks associated with these dappling masts?

3. What are the residents' sources of information on health risks associated with radiation that comes from dappling telecommunication masts?
4. What is their level of practice of precautionary measures against the health risks associated with radiation that comes from dappling telecommunication masts?
5. What demographic variables influence knowledge and compliance in regard to health risks associated with radiation that comes from dappling telecommunication masts?

1.5. Significance of the Study

Since the erection of telecommunication masts have become a common phenomenon in the country, this study is significant to the regulatory agencies, health communication experts and stakeholders (lessors, lessees and residents) in the telecommunication business. For regulatory agencies, it will help them to monitor telecommunication companies who are not compliant to the regulations of setting telecommunication masts in order to take appropriate action.

For Health communication experts, the result of this study will help them in the design and implementation of effective health communication that will help the society grapple with attendant implications of radiation from dappling telecommunication masts. For lessors the findings will benefit them in having a better knowledge and understanding on the kind of site/land that can be leased to telecommunication companies for the erection of masts in line with the appropriate standards.

For lessees, it will help them to have adequate information on the kind of land/site to lease and erect telecommunication masts according to requirement of regulatory agencies, for resident, this study will give them a better understanding of radiation from telecommunication masts and debunk the general idea that those living within the vicinity are heading to their grave. For leesors and the general public (especially residents living within range of the masts), this study will serve in enlightening them as to the dangers of their closeness to dappling masts, this way, possibly eliciting precautionary response from them.

The study on a general note, will contribute significantly to existing literatures and the body of knowledge.

1.6. Scope of the Study

This work was limited to exploration of awareness, knowledge and compliance in relation to health risks associated with radiation of dappling telecommunication masts in Nigeria. Hence, data collection and analysis were restricted to the following variables: awareness/knowledge, information source, compliance and influence of demographic variables on knowledge and compliance.

Furthermore, the study was limited to residents living within close radius of telecommunication masts in the capital cities of the states within the South-South of Nigeria. This was further restricted to adults among the residents given the nature of the variables being investigated.

1.7. Definition of Terms

Certain key terms were recurring in this study; for purposes of clarity, the researcher defined these terms as follows:

Awareness: The state of knowing that there are health risks associated with living close to dappling telecommunication masts. It involves being conscious of the fact that exposure to radiations from telecommunication masts poses health hazards to humans.

Dappling: Crowded telecommunication masts in capital cities of South-South, Nigeria. It has to do with clusters of masts located where humans are living.

Health Education – This involves telling and teaching the people about their health and how best to manage it. Teaching basic health behaviour that enables the citizens to cultivate healthy habits and teach same to their offspring. It is a key step towards attaining health literacy.

Health Literacy – The ability of the citizens to understand the stimuli on health issues and decode same for effective management and control of health situations that might arise. It is a product of effective health education and health promotion.

Health Promotion – Health promotion involves a conscious approach towards educating the citizens on best health practices through all forms of media even before the outbreak of a contagious disease. Effective health promotion leads to health literacy.

Implications – The attendant positive or negative outcome arising from the location of the masts to the people and include social, health, economic, environmental and cultural; in other words, the effect of such indiscriminate location of masts on humans.

Influence – The likely impact and extent of effect that occur from the effective or ineffective application of surveillance campaigns in prevention and controlling disease. It is the outcome of adequate or inadequate preventive intervention in human health including communication-based intervention.

Knowledge: One's extent of understanding regarding the health risk associated with living close to dappling telecommunication masts. As differentiated from awareness, it involves deeper appreciation of the risks and precautionary measures against them.

Perception: One's assessment or judgment regarding the health risk associated with living close to dappling telecommunication masts. It denotes a person's evaluation of such risks; their existence, nature and how vulnerable he/she is to them.

Radiation: A type of dangerous and powerful energy that is produced by radioactive substances and nuclear reactions from telecommunication masts in South-South, Nigeria. These emissions constitute danger to the health of humans, especially when one is exposed to them to a certain level.

Residents: Those living within close radius of telecommunication masts in the capital cities of South-South, Nigeria. They are people whose houses are located in areas where there are dappling telecom masts. A resident here, is the head of a house hold – could be a man or a woman.

South-South: The Niger Delta, and the "South South Zone", which includes: Akwa-Ibom State, Bayelsa State, Cross River State, Delta State, Edo State and Rivers State are two different entities. While the Niger Delta is the oil-producing region the Nigerian South-South is a geo-political zone. The Niger Delta, as now defined officially by the Nigerian government, extends over about 70,000 km2 (27,000 sq mi) and makes up 7.5% of Nigeria's land mass.

CHAPTER TWO
LITERATURE REVIEW

In this chapter, the researcher reviewed conceptual, theoretical and empirical literature in relation to the research questions raised, in order to elucidate both the foreground and the background of the focal issue which informs the present inquiry. The theoretical framework was also discussed with the statement of the research hypothesis coming at the end of the chapter.

CONCEPTUAL LITERATURE

2.1. Radiation and Human Health: An Overview

Radiation is energy that propagates through matter or space. Radiation energy can be electromagnetic or particulate. Radiation is usually classified into non-ionizing (visible light, TV, radio wave) and ionizing radiation. Ionizing radiation has the ability to knock electrons off of atoms, changing its chemical properties (Weisstein, 2014). This process is referred to ionization (hence the name, ionizing radiation). Ionizing radiation is the main concern for health effects since it can change chemicals' properties in the human body (Levins *et al.,* 2015).

Radiation comes from many sources including cosmic rays from the universe, the earth, as well as man-made sources such as those from nuclear fuel and medical procedures. Radiation has been used in many industries including diagnostic imaging, cancer treatment (such as radiation therapy), nuclear reactors with neutron fission, radioactive dating of objects (carbon dating), as well as material analysis (Kwan-Hoong, 2003).

There are four main types of ionizing radiation: electrons (also known as beta), photons (mostly gamma ray and X-ray), charged particles (alpha) and neutrons. In a nuclear reactor, the radiation is formed due to the decay of radioactive isotopes, which are produced as part of nuclear reactions inside the reactor (Weisstein, 2014).

Each ionizing radiation type interacts with the body differently but the end results are similar. When radiation enters a body, it can deposit enough energy that can directly damage DNA or cause much ionization of atoms in tissues that would eventually cause damage to critical chemical bonds in the body. The mechanisms of how radiation damages tissues and the degree of

damage of each type of radiation are different. However, the amount of radiation needed to cause permanent damage to the tissue depends on the total dose to the body, the type of radiation, and the amount of time it takes to get that amount of radiation (dose rate). Also, depending on the total dose and/or dose rate, the effect can be acute (happen right away such as radiation burns, sickness, nausea) or delayed (long-term, such as cancer).The way that ionizing photons cause cancer is as follows. DNA is the famous double-helix chemical strand that controls how our cells manufacture proteins. It is a delicate process. DNA is held together by chemical bonds, the same as all other molecules are. High energy photons can knock electrons out of their orbits, or sometimes interact with the nucleus of an atom. To do this, the frequency of the radiation has to be high enough. It can then damage the DNA. If the frequency isn't high enough (mobile phones and radio waves are not), then, the radiation cannot cause ionization no matter how much of the radiation there is. Even when it is absorbed it is rarely cancerous (Levins *et al.,* 2015).

Most the time, because of the double-helix structure and various cellular mechanisms of DNA monitoring, the damage is repaired. It is very unlikely that photons happen to hit DNA in a cell (a cell is very large compared to the size of the DNA in the nucleus). It is also rare that when a photon hits DNA that it causes any lasting damage. And if a cell goes wrong, it is also rare that this causes the cell to turn into a cancer as most genetically damaged cells are either destroyed or self-destruct (apoptosis).

Because of the negating factors, it requires continued exposure to high doses of appropriate radiation in order for cancers to be caused. The sun, being a massive nuclear reactor (333 thousand times more massive than the Earth), is one such source. Compared to everyday exposure to ultraviolet light from the sun, no everyday human technology poses a comparable risk, and in addition, the frequencies used by telecommunications equipment is simply not high enough to be ionizing, no matter what strength of signal you are exposed to (Jelili, Asani & Afolabi**,** 2015; Levins *et al.*, 2015).

It is important to note that the health effects of radiation exposure vary for different doses. It is important to note dose is different from dose rate. Dose refers to the total amount of exposure,

while dose rate refers to the exposure per unit of time (typically per hour). The dose numbers provided in the following discussion are not exact numbers, but instead general averages.

An acute dose (received in a few days) above 250-400 Rem (2.5 – 4.0 Sv) is considered to be lethal for at least half of the population exposed. Not much is known about doses between 50 Rem and 250 Rem (500 mSv and 2500 mSv), but the exposed person will experience acute radiation sickness. The symptoms of such exposure can include nausea, vomiting, diarrhea, burns, and hair loss, but may or may not lead to near term death (Jelili, Asani & Afolabi**,** 2015; Levins *et al.,* 2015).

Below this level, no acute symptoms have been observed. For radiation exposure of less than 50 Rem there is the potential for delayed effects such as non-specific life shortening, genetic effects, fetal effects, and cancer, but little is known about the long term consequences of exposures in this range. For doses less than 25 Rem there are not enough data to determine if such an exposure can cause any long-term effects on human health at all (Jelili *et al.,* 2015).

The radioactive fission products from the affected reactors include noble gases (xenon and krypton), volatile radioactive isotopes (iodine-131 and cesium-137) and non-volatile fission products. As mentioned before, these radioactive products release radiation as they decay. Therefore, over exposure and/or contact with them is dangerous. The noble gases are usually not of a big concern since they are inert, and tend to impose very small doses. Non-volatile fission products usually stay within the fuels so that is not much of a concern to the general public either.

The fission products of most concern are the volatile ones such as I-131 and Cs-137 since they can be dispersed in air and get carried far away by wind from the affected reactors. Iodine-131 is a radioactive isotope that releases beta particles (electrons). Concentration of iodine-131 in the thyroid has been shown to cause thyroid cancer. Therefore, it is a big concern if too much iodine-131 gets out of the reactor and falls to the ground away from the affected reactors. This can contaminate food, water, and animal products such as milk.

The Japanese government has distributed iodine pills to people in the affected area. These iodine pills contain stable iodine-127, which does not cause cancer. When people take these iodine pills their bodies absorb the stable iodine to a level that prevents or limits the absorption of I-131, which helps to prevent the risk of thyroid cancer. Another fact about radioactive iodine-131 is that its half-life (the time it takes for half of it to decay to another nuclear isotope) is only about 8 days. This means that after about three months, almost all of the radioactive iodine-131 would have decayed away. Cs-137 also emits a beta particle as it decays. Exposure to Cs-137 can also increase the risk of getting cancer but that again depends on the dose and the dose rate. However, Cs-137 causes a much longer term contamination problem because its half-life is about 30 years. Depending on the amount of Cs-137 that is released, and the regulations for acceptable elevated background radiation levels, the area contaminated with Cs-137 may not be inhabitable for a long time.

2.2. Radiation – Types

Radiation is energy in the form of waves of particles. There are two forms of radiation – non-ionizing andionizing (Canadian Nuclear Safety Commission, 2003).

2.2.1. Non-Ionizing Radiation

Non-ionizing radiation has less energy than ionizing radiation; it does not possess enough energy to produce ions. Examples of non-ionizing radiation are visible light, infrared, radio waves, microwaves, and sunlight. Global positioning systems, cellular telephones, television stations, FM and AM radio, baby monitors, cordless phones, garage-door openers, and ham radios use non-ionizing radiation. Other forms include the earth’s magnetic field, as well as magnetic field exposure from proximity to transmission lines, household wiring and electric appliances. These are defined as extremely low-frequency (ELF) waves and are not considered to pose a health risk (Canadian Nuclear Safety Commission, 2003).

2.2.2. Ionizing Radiation

Ionizing radiation is capable of knocking electrons out of their orbits around atoms, upsetting the electron/proton balance and giving the atom a positive charge. Electrically charged molecules

and atoms are called ions. Ionizing radiation includes the radiation that comes from both natural and man-made radioactive materials. There are several types of ionizing radiation:

(i) Alpha radiation (α) : Alpha radiation consists of alpha particles that are made up of two protons and two neutrons each and that carry a double positive charge. Due to their relatively large mass and charge, they have an extremely limited ability to penetrate matter. Alpha radiation can be stopped by a piece of paper or the dead outer layer of the skin. Consequently, alpha radiation from nuclear substances outside the body does not present a radiation hazard. However, when alpha-radiation-emitting nuclear substances are taken into the body(for example, by breathing them in or by ingesting them), the energy of the alpha radiation is completely absorbed into bodily tissues. For this reason, alpha radiation is only an internal hazard. An example of anuclear substance that undergoes alpha decay is radon-222, which decays to polonium-218 (Canadian Nuclear Safety Commission, 2003).

(ii) Beta radiation (β): Beta radiation consists of charged particles that are ejected from an atom's nucleus and that are physically identical to electrons. Beta particles generally have a negative charge, are very small and can penetrate more deeply than alpha particles. However, most beta radiation can be stopped by small amounts of shielding, such as sheets of plastic, glass or metal. When the source of radiation is outside the body, beta radiation with sufficient energy can penetrate the body's dead outer layer of skin and deposit its energy within active skin cells. However, beta radiation is very limited in its ability to penetrate to deeper tissues and organs in the body. Beta-radiation-emitting nuclear substances can also be hazardous if taken into the body. An example of a nuclear substance that undergoes beta emission is tritium (hydrogen-3), which decays to helium 3 (Canadian Nuclear Safety Commission, 2003).

(iii) Photon radiation (gamma [γ] and X-ray): Photon radiation is electromagnetic radiation. There are two types of photon radiation of interest: gamma (γ) and X-ray. Gamma radiation consists of photons that originate from within the nucleus, and X-ray radiation consists of photons that originate from outside the nucleus, and are typically lower in energy than gamma radiation (Canadian Nuclear Safety Commission, 2003).

Photon radiation can penetrate very deeply and sometimes can only be reduced in intensity by materials that are quite dense, such as lead or steel. In general, photon radiation can travel much greater distances than alpha or beta radiation, and it can penetrate bodily tissues and organs when the radiation source is outside the body. Photon radiation can also be hazardous if photon-emitting nuclear substances are taken into the body. An example of a nuclear substance that undergoes photon emission is cobalt-60, which decays to nickel-60 (Canadian Nuclear Safety Commission, 2003).

(iv) Neutron radiation (n): Apart from cosmic radiation, spontaneous fission is the only natural source of neutrons (n). A common source of neutrons is the nuclear reactor, in which the splitting of a uranium or plutonium nucleus is accompanied by the emission of neutrons. The neutrons emitted from one fission event can strike the nucleus of an adjacent atom and cause another fission event, inducing a chain reaction. The production of nuclear power is based upon this principle. All other sources of neutrons depend on reactions where a nucleus is bombarded with a certain type of radiation (such as photon radiation or alpha radiation), and where the resulting effect on the nucleus is the emission of a neutron. Neutrons are able to penetrate tissues and organs of the human body when the radiation source is outside the body. Neutrons can also be hazardous if neutron-emitting nuclear substances are deposited inside the body. Neutron radiation is best shielded or absorbed by materials that contain hydrogen atoms, such as paraffin wax and plastics. This is because neutrons and hydrogen atoms have similar atomic weights and readily undergo collisions between each other (Canadian Nuclear Safety Commission, 2003).

2.3. Effects of Radiation

Ionizing radiation for example interacts in physico-chemical manner on contact with matter or tissue causing damage depending on the range in air and tissue penetration.

Affecting mainly dividing cells like bone marrow and gastrointestinal mucosa.

Effect may occur in exposed individuals or their offspring’s due to effect on the germ cells of the exposed individual. Effects can be deterministic or stochastic.

2.3.1. Deterministic effects:

- Increase severity with increasing dose above treshoid will lead to
- Bone marrow aplasia – cannot produce blood cells.
- Gastro intestinal tract effect leading to vomiting, diarrhea, dehydration.
- Gonads (Testis and ovaries) leading to sterility.
- Lungs – leading to acute inflammation (pneumonitis) and pulmonary fibrosis.
- Central Nervous system (CNS) causing neurological deficit.
- Skin - radiation burns, photo-dermatosis as in photo testing.
- Bone - Can cause necrosis and lymphatic fibrosis especially in therapy of breast cancer.

2.3.2. Stochastic Effects

Here severity is independent of dose but risk increases with dose and interval of exposure. Radiations that cause cancer are in this group. E.g

- Radium and thorium, ultraviolet light like sunlight - causing skin cancer like melanoma
- Radon gas is a natural form of radiation from rocks like granite, it can cause cancer of bone marrow - Leukemia (cancer of the white blood cells in the bone marrow).
- Solid tumours.

2.4. GSM Base Stations and Health Hazards

Man as a social being must interact and this is achieved by exploring every avenue that provides a cheap mean among alternatives. Cell phones serve as tool for social connection and managing social relationships among people (Banjo, Huand Sundar, 2008). However, there is currently considerable confusion over the health and safety issues relating to non-ionizing radiation emitted by GSM telephony base stations and handsets. There is obviously conflicting information from the various scientific sources and environmental groups with respect to health hazards associated with GSM telephony (Yusuf, 2009).

A growing number of studies have linked electromagnetic field associated with the operation of mobile telephony with health hazards ranging from changes in cognitive performance and sleep disturbances to serious illness and disablement, with even higher cancer rates (Abdel-Rassoul, Abou El-Fatech, Abou Salem, Michael, Farahat, El- Batanouny & Salem, 2006; Cherry, 2000;

Eger, Hagen, Lucas, Vogel & Voit, 2004; Navarro, Segura, Portolés, Gómez-Perretta, 2003; Santini, Santini, Danze, Le Ruz & Seigne, 2002; Wolf & Wolf, 2004). Hamblin and Wood (2002) claim that exposure to electromagnetic radiation can affect the natural rhythms of the brain's electrical activity, as measured by Electroencephalogram. Fernie and Reynolds (2005) note that studies of the effects of exposure to electromagnetic fields on populations of wild birds can provide further insights into the potential impacts on animal and human health. According to Cherry (2000), cell sites are risk factors for cancer, specifically brain tumours and leukemia; heart attack and heart disease, particularly arrhythmia; neurological effects including sleep disturbance, learning difficulties, depression and suicide; reproductive effects, especially miscarriage and congenital malformation; viral and infectious diseases because of reduced immune system competency associated with reduced melatonin and altered calcium ion homeostasis.

Contrariwise, some research works opposed the assertion that erection of GSM mast within residential neighbourhoods has negative effect on people's health. For instance, Chagnaud *et al.* (1999) and Heikkinen *et al.* (2001) looked at the short time effects of pulse microwave radiation on rodents and the result produced negative evidence of the effect of mast on these animals. This further alleviated the fears of people who live in close proximity to these masts. In September 1999, the Health Council of the Netherlands received a request from the Minister of Housing, Spatial Planning and the Environment; Minister of Health, Welfare and Sport; the State Secretary of Social Affairs and Employment and the State Secretary of Transport, Public Works and Water Management to advise on whether exposure to electromagnetic fields used for the data transfer between mobile telephones and base stations may result in negative health consequences. The Committee based its report on several reviewed articles and reports which have been published in recent years. Both thermal and non-thermal effects of GSM base stations on health were examined. It could not be established if exposure to electromagnetic field could cause changes to the functioning of the cell membrane (Heikkinen *et al.*, 2001).

Damage to the DNA, the genetic material, which can form a step in the development of cancer, could not also be established. The effects on brain function were investigated and on the basis of the available data, the Committee concluded that the occurrence of health problems at exposure

levels associated with the use of mobile phones is unlikely. It is considered virtually impossible that the low field strengths in the vicinity of base stations give rise to changes in cognitive functions (Health Council of Netherland, 2000).

2.5. Studies in Electromagnetic Radiation and Health Risks

European worry-worts are often criticized for their hindering of European industry with health and safety red-tape. It sometimes seems that these bureaucrats, and those staffing international bodies, go out of their way to find unlikely dangers in products. Yet despite their best efforts (over 25 000 articles have been published), the scientists have found that this time, there is no threat. Communication masts, mobile phones and power lines do not interfere with human health.

- The World Health Organisation in its 2004 report "*What are Electromagnetic Fields: Health Effects*" recorded that 25 000 articles have been published on the effects of EMF radiation in the last 30 years. It stated authoritatively that there is no evidence from these studies that the electric fields we are exposed to by masts have any negative effects on health.

- The European Parliament's scientific advisory body (SCENIHR) released a comprehensive new report in 2009 entitled "*Health Effects of Exposure to EMF*" and concluded that not only is there no likely risk from the new uses that we find for radio waves, but, modern base stations are more efficient and emit lower-intensity radiation than old-style broadcast transmitters on which extensive tests have already been done.

- The FDA and the CDC in the USA have come to similar conclusions, as have "most of the world's major national public health organizations"

- Articles in an edition of Skeptical Inquirer (2009) have served as my main sources on this page. This magazine excels at finding fault with lines of thought not supported by evidence. Its science investigators have failed to find any failings in the mainstream scientific opinion that communications technologies pose no risk to health.

One collaborative report has found that there are serious health risks, but this report is itself considered to be poor quality science:

- The *Bio-Initiative Report* was composed by "a minority of scientists [who] have helped fuel the hysteria. Yet the Bio-Initiative Report has been widely criticized in the scientific community for promoting only poorly conducted studies that support its alarmist views while ignoring far more rigorous and comprehensive studies that show no danger.

2.6. Discourses on Health Literacy

WHO (2014) sees health literacy:

> As the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health. Health Literacy means more than being able to read pamphlets and successfully make appointments. By improving people's access to health information and their capacity to use it effectively, health literacy is critical to empowerment.

This attempt explores the frame of health literacy to encompass the “narrow concept of health education and individual behaviour-oriented communication, and addresses the environmental, political and social factors that determine health”. It is a more recognizable form of internalizing health information and making a life out of it, pushing the frontiers beyond the purview of health information dissemination to health information internalization. Health Literacy promotes empowerment, which in turn is vital for achieving the internationally agreed health and development goals as well as the emerging threats such as from the pandemic influenza, climate change and non-communicable diseases.

In an earlier work, WHO (2013) makes a clear case for policy action on health literacy. The import of the document is that the extent of health literacy available to the people is significantly related to the extent of the health they have and by implication poor health literacy portends greater risk for the people. The document rooted on empirical work supports a wider and relational whole-of-society approach to health literacy that considers both an individual’s level of health literacy and the complexities of the contexts within which people act.

The data indicate that weak health literacy skills are associated with riskier behaviour, poorer health, less self-management and more hospitalization and costs while strengthening health literacy has been shown to build individual and community resilience, help address health inequities and improve health and well-being. Therefore, sectorial inputs are required to brazen up the challenges, from educational settings, workplaces, marketplaces, health systems, new and traditional media and political arenas.

Sørensen, Broucke, Fullam, Doyle, Pelikan, Slonska, Brand & Consortium Health Literacy Project European (2012) see health literacy as concerned with the knowledge and competences of persons to meet the complex demands of health in modern society noting that its importance is increasingly recognized but with concerns as to what should constitute its conceptual framework. Their conclusion was based on several definition and conceptual models that resulted in a twelve-dimension modeling to knowledge, motivation and competencies of accessing, understanding, appraising and applying health-related information within the healthcare, disease prevention and health promotion setting. They noted that apart from the dimensions of health literacy, the conceptual models summarized also give the main antecedents and consequences of health literacy outlined in the literature.

Despite the depth of literature available in this area, there has been little attention (Sørensen *et al.*, 2012) to this issue and by implication most decisions taken have been done without recourse to the health risk implication of the action. Most hit are those lessee and lessor and even residents around dappling telecommunication masts. This some argued is influenced primarily and overtly by the short term economic gains as compared to the long term health loss.

Studies have shown relationships between people's understanding of health information, that is, their level of health literacy (Parker & Schwarzberg, 2001) measured through standardized tests, and the prevalence of diabetes and hypertension (Schillinger, Grumbach, Piette, Wang, Osmond, Daher, Palacios, Sullivan & Bindman, 2002; Schillinger, Bindman, Wang, Stewart & Piette, 2004). Health literacy has, furthermore, been linked to age and education level (Baker *et al.*, 2000; Gazmararian *et al.*, 1999).

Health information literacy includes both health literacy and information literacy and can be defined as abilities required to recognize a need for health information, to know how and where to find information about health, and how to evaluate and use this information in everyday life to make good health decisions (Medical Library Association, 2003). In all, Eriksson-Backa (2014) contends that there is significant relationships between quality of health literacy and some illnesses which are often naturally more prevalent especially among people of higher age. Persons with lowest level of education were often more overweight or obese than others owing to the paucity of health information at their use and that health literacy is most likely to be measured in quite a different way.

McIntyre *et al.* (2013) maintained that health literacy scores varied in this sample of medical aid program members recently discharged from the hospital they studied in London where 15% had scores indicating they may struggle with most patient education material. However, health literacy level was not associated with degree of medication adherence after discharge. Planned next steps in this study are to explore the role of motivation and other individual characteristics on medication adherence and other self-care behaviors. Improved understanding of experiences and behaviors following hospital discharge will aid in the tailoring of interventions to reduce avoidable readmissions for persons receiving medical aid.

2.6.1. Health Literacy and Health Risks

In the discourse about health risks, health literacy inevitably becomes relevant given that it is an important variable in the manner and extent people are protected or exposed to health risks (Becker & Maiman, 1975; Glendon & Walker, 2013). Health literacy within the context of health risk relates to awareness of risk, knowledge of risk, source of information on risk, perception of risk and precautionary action against risk among others. These concepts are discussed below.

2.6.1.1. Awareness/Knowledge of Health Risks

Awareness, as a health communication concept, relates to the extent to which a person knows of existence of a fact or situation (Adenike, Surukat, Sennuy, Adegboyega, 2015). Awareness, in other words, is associated with one’s level of consciousness about a particular state of things. It

describes the state of knowing that a thing or a situation exists. Awareness is an initial crucial step towards behaviour change and since a health message ultimately aims at inducing behaviour change – whether corrective or preventive – in the audience, it ought to be concerned with the extent to which such campaign induces awareness (Amah, 2008). Adenike *et al.* (2015) discuss this crucial place of awareness in attitude change:

> Awareness of personal risk behaviour is supposed to be especially important to proceed to behaviour change. It can be expected that people may only proceed to contemplate behaviour change when they are aware that their current behaviour has some risk associated with it. Without such awareness, they may not be motivated to change (p.315).

The above argument has been aptly summarized by Noar (2006) when he argues that "behaviour change must begin with awareness" (p.39). Stated differently, awareness is a crucial variable in positive health behaviour; one who has awareness is more likely to avoid risky behaviour than one who lacks such (Adenike *et al.*, 2015).

Knowledge is a deeper cognitive disposition than awareness. While the two words – "awareness" and "knowledge" – have been used interchangeably, development communication experts often see the need to draw a line between the two. This tendency is evident in the following comments by Noar (2006):

> Awareness and knowledge are two words that can be used interchangeably in certain contexts. However, there is a distinct difference between awareness and knowledge. Awareness is perceiving, knowing, feeling, or being conscious of events, objects, thoughts, emotions, or sensory patterns. Knowledge is facts, information, and skills acquired through experience or education. The key difference between awareness and knowledge is that knowledge is associated with deep understanding and familiarity with a subject whereas awareness does not imply a deep understanding (p.37).

Stated differently, knowledge is deeper than awareness; it denotes further insight beyond mere consciousness of a fact or situation. Hence, knowledge has equally been defined as awareness taken a step further. Adenike *et al.* (2015) contend that knowledge may not always be enough in achieving behaviour change as a person may require deeper appreciation of a situation to be adequately equipped for creative response.

In the context of health risk, one may be considered to have some reasonable degree of awareness and knowledge in the following circumstances, according to Noar (2006):

i. If they are aware that a certain risk exists
ii. If they understand the behaviours that exposes one to such risk
iii. If they understand the circumstances that makes one exposes to such risk
iv. If they appreciate how much they are exposed to such risk
v. If they know preventive actions to take against such risk
vi. If they know corrective actions to take against such risk

Like other qualities acquired by humans, awareness and knowledge do not subsist in a vacuum. Their existence or non-existence is hinged on certain factors of personal and environmental nature. Thus, awareness and knowledge are influenced by one's interest in a subject or issue, availability of information, access to means of information (media, conferences, etc), and culture (Noar, 2006; Amah, 2008). Also of influence on awareness and knowledge are demographic factors like gender, age, level of education, and occupation. For instance, men and older adults have been found to be more knowledgeable on a lot of health issues than women and younger adults (Becker & Maiman, 1975; Glendon & Walker, 2013). Similarly, People's level of education often helps or undermines their chances of knowing and understanding a health phenomenon (Becker & Maiman, 1975; Noar, 2006; Amah, 2008; Glendon & Walker, 2013). The same also applies to people's occupation. For instance, an electrical engineer or a health personnel may be more likely to possess more knowledge on the health risks of radiations from telecommunication masts (Noar, 2006; Amah, 2008). Thus, knowledge and awareness cannot be explained just simplistically without taking cognizance of the complex nexus of variables of psychological and sociological nature that shape them (Becker & Maiman, 1975; Noar, 2006).

2.6.1.3. Source of Information on Health Risks

Source of information is a crucial factor in the extent one knows, believes and perceives a health risk (Erdogan, 1999; Eisend, 2006). By source of information is meant the channel through which one is exposed to information. One's source of information may help or undermine clarity, comprehension and credibility/believability in relation to such information (Erdogan, 1999; Eisend, 2006). Information sources like television and radio may be viewed to be more

favourable in terms of clarity than say newspaper or magazine depending on the nature and context of the message in question, while the reverse may be the case in another situation (Eisend, 2006). Of course one's personal preference and disposition are also put into consideration in this respect.

On the credibility front, much has been said and written about how traditional sources like newspaper, radio and television represent a more reliable source of information than the Internet. This is due to the Internet's unregulated nature which opens the way for entry of all manner of information ranging from the most insightful to the most ridiculous (Davenport, 2012; Nwagwu, 2007). However, this position has also been challenged on the ground that context of communication and personal orientation of the receiver could affect their perception of source credibility (Dreyfus, 1998; Armstrong & Forde, 2003; Christopherson, 2007; Adeniran, 2008).

Importantly, one's access or non-access to a given source of information could be a decisive factor in the person's ability to know about something in the first place. Hence, exposure to information sources particularly the mass media has been an important subject of attention in the study of health communication (Eisend, 2006). Such exposure is as critical as the media themselves because without audience exposure, the media are as good as ineffective as argued by Daramola (2003):

> When the media give out messages – be they news, entertainment or advertisement – the intention is to get it across to a targeted set of viewers, listeners or readers otherwise known as the audience. This category of persons ought to receive these messages, if not, the messages are dead on arrival. They must receive the messages before ever one can think of their reaction or feedback… In essence, the audience is an integral part of the communication process because if the message does not get to it, then the communication chain is broken (p.117).

Hence, Billy (2009) is right when she asserts that the first aim of any media campaign is to achieve audience exposure. Regarding health campaigns, she argues that "our desire to elicit positive response from the audience must first of all recognize that no such response can be possible in the first place without exposure" (p.114).

Scholars like Okunna and Omenugha (2012), McQuail (2010), Baran and Davis (2010) and Daramola (2003) among others have engaged the question of exposure and how it operates in our media-saturated society. The consensus generally has been that media exposure is a function of several variables which are at times interlocking. According to Daramola (2003), media exposure could be determined by audience-related factors such as the economic standing of the audience, their literacy level, disposition, preferences and habit, location etc and environmental factors such as availability of a particular medium in a place, the availability and effectiveness of supporting infrastructure such as electricity and the media use culture prevalent in a place.

2.6.1.3. Precautionary Practices Against Health Risks

Precautionary practices against health risks refer to the appropriate behaviour which a person may take against a health risk. It has to do with some actions that may be taken or avoided in order to forestall the perceived hazard (Becker & Maiman, 1975; Eisend, 2006; Glendon & Walker, 2013).

According to Eisend (2006) proper behaviour towards health risk would include the following actions:

i. Avoiding the risky circumstance
ii. Stopping the action that exposes one to the risk
iii. Seeking medical check/treatment after exposure to risk

In other words, the foregoing are the desirable actions expected of those exposed to one form of health risk or the other. However, for such behaviour to be realised, there ought to be first awareness, knowledge and proper attitude. A person ought to perceive risk in a situation and know the recommended action for dealing with the risk before he/she may be expected to take any reasonable action against the risk (Glendon & Walker, 2013). It is in this light that the protection motivation theory holds that “people are more likely to protect themselves when they anticipate negative consequences, have the desire to avoid them and feel they have the ability to take preventive measures” (Becker & Maiman, 1975, p.209). Anticipation of negative consequences is related to awareness and knowledge; it is another way of saying that one is

aware or knowledgeable about a risk situation. It is also referred to as threat appraisal process which Glendon and Walker (2013) comment on as follows:

> The threat appraisal process consists of both the severity and vulnerability of situation. It focuses on the source of the threat and factors that increase or decrease likelihood of maladaptive behaviours. Severity refers to the degree of harm from the unhealthy behavior. Vulnerability is the probability that one will experience harm. Another aspect of the threat appraisal is rewards. Rewards refer to the positive aspects of starting or continuing the unhealthy behavior. To calculate the amount of threat experienced take the combination of both the severity and vulnerability, and then subtract the rewards (p.3).

In other words, health action is necessarily preceded by awareness/knowledge and proper attitude or perception (Glendon & Walker, 2013). Thus, the sequence of response to risk proceeds from awareness/knowledge to attitude (perception) and ultimately to behaviour. This sequence of effect occurs in the three domains of human mind which Cartwright (1972) describes respectively as the cognitive structure, the motivational structure and the behavioural structure.

But apart from awareness/knowledge and attitude, there are other factors affecting the likelihood that a person will take precautionary action against an identified health risk. These include socio-economic factors which may affect an individual's capacity to take the requisite action where, for instance, such action requires spending. The accessibility of the means of such action may also be of a limiting effect; for instance, where one may need to visit a hospital or consult an expert but cannot find such available (Becker & Maiman, 1975; Glendon & Walker, 2013).

2.7. Health Risk Implications of Telecommunication Masts

Despite arguments in favour of non-existence of risk factors with regard to telecommunication masts, a study by Akintonw, Busari, Awodele and Olayemi (2009) contends that there are health hazards of non-ionizing radiation from telecommunication mast on exposed community with the hazard profile showing majority (62%) having different symptoms with headache being the most frequent (51.6%), similar to other established findings. There is equally a 'significant synergistic relationship between high voltage cable and telecom mast on the health effect, where the proximity and duration of exposure to mast radiation is directly proportional to hazard effect. It

concluded emphatically that there are health implications of exposure to mast radiation and minimizing them will go a long way to improve healthy living.

The benefits include access to reliable, open and widespread system for transmitting information, drastic revolutions in communication psyche of people in developing countries, access to educational opportunities, cheaper and better telecommunication services, telemedicine, change in the way people conduct businesses, change in banking transactions and e-governance around the globe (Wilson and Wong, 2003).ICT have also aided many rescue operations by providing information on early warning signals based on geological and climatic information (Grasso, 2008).

The GSM however requires infrastructure such as transmission receiver stations which are used in boosting communication coverage. Telecommunication Base trans-receiver stations (BTSs) are designed to enhance communication radio-frequency network signals for the rapidly expanding digital telecommunication users both in urban and rural communities (Turletti et al., 1999) It also facilitates the extension of communication network accessibility to sub-urban and rural communities lacking access to telecommunication services. Typical BTS consists of telecommunication mast on which are installed radio frequency transmitters and receivers, powered by digital electronic boasters which are installed in shelters within the BTS site.

A number of environmental issues have attended the introduction of this technology. This includes the indiscriminate erection of base trans-receiver stations all over Nigeria. A conservative estimate of over 20,000 Base trans-receiver stations are scattered around the country. Many of the BTSs are situated within residential, commercial, industrial and transit routes. Aside from the risk of chronic human and environmental exposure to radiations and other environment and safety matters, air quality damage appears to be of priority (IFC, 2007), since many of the base trans-receiver stations are powered by diesel run power generating sets. Diesel run combustion engines are known to release fugitive emissions and other air pollutants (Dürkop & Englert, 2004).

Thus, the atmosphere receives gaseous and particulate pollutants from BTSs operations. The health related implications of gaseous and particulate release are of great concern (Sarnat, 2011). Some gaseous releases also have detrimental consequences such as the destruction of ozone layer, global warming and incidence of acid rain (Sivasakthivel and Siva Kumar Reddy, 2011). As a result, atmospheric emissions resulting from BTSs operations are of environmental concern. Hence the characterization of air quality in vicinities around operating base trans-receiver station sites is important in order to ascertain the human and environmental risk associated with base trans-receiver station operation.

But a recent study however contend that all the demanding attention due to the expansion of networks and base station installation does not really amount to anything since after comparing with international best practices and maximum permissible exposure limit of 107µW/m2. The study specifically revealed that the exposure levels in these areas are low and as such not able to produce significant health risks among the people of these areas (Akpolile, Akpolile & Osalor, 2014).

Nevertheless, Simpson (2012) stated that the proliferation of masts across our landscapes nowadays has been in direct response to increased desire for mobile communication services by the public. In order to prevent chaotic building of masts or towers all over the metropolis and to placate the citizenry who are nervous about possible health and environmental impact of these masts, co-location has been widely recommended by industry experts. A number of location strategies such as Centroid Method, Location Break-even Analysis, Factor Rating and Factor Analysis were observed by the researcher. Factor rating method was adopted to solve this problem.

The goal of Factor rating is for a mobile service provider to be able to carefully derive the maximum benefit that can be used to achieve the company's objectives by considering all relevant factors involved in deciding to locate a mast. Following the strict implementation of factor rating method on mast locations in the Cape Coast metropolitan area by five mobile service providers, optimal locations were discovered. Based on findings, propositions which can be inferred include; relocation of existing mast, mounting of additional telecommunication

equipment on existing mast, sharing of telecommunication infrastructure, outsourcing of tower and mast management to third party companies, and finally, consideration for co-location by telecom companies as a means of dealing with any health issues arising from all of these. Invariably, how well are the residents aware of all of these and how do they attend to them?

Findings from Olatunji and Olatunbosun (2013) suggest that atmospheric concentrations of gasses and noise variants measured in the base telecommunication stations investigated were low and did not exceed the Federal Ministry of Environment (FMENV) stipulated threshold concentrations for potential air contaminants in the ambient air, except in some rare chemical cases but not at detectable levels. The measured noise levels were below the 90 dB FMENV.

2.8. Regulation of Telecommunications Installations

Telecommunications regulatory bodies are established in different countries. These bodies are saddled with the responsibility of regulating the activities and affairs of telecommunications industry. In Nigeria, the Nigerian Communications Commission (NCC) is the specific regulatory body in the telecommunications industry. The NCC was first established in 1992 by the Nigerian Communications Commissions Act No 75 of 1992.

By the enactment of the Nigerian Communications Act 2003, which repealed the Nigerian Communication Commission Act, the NCC is a body corporate with perpetual succession and a common seal, capable of suing and being sued in its corporate name. It is conferred with the power to do all such things that are necessary for or incidental to the carrying out of its functions and duties under the law. The NCC has many functions under the Act, but with particular reference to installation of telecommunications equipment and facilities, the commission has the function of:

- Proposing, adopting publishing and enforcing technical specifications and standards for the importation and use of communications equipment in Nigeria and for connecting and interconnecting communications equipment and systems.
- The formulation and management of Nigeria’s inputs into the setting of international technical standards for communications services and equipment.

- Carrying out type approval tests on communications equipment and issuing certificates therefor on the basis of technical specifications and standards prescribed from time to time by the commission.

2.8.1. Technical Specifications for the Installation of Telecommunications Masts and Towers

By the power conferred upon it under the Act, the NCC in 2009 published *Guidelines on Technical Specifications for the Installation of Masts and Towers*. The guidelines provide standards to be adhered to by telecommunications services providers/operators, designers, fabricators and installers of telecommunications towers towards ensuring environmental safety and sound engineering practices (Adekunle, Ibe, Kpanaki, Umanah, Nwafor & Essang, 2015).

The guidelines take cognizance of types and constituents of tower structures and also provide a comprehensive data on wind speed in Nigeria which may be used as reference materials for engineers in the design of masts and towers. In the guidelines, concerns about public safety and safety of personnel and equipment are addressed and accordingly the responsibilities of owners, designers and fabricators of telecommunications masts and towers relating thereto are set out.

2.8.2. Erection of Towers and Masts

The sitting of telecommunications masts and towers must take cognizance of the provisions of the Nigerian Communications Act and be guided by the provisions of the Guidelines on Collocation and Infrastructure Sharing issued by the Commission, in such a way as to minimize the number, protect and promote public safety and mitigates adverse visual impacts on the community. All masts and towers located within residential areas must conform to the stipulated set back guidelines to mitigate the effect of heat, smoke and noise pollution arising from generating sets.

Thus, the general rule is that telecommunications towers above 25 metres in height would not be permitted within residential areas. However, the Commission may permit towers above 25 metres height and in such a case, the towers must be placed at a minimum of 5 metres distance to the nearest demised property, excluding the fence. What is important here is that prior

permission of the NCC must be obtained. The commission reserves the power to remove any tower or mast located in contravention of the guidelines on sitting of towers and masts and the owner would bear the cost of such removal.

All towers must be located within the buildable area of the property and not within the front, rear or side building setbacks. All towers in excess of 150 metres in height must be set back by a minimum of 50 metres from the right of way of all controlled access designed as freeways in order to provide unobstructed flight paths for helicopter. In respect of demised properties, the distance for setback is 5 metres excluding the fence or the distance specified as a potential hazard area by the designer of the structure.

2.8.3. Environmental Requirements

Generally, the maximum height for a telecommunications tower shall not exceed 150 metres, otherwise the approval of the commission must be obtained of it is satisfied that the increased height:

- will not be detrimental to public health safety or general welfare;
- will not have negative effect on the neighborhood;
- is in conformity with the plan of the particular area and the general plan of the community; and
- will not impair compliance with any other applicable laws or guidelines.

2.8.4. Structural Certification

Before the installation of a tower, mast or antenna support structure on any building or roof, the commission must be provided with a structural engineer's certification that the structure will support and not be adversely affected by the proposed masts, tower, antenna and associated equipment.

2.8.5. Collocation and Infrastructure Sharing

In its responsibility to promote fair competition and encourage and promote infrastructure sharing among licensees, the NCC developed and issued guidelines for collocation and infrastructure sharing. Collocation is the placement of transmission equipment owned by the

interconnection demanding operator in the premises of the interconnection providing operator for interconnection to that operator's network. Infrastructure sharing is the joint use of network facilities by two or more operators subject to agreement specifying relevant technical and commercial conditions (Adekunle *et al.*, 2015).

The guidelines on collocation and infrastructure sharing are designed and developed to encourage collocation and infrastructure sharing (C/IS) between operators within a predetermined framework to remove uncertainty and create an environment for better co-operation (Adekunle *et al.*, 2015).

2.8.6. Objectives of the Guidelines on Collocation and Infrastructure Sharing

The primary object of the guidelines is to establish a framework within which communications operators can negotiate Collocation and Infrastructure Sharing arrangements. Specifically, the Guidelines are made:

• To ensure that incidence of unnecessary duplication of infrastructure is minimized or completely avoided;

• To protect the environment by reducing the proliferation of infrastructure and facilities installations;

• To promote fair competition through equal access being granted to the installations and facilities of operators on mutually agreed terms.

• To ensure that the economic advantage derivable from the sharing of facilities is harnessed for the overall benefit of all telecommunications stakeholders;

• To minimize operators' capital expenditure on supporting infrastructure and to free more funds for investment in core network equipment; and

• To encourage operators to pursue a cost-oriented policy with the added effect of a reduction in the tariffs chargeable to customer.

2.8.7. Legal Framework for Environmental Protection

Prior to the dumping of toxic waste in Koko Village in Delta State of Nigeria in 1987, Nigeria was ill-equipped in managing serious environmental issues as there were no institutional arrangements or mechanisms for environmental protection and enforcement of environmental laws and regulations in the country. Following the Koko toxic waste episode, the Federal

Government promulgated the Harmful Waste Decree 42 of 1988, which facilitated the establishment of the Federal Environmental Protection Agency (FEPA) through Decree No 58 of 1988.

However, the establishment of FEPA was without an appropriate enabling law on enforcement issues, and in order to address the highly situation of lack of enforcement law in the field of environmental law, the National Environmental Standards and Regulations Enforcement Agency (NESREA) was established as a parastatal of Federal Ministry of Environment, Housing and Urban Development.

2.9. A Glance at the Major Telecoms HSE Regulatory Bodies in Nigeria

There are no specific standard and regulatory bodies or agencies dedicated for the regulation and management of mobile telecoms HSE in Nigeria. This understandably, and like in many parts of the world, is largely due to the diverse and multi-disciplinary nature of the HSE related hazards or issues. In Nigeria, telecoms HSE related issues are generally handled by appropriate Ministries and/or their designated agencies/departments. Not one agency has come out with detailed telecoms related occupational health and safety specific hazards or Environmental aspects management requirement or guideline.

However, this is not to undermine the effort of the National Environmental Standards and Regulations Enforcement Agency (NESREA) to evolve the industry specific Environmental regulatory standards in 2011: The *National Environmental (standards for telecommunications and broadcast facilities) Regulations 2011*. Below are some of the key players in HSE regulation and administration in Nigeria.

2.9.1. The factories Act (Factory Act cap 126, LFN, 1990) and 'the Occupational safety and Health bill 2005*:*

The factories Act as contained in the Laws of the Federation of Nigeria 1990 seek to legislate and regulate the conduct of health and safety in the Nigerian workplaces. It was enacted in June 11, 1987 with the desire to protect the workers and other professionals against exposure to occupational hazard. The director of factories at the Federal Ministry of Employment, labor and

productivity is responsible for the administration of the provisions or requirements of this Act. The director and his team (inspectors) are vested among other, with responsibilities to register, inspect premises or factories, prohibit and administer penalties.

The apparent limitations in the nomenclature, scope, suitability and applicability of the factories Act within the current occupational Health and safety realities led to proposition of the Occupational Safety and Health bill 2005. For instance, on failure to report fatal accident by a company, the factories Act section 51(4) of the Act state: Any employer or occupier of a factory who fails to report an incident under this section shall be guilty of an offence and shall on conviction be liable to a fine not exceeding N1000:00. You'll agree with me that this penalty is inadequate to deter any factory from failing to report fatal incidents.The bill which also falls short of providing regulations standards for telecoms specific occupational Health and Safety hazards challenges is yet to move beyond the second reading at the National Assembly since 2005.

2.9.2. The National Environmental Standards and Regulations Enforcement Agency Act (NESREA Act 2007):

The National Environmental Standards and Regulations Enforcement Agency (NESREA) of the Federal ministry of Environment, housing and urban development is charged with the responsibilities of ensuring the wholesomeness of the entire Nigerian Environment through the development and enforcement of Environment standards and regulation.

This is explicitly stated in the NESREA act 2007 sections 2 and 7(a - m); Section 2 reads: 'the Agency (NESREA), shall, subject to the provision of the Act, have responsibility for the protection and development of the Environment, biodiversity conservation and sustainable development of the Nigeria's natural resources in general and environmental technology, including coordination and liaising with relevant stakeholders within and outside Nigeria on matters of enforcement of environmental standards, regulations, rules, laws, policies and guidelines. These functions obviously include the telecoms sector environmental standards and regulatory requirements.

NESREA is charged with the responsibility for the protection and development of the environment, biodiversity conservation and suitable development in Nigeria's natural resources in general. The vision of the agency is to ensure a cleaner and healthier environment for all Nigerians while the mission is to inspire personal and collective responsibility in building an environmentally conscious society for the achievement of sustainable development in Nigeria.

The agency has a wide range of powers. In the sphere of environmental protection, the agency can prohibit processes and use of equipment or technology that undermine environmental quality. It can also conduct field follow-up compliance with set standards and take procedures prescribed by law against any violator.

The agency is also empowered to establish mobile courts to expeditiously dispense cases of environmental infringements. The agency can conduct public investigations and make proposals to the Minister for the review of existing guidelines, regulations and standards on environment. The agency can also establish programmes for setting standards and regulations for the prevention, reduction and elimination of pollution and other forms of environmental degradation in the nation's air, land, oceans, seas and other water bodies and for restoration and enhancement of the nation's environment and natural resources.
Specifically, the functions of NESREA are to:

(a) Enforce compliance with laws, guidelines, polices and standards on environmental matters;
(b) Coordinate and liaise with stakeholder, within and outside Nigeria, on matters of environmental standards, regulations and enforcement;
(c) Enforce compliance with the provisions of international agreements, protocols, conventions and treaties on the environment, including climate changes, biodiversity, conservation, desertification, forestry, oil and gas, chemicals, hazardous wastes, ozone depletion, marine and wide life, pollution, sanitation and such other environmental agreements as may from time to time come into force;
(d) Enforce compliance with policies, standards, legislation and guidelines on water quality, environmental health and sanitation, including pollution abatement;

(e) Enforce compliance with guidelines and legislation on sustainable management of the ecosystem, biodiversity conservation and the development of Nigeria's natural resources;
(f) Enforce compliance with any legislation on sound chemical management, safe use of pesticides and disposal of spent packages thereof;
(g) Enforce compliance with regulations on the importations, exportation, production, distribution, storage, sale, use, handling and disposal of hazardous chemicals and waste other than in the oil and gas sector;
(h) Enforce through compliance monitoring, the environmental regulations and standards on noise, air, land, seas, oceans and other water bodies other than in the oil and gas sector;
(i) Ensure that environmental projects founded by donor organizations and external support agencies adhered to regulations in environmental safety and protection;
(j) Enforce environmental control measures through registrations, licensing and permitting systems other than in the oil and gas sector;
(k) Conduct environmental audit and establish data bank on regulatory and enforcement mechanisms of environmental standards other than in the oil and gas sector;
(l) Create public awareness and provide environmental education on sustainable environmental management, promote private sector compliance with environmental regulations other than in the oil and gas sector and publish general scientific or other data resulting from the performance of its functions;
(m) Carry out such activities as are necessary or expedient for the performance of its functions.

2.9.3. Right to Quality of Telecommunications Services versus Right to Healthy Environment

Every consumer of telecommunications services is entitled to such minimum standards of quality of service. Quality of Service in this sense is a measure of the telephone service provided to a subscriber. Call must be clear and easy to hear. It must be loud enough and the longest time a consumer should wait after picking up the phone before receiving dial tone must be adequately determined.

The consumers should be able to enjoy required applications services such as emergency services, directory assistance services, operator assistance service and services for disabled

customers. As part of the functions of NCC, the NCC shall protect and promote the interests of customers against unfair practices including matters relating to availability and quality of communications services, equipment and facilities.

Operating companies must provide and list in their directory a 24 hour repair service number. Consumers should have the right to access vendor's annual quality of service reports. Licensees must also comply and cause their agents to comply with the relevant fault repair standards set out in the NCC's Quality of Service Regulations. Licensees must also endeavour to give advance warning of anticipated service disruptions or planned outages, including details of the disruption or outage, the services and service area affected and any applicable compensation or other remedies.

The consumer has right to be protected against the marketing of goods that are hazardous to public health. In specific regard to emergency services, the NCC has the responsibility to promote and enhance public safety through the use of a particular number which shall be designated as the universal safety and emergency assistance number for telephony services generally.

The need for consumer right to safety is to provide goods and render services, the consumption of which will not be inimical or hazardous to consumer's health and the social well-being at large. The crucial question is how an average consumer of telecommunications service discerns exactly how unhealthy radiation is being emitted from the hand-phone while making or receiving calls or charging the batteries? Can one assume that a consumer of telecommunications service can know whether tasteless and odourless poisonous and harmful gases or other objects is seeping into his mouth, ear and environment from the hand-phone or base stations?

The licensee is duty-bound under section 135 (3) (b) of the Nigerian Communications Act to take all reasonable care in connection with installation of network facilities to protect the safety of property. This is done by the agency carrying out series of inspections and testing of equipment to be used.

2.10. Environmental Impacts of Telecommunications Installations

The Nigerian telecommunications sector is the fastest growing sector of the economy in Africa, from about 450,000 telephone lines in 2001 to over 78,000,000 in 2010. However, this growth has resulted in the establishment of more telecommunications infrastructure such as installations of masts and base stations. This has raised serious environmental concerns, especially in the area of Environmental Impact Assessment. NESREA has clamped down on telecommunications operators and has even decommissioned some telecommunications masts for failure to comply with Environmental Impact Assessment (Adekunle *et al.*, 2015).

Telecommunications installations need to consider environmental implications in the installations. Non- compliance with Environmental Impact Assessment may result in very high noise level, compared to what should be obtainable in a residential area. Quite often, installations made without Environmental Impact Assessment become curses instead of blessings they were originally conceptualize to become. The failure of telecommunications operators and service providers to adhere to Environmental Impact Assessment regulations before installation of equipment and base stations may also be responsible for the worsening of ecological problems across the country (Adekunle *et al.*, 2015)..

The need to have an environmental regulation governing the telecommunications sector is as a result of petitions and out-cries of Nigerian public on the activities of telecommunication operators, especially with regard to the setting of their masts. Noise from their base-stations, oil leakages, the vibration, the smoking pollution and oil to well pollution are the adverse effects of telecommunications installations if necessary assessment is not carried out (Adekunle *et al.*, 2015)..

The health hazards of indiscriminate installation of masts and base stations are also associated with Electro Magnetic Fields (EMF) emissions from base stations and telecoms masts. There have been growing concerns about the adverse effects on the general public from exposure to radiofrequency energy and concerns have also been expressed about the erection of Radio Frequency (RF) base stations close to residential buildings (Adekunle *et al.*, 2015)..

2.11. Health Risk Implications from Telecommunication Masts

Despite arguments that arguments of non-existence risk factors associated with telecommunication mast, study by Akintonw, Busari, Awodele & Olayemi (2009) contends that there are health hazards of non-ionizing radiation from telecommunication mast on exposed community with the hazard profile showing majority (62%) having different symptoms with headache being the most frequent (51.6%), similar to other established findings. There is equally a 'significant synergistic relationship between high voltage cable and telecom mast on the health effect, where the proximity and duration of exposure to mast radiation is directly proportional to hazard effect. It concluded emphatically that there are health implications of exposure to mast radiation and minimizing them will go a long way to improve healthy living.

The benefits include access to reliable, open and widespread system for transmitting information, drastic revolutions in communication psyche of people in developing countries, access to educational opportunities, cheaper and better telecommunication services, telemedicine, change in the way people conduct businesses, change in banking transactions and e-governance around the globe (Wilson and Wong, 2003).ICT have also aided many rescue operations by providing information on early warning signals based on geological and climatic information (Grasso, 2008).

The GSM however requires infrastructure such as transmission receiver stations which are used in boasting communication coverage. Telecommunication Base trans-receiver stations (BTSs) are designed to enhance communication radio-frequency network signals for the rapidly expanding digital telecommunication users both in urban and rural communities (Turletti et al., 1999) it also facilitates the extension of communication network accessibility to sub-urban and rural communities lacking access to telecommunication services. Typical BTS consists of telecommunication mast on which are installed radio frequency transmitters and receivers, powered by digital electronic boosters which are installed in shelters within the BTS site.

A number of environmental issues have attended the introduction of this technology. This includes the indiscriminate erection of base trans-receiver stations all over Nigeria. A conservative estimate of over 20,000 Base trans-receiver stations are scattered around the

country. Many of the BTSs are located within residential, commercial, industrial and transit routes. Aside from the risk of chronic human and environmental exposure to radiations and other environment and safety matters, air quality damage appears to be of priority (IFC, 2007), since many of the base trans-receiver stations are powered by diesel run power generating sets. Diesel run combustion engines are known to release fugitive emissions and other air pollutants (Dürkop and Englert, 2004).

Thus, the atmosphere receives gaseous and particulate pollutants from BTSs operations. The health related implications of gaseous and particulate release are of great concern (Sarnat, 2011). Some gaseous releases also have detrimental consequences such as the destruction of ozone layer, global warming and incidence of acid rain (Sivasakthivel and Siva Kumar Reddy, 2011). As a result, atmospheric emissions resulting from BTSs operations are of environmental concern. Hence the characterization of air quality in vicinities around operating base trans-receiver station sites is important in order to ascertain the human and environmental risk associated with base trans-receiver station operation.

But a recent study, however, contends that all the concern about expansion of networks and base station installation is not really necessary in the light of international best practices and maximum permissible exposure limit of 107μW/m2. The study specifically revealed that the exposure levels in these areas are low and as such not able to produce significant health risks among the people of the areas (Akpolile, Akpolile & Osalor, 2014).

Nevertheless, Simpson (2012) states that the proliferation of masts across our landscapes nowadays has been in direct response to increased desire for mobile communication services by the public. In order to prevent chaotic building of masts or towers all over the metropolis and to placate the citizenry who are nervous about possible health and environmental impact of these masts, co-location has been widely recommended by industry experts. A number of location strategies such as Centroid Method, Location Break-even Analysis, Factor Rating and Factor Analysis were observed by the researcher. Factor rating method was adopted to solve this problem.

The goal of Factor Rating is for a mobile service provider to be able to carefully derive the maximum benefit that can be used to achieve the company's objectives by considering all relevant factors involved in deciding to locate a mast. Following the strict implementation of factor rating method on mast locations in the Cape Coast metropolitan area by five mobile service providers, optimal locations were discovered. Based on findings, propositions which can be inferred include; relocation of existing mast, mounting of additional telecommunication equipment on existing mast, sharing of telecommunication infrastructure, outsourcing of tower and mast management to third party companies, and finally, consideration for co-location by telecom companies as a means of dealing with any health issues arising from all of these. Invariably, how well are the residents aware of all of these and how do they attend to them?

Findings from Olatunji and Olatunbosun (2013) suggest that atmospheric concentrations of gasses and noise variants measured in the base telecommunication stations investigated were low and did not exceed the Federal Ministry of Environment (FMENV) stipulated threshold concentrations for potential air contaminants in the ambient air, except in some rare chemical cases but not at detectable levels.

2.12. The Challenges of the Setback Regulations.

The NCC and NESREA prescribed setbacks of 5m and 10m respectively for sitting telecoms mast/towers away from existing building. Understandably, the aim is to ensure minimal exposures to such Environmental hazards as noise, vibration, Gen set fumes and gaseous emission and RF EMF exposure etc. This is placing additional strain on the deployment of the required Base stations especially in built-up areas. One of the options available for the operators will be to locate them away from the communities as green fields. Such locations will be built-up sooner or later anyway and the cycle will continue. More so, providing telecom coverage for such areas will require transmitting at relatively higher powers for the desired result thus, bringing yet another challenge associated with elevated Environmental RF EMF level and service interruptions.

Interestingly, experience has shown that a well-positioned, adequately maintained and sound-proofed 27KvA generator (note that more than 75% of the generators at base station sites are

usually 15KvA), not only conform to day and night noise requirements even at closer range but, that the change in the levels of these parameters at 5m or 10m is negligible (usually an average of 0.5-1.5 decibels for noise). Poorly maintained and inappropriately positioned gen sets at 20m or more away from residence are known to fail the requirement. Ironically people living 5m-150m range of base station are exposed to far lower RF EMF than those immediately beyond and the exposed level are usually several thousand times below the ICNIRP permissible exposure limits. So, in reality there is little benefit from the setback requirement.

2.13. EMPIRICAL LITERATURE

The empirical literature involved studies that could be broadly classified into two based on the respective themes they treated:

- Studies Related to Health Effects of Telecommunication Masts
- Studies Related to Behaviour Towards Health Effects of Masts/Radiation (i.e. awareness, perception, precautionary measures etc)

2.13.1. Studies Related to Health Effects of Telecommunication Masts

A study carried out by Akintonwa, Busari, Awodele and Olayemi (2009), examined the Hazards of Non-Ionizing Radiation of Telecommunication Mast in an Urban Area of Lagos, Nigeria. The study employed a descriptive cross-sectional survey. The socio-demographic pattern and hazard profile of the respondent were documented. The results of showed that majority of respondents (60.8%) were youth within age range of 20 – 30 years. Hazard profile showed majority (62%) having different symptoms with headache being the most frequent (51.6%), similar to other established findings. There is a significant synergistic relationship between high voltage cable and telecom mast on the health effect, with p value < 0.05. It was also shown that proximity and duration of exposure to mast radiation is directly proportional to hazard effect, with p value < 0.05. This study therefore concluded that there are health implications of exposure to mast radiation and minimizing them will go a long way to improve healthy living.

A study carried out by Michael, Nnaemeka and Taiwo (2013), examined Locational Effect of GSM Mast on Neighbouring Residential Properties' Rental Values in Akure, Nigeria. The town was divided into high, medium and Low density zone; and three GSM masts were selected from

each of the zones for the study. In all, a total of 180 questionnaires were administered on residents within the radius and 139 (77.22%) were retrieved and good for analysis. The findings revealed that majority of the respondents (70.5%) indicates no feeling about the presence of GSM mast in their neighbourhood; 21(15.1%) are happy about the location of Mast in their neighbourhood, while only 20 respondents representing 14.4% have negative feeling concerning it. On issue of perception most of the respondents (47.5%) do not see anything wrong in having Mast around them 21.6% and 13.7% of the respondents are highly satisfied and satisfied respectively, while only 17.3% are not satisfied with GSM Mast being located within their neighbourhood. This is an indication that most residents do not perceive any danger orproblem inherent in having mast near their residence. This however contradicts the findings of Bello (2010) which reveals that residents within a close proximity of GSM mast are not satisfied with the location of the mast in their neighbourhood. The perception of the respondents to the effect of mast on health has changed over the years as people no longer consider mast a threat to their health. The level of satisfaction of the respondents further reveals that Mast location is not a criterion for choice of accommodation by tenants within a neighbourhood. Respondent's Perception on the Effect of Mast on Residential Property Loss of aesthetic value of the neighbourhood was the only major effect that mast has on properties in the neighbourhood. This is evidenced by the mean score of 3.52. However, it does not have effect on the economic values of properties in the area and neither does it increase nor reduce the demand for and rent of residential properties in the area. This shows that landlord do not consider this when fixing the rents on their properties. The only major effect which a Mast has on neighbouring properties is that of loss of aesthetic values of the property. This supports the findings of Picard (1996) and Bond *et al.* (2003) that GSM mast or base station hampers the aesthetic view of neighbouring residential properties. This is in form of blockage of views of the properties. However, it neither increases nor decreases the demand or rent passing on properties. This result reveals the reason behind respondents living even in compounds where there is GSM mast. The location of GSM mast has no significant effect on rental values of residential properties in the high and medium density residential zones of Akure. This is attributable to the fact that demand for residential properties in town is generally very high, and the residents are left without much choice due to attendant high rent charged on existing residential properties.

Akin and Adeniji (2014) investigated the location adequacy of telecommunication masts and residents livability in Osogbo Local Government Nigeria. The inventory of mast in the study area was taken, the location analysis of mast and the effect of the masts and its location on residents was done. The study enumerated 35 masts located in different locations in the study area and random sampling (balloting) was used to select 12 masts in different locations. With cognizance to the acceptable standards, four zones were marked using 3m, 5m, 10m and 20m radii. for zones 1 to 4 respectively. The number of houses in each concentric zone formed the size of sample. Thus, a structured questionnaire was administered on 10 residents using systematic sampling.Correlation analysis was used to test the relationship between building-mast proximity and residents' livability. Most masts were observed to be built very close (<10m) to residences. These houses were observed to experience high disturbance due to noise from the mast, vibrations, fumes from mast generator and pollution. Health problem like headache and sleep disorder due to noise and vibration from mast, respiratory disease were also observed among such residents. Property value decline and reduced patronage were experienced by landlords of the houses closest to mast.

Adekunle, Ibe, Kpanaki, Umanah, Nwafor and Essang (2015) evaluated the effects of radiation from cell towers and high tension power lines on inhabitants of buildings in Ota, Ogun state. A case study of the effect of a cell tower with respect to buildings in Ota was done; the power densities of electromagnetic radiation on buildings around the cell tower were calculated. The calculated values were then compared with radiation norms adopted in Nigeria and other countries after which inferences were drawn. Also, the magnetic fields on buildings around the high tension transmission lines were obtained through the inverse square law and by direct measurement using a gauss meter. The results were found to exceed the safe radiation level of 0.4μT using the European standard.

Jelili, Asani and Afolabi (2015) evaluated the health implication of telecommunication mast on residents of Ogbomoso. A total of 150 copies of the questionnaire were randomly administered on residents within 50m service radius to the telecom mast, while seven other copies were administered to telecommunication service providers with masts in the study area. Secondary sources of data include the register of number and locational pattern of each of the telecom masts

as obtained from the respective service providers in Ibadan headquarter and Ogbomoso area offices. Likert's scale was used to assess the perceived psychological, physiological and environmental impacts of the mast on residents, one-sample t-test was used to compare the magnitude of such impacts with the 'test-value' of 3.00 (condition of no impact), linear regression analysis was used in testing the relationship between residents' health and distance to mast. The results, among others, show that while the psychological impact is not statistically significant, it is for physiological impact and that there is a significant relationship between residents' health and distance to mast. It was also found out that generator used in powering the mast causes water pollution.

2.13.2. Studies Related to Behaviour Towards Health Effects of Masts/Radiation

In a study to test patients' knowledge of side effects after they review six easy-to-read pamphlets on radiation side effects, Wilson, Mood, &Nordstrom (2010) reported that scores for each knowledge test increased with literacy level, with statistically significant correlations for pamphlets on fatigue, skin problems for women, and skin problems for men. That is the higher the educational level the higher the extent of health literacy and the lower the impact occasioned from health risky habits. They content that although the pamphlets were deemed easy to read, patients who had the lowest reading levels still had difficulty understanding them. Therefore, health literacy could as well be a function of interest.

Biebuma and Esekhaigbe (2011) sought to ascertain how informed and prepared consumer/users are against the reported health hazards from GSM technology. Selected places and BTS sites located at schools, residential areas and worship centres in Rivers State were used for data collection; which was done via questionnaire, oral interview and measurements. The results revealed that GSM operators in Nigeria do not detail consumers the full content of their product and slightly adhere to ICNIRP guidelines. Majority of handset dealers and users have little or no knowledge regarding the hazardous effects currently debated by the scientific community.

Edewor and Imhonopi (2013) studied the perceptions of health professionals and radiation experts in Ogun State, Nigeria on the health risks of global system of mobile communication (GSM). The study utilized evidence from literature and responses to questionnaire and in-depth

interviews among health professionals and microwave telecommunication experts in Ogun state, Nigeria. The results showed two rather opposing schools of thought. On the one hand, there are those who share the view that the radiation emitted from handsets and mast towers constitutes serious health hazards, while on the other hand, there are also those who argue that the radiations are so minimal and, as such, do not constitute any health hazards and that there is no proof of any harmful effects of GSM use. The study concluded that this controversy calls for more independent investigation on this subject while necessary precautions should be taken in the mean time.

Temaugee, Daniel, Oladejo and Daniel (2014) investigated the level of public awareness of detrimental effects of ionizing radiation in Nigeria, a case study of Federal College of Education Kontagora Niger State. A total of thirty-five (35) Lecturers and seventy-five students (75) were randomly selected from the five schools in the College. The instrument used for data collection was a questionnaire. Data obtained from the questionnaire was analysed using simple percentages. The result of the study revealed that 10 (28.6%) out of 35 lecturers and 32 (42.7%) out of 75 students of the sampled population were totally unaware of ionization radiation and its health detriments. Moreover, the remaining percentage of both Lecturers and Students had limited knowledge about ionizing radiation and its detrimental effects to humans. The research also shows that a significant percentage of both Lecturers and Students claimed that the topic 'Ionizing radiations and their health detriments' is not relevant to their field of academic inclination.

Levins, O'Meara, Ruhotina, Smith and Delaney (2015) studied public awareness and perception of ionizing radiation and guide to public health practice in Vermont United States. A questionnaire designed to assess public perception and knowledge of ionizing radiation was administered at six Vermont locations (n = 169). Descriptive and inferential statistical analyses were conducted. Eighty percent of respondents underestimated the contribution of medical imaging tests to total ionizing radiation exposure. Although only thirty-nine percent of participants were confident in their healthcare professional's knowledge of ionizing radiation, most would prefer to receive information from their healthcare professional. Only one-third of individuals who received a medical imaging test in the past year were educated by their

healthcare professional about the risks of these tests. Those who tested their home for radon were twice as likely to choose radon as the greatest ionizing radiation risk to self. Although respondents had an above-average education level, there were many misperceptions of actual risks of exposure to ionizing radiation, particularly of medical imaging tests. Educating healthcare professionals would therefore have a profound and positive impact on public understanding of ionizing radiation.

Husain, Gwary, Yusuf and Yusuf (2017) studied perception of effects of GSM infrastructure on human health in Gombe, Nigeria. The objectives of the study were to identify the location/distribution and number of existing GSM masts by service providers in Gombe metropolis, and to determine residents perception of the effect of spatial distribution of Global System for Mobile telecommunications (GSM) infrastructure on human health and the environment in Gombe metropolis. Data were collected through personal observations, interviews and questionnaire administration to residents. The study revealed that the total number of GSM masts in Gombe metropolis is 67 with the breakdown as follows; Globacom – 17 masts, accounting for 25%, Etisalat – 13 masts accounting for 19%, Airtel – 18 masts, accounting for 27%, MTN – 16 masts accounting for 24%, while Mtel has three of the masts (although not functional) accounting for 5% of masts. It was found that the GSM masts were erected within residential areas and majority of people were not comfortable living close to the masts. Accidental collapse, radiation emission, public health concern and environmental pollution are the major risks perceived by the residents. Furthermore, the study revealed that the residents perceived that the special location of the mast have introduced some changes into the environment as a result of petrochemical wastes, noise from power generating sets, RF and smoke emissions from GSM base stations and negative visual impact which the residents perceived may adversely affect human health and the environment.

2.14. Theoretical Framework

The theoretical perspective for this study revolves around the following theories:

- The Health Belief Model
- The Theory of Reasoned Action

2.14.1. Health Belief Model (HBM)

Health Belief Model (HBM) was developed to help understand why people did or did not use preventive services offered by public health departments in the 1950is, and has evolved to address newer concerns in prevention and detection (e.g., mammography screening, influenza vaccines) the HBM theorizes that people's beliefs about whether or not they are at risk for a disease or health problem, and their perceptions of the benefits of taking action to avoid it, influence their readiness to take action.

Rosenstock (1974) says the Health Belief Model (HBM) is an intrapersonal (within the individual, knowledge and beliefs) theory used in health promotion to design intervention and prevention programs. It was designed in the 1950s and continues to be one of the most popular and widely used theories in intervention science. The model was created in reaction to a failed, free tuberculosis screening program. The focus of the HBM is to assess health behaviour of individuals through examination of perceptions and attitudes someone may have towards disease and negative outcomes of certain actions.

The HBM was founded on attempts to integrate stimulus-response theory with cognitive theory in explaining behaviour. The design of the HBM was influenced by Kurt Lewin's theories which state that perceptions of reality, rather than objective reality, influence behaviour. Earlier stimulus-response theory had stressed the importance of the consequences of behaviour in predicting actions, while cognitive theory modified this by stressing the relevance of the person's subjective valuations, and their judgment of the likelihood that an action would have desired consequences.

This combined approach was termed value-expectancy theory. In this perspective, health behaviours are influenced by a person's desire to avoid illness or to get well, and by their confidence that the recommended action will achieve this. This implied a phenomenological approach; it is not the actual world, but the person's perceptions of it that influence their behaviour. It was an early attempt to improve on a behaviourist stimulus – response model and to incorporate cognitive components.

The HBM assumes that behaviour change occurs with the existence of three ideas at the same time:

1. An individual recognizes that there is enough reason to make a health concern relevant. (Perceived susceptibility and severity)
2. That person understands he or she may be vulnerable to a disease or negative health outcome. (Perceived threat)
3. Lastly the individual must realize that behaviour change can be beneficial and the benefits of that change will outweigh any costs of doing so. (Perceived benefits and barriers)

The model focused on individual perceptions, modifying factors, and lastly likelihood of action. Individual perceptions speak directly to the knowledge and beliefs that a person has about his behaviours and the outcomes they could have. This includes perceived susceptibility and perceived severity. Within the health field susceptibility refers to the risk a person has to a particular disease or health outcome. Within the context of the HBM, perceived susceptibility examines the individual's opinions about how likely the behaviours they partake in are going to lead to a negative health outcome.

For example, look at an individual who smokes. Smoking is known to have many complications such as lung cancer, bladder cancer, etc. If a smoker does not feel that he is at risk of developing any of these diseases, he has no reason in his mind to make a behaviour change. One of the Goals of the HBM is to change perceptions of susceptibility in order to move towards behaviour change.

On perceived severity, most people are familiar with the word severity as how serious a situation or action can be. In the HBM perceived severity addresses how serious the diseases that a person is susceptible to can be. In the case of a smoker, lung cancer is one of the leading causes of death among the population. A smoker may not understand how difficult lung cancer can be to detect and how difficult it can be to treat. They also may not know how painful and long lasting a disease it can be later in life. The HBM seeks to increase awareness of how serious the outcomes of behaviours can be in order increase the quality of one's life (Janz & Becker, 1984).

While individual perceptions were internalized, modifying factors step outside the body to examine and use outside influences to affect the how threatened a person feels by the outcomes of continuing the same behaviours that put him at risk. These include perceived threat which is the on how someone acknowledged that their behaviour could lead to a specific disease. Threat takes the idea one step further by examining just how likely it is that the disease could be developed.

To use lung cancer again, someone who has been smoking for a year may not feel threatened by potential disease because they have not been doing it very long and if they quit their body can recover. On the other hand, a smoker who has been doing so for 25 years may feel very threatened by lung cancer if he has developed a strong cough. The cough could be a symptom that increases his level of threat and triggers his decision to quit. Others are environmental factors and cues to action (Rosenstock, 1974).

2.14.2. Relevance of Health Belief Model to study Radiation and Dappling Telecommunication Masts

The establishment of more telecommunications infrastructure such as masts and base stations has raised some environmental concerns, especially in the area of Environmental Impact Assessment. It has become a part of the environment to see tall masts in different locations around the country. These masts though helpful, are believed to have negative health effects on people living near where they are erected. It is argued that telecom towers interfere with aircrafts approaching landing and feared that towers could fall on people and property. The erection of masts clustered in built-up areas are thus said to be hazardous.

The HBM has been most-often applied for health concerns that are prevention related and asymptomatic, such as early cancer detection and hypertension screening where beliefs are as important as or more important than overt symptoms.

The theory of B.F. Skinner is based upon the idea that learning is a function of change in overt behaviour. Changes in behaviour are the result of an individual's response to events (stimuli) that occur in the environment.

2.14.3 The Theory of Reasoned Action

The Theory of Reason Action is a model for the prediction of behavioral intention, spanning predictions of attitude and predictions of behaviour. The subsequent separation of behavioral intention from behavior allows for explanation of limiting factors on attitudinal influence (Ajzen, 1980). The Theory of Reasoned Action was developed by Martin Fishbein and Icek Ajzen (1975, 1980), derived from previous research that started out as the theory of attitude, which led to the study of attitude and behavior. The theory was "born largely out of frustration with traditional attitude–behavior research, much of which found weak correlations between attitude measures and performance of volitional behaviors".

Derived from the social psychology setting, the theory of reasoned action (TRA) was proposed by Ajzen and Fishbein (1975 & 1980). The components of TRA are three general constructs: behavioral intention (BI), attitude (A), and subjective norm (SN). TRA suggests that a person's behavioral intention depends on the person's attitude about the behavior and subjective norms (BI = A + SN). If a person intends to do behaviour then it is likely that the person will do it.

Theory of Reasoned Action suggests that a person's behaviour is determined by his/her intention to perform the behaviour and that this intention is, in turn, a function of his/her attitude toward the behaviour and his/her subjective norm. The best predictor of behavior is intention. Intention is the cognitive representation of a person's readiness to perform a given behaviour, and it is considered to be the immediate antecedent of behaviour. This intention is determined by three things: their attitude toward the specific behaviour, their subjective norms and their perceived behavioral control. The theory of planned behaviour holds that only specific attitudes toward the behavior in question can be expected to predict that behavior.

In addition to measuring attitudes toward the behaviour, we also need to measure people’s subjective norms – their beliefs about how people they care about will view the behavior in question. To predict someone’s intentions, knowing these beliefs can be as important as knowing the person’s attitudes. Finally, perceived behavioral control influences intentions. Perceived behavioral control refers to people's perceptions of their ability to perform a given behavior. These predictors lead to intention. A general rule, the more favorable the attitude and the

subjective norm, and the greater the perceived control the stronger should the person's intention to perform the behavior in question.

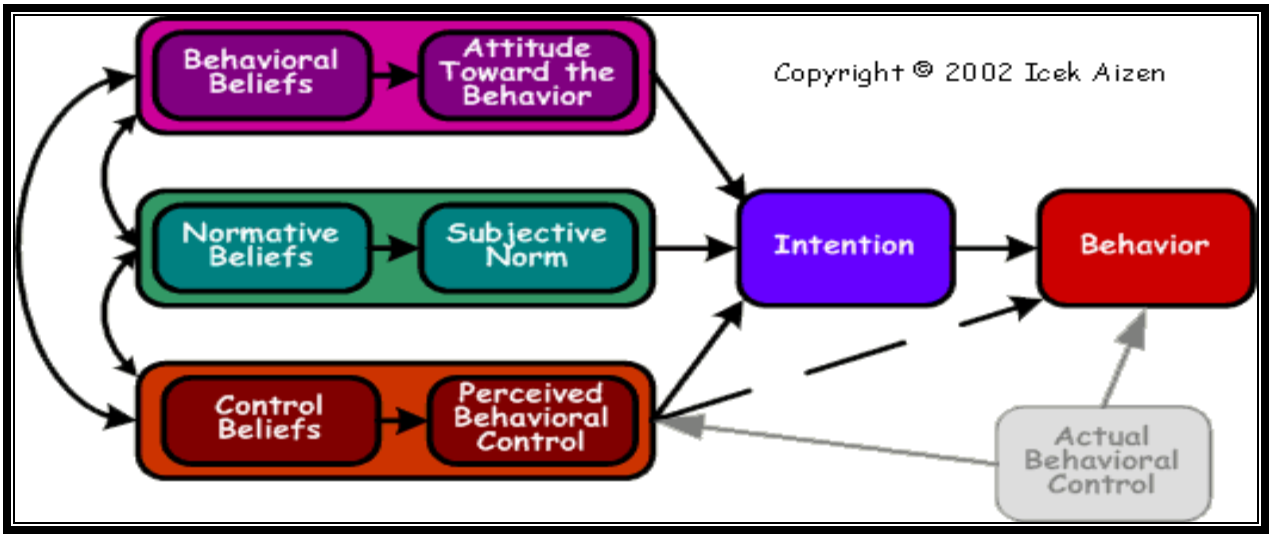

Figure 1: Conceptual Model

Source: Ajzen, I. (1991)

Sheppard *et al.* (1988) disagreed with the theory but made certain exceptions for certain situations when they say "a behavioral intention measure will predict the performance of any voluntary act, unless intent changes prior to performance or unless the intention measure does not correspond to the behavioural criterion in terms of action, target, context, time-frame and/or specificity."

2.14.4 Relevance of the Theory of Reasoned Action to study Radiation and Dappling Telecommunication Masts

Lately, attention has shifted to the hazardous effects of radiation of telecom towers on human health. Currently, there is a huge debate, within the public domain, about the dangers of frequencies radiations from telecom towers to human health. Along with that come complaints about noise, vibrations and fumes from standby power generators at telecom base stations; telecom towers interfering with aircrafts approaching landing, and towers falling on people and property. These concerns stem from the recent proliferation of telecom masts across country, particular in residential areas, resulting from the licensing several telecommunication companies

in Nigeria. Much as telecommunication is desirable for national development, it seems people are not ready to coexist with telecom infrastructure, without which the required quality mobile network service cannot be possible.

The Theory of Reasoned Action basically discusses how people decide to perform certain behaviour on telecommunication masts. The theory reasons that people consider their actions before they decide to perform or not perform a certain behavior. Intention is a major component of this theory. The Theory of Reasoned Action assumes that individuals will usually act upon their intentions. These specific intentions are comprised of two major attributes: an individual's attitude toward behaviour, basically whether it is right or wrong; and an individual's beliefs regarding social pressures to either perform or not perform the behaviour.

2.15. Summary of Literature Review

Literature review showed that the issue of the provision and erection of these towers (masts) within the country, which are sine qua non for availability of telecommunication and internet services, for fast-tracking business and government cum social services, is not without some issues and concerns. The health risks most times are not unconnected with the indiscriminate erection of the telecommunication masts in especially residential areas, and perhaps, without strict compliance with standard regulations guiding such activities by the telecommunication service providers. (Given the current global interests, concerns, and increased advocacies for environmental sustainability, espoused in the 2000-2015 Millennium Development Goals.)

Health literacy skills are associated with riskier behaviour, poorer health, less self-management and more hospitalization and costs while strengthening health literacy has been shown to build individual and community resilience, help address health inequities and improve health and well-being. Therefore, sectorial inputs are required to brazen up the challenges, from educational settings, workplaces, marketplaces, health systems, new and traditional media and political arenas.

Despite arguments of non-existent risk factors associated with telecommunication mast, study contends that there are health hazards of non-ionizing radiation from telecommunication mast on

exposed community with the hazard profile showing majority. There is equally a ‘significant synergistic relationship between high voltage cable and telecom mast on the health effect, where the proximity and duration of exposure to mast radiation is directly proportional to hazard effect. It concluded emphatically that there are health implications of exposure to mast radiation and minimizing them will go a long way to improving healthy living.

However, the dappling of telecommunication masts has brought about access to reliable, open and widespread system for transmitting information, drastic revolutions in communication psyche of people in developing countries, access to educational opportunities, cheaper and better telecommunication services, telemedicine, change in the way people conduct businesses, change in banking transactions and e-governance around the globe and Nigeria is not left out.

Review of empirical literature shows that there exist studies on audience perception, awareness and behaviour in regard to health risks associated with radiations from telecommunication masts. However, each of these studies was restricted to only a particular area (such as a town within a state of the country). None went beyond this limited geographical scope in order to offer a broader view of people’s perception and behaviour in regard to proximity to such masts across the country. Secondly, none of the studies reviewed looked at the demographic variables that possibly influence people’s awareness and behaviour in regard to health risks of dappling telecommunication masts. The essence of seeking to understand health behaviour in terms of differing demographics is underscored by the fact that such insight is typically indispensable for effective designing of health campaign (Edewor & Imhonopi, 2013). Thus, the studies generally lumped the respondents together without seeking to categorise their behaviour in terms of their varying demographics. The above observations constituted the research gap which this study attempted to fill.

The work is couched on the Health Belief Model and the Theory of Reasoned Action. The HBM theorizes that people’s beliefs about whether or not they are at risk for a disease or health problem, and their perceptions of the benefits of taking action to avoid it, influence their readiness to take action, while the Theory of Reason Action is a model for the prediction of behavioural intention, spanning predictions of attitude and predictions of behaviour.

2.16. Hypothesis

Against the backdrop of the literature review and the theoretical framework, the following hypothesis was formulated for test:

H_1: If residents are aware of the health risks associated with exposure to radiation emitted from telecommunication masts then they would take health action to guard against health conditions as a result of such exposure.

H_0: If residents are not aware of the health risks associated with exposure to radiation emitted from telecommunication masts then they would take health action to guard against health conditions as a result of such exposure.

The above hypothesis involved an independent variable; awareness and a dependent variable; action (compliance). It was formulated to determine whether awareness of the health risks of exposure to radiations from telecommunication masts would lead to taking precautionary action against such risks.

CHAPTER THREE
METHODOLOGY

Here, in line with the objectives of the study and with considerations of the research questions, the researcher outlined the methodology for the study. This includes determining the research design, area of study, population of study, sample/sampling procedure, data collection, measurable variables, validity/reliability, and statistics.

3.1. Research Design

For the design, the researcher chose the mixed method. Specifically, the mixed approach involved a quantitative and qualitative aspect; whereas the quantitative aspect of the study was survey, the qualitative aspect was focus group discussion (FGD). The combination of the two designs was aimed at exploring the strengths of the two methods – while the survey was expected to make for more empirical accuracy, the focus group discussion would provide in-depth analysis of the variables being measured.

3.2. Area of Study

The South-South region which was the study area for the study consists of Akwa Ibom State, Bayelsa State, Cross River State, Delta State, Edo State and Rivers State. The South-South region which is also referred to as Niger Delta is the oil-producing region in Nigeria. The Niger Delta, as now defined officially by the Nigerian government, extends over about 70,000 km^2 (27,000 sq mi) and makes up 7.5% of Nigeria's land mass (Niger Delta Development Commission, NDDC, 2004). Like other parts of Nigeria, cities in the Niger Delta region have their own fair share of the dappling telecommunication masts (See Appendix IV).

3.3. Population of the Study

The universe was all persons living in the South-South of Nigeria while the population was residents living within the close radius of telecommunication masks. According to the 2006 census population, the South-South has 21,044,081. A purpose decision was made to limit the residents to adults who live in the capital cities of the states of the region.

3.4. SURVEY

3.4.1. Sample Size and Sampling Procedure

A study sample of 663 was drawn from the population of study. This sample size was determined by looking at the sample sizes worked out by Israel (2006) who modified the formula recommended by Krejcie and Morgan (1970) by increasing the confidence level from 95% to 99%. His sample size recommendations are shown in the table below.

Table 1

Populations and Sample Sizes

Population Size	**Error Margin = 5%**	
	95% Confidence Level	**99% Confidence Level**
100	80	87
500	217	285
1, 000	278	399
10, 000	370	622
100, 000	383	659
500, 000	384	663
1 million and above	384	663

Given that the researcher's population was over 20 million, she settled for a sample of 663 for 99% confidence level and 0.05 error margin.

The sampling procedure was multi-staged. The first stage involved the selection of streets from the six South-South states and five (5) quarters/streets were purposely selected from each capital state from the region, the focus was on street with telecommunication masts.

The second stage involved selection of compounds from the streets selected, and five (5) compounds were randomly selected using the lottery method (the researcher numbered the houses accordingly and wrote them down and picked five out from a bowl), the table below further explains it.

Table 2

Sampling Procedure

State	Quarter/Street	Compound
AkwaIbom State	Ikop Ekepan, Obot Epkeme, Edouru, Etukapkan, Nung Ukot Itan	Five compounds
Bayelsa State	Participant No. 12, Ebis, Azikoro, Amarata, Ere Robison	Five compounds
Cross Rivers State	Mayne quarter, Etonka quarter, Sabongari quarters, Marian quarters and Esitta quarter	Five compounds
Delta State	Amb. Leo Okogwu quarter, Ndah. F.C.Ekene quarter, Olishe quarter, Umuagu quarter and Lady Stella quarter.	Five compounds
Edo State	Iyen quarter, Ikpobi quarter, Isumwa quarter, Akapakpwa quarter and Igun quarters	Five compounds
Rivers State	Agip quarters, Eliowahani quarters, Mgbuoshimin Larry quarter, Rumukuta quarter, Rumukoro quarter	Five compounds

At the third stage, a given number of respondents were selected from each of the houses in the compound randomly selected.

3.4.2. Instrument of Data Collection

The data collection instrument was structured questionnaire (See Appendix I). The questionnaire comprised close-ended questions segmented into five sections. Section I had questions on the respondents' demographic variables; Section II was on their proximity to telecommunication masts; Section III was on their awareness/understanding of health risks associated with dappling telecommunication masts; Section IV had questions probing their extent of adoption of precautionary measures against the health risks; while Section V was on their awareness/knowledge of the regulations and regulatory agencies in regard to erection of masts.

3.4.3. Measurable Variables (Operational Definitions)

The measurable variables for this research included Independent and Dependent Variables. The independent or demographic characteristics such as gender, marital status, occupation, occupant,

how long the occupant have lived there and these were measured by asking questions that sought demographic data.

The dependent variables measured in this study included:

- **Awareness and knowledge of health risks associated with radiation that comes from dappling telecommunication masts:** Measured by asking the respondents questions regarding whether they know that there are health risks associated with radiation coming from dappling telecommunication masts.

- **Knowledge of health risks associated with radiation that comes from dappling telecommunication masts:** Measured by asking the respondents questions regarding the much they know and understand the specific health risks associated with radiation coming from dappling telecommunication masts.

- **Source of information on health risks associated with radiation that comes from dappling telecommunication masts:** Measured by asking the respondents questions regarding their source of information about the health risks associated with radiation coming from dappling telecommunication masts.

- **Compliance with precautionary measures against the health risks associated with radiation that comes from dappling telecommunication masts:** Measured by asking the respondents questions regarding how much they act in line with the preventive measures against the health risks associated with radiation coming from dappling telecommunication masts.

3.4.4. Pre-test of instrument

Pre-test of instrument serves to establish the validity cum reliability of the data collection tool. While validity determines whether the said instrument correctly measures the concerned variables, reliability determines how consistent the instrument would be in measuring such variables (Asika, 1991, p.105).

To test the validity and reliability of her instrument, the researcher conducted a pilot study using 40 respondents randomly selected from her population. The instrument was administered to the respondents who filled and returned them. Analysis of their answers helped the researcher in establishing the validity of the instrument.

To further confirm its reliability (consistency), the researcher re-administered the same instrument to the same 40 respondents after two weeks of the first exercise. Thereafter, she analysed their answers and compared it with their answers in the previous exercise to determine the degree of their consistency. Such consistency served as a yardstick for determining the instrument's reliability.

3.4.5. Data Collection Procedure

Data were collected over a period of one month with the help of five (5) research assistant for the purpose. The research assistants were PGD and Master's students who were conversant with research methodology and came from the South-South region, each from one state of the region, after being further trained and instructed on what to do.The researcher and the assistants distributed copies of the questionnaire to the respondents and collected them back after filling them, trying all possible means to ensure a 100 percent return rate.

3.5. FOCUS GROUP DISCUSSION

3.5.1. Sample Size and Sampling Procedure

The researcher assembled two focus groups in two states of the South-South region randomly selected – Delta and Cross River States. Each of the groups was made up of six discussants resulting in a total of 12 discussants. The snowball technique (where one contact generates another) was used for selecting the groups. One group consisted of three males and three females of between the ages of 18 – 45 years, while the other group comprised three males and three females of between the ages of 46 – 60 years. The discussants were purposively selected to reflect variations in age, sex and level of education. The discussants were allowed to go with pseudonyms (if they chose) for privacy purposes.

3.5.2. Instrument of Data Collection

The data collection instrument for the FGD was focus group discussion (FGD) guide (See Appendix II). It comprised key questions which the researcher directed to the discussants as well as key points (probes) the researcher should look out for in the answer of the discussants. The FGD session was recorded with a tape recorder and later transcribed for analysis.

3.5.3. Method of Data Collection

The FGD sessions were moderated by the researcher. She was assisted by a recorder. The discussion sessions were recorded on tape while the note taker noted down important points (See Appendixes IIIA and IIIB for the transcripts of the sessions). The moderator raised a question or issue which the discussants went on to discuss while the moderator interjected with follow-up questions and comments to guide the discussion (See Appendix III).

3.6. Method of Data Analysis

The Statistical Package for Social Sciences (SPSS) version 20 was used for analyzing the quantitative data. The data so obtained were presented in charts and statistical tables. The researcher employed the following statistical tools in the analysis: simple percentages and Pearson's Product Moment Correlation Coefficient. On the other hand, the descriptive thematic method was applied for the qualitative data. This involved generation of specific themes and analyzing the FGD data under them. Thereafter, both the quantitative and qualitative data were read and interpreted together to generate the findings of the study.

CHAPTER FOUR
DATA PRESENTATION, ANALYSIS AND INTERPRETATION

This chapter dwells on the results of the data collection and analysis. The quantitative data extracted from the returned questionnaire copies were presented in charts and statistical tables. Simple percentages, Pearson's Chi-Square Goodness of Fit Test and Pearson's Product Moment Correlation Coefficient were the statistical tools utilized. The FGD responses were analysed using descriptive thematic method. The research questions were thereafter answered by combined reading of the quantitative and qualitative data. The interpretation of the correlational data helped in testing the hypothesis. A synoptic discussion of the findings rounded off the chapter.

4.1. Survey Data Presentation

The survey (quantitative) data are segmented as follows: response rate, respondents' demographic variables, awareness level of health risks associated with radiation emitted from dappling telecommunication masts, knowledge about health action that guard against health risks associated with dappling telecommunication masts, and health actions to guard against health risks associated with dappling telecommunication masts.

4.1.1. Response Rate

Table 3

Response Rate

	Frequency	Percentage
No. Recovered	581	87.6%
No. Not Recovered	82	12.4%
Total	**663**	**100%**

Table 3 shows that out of the 663 questionnaire copies distributed among the respondents, 581 representing 87.6% were recovered, while 82 representing 12.4% were not. Thus, 87.6% response rate was recorded as against 12.4% casualty rate.

4.1.2. Demographic Variables

Data were collected on respondents' demographic variables as follows: gender, age, state of residence, marital status, educational level, and occupation. These data are as presented in Tables 4 to 9 below

Table 4

Demographic Variables

VARIABLES	ITEMS	FREQUENCY	PERCENTAGE
Gender	Male	351	60%
	Female	230	40%
	Total	**581**	**100%**
Age Bracket	18 – 20 years	25	4%
	21 – 25 years	242	42%
	26 – 30 years	0	0%
	31 – 35 years	110	19%
	36 – 40 years	0	0%
	41 – 45 years	131	23%
	46 – 50 years	30	5%
	51 years and above	43	7%
	Total	**581**	**100%**
Marital Status	Single	447	92.9%
	Married	34	7.1%
	Total	**481**	**100%**
State of Residence	Akwa – Ibom	95	16.40%
	Bayelsa	96	16.50%
	Cross River	98	16.90%
	Delta	99	17%
	Edo	97	16.70%
	Rivers	96	16.50%
	Total	**581**	**100%**
Marital Status	Single	230	40%
	Married	239	41%
	Divorced	112	19%
	Total	**581**	**100%**

	SSCE/Equivalent	93	16%
	OND	94	16%
Highest Educational	HND	91	15.7%
Qualification	Bachelor's degree	282	49%
	Master's degree	11	2%
	PhD	10	1.7%
	Total	**581**	**100%**
	Student	2	1%
	Farming	142	24%
	Teaching	54	9%
Occupation	Business	68	11%
	Banking	67	11.4%
	Civil Service	134	22.4%
	Others	114	20%
	Total	**581**	**100%**

Table 4 shows the ratio between the number of male and female gender among the respondents. Out of 581 respondents, 60 percent (N=351) were males, while 40 percent (N=230) were females. Thus, there was 20% difference between the number of male and number of female respondents. In terms of age, the respondents within the 21-25 age bracket were predominant at 42 percent (N=242), more than any other age bracket. They were closely followed by the 41-45 age bracket at 23 percent (N=131), next were 31-35 age bracket at 19 percent (N=110). While ages 51 and above, 46-50years and 16-20 years constituted 7 percent (N=43), 5 percent (N=30) and 4 percent (N=25) respectively of the respondents. In terms of state of residence, 17 percent (N=99) lived in Delta State, closely followed by Cross rivers with 16.9 percent (N=98); next was Edo State with 16.7 percent (N=97), while Bayelsa State, Rivers State and Akwa Ibom State had 16.5 percent (N=96), 16.5 percent (N=96) and 16.4 percent (N=95) respectively. The table also shows that married respondent predominant with 41 percent (N=239), followed by single with 40 percent (N=230) and followed with 19 percent (N=112) for divorced. Hence, about the same percentage of the respondents were single and married while about half of this number were divorced. In terms of educational qualification, the table indicates that individuals in the state capitals of South-South are educated as close to half of the respondents were first degree holders. This would suggest that they were highly educated. Details in this table show that 49 percent

(N=282) of the respondent had a first degree as the highest educational qualification. About 16 percent indicated OND and SSCE/Equivalent. 15.7 percent (N= 91) said they had HND. Two percent (N=11) indicated Master's, while 1.7% (N=10) indicated PhD. On the occupation front, 142 respondents were farmers representing 24% of the total respondents, followed by civil servants with 134 participants representing 22.4%, while students had least number (1%) of participants. Hence, civil service was the modal occupation whereas schooling was the least featured.

4.1.3. Proximity to Telecommunication Masts

Data were collected from the respondents to measure their extent of proximity to telecommunication masts. The data generated in this regard are as presented in Tables 5 and 6 below.

Table 5

Respondents' Proximity to Telecommunication Masts

	Frequency	Percentage
MTN	212	36.5%
GLO	103	17.7%
AIRTEL	102	17.6%
ETISALAT	65	11%
Can't say	99	17%
Total	**581**	**100%**

From the Table 5 above, it can be seen that MTN telecommunication masts are closer to respondents' area as 36.5 percent (N=212) of the respondents admitted it, followed by GLO with 17.7 percent (N=103), next was AIRTEL 17.6 percent (N=102). 17 percent of the respondents could not identify which telecommunication masts was located in their area, while 11 percent (N=65) of the respondents admitted its ETISLAT. As can be seen, MTN masts were the ones to which the highest number of respondents lived close to. This must have stemmed from the fact that MTN has the widest spread in the country judging by the number of lines active lines it has released into the market so far (Nigeria Communications Commission, NCC, 2018).

Table 6

Distance of Nearest Telecommunication Mast

	Frequency	Percentage
Very close	229	39.4%
Close	152	26.2%
Far	114	19.6%
Very far	86	14.8%
Total	**581**	**100%**

Data in Table 6 show that 39.4% of the respondents had a telecommunication mast very close to their resident, 26.2% had it close to them, 19.6% had it far from theirs, whereas 14.8% had a mast very far from them. Thus, almost more than 65% had a telecommunication mast either very close or close to them, implying that majority lived reasonably close to a telecommunication mast. This situation appears to suggest that these masts are located very close to people's residents; a form of indiscriminate erection which has been observed in literature (Edewor & Imhonopi, 2013; Husain, Gwary, Yusuf & Yusuf, 2017).

4.1.4. Awareness and Knowledge of Health Risks Associated with Dappling Telecommunication Masts

The respondents were asked questions related to their awareness and knowledge of the health risk associated with situating telecommunication masts close to people's residents. The data generated in this regard are as presented in Table 7 to 10 below.

Table 7

Awareness of Health Risk Associated with Erecting Telecommunication Masts Close to People's Residents

	Frequency	Percentage
Yes	266	45.8%
No	315	54.2%
Total	**581**	**100%**

Table 7 indicates that while 45.8% of the respondents were aware that there are health risks associated with dappling telecommunication masts, 54.2% were not aware of this. Thus, merely less than half of the respondents were aware of the health risks associated with telecommunication masts. This shows low level of awareness of these risks which may suggest that the respondents could be vulnerable to these risks themselves.

Table 8

Knowledge of Health Risks Associated with Erecting Telecommunication Masts Close to People's Residents

	Telecommunication masts emit radiation that exposes one to risk of cancer?	Telecommunication masts emit radiation that exposes one to risk of headache?	Telecommunication masts emit radiation that exposes one to risk of cardiovascular stress?	Telecommunication masts emit radiation that exposes one to risk of memory loss?	Telecommunication masts emit radiation that exposes one to risk of low sperm count?	Telecommunication masts emit radiation that exposes one to risk of birth defects?	Telecommunication masts emit radiation that exposes one to risk of other health conditions?
True	34.1%	41.5%	10.1%	31.7%	45.8%	25.3%	14.5%
	N = 198	N = 241	N = 59	N = 184	N = 266	N = 147	N = 84
False	65.9%	58.5%	89.9%	68.3%	54.2%	74.7%	85.5%
	N = 383	N = 340	N = 522	N = 397	N = 315	N = 434	N = 497
	100%	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Total	**N = 581**	**N = 581**	**N = 581**	**N = 581**	**N = 581**	**N = 581**	**N = 581**

Table 8 shows that 34.1% of the respondents knew that telecommunication masts emit radiation that exposes one to risk of cancer, while 65.9% did not know this. Similarly, 41.5% knew that

telecommunication masts emit radiation that exposes one to risk of headache as against 58.5% that did not know. Also, while 10.1% knew that telecommunication masts emit radiation that exposes one to risk of cardiovascular stress, 89.9% did not. Then, 31.7% knew that such masts emit radiation that exposes one to risk of memory loss, 68.3% did not know. Further, 45.8% knew that telecommunication masts emit radiation that exposes one to risk of low sperm count, 34.2% did not know. While 25.3% knew masts emit radiation that exposes one to risk of birth defects, 74.7% did not. Lastly, 14.5% knew masts emit radiation that exposes one to risk of other health conditions while 85.5% did not. Thus, apart from where it relates to possible collapse of telecommunication masts, only a minority of the respondents knew of the risks associated with living close to dappling telecommunication masts. This suggests low knowledge on the part of the respondents, which is predictable based on the data in Table 7 that indicate low awareness; awareness ought to precede knowledge.

Table 9

Degree of Knowledge of Health Risks Associated with Erecting Telecommunication Masts Close to People's Residents

	Frequency	Percentage
High knowledge	84	14.5%
Average knowledge	171	29.4%
Low knowledge	326	56.1%
Total	**581**	**100%**

As a way of further crystallizing the data in Table 8, the respondents who got correct answers in 5 – 7 questions were categorized as possessing "high knowledge" of health risks associated with telecommunication masts, those that got 3 – 4 correct as possessing "average knowledge" while those that got less than 3 correct were categorized as possessing "low knowledge". Table 9 shows the results of the computation based on this categorization which indicate that 14.5% of the respondents possessed high knowledge of the health risks associated with dappling telecommunication masts, 29.4% had average knowledge, while 56.1% possessed low knowledge. In other words, majority were not knowledgeable vis-à-vis the health risks associated with situating telecommunication masts close to people's residents. As noted earlier, this low knowledge is predictable based on the earlier indication that awareness is also low. Admittedly,

this low awareness and knowledge potentially renders the residents susceptible to the said health hazards.

Table 10

Major Source of Information on Health Risks

Associated With Dappling Telecommunication Masts

	Frequency	Percentage
Mass media	229	39.4%
Internet	168	28.9%
Conferences/Seminars/Workshops	18	3.1%
Family/Peers	85	14.6%
Others	81	13.9%
Total	**581**	**100%**

Table 10 shows that 39.4% of the respondents got information about the health risks associated with dappling telecommunication masts mainly from the mass media, 28.9% got theirs from the Internet, 3.1% got theirs from conferences/seminars/workshops, 14.6% got their information from family/peers, while 13.9% got theirs from other (unspecified) sources. In other words, mass media and the Internet were for the majority the main source of information on the health risks associated with situating telecommunication masts close to human location. Family/peers equally featured fairly significantly as a source of such information. This suggests that interpersonal channels have played less role than the media in this regard. This is significant because interpersonal channels, given their greater personalisation and intimacy, have been noted to be generally more effective in inducing behaviour change than mass media that are largely impersonal (Daramola, 2003; Baran, 2010).

4.1.5. Precautionary Practice Against Risks

The respondents were asked questions related to their taking of precautionary measures against the health risk associated with situating telecommunication masts close to people's residents. The data generated in this regard are as presented in Table 11 to 16 below.

Table 11

Concern About Potential Health Risk of Erection

Telecommunication Mast Close to Residence

	Frequency	Percentage
Yes	196	33.7%
No	385	66.3%
Total	**581**	**100%**

Table 16 shows that while 33.7% of the respondents had been concerned about the potential health risks of telecommunication masts located close to them, 66.3% had not. The implication of the foregoing is that majority were not worried about the likely health consequence of such close masts. This could be a function of low awareness and knowledge as already reflected in Tables 7 to 10.

Table 12

Ever Considered Taking Action Against Health Risk

of Erection of Telecommunication Mast Close to Residence

	Frequency	Percentage
Yes	121	20.8%
No	460	79.2%
Total	**581**	**100%**

Table 12 shows that 20.8% of the respondents had considered taking action against the possible health risks of dappling telecommunication masts, while 79.2% had not considered such action. This, probably, is to be expected given the respondents' low awareness, low knowledge and low level of concern regarding these health risks as shown in Tables 7 to 10 above. In other words, the respondents were not likely to consider taking action against the health risks when they don't have sufficient awareness, knowledge and proper attitude towards them.

Table 13

Avoidance of Closeness to Telecommunication Mast Due to Health Concerns

	Frequency	Percentage
Always	21	3.6%
Sometimes	54	9.3%
Rarely	37	6.3%
Never	469	80.7%
Total	**581**	**100%**

Table 13 shows that 3.56% of the respondents always avoided closeness to telecommunication masts due to health concerns, 9.3% avoided this sometimes, 6.3% avoided it rarely, while 80.7% never took this precautionary measure. Thus, majority (80.7%) never avoided being close to dappling telecommunication masts due to the associated health hazards. This finding could be linked to the data in the previous tables indicating low awareness, low knowledge and poor attitude among the respondents vis-à-vis these risks.

Table 14

Avoidance of Spending so Much Time Close to

Telecommunication Mast Due to Health Concerns

	Frequency	Percentage
Always	47	8.1%
Sometimes	39	6.7%
Rarely	34	5.9%
Never	461	79.3%
Total	**581**	**100%**

Table 14 shows that 8.1% of the respondents always avoided spending so much time close to telecommunication masts due to health concern, 6.7% sometimes avoided this, 5.9% avoided it rarely, while 79.3% never took this precautionary measure. This implies that majority (almost 80%) did not limit the time they spend very close to telecommunication masts as a matter of health precaution. This arguably is a reflection of the respondents' low awareness, low

knowledge and low level of concern regarding these health risks as shown in Tables 7 to 11 above. When there is low awareness, low understanding and indifference, what becomes predictable is low compliance.

Table 15

Going for Medical Check or Advice Due to Health Concerns Arising From The Closeness Of Telecommunication Mast To You

	Frequency	Percentage
Yes	0	0%
No	581	100%
Total	**581**	**100%**

Table 15 shows that none (0%) of the respondents had gone for medical check or sought advice due to health concerns arising from their closeness to dappling telecommunication masts. In other words, there was zero practice of medical check by the respondents in relation to the health risks associated with living close to telecommunication masts. This attitude could be linked to the respondents' poor awareness and knowledge as well as their indifferent attitude to these risks as observed above (Table 11). Going for medical check is a function of one perceiving and understanding a health risk.

Table 16

Extent of Precaution Towards Health Risks Associated With Telecommunication Masts

	Frequency	Percentage
Very precautious	58	10%
Somewhat precautious	43	7.4%
Rarely precautious	480	82.6%
Total	**581**	**100%**

Table 16 shows that 10% of the respondents were very precautious towards the health risks associated with dappling telecommunication masts, 7.4% were somewhat precautious, while 82.6% were rarely precautious. Therefore, majority (a little more than 82%) of the respondents were rarely precautious against the likely health hazards of living close to telecommunication

masts. However, when compared to the data related to seeking medical check (Table 15) this represents some improvement as far as precautionary measures are concerned. Nevertheless, the proportion of the respondents that takes this precaution is hardly satisfactory.

4.1.5. Environmental Regulatory Agencies and Enforcement of Relevant Laws

The respondents were asked questions related to what they know about the environmental regulatory agencies and their duty of enforcement of laws related to erection of telecommunication masts. The data generated in this regard are as presented in Table 17 to 21 below.

Table 17

Awareness of Regulations on Erection of Telecommunication Masts

	Frequency	Percentage
Yes	146	25.1%
No	435	74.9%
Total	**581**	**100%**

Data in Table 17 indicate that 21.5% of the respondents were aware that there are regulations guiding erection of telecommunication masts ass against 74.3% that were not aware. Thus, majority of the respondents were ignorant of the existence of a regulatory framework for erection of telecommunication masts leaving 49.8% difference between the number that were aware and the number that were not. Not being aware of the existence of these regulations could mean that even if the respondents are aware of the risks of living close to these masts, they might not be in a position to insist on their right to have such masts located only at a reasonable distance from their residents.

Table 18

View on Necessity of Regulations

	Frequency	Percentage
Very necessary	281	48.4%
Fairly necessary	196	33.7%
Scarcely necessary	104	17.9%
Total	**581**	**100%**

Table 18 shows that 48.4% of the respondents viewed as necessary regulatory framework for erection of telecommunication masts, 33.7% viewed it as fairly necessary whereas 17.0% viewed it as scarcely necessary. Therefore, despite the respondents' ignorance of the existence of this framework (Table 17), they were still largely of the opinion that such was necessary. This could mean that their reason for viewing this regulation as necessary might be connected to other considerations different from health concerns.

Table 19

View on Whether Telecommunication Companies Operate in Line With the Regulatory Guidelines

	Frequency	Percentage
To a large extent	18	3.1%
To some extent	69	11.9%
To a little extent	63	10.8%
Don't know	431	74.2%
Total	**581**	**100%**

Table 19 shows that 3.1% of the respondents thought that the telecommunication companies are to a large extent operating in line with the regulations guiding erection of masts, 11.9% thought they do this to some extent, while 10.8% believed they comply only to a little extent. However, majority (74.2%) indicated their ignorance of this; a reflection of the fact that majority were unaware of the existence of this regulatory framework (Table 17). This ignorance, as earlier noted (under Table 17), may reduce the likelihood that the residents will insist on their right to have such masts located only at a reasonable distance from their residents.

Table 20

Awareness of Agencies Regulating Erection of Telecommunication Masts

	Frequency	Percentage
Yes	141	24.3%
No	440	75.7%
Total	**581**	**100%**

Table 20 shows that 24.3% of the respondents were aware of agencies regulating erection of telecommunication masts, while 75.7% were not. This leaves 51.4% difference between the number of those that were aware and the number of those that were ignorant. This high rate of unawareness reflects the data in Table 17 which indicate that majority of the respondents were even ignorant of the fact that a regulatory framework exists for erection of telecommunication masts. In other words, their ignorance of the regulatory agencies could be logically linked to their ignorance of the existence of regulations in the first place.

Table 21

Views on Performance of Regulatory Agencies in Enforcing Guidelines for Erection of Telecommunication Masts

	Frequency	Percentage
To a large extent	8	1.3%
To some extent	12	2.1.%
To a little extent	27	4.6%
Don't know	534	91.9%
Total	**581**	**100%**

Data in Table 21 show that 1.3% of the respondents viewed the regulatory agencies as having to a large extent performed well in terms of enforcement of guidelines for erection of masts, 2.1% viewed them as having performed to some extent, while 4.6% viewed them as having done so to a little extent. Nevertheless, the majority (91.9) did not have opinion on this; a situation that seemed to be linked to the high rate of ignorance of the existence of guidelines (Table 17) and regulatory agencies among the respondents (Table 20).

Table 22

Zero Order Correlation Matrix on the Independent and Some Key Dependent Variables

	1	2	3	4	5	6	7	8	9
1. Gender	1	.337**	.548**	-.010	-.595**	-.062	.183**	.147**	-.011
2. Age		1	.743**	.314**	-.087*	-.049	-.070	-.004	.240**
3. Marital status			1	.225**	-.280**	-.094*	.167**	.286**	-.007
4. Education				1	.052	-.371**	-.148**	.065	.058
5. Occupation					1	.288**	-.282**	-.236**	.127**
6. State of Residence						1	-.200**	-.216**	.028
7. Awareness							1	.514**	.286**
8. Knowledge								1	.026
9. Precautionary practice									1

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

*. Correlation is significant at the 0.05 level (2-tailed).

Table 22 shows that gender correlates positively with age (r = .337), marital status (r = .548), negatively with occupation (r = -.595), positively with awareness (r = .183) and knowledge (r = .147). Then age correlates positively with marital status (r = .743), education (r = .314), negatively with occupation (r = -.087), and positively with precautionary practice (r = .240). Marital status correlates positively with education (r = .255), negatively with occupation (r = -.280), state of residence (r = -.094) and positively with state of residence (r = .167) and awareness (r = .286). Education correlates negatively with state of residence (r = -.371) and awareness (r = -.148). Occupation correlates positively state of residence (r = .288), negatively with awareness (r = -.282) and knowledge (r = -.236), and positively with precautionary practice

(r = .127). State of residence correlates negatively with awareness (r = -.200) and knowledge (r = -.216). Lastly, awareness correlates positively with knowledge (r = .514) and precautionary practice (r = .286).

4.2. Focus Group Discussion (FGD) Data Presentation

The respondents' contributions at the focus group discussion (FGD) sessions were recorded on tape while notes were also taken in the process. The researcher critically and systematically read the transcripts of the two sessions and made observations relevant to the study objectives. These observations are the data generated via the FGD and they come under the following themes:

i. Awareness/Knowledge of Health Risks
ii. Concern About Health Risks
iii. Precautionary Practices
iv. Awareness of Regulatory Agencies/Framework
v. Compliance of Telecommunication Companies

4.2.1. Awareness/Knowledge of Health Risks

The respondents largely admitted that they were not informed as to the health implications of living close to telecommunication masts. It was just three out of the 12 discussants that stated that they knew about this. Participant No. 1 admitted:

> I'm aware that closeness to such masts entails some risk, health risk. I know for instance that it could lead to cancer due to radiation. I am sure there are as well other health hazards here which I may not be able to recall exactly.

Participant No. 2 in the same vein noted:

> Being close to telecommunication mast could lead to cancer. It causes heat and as well pollutes the environment due to the noise and smoke emanating from the station. All these are health risks.

Participant No. 7 equally submitted:

> I know of radiation which is said to emit from the mast. I don't know exactly how it affects the body, but all I know is that it is dangerous to our health; it is something we should expose ourselves to.

Instructively, none of the respondents was aware of the emission of magnetic field by dappling telecommunication masts. However, majority of the respondents were ignorant of any health hazard associated with such masts. Participant No. 8 admitted:

> I don't know of any health risk linked to living close to a mast. While it seems to me that I have heard that it is dangerous for people to stay very close to masts, I don't think I am precisely aware of the said risk.

Participant No. 9 similarly stated:

> I am not aware that being close to a mast can harm someone. I'm hearing that for the first time. I wouldn't go close to a mast because of fear of electric shock and not because of any other risk (I have phobia for electricity).

Participant No. 3 equally admitted:

> There are about two telecommunication masts very close to my house; I don't think I have ever thought of their being dangerous to health. Of course, I am ignorant of this fact and so had never thought of that.

Participant No. 10 had this to say:

> I see telecommunication masts the same way I see electric poles; I never thought being close to them would constitute any health risk unless one is electrocuted. I understand the masts to be for telephone reception and never saw them as capable of doing harm to anybody's health.

The foregoing shows that awareness and knowledge of the health risks associated with dappling telecommunication masts was low among the respondents. Only a few of them had this awareness and knowledge while the majority were totally ignorant of this. This reflects the survey data in Table 7 and Table 9 above which indicate low awareness and low knowledge respectively among the respondents.

4.2.2. Concern About Health Risks

Since one has to be aware of a risk before being concerned about it, it was no surprise that most of the discussants admitted not to have felt concerned about the health risk associated with living close to dappling telecommunication masts. However, even two of the three discussants that said

they were aware of such risks stated that they had not felt really concerned. For instance, Participant No. 2 admitted:

> I have not in truth felt really worried by the fact that I live close to a telecommunication mast. Even though I am aware of its health dangers, I have felt safe enough not to worry, but I know this shouldn't be the case; it is not a positive attitude.

Participant No. 1, another discussant that claimed awareness of health risks associated with living close to telecommunication masts, stated in the same manner:

> Despite the fact that I am aware of the health risks, I have never felt really bothered. If you ask me whether I had given thought to packing out of the house due to closeness to mast, my answer will be categorical no. So, this is clear evidence that I as a person has never feared suffering any health consequences due to my proximity to a mast though I'm convinced the risks are real.

Other discussants were in the same manner largely unconcerned. Participant No. 3 noted:

> I have not felt concerned or worried about any health implication. I think I have gone about my business normally without minding any mast. I see the mast as just being there, while I am just there.

Participant No. 12 admitted:

> I have never been worried. I didn't even know the masts are dangerous to health. I remember having stood there taking selfies without any feeling at all of being close to danger.

For Participant No. 11, the story is the same:

> I don't feel worried at all. How would I, for God's sake being that I never thought of the masts being dangerous health wise?

In the words of Participant No. 9:

> My experience is that I have lived with the masts the same way I have lived with other installations such as pipelines and electric installations. I have never felt any special concerned about the masts; I never saw them as dangerous.

Participant No. 10's observation is insightful:

> I think one needs to know of a danger before being worried by it. I am ignorant of such (health risk) and so have nothing to fear naturally. I also

> think it's like that for most people, if not, we should be hearing people complaining and raising alarm because these masts are ubiquitous in residential areas; but we aren't seeing such complaints implying that people don't really care.

The only exception to the unconcerned attitude among the discussants was Participant No. 7 who earlier noted his awareness of such danger. His words:

> I must admit that I have felt worried or even afraid of the possible health hazards of the telecommunication mast that is right inside my compound. I know of the radiation and its effect and this has made me to nurse the fear at times that one might be subjecting himself to a serious danger.

The foregoing submissions from the respondents indicate that they were less likely to feel concerned about the possible health risks of living close to telecommunication masts. This reaffirms the survey data in Table 11 showing that majority of the respondents had not felt worried or concerned over the likely health hazards of their residential proximity to dappling telecommunication masts.

4.2.3. Precautionary Practices

The discussants' lack of awareness and knowledge regarding the health risks associated with living close to dappling telecommunication mast also implied that they largely did not engage in the precautionary practices against this danger. Participant No. 5 stated as follows:

> I have never done any of those (medical check, avoiding closeness to mast) simply because I did not know of any risk. The mast in my area has been there for ages and it has never occurred to me to avoid them or to visit a hospital to see if I have been harmed; never.

Participant No. 6 submitted:

> I don't think I have taken any serious measure against any health risk. The truth is that I am not even informed of these risks. The only thing that I can say is that whenever I am approaching a mast, there is this phobia of the mast falling on me. I try to conquer it because I know it is a function of nervousness.

Participant No. 8's own phobia is related to possible electrocution:

> I always feared that there one could be electrocuted going near the mast especially when the environment is wet. That is the same feeling I have

> of electric transformers, though when it comes to masts, I'm not sure how correct I am. As for any other health risks that have been mentioned here, I have not been aware of them talk more of taking precaution.

Participant No. 12 equally submitted:

> Since I have never seen my closeness to the mast as a health issue, I couldn't have bothered to go for medical check or even try to avoid the mast. The truth is that I have never seen as a matter to give attention to.

Participant No. 11 noted that she finds the idea of going for medical check because of living close to a mast funny:

> I even find the whole idea of going to see a doctor because I live close to a mask funny, though I may be wrong. However, why would I live close to something that would make it necessary for me to be seeing my doctor periodically as a matter necessity? Why not move out of the place entirely? It's sounds like one choosing to live close to where mosquito breeds only to be treating malaria as a matter of routine. For me, I never saw the mast as necessitating my going to hospital, but once I see it that way, then the best thing, I think,, would be to pack out of the place.

Participant No. 10 simply admitted his inaction in this regard:

> To state it plainly, I have never thought of any precautionary measure because I never saw any risk in the first place, not to talk of preventing it.

Participant No. 7, however, admitted that his only precautionary measure was avoidance of closeness to the mast and limiting the time he spent there whenever he had to be there:

> I try to avoid being very close to the mast even though it's always close. Also, whenever for one reason or the other I can't avoid coming very close, I just try to reduce as much as possible the length of time I spend there. It has become ever present in consciousness that at times I don't even know when I do it. The mere thought of being vulnerable to cancer is enough for me to act this way.

Participant No. 1 and Participant No. 2 equally admitted that they were somewhat mindful of the extent they stay very close to telecommunication masts due to health concerns. However, like Participant No. 7, they never thought it necessary to go for medical check on account of this. But as could be seen so far, majority of the discussants were apparently not disposed to any precautionary measure against the possible health hazards of their closeness to dappling

telecommunication mast probably due to their ignorance of these hazards. This reflects the survey data in Tables 12 to 16.

4.2.4. Awareness of Regulatory Agencies/Framework

The discussants were asked to share the extent they were aware of the existence of regulatory agencies as well as regulatory framework for erection of telecommunication masts in Nigeria. They were, however, largely ignorant of these. None of the respondents knew of the role of the National Environmental Standards and Regulations Enforcement Agency (NESREA). Participant No. 9 contributed:

> I never knew of any agency. I am not even aware that it is regulated. But I know we have NCC which regulates the operations of the telecom companies.

Participant No. 1 admitted knowing of NCC but was ignorant of its regulatory role in relation to setting up telecommunication masts:

> I know that we have Nigerian Communications Commission who supervises the GSM companies but I never knew they also regulate where and how they set up their masts. My feeling was that people erect masts indiscriminately without getting approval; honestly, that has been my impression.

Participant No. 7's contribution is similar:

> I had always thought that erection of masts ought to be regulated, but I don't think I have actually known who does this and the applicable regulations neither have I made any effort to know these.

Other discussants were simply straightforward in expressing their ignorance:

Participant No. 6: I am unaware of any regulations or authority that enforces them.

Participant No. 3: I am equally unaware that erection of masts is regulated.

Participant No. 4: I didn't know this.

Participant No. 5: I am as well not aware of this situation. I felt people mounted masts wherever and whenever they want.

The foregoing shows that the discussants were simply uninformed regarding the regulatory framework as well as the agencies charged with regulation of erection of telecommunication masts.

4.2.5. Compliance of Telecommunication Companies

The discussants' poor awareness of regulatory agencies and regulatory framework for erection of telecommunication masts reflected in the way they reacted to the question as to how much the agencies have been performing and the extent the telecommunication companies are complying with the regulations. The respondents admitted that they could not make any informed assessment. According to Participant No. 9:

> Since I don't even understand the terrain, I don't know what to say. I have no understanding of how the regulations work and I don't know about the agencies involved, so can't say anything about their performance.

Participant No. 12 admitted:

> I'm not aware of the regulations and so cannot say how well they have worked or how well the people involved have performed.

Participant No. 11 equally admitted:

> I am not informed at all to make an evaluation here. I can only do so when I get adequately informed.

Participant No. 4 was of the same disposition:

> I cannot say because I don't know the basis for assessment. I don't know what the standards are.

Participant No. 3 stated in the same vein:

> I'm not in a position to speak on this; I'm not knowledgeable enough to comment.

However, a few of the respondents, while admitting their ignorance, were still able to speculate based on what they saw. In the words of Participant No. 10:

> Though I don't know what the rules are, I would guess the agencies may not be doing their work well which may have encouraged the companies to be flouting the rules. I say this because I think the way masts are located suggest it is done arbitrarily.

Participant No. 8 Submitted:

> I am not conversant with the guidelines but I would agree that the guidelines may not be working efficiently based on what we have seen so far. The masts at times seem indiscriminately located – that's my assessment anyway.

The above submissions by the discussants show their inability to competently judge the performance of the regulatory agencies and the compliance level of the telecommunications companies given their lack of information on the nature of the regulatory framework and the regulatory agencies. This agrees with the survey data in Tables 17 to 21 above.

Generally, from the FGD data, it is deducible that the discussants were largely ignorant of the health risks inherent in exposure to radiation from telecommunication masts. The natural implication of this ignorance is that they would likely not perceive any risk in their living close to such masts. This near absence of risk perception was clear in the responses given by the discussants above. Furthermore, the implication of this lack of risk perception is that the discussants were not likely to take any precautionary measures against such risk. This was also evident in the responses they gave above.

Consequent on the foregoing, therefore, a sort of vicious circle is created whereby ignorance leads to non-appreciation of risk and the latter results in inaction against risk. Overall, what is revealed is a vulnerable group; individuals who would not guard against hazards associated with exposure to radiations from telecommunication masts owing primarily to their poor awareness and knowledge of these hazards and their resultant inability to perceive any risk in their living close to dappling masts.

4.3. Analysis of Research Questions

The first research question sought to determine the extent of the residents' awareness of health risks associated with radiation that comes from dappling telecommunication masts. Data in Table 7 indicate that less than half (45.8%) of the respondents were aware of the health risks associated with telecommunication masts. This implied that the majority were ignorant of the basic fact that living close to dappling telecommunication masts constitutes some health risk. Therefore, it could be stated in answer to the first research question that there is low awareness of the health risks associated with dappling telecommunication masts among residents in South-South Nigeria.

The second research question sought to find out the extent of the residents' knowledge of health risks associated with radiation that comes from dappling telecommunication masts. Table 8 indicates that only a minority of the respondents knew of the risks associated with living close to dappling telecommunication masts in terms of the various health conditions that could result from such exposure. Table 14 then gives a cumulative picture indicating that majority were not knowledgeable vis-à-vis the health risks associated with situating telecommunication masts close to people's residents. The FGD data as presented in 4.2.1. also corroborated these figures. Therefore, it could be stated in answer to the second research question that there is low knowledge of the health risks associated with dappling telecommunication masts among residents in South-South Nigeria.

The third research question sought to find out the residents' source of information on health risks associated with radiation that comes from dappling telecommunication masts. Data in Table 10 indicate that mass media (39.4%) and the Internet (28.9%) were the main sources of information for the respondents on the health risks linked with living close to dappling telecommunication masts. Consequently, it could be stated in answer to the third research question that mass media and the Internet are the major sources through which residents in South-South Nigeria gained information on health risks associated with radiation that comes from dappling telecommunication masts.

The fourth research question sought to ascertain the residents' level of practice of precautionary measures against the health risks associated with radiation that comes from dappling telecommunication masts. Data in Table 11 show that majority (66.3%) of the respondents were not worried about the likely health consequence of such close masts. Similarly, Table 12 shows that only a minority (20.8%) of the respondents had considered taking action against the possible health risks of dappling telecommunication masts even as Table 13 shows that majority (80.7%) never avoided being close to dappling telecommunication masts due to the associated health hazards. Similarly, Table 14 indicates that that majority (almost 80%) did not limit the time they spend very close to telecommunication masts as a matter of health precaution. Table 15 then shows that none (0%) of the respondents had gone for medical check or sought advice due to health concerns arising from their closeness to dappling telecommunication masts. However, a more precise picture is seen in Table 16 indicating that majority (a little more than 82%) of the respondents were rarely precautious against the likely health hazards of living close to telecommunication masts. This tendency is corroborated in the FGD data as presented in 4.2.3. above. Consequently, it is admitted in answer to the fourth research question that there is low practice of precautionary measures by the residents against the health risks associated with radiation that comes from dappling telecommunication masts.

The fifth research question sought to ascertain demographic variables that influence knowledge and precautionary practice in regard to health risks associated with radiation that comes from dappling telecommunication masts. Table 22 shows that gender correlates positively with awareness (r = .183) and knowledge (r = .147) while age correlates positively with precautionary practice (r = .240). Then, marital status correlates positively with awareness (r = .286); Education correlates negatively with awareness (r = -.282) and knowledge (r = -.236), and positively with precautionary practice (r = .127); while state of residence correlates negatively with awareness (r = -.200) and knowledge (r = -.216). This is even as occupation correlates positively with precautionary practice (r = .127). Therefore, it could be stated in answer to the fifth research question that awareness of health risks associated with radiations coming from dappling telecommunication masts seems to be influenced by gender, marital status, level of education and state of residence of the residents. Also, their knowledge of these risks is probably

influenced by their gender, level of education and state of residence; while their practice of precautionary measures is likely influenced by their age, level of education and occupation.

4.4. Testing of Hypothesis

H_1: If residents are aware of the health risks associated with exposure to radiation emitted from telecommunication masts then they would take health action to guard against health conditions as a result of such exposure.

H_0: If residents are not aware of the health risks associated with exposure to radiation emitted from telecommunication masts then they would take health action to guard against health conditions as a result of such exposure.

The correlation data in Table 22 indicate that awareness of health risks correlates positively with precautionary practice against the risks (r = .286). Consequently, the null is rejected and it is accepted that if residents are aware of the health risks associated with exposure to radiation emitted from telecommunication masts, they would take health action to guard against health conditions as a result of such exposure.

4.5. Discussion of Findings

The first and second findings of this study showed that there is low awareness and knowledge of the health risks associated with dappling telecommunication masts among residents in South-South Nigeria. The implication of this is that the residents lack the requisite information on the health implications of their situation (i.e. proximity to telecommunication masts) which means that they are likely not to take the needed precautions against the health hazards. The fourth finding corroborates this reasoning by indicating that there is low practice of precautionary measures by the residents against the health risks associated with radiation that comes from dappling telecommunication masts. This sort of attitude is typically a necessary outcome of lack of requisite health information; in other words, when people lack requisite health information, they typically become vulnerable (Akin & Adeniji, 2014; Husain, Gwary, Yusuf & Yusuf, 2017). The result of the hypothesis testing makes this clear and more straightforward by indicating that if the residents are aware of the health risks associated with exposure to radiation emitted from

telecommunication masts then they would take health action to guard against health conditions as a result of such exposure.

The third finding of the study indicates that mass media and the Internet are the major sources through which the residents gain information on health risks associated with radiation that comes from dappling telecommunication masts. The implication of this is that interpersonal communication channels might not have been adequately utilized in enlightened the people on these health risks. The place of interpersonal channels in persuasive communication cannot be overemphasized. According to Baran (2010), interpersonal channels evoke situational immediacy, enhances intimacy and trust between the communicator and the receiver such that persuasion is more easily achieved than could be done via the mass media with their impersonal and public character. Daramola (2003), with reference to health communication, observes as follows:

> The strength of interpersonal communication has been demonstrated in many instances of health communication across the world. Persuasive messages urging people to take actions such as immunization and medical checks have, research been shown, very effectively conveyed through interpersonal communication, and which in many instances have proved more efficient than the mass media in this regard (p.342).

The fifth finding of the study shows that awareness of health risks associated with radiations coming from dappling telecommunication masts seems to be influenced by gender, marital status, level of education and state of residence of the residents. Also, their knowledge of these risks is probably influenced by their gender, level of education and state of residence; while their practice of precautionary measures is likely influenced by their age, level of education and occupation. The influence of these demographic variables is a fact that has been well recognized in the study of communication effect. These variables (among other variables) influence the result of a communication in such a way that it does not occur in a straightforward and easily predictable manner (McQuail, 2010). In relation to the subject matter of this study, this situation underscores the need for any public enlightenment campaign on the health risks of dappling telecommunication masts to be preceded by proper audience profiling in order to properly ascertain the characteristics of the target population for more effective message designing and media selection.

Against the backdrop of the Health Belief Model (HBM), it could be seen that residents in the South-South of Nigeria failed to take the necessary health action regarding radiation from dappling masts perhaps because they lacked the requisite “health belief”. A person has to be convinced about the efficacy of a health action before they could take it, and such conviction comes only when the individual perceives their situation as requiring such action (Janz & Becker, 1984). In this case, the residents did not perceive their situation (proximity to telecommunication masts) as requiring any health action. Similar thing could be said about the Reasoned Action Theory which suggests that a person’s performance or non-performance of a health action is determined by his/her intention towards the action, and that this intention is, in turn, a function of his/her attitude toward the said action and his/her subjective norm (Ajzen, 1980). Thus, the residents may take action against the health risks of being close to dappling telecommunication masts only as motivated by their intention and subjective norm, and such intention and subjective norm could result from their extent of information and knowledge on the danger of their situation.

CHAPTER FIVE
SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1. Summary

This study assessed the risk perception among residents in the South-South Nigeria in regard to radiation coming from dappling telecommunication masts. In more specific terms, the following objectives were pursued: to determine the extent of the residents' awareness and knowledge of health risks associated with radiation that comes from dappling telecommunication masts; to find out the residents' source of information on health risks associated with radiation that comes from dappling telecommunication masts; to ascertain their level of practice of precautionary measures against the health risks associated with radiation that comes from dappling telecommunication masts; and to ascertain demographic variables that influence knowledge and compliance in regard to health risks associated with radiation that comes from dappling telecommunication masts. The researcher employed the mixed method approach encompassing a quantitative aspect (survey) and a qualitative aspect (focus group discussion, FGD). The area of study was South-South geopolitical zone of Nigeria. A total of 663 respondents were selected from the region for survey while 12 discussants were selected for two FGD sessions of six persons per session. After the analysis of the quantitative and qualitative data, the study found that there is low awareness and knowledge of the health risks associated with dappling telecommunication masts among residents in South-South Nigeria. However, it was also found that mass media and the Internet are the major sources through which the residents gain information on health risks associated with radiation that comes from dappling telecommunication masts. Nevertheless, there is low practice of precautionary measures by the residents against the health risks associated with radiation that comes from dappling telecommunication masts. The study further discovered that awareness of health risks associated with radiations coming from dappling telecommunication masts seems to be influenced by gender, marital status, level of education and state of residence. Also, their knowledge of these risks is probably influenced by their gender, level of education and state of residence; while their practice of precautionary measures is likely influenced by their age, level of education and occupation. Hypothesis testing indicates that if the residents are aware of the health risks associated with exposure to radiation emitted from telecommunication

masts, then they would take health action to guard against health conditions as a result of such exposure.

5.2. Conclusion

The findings of this study indicate low awareness and knowledge as well as low precautionary practices in regard to radiations from dappling telecommunication masts among residents in the South-South of Nigeria. This result leads to the conclusion that these residents are a very vulnerable group as far as the health implications of situating telecommunication masts close to human residents are concerned. This vulnerability is linked to their low knowledge which resulted in their inability to perceive the risk involved and acting accordingly. Akin and Adeniji (2014) observe that the essence of health information is to reduce an individual or community's vulnerability to health hazards as being armed with such information makes one vigilant and encourages positive attitude that undermines health vulnerability. Commenting on this fact, Husain, Gwary, Yusuf and Yusuf (2017) put it this way:

> Health information is very crucial to human survival, and this is the reason health communication ought to occupy a prime place in the life of any community or nation. A health-informed community or nation is in a better position to take positive health actions whereas their uninformed counterpart is a serious risk unto itself… Once health awareness and knowledge exist, there is more likelihood that an individual or community would act safely and live healthily. When these are absent, then the reverse definitely becomes the case (p.16).

Against the foregoing, one could safely affirm that the situation whereby there is poor knowledge and awareness leading to absence of risk perception and precautionary practices in relation to health hazards of telecommunication masts among the residents presents a potentially precarious health scenario. This conclusion stems from the fact that such disposition increases the residents' vulnerability to the stated risks (Akin & Adeniji, 2014; Husain, Gwary, Yusuf & Yusuf, 2017).

5.3. Recommendations

Based on the findings of this study and observations from literature, the following recommendations are made by the researcher:

1. There is need for a massive and sustained public enlightenment campaign regarding the health risks associated with radiations coming from telecommunication masts. Such campaign should be executed through the mass media, religious groups, conferences and seminars. This will help improve people's awareness and knowledge, thus reducing their likelihood to engage in risky behaviour.

2. Concerned regulatory bodies such as the NCC and NESREA should ensure adequate and strict enforcement of applicable environmental regulations in regard to erection of telecommunication masts. This is one way of addressing the health risks attendant on the spread of telecommunication installations around the country.

3. The nation may also need to review her town planning laws in order to address the problem of encroachment on areas within the designated range of telecom infrastructure as a result of change in demographics. For instance, such review should restrict development around areas with already installed telecommunication masts.

4. The mass media, in their report of environmental and health matters, should also give adequate attention to issues of health and environmental risks associated with situating telecommunication masts close to people's residents. Such reportage would serve as a form of advocacy for appropriate response from the authorities as well as an enlightenment for the populace.

5.4. Suggestions for Future Studies

i. Replicative studies should be conducted in other parts of Nigeria and even sub-Saharan Africa with the view to comparing findings and further validating the results of the present study.

ii. Research on similar study should aim to improve on what has been done here through expanding the scope of the study by way of a larger sample size, larger geographical scope and so on. This way, the results of the study could be more generalisable.

iii. A content analysis version to this study should be conducted. This time, the focus should be on analysing and ascertaining the content of the media in regard to news and other content focusing on the environmental and health implications of situating dappling telecommunication masts close to people's location. This would complement the survey study done here and as well potentially improve our knowledge of the subject matter on focus.

5.5. Limitations of the Study

This study was not without limitations. First, the sample used limited generalization to just the population studied. This necessitated the recommendation that further studies should focus on other populations.

There also appeared to have been misconceptions and lack of awareness on the part of some of the respondents regarding the real intention of the researcher might have caused some of the people to turn in partially completed and uncompleted surveys. As a result, the questionnaire was completed by 581 respondents.

Furthermore, the researcher's literature search revealed an apparent dearth of local empirical literature on risk perception regarding dappling telecommunication masts. Consequently, the researcher incorporated literature that dwelt generally on the health implication of radiation and people's awareness, perception and response to it.

REFERENCES

Adekunle, A., Ibe, K. E., Kpanaki, M. E., Umanah, I. I. Nwafor, C. O. & Essang, N. (2015). Evaluating the effects of radiation from cell towers and high tension power lines on inhabitants of buildings in Ota, Ogun state. *Communications in Applied Sciences*, 3 (1), 1 – 21.

Adenike, I., Surukat, O.I., Sennuy, E., Adegboyega, A. (2015). The behaviour of youths and their vulnerability to drug abuse menace in Nigeria. *European Journal of Social Sciences* 10(1) pp.33-40.

Adeniran, A. I. (2008). The Internet and emergence of *Yahooboys* sub-culture in Nigeria. *International Journal of Cyber Criminology*, 2 (2), 368–381

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50, 179-211.

Akin, A. O. & Adeniji, M. (2014). Location adequacy of telecommunication masts and residents livability in Osogbo, Nigeria. *International Journal of Research in Applied*, 12(11), 7 – 16.

Akintonwa, A., Busari, A. A., Awodele, O. & Olayemi, S. O. (2009). The hazards of non-ionizing radiation of telecommunication mast in an urban area of Lagos, Nigeria. *African Journal of Biomedical Research*, 12(1), 31 – 35.

Akpolile, F. A., Akpolile, F. D. & Osalor, O. J. (2014). Radiofrequency power density measurements of telecommunication masts around some selected areas in Delta State. *Journal of Natural Science Research,* 4(15), 77-79.

Alabi, G.A. (1996). 'Telecommunications in Nigeria. Retrieved from' http://www.africa.upenn.edu/ECA/aisi_inftl.html.

Amah, E. (2008). Prevalence and risk factors of substance use among urban adolescents: An experimental study. *Journal of Psychology*, 2(5), 234 – 239.

Anaeto, S. G., Onabajo, O. S. & Osifeso, J. B. (2008).*Models and theories of communication.* Maryland: African Renaissance Books Incorporated.

Armstrong, H. L. & Forde, P. J. (2003). Internet anonymity practices in computer crime. *Information Management & Computer Security*, 11(5), 209 – 215. Retrieved from http://dx.doi.org/10.1108/09685220310500117

Baba, C., Cherecheş, R. M. & Moşteanu, O. (2007). The mass media influence on the impact of health policy. *Transylvanian Review of Administrative Sciences, 19 E/2007,* 15-20.

Baker, D. W., Gazmararian, J. A., Sudano, J.& Patterson, M. (2000).The association between ageand health literacy among elderly persons. *The Journals of Gerontology: Series B: Psychological Sciences,* 55(6), 68 – 74.

Baran, S. J. (2010). *Introduction to mass communication, media literacy and culture.* New York: McGraw-Hills.

Baran, S. J. and Davies, D. K. (2009).*Mass communication theory: Foundations, ferment, and future* (5th ed.). Wadsworth: CENGAGE Learning.

Baran, S. J. & Davies, D. K. (2012). *Mass communication theory: Foundations, ferment, and future* (6th ed.). Wadsworth: CENGAGE Learning.

Biebuma, J.J. & Esekhaigbe, E. (2011). Assessment of radiation hazards from mobile phones and GSM base stations. *Journal of Innovative Research in Engineering and Science,* 2(1), 1 – 9.

Becker, E. & Maiman, W. (1975). *Safety theories: History and perspectives.* Englewood Cliff, NJ: Prentice Hall.

Billy. O. (2009). Health effects of drug addiction on academic performance of post primary school students. *Journal of Education and Practice,* 3(5), 100 – 110.

Carpenter, C. (2010). 'A Meta-Analysis of the Effectiveness of Health Belief Model Variable in Predicting Behaviour.' *Health Communication* 25(8), 661 – 669.

Cartwright, D. (1972). Some principles of mass persuasion: Selected findings of research on the sale of U.S. war bonds. In W. Schramm & D. Roberts (Eds.), *The process and effects of mass communication* (pp.98 – 113). Urbana, Chicago, University of Illinois.

Christopherson, K. M. (2007). The positive and negative implications of anonymity in Internet social interactions: "On the internet, nobody knows you're a dog". *Computers in Human Behavior,* 23 (6), 3038–3056. Retrieved from http://www.sciencedirect.com/science/article/pii/S0747563206001221

Daramola, I. (2003). *Introduction to mass communication* (2nd ed.). Lagos: Rothan.

Davenport, D. (2012). Anonymity on the Internet: Why the price may be too high. *Communications of the ACM,* 45 (4), 33 – 35

Dominick, J. (2012). *Dynamics of mass communication: Media in transition* (12th ed.). New York: McGraw-Hill Higher Education.

Dreyfus, H. L. (1998). Education on the internet: Anonymity vs. commitment. *The Internet and Higher Education,* 1 (2), 113–123. Retrieved from http://www.sciencedirect.com/science/article/pii/S1096749499801743

Dürkop, H. J. &Englert, N. (2004). *Environmental health in Germany Every day examples: Status as of April 2004.* Postfach: BundesamtfürStrahlenschutz, Federal Office for Radiation Protection.

Edewor, P. A., & Imhonopi, D. (2013). The health risks of global system of mobile communication (GSM): Perceptions of health professionals and radiation experts in Ogun State, Nigeria. *International Journal of Social Sciences and Humanities Review*, 4(2), 72 – 78.

Eisend, M. (2006). Source credibility dimensions in marketing communication – A generalized solution. *Journal of Empirical Generalizations in Marketing, 10*(2), 1-33.

Erdogan, B. Z. (1999). Celebrity endorsement: A literature review. *Journal of Marketing Management, 15*(4), 291-314.

Eriksson-Backa, K. (2014). Health information literacy and demographic background in relation to health risks, diabetes and heart disease among older Finnish adults. *Informaatiotutkimuksenpäivät,* 6(7), 234-244.

Gazmararian, J. A., Baker, D. W., Williams, M. V., Parker, R. M., Scott, T. L., Green, D. C., Fehrenbach, N., Ren, J.&Koplan, J. P. (1999). Health literacy among Medicare enrollees in a managed careorganization.*JAMA,* 281(6), 545-551.

Glendon, R. & Walker, F. (2013). *Understanding the protection motivation theory.* Retrieved from http://www.academicarticles.org/understanding-protection-motivation-theory.13567_pdf

Grasso, V. F. (2008). *United Nations Environment Programme (UNEP) Early warning systems: State-of-art analysis and future directions*. Retrieved from na.unep.net/geas/docs/Early_Warning_System_Report.pdf.

Green-Pedersen, C. and Stubager, R. (2010). 'The political conditionality of mass media influence: When do parties follow mass media attention?' *British Journal of Political Science,* 40, 663 – 677.

Husain, M. A., Gwary, M. S., Yusuf, I. D. & Yusuf, M. (2017). Perception of effects of GSM infrastructure on human health in Gombe, Nigeria. *IOSR Journal of Environmental Science, Toxicology and Food Technology,* 11(7), 44 – 52.

IFC (2007). *General EHS guidelines: Environmental air emissions and ambient air quality: Environmental, health, and safety guidelines*. Oslo: International Finance Corporation.

Internet World Stats (2017). *Internet users in Africa 2017*. Retrieved from http://www.internetworldstats.com/stats1.htm

Israel, D. (1992). *Determining sample size. University of Florida Fact Sheet PEOD-6.* Retrieved from http://sociology.soc.uoc.gr/socmedia/papageo/metaptyxiakoi/sample_size/samplesize1.pdf

Janz, N. & Becker, M. (1984). 'The Health Belief Model: A Decade Later.' *Health Education Behaviour,* (11), 1 – 47.

Jelili, O. O. O., Asani, M. O. & Afolabi, M. (2015). Telecommunication mast location and its health implication for residents in Ogbomoso, Nigeria. *Civil and Environmental Research,* 7(9), 57 – 64.

Levins, J., O'Meara, A., Ruhotina, M., Smith, R. & Delaney, T. (2015). An exploratory analysis of public awareness and perception of ionizing radiation and guide to public health practice in Vermont. *Journal of Environmental and Public Health,* 3(2), 1 – 6.

Martı´nez-Gonza´lez, M. A., Gual, P., Lahortiga, F., Alonso, Y., Irala-Este´vez, J. & Cervera, S. (2003). *Pediatrics,* 111(2), 315 – 320.

McIntyre, R., Thibodeaux, L., Hochhalter, A. & Zeber, J. (2013).PS3-41: The role of health literacy on medication adherence after discharge among medical aid program members. *Clinical Medicine & Research,* 11(3), 172 – 186.

McQuail, D. (1979). The influence and effects of mass media. In Curran, J. Gurevitch, M. and Woolacott, J (Eds.) *Mass communication and society* (pp.70 – 93). London: SAGE Publications.

McQuail, D. (2010). *McQuail's mass communication theory: An introduction* (6th ed.). Beverly Hills CA: Sage.

Medical Library Association (2003). *Health information literacy*. Retrieved from http://www.mlanet.org/resources/healthlit/define.html.

Niger Delta Development Commission, NDDC (2004). *Report of assessment for project erection and planning.* Abuja: Author.

Noar, S. M. (2006). A 10-year retrospective of research in health mass media campaigns: Where do we go from here?" *Journal of Health Communication: International Perspectives* 11(1): 21 – 42.

Okunna, C. S. & Omenugha, K. A. (2012). *Introduction to mass communication* (3rd ed.). Enugu: New Generation Books.

Olatunji, O. S. & Olatunbosun, A. (2013). Assessment of air quality and noise around some telecommunication base transceiver stations in Ibadan South West Nigeria. *International Journal of Engineering Research and Applications (IJERA),* 3 (2), 1041 – 1048.

Osibanjo, O. (2009). Electronic waste: A major challenge to sustainable development in Africa. Retrieved from http://ewasteguide.info/files/Osibanjo_2009_R09.pdf.

Parker, R. M. & Schwartzberg, J. G. (2001). What patients do - and don't - understand. *Postgraduate Medicine,* 109(5), 13-16.

Sampei, Y. & Aoyagi-Usui, M. (2009).Mass-media coverage, its influence on public awareness of climate-change issues, and implications for Japan's national campaign to reduce greenhouse gas emissions. *Global Environmental Change,* 19, 203–212.

Sarnat, J. A., Brown, K. W., Schwartz, J., Coull, B. A. & Koutrakis, P. (2011). Ambient gas concentrations and personal particulate matter exposures: implications for studying the health effects of particles. *Epidemiology,* 16(3), 385 – 95.

Schillinger, D., Bindman, A., Wang, F., Stewart, A. & Piette, J. (2004).Functional health literacy and the quality of physician – patient communication among diabetes patients. *Patient Education and Counseling,* 52(3), 315 – 323.

Schillinger, D., Grumbach, K., Piette, J., Wang, F., Osmond, D., Daher, C., Palacios, J., Sullivan,G. D.& Bindman, A. B. (2002).Association of health literacy with diabetes outcomes. *JAMA,* 288(4), 475-482.

Simpson, T. (2012).*Optimal location of mobile telecommunication masts: A case study of Cape Coast metropolitan area* (Master's thesis). Kwame Nkrumah University of Science and Technology Kumasi. Retrieved from http://hdl.handle.net/123456789/3937, retrieved November 11, 2014.

Sivasakthivel, T. & Siva Kumar Reddy, K. K. (2011). Ozone layer depletion and its effects: A review. *International Journal of Environmental Science and Development,* 2(1), p. 30-37.

Sørensen, K., Stephan Van den Broucke, S. V., Fullam, J., Doyle, G., Pelikan, J., Slonska, Z., Brand, H. & (HLS-EU) Consortium Health Literacy Project European (2012). Health literacy and public health: A systematic review and integration of definitions and models. *BMC Public Health,* **12**(80). Retrieved from http://www.biomedcentral.com/1471-2458/12/80.

Taylor, S. & Todd, P. (1995). An integrated model of waste management behaviour: a test of household recycling and composting intentions. *Environ. Behav.* 27(5), 603 – 630.

Temaugee, S.T., Daniel, T.A., Oladejo, K.O., Daniel, S. (2014). Assessment of public awareness of the detrimental effects of ionizing radiation in Kontagora, Niger State, Nigeria. *International Journal of Science and Technology,* 4(7), 131 – 141.

Terry, D.J., Hogg, M. A. & White, K. M. (1999). The theory of planned behaviour: Self-identity, social identity and group norms. *Br. J. Social Psychol.* 38(3), 225–244.

Turletti, T., Bentzen, H. J. & Tennenhouse, D. (1999). Toward the software realization of a GSM base station. *IEEE Journal on Selected Areas in Communications*, 17(4), 603-612.

Ward, M. L., Day, K. M. & Epstein, M. (2006). Uncommonly good: Exploring how mass media may be a positive influence on young women's sexual health and development. *New Directions for Child and Adolescent Development,* 112, 57 – 70. Retrieved from www.interscience.wiley.com.

WHO (2013). *Health literacy: The solid facts.* Kickbusch, I., Pelikan, J. M., Apfel, F. &Tsouros, A. D. [Eds.]. Denmark: WHO Regional Office for Europe. Retrieved from http://www.euro.who.int/pubrequest

WHO (2014). Track 2: Health literacy and health behaviour. *Health promotion*. Retrieved from http://www.who.int/healthpromotion/conferences/7gchp/track2/en/

Wilson, F. L., Mood, D. &Nordstrom, C. K. (2010).The influence of easy-to-read pamphlets about self-care management of radiation side effects on patients' knowledge. *Oncology Nursing Forum,* 37 (6), 774 – 781.

Wright, P. J. (2011). Mass media effects on youths' sexual behaviour: Assessing the claim for causality. In C. T. Salmon (Ed.) *Communication Yearbook,* 35, 343 – 385.

APPENDIX I

QUESTIONNAIRE

Dear respondent,

I am Abuah Florence Adaeze, a PhD student in the Department of Mass Communication, NnamdiAzikiwe University, Awka. I am conducting a study on **Radiations From Dappling Telecommunication Masts: Assessment of Risk Perception Among Residents Within Range of Telecommunication Masts in South-South Nigeria**. Please take a while to respond to the items raised in the questionnaire directed at measuring the health risk literacy of residents on the implications of radiation and dappling telecommunication masts. Your confidentiality is guaranteed as this is strictly academic.

Yours Sincerely,

Abuah, Florence Adaeze

Instruction: Indicate your answer by ticking in the appropriate box as in √

S/N	SECTION I: DEMOGRAPHIC VARIABLES	
1.	What is your gender?	(a) Male (1) ☐ (b) Female (2) ☐
2.	What is your age bracket?	(a) 18 – 20 ☐ (b) 21 – 25 ☐ (c) 26 – 30 ☐ (d) 31 – 35 ☐ (e) 36 – 40 ☐ (f) 41 – 45 ☐ (g) 46 – 50 ☐ (h) 50 and above ☐
3.	What is your marital status?	(a) Single (1) ☐ (b) Married (2) ☐ (c) Divorced (3) ☐

4.	What is your state of residence?	(a) Akwa – Ibom (1) ☐ (b) Bayelsa (2) ☐ (c) Cross River (3) ☐ (d) Delta (4) ☐ (e) Edo (5) ☐ (f) Rivers (6) ☐
5.	What is your highest educational qualification?	(a) SSCE/Equivalent (1) ☐ (b) OND (2) ☐ (c) HND (3) ☐ (d) Bachelor's degree (4) ☐ (e) Master's degree (5) ☐ (f) PhD (6) ☐
6.	What is your occupation?	(a) Student (1) ☐ (b) Farming (2) ☐ (c) Teaching (3) ☐ (d) Business (4) ☐ (e) Banking (5) ☐ (f) Civil Service (6) ☐ (g) Others (7) ☐
SECTION II: PROXIMITY TO TELECOMMUNICATION MASTS		
7.	Do you have telecommunication masts in your area?	(a) Yes (1) ☐ (b) No (2) ☐
8.	Which of the telecommunication companies has its mast closest to your area?	(a) MTN (1) ☐ (b) GLO (2) ☐ (c) AIRTEL (3) ☐ (d) ETISALAT (4) ☐ (e) Can't say (5) ☐
9.	What is the distance of the nearest telecommunication mast from your house?	(a) Very close ☐ (b) Close ☐ (c) Far ☐ (d) Very far ☐

SECTION III: AWARENESS AND KNOWLEDGE OF HEALTH RISKS ASSOCIATED WITH DAPPLING TELECOMMUNICATION MASTS		
10.	Are you aware that situating telecommunication masts close to people's residents constitutes some health risk?	(a) Yes ☐ (b) No ☐
11.	Telecommunication masts emit radiation that exposes one to risk of cancer?	(a) True ☐ (b) False ☐
12.	Telecommunication masts emit radiation that exposes one to risk of headache?	(a) True ☐ (b) False ☐
13.	Telecommunication masts emit radiation that exposes one to risk of cardiovascular stress?	(a) True ☐ (b) False ☐
14.	Telecommunication masts emit radiation that exposes one to risk of memory loss?	(a) True ☐ (b) False ☐
15.	Telecommunication masts emit radiation that exposes one to risk of low sperm count?	(a) True ☐ (b) False ☐
16.	Telecommunication masts emit radiation that exposes one to risk of birth defects?	(a) True ☐ (b) False ☐
17.	Telecommunication masts emit radiation that exposes one to risk of other health conditions?	(a) True ☐ (b) False ☐
18a.	**This instruction is for official use only:** Sum up the respondents' correct answers (one correct answer = 1) for items 11 – 16 and record accordingly in the space on the right.	(a) High knowledge (5 – 7) ☐ (b) Average knowledge (3 – 4) ☐ (c) Low knowledge (0 – 2) ☐
19.	What is your major source of information about the health risks associated with dappling telecommunication masts?	(a) Mass media ☐ (b) Internet ☐ (c) Conferences/Seminars/Workshops ☐ (d) Family/peers ☐ (e) Others ☐

SECTION IV: PRECAUTIONARY PRACTICES AGAINST HEALTH RISKS OF DAPPLING TELECOMMUNICATION MASTS		
20.	Have you been concerned about the potential health implication of the telecommunication mast situated in your area?	(a) Yes (1) ☐ (b) No (0) ☐
21.	If yes, have you ever thought of taking action against this health implication?	(a) Yes (1) ☐ (b) No (0) ☐
22.	Do you avoid going very close to the location of the mast due to health concerns?	(a) Always (3) ☐ (b) Sometimes (2) ☐ (c) Rarely (1) ☐ (d) Never (0) ☐
23.	Do you avoid spending so much time very close to the location of the mast due to health concerns?	(a) Always (3) ☐ (b) Sometimes (2) ☐ (c) Rarely (1) ☐ (d) Never (0) ☐
24.	Have you ever gone for medical check or advice due to health concerns arising from the closeness of telecommunication mast to you?	(a) Yes (1) ☐ (b) No (0) ☐
25.	How generally precautious would you rate yourself as being towards the health risks associated with telecommunication masts?	(a) Very precautious (2) ☐ (b) Somewhat precautious (1) ☐ (c) Rarely precautious (0) ☐
SECTION V: ENVIRONMENTAL REGULATORY AGENCIES AND ENFORCEMENT OF RELEVANT LAWS		
26.	Do you know that there are regulations guiding erection of telecommunication masts in the country?	(a) Yes ☐ (b) No ☐
27.	Do you think these regulations are necessary?	(a) Very Necessary ☐ (b) Fairly Necessary ☐ (c) Scarcely Necessary ☐

28.	Do you think the telecommunication companies operating in line with the regulatory agencies in terms of erection of mast?	(a) To a large extent ☐ (b) To some extent ☐ (c) To some extent ☐ (d) Don't know ☐
29.	Do you know there are agencies regulating erection of telecommunication masts in the country?	(a) Yes ☐ (b) No ☐
30.	Do you think these regulatory agencies are doing enough in terms of enforcing the guidelines for erection of telecommunication masts?	(a) To a large extent ☐ (b) To some extent ☐ (c) To some extent ☐ (d) Don't know ☐

APPENDIX II

FOCUS GROUP DISCUSSION GUIDE

Date_____

Location _____

Team Member:

Moderator:

Note taker:

Observer:

Duration of Discussion:

Start_____

End_____

Characteristics of Participants

S/N	Age	Gender	Educational Level
1			
2			
3			
4			
5			
6			

i. **Introduction:** Good day, my name is _____ and my colleague is _____ from the Department of Mass Communication of the Nnamdi Azikiwe University, Awka. I am carrying out a research on **Radiations From Dappling Telecommunication Masts: Assessment of Risk Perception Among Residents Within Range of Telecommunication Masts in South-South Nigeria**. Please be free with your answers as your anonymity is guaranteed. Your responses will be used for academic purposes only.

ii. **Group No. _____**

iii. **Location: _____**

iv. **No. of Participants: _____**

Conduct of the Discussion:

I want to encourage everyone to participate in the discussion. No answer given is wrong or right; what is important is that everyone is free to raise all ideas/opinions that they think or know and in the way they perceive it. The discussion will go this way: when a question is raised, one person will start with contribution while others follow with their own contributions one after the other. I look forward to your generous cooperation. Thank you in anticipation.

1. Could you share with us how much you know of the health risks associated with living close to telecommunication masts?

   Probe for:

   - *Whether the respondents are aware of health risks associated with telecom masts*
   - *Their source of exposure to information on this*
   - *Their extent of knowledge of details of these risks*

2. Would you say you have been worried or concerned by the fact that you stay close to a telecommunication mast?

   Probe for:

   - *Whether the respondents had felt concerned about their proximity to telecom masts*
   - *The specific health risks that they were concerned about*
   - *How sustained this concern is; continuous or momentary*

3. How much have you been taking precautionary measures against the possible risks associated with living close to telecommunication masts?

   Probe for:

   - *Whether the respondents are aware of the precautionary measures*
   - *Whether they take it*
   - *Their frequency of taking the precautionary measures*

4. How much do you know about the regulatory framework and regulatory agencies for erection of telecommunication masts in the country?

Probe for:

- *Whether the respondents know the regulatory framework and agencies*
- *Whether the respondents understand how the agencies and framework function*

5. Do you believe these agencies have been doing their work efficiently and do you think the telecommunication companies have been complying`?

Probe for:

- *Respondents' assessment of the performance of the regulatory agencies*
- *Their assessment of the compliance level of telecom companies*

APPENDIX IIIA

FOCUS GROUPS DISCUSSION TRANSCRIPT

(GROUP I, WARRI DELTA STATE)

Moderator: Friends you are welcome to this focus group discussion session. I want to encourage everyone to participate in the discussion. No answer given is wrong or right; what is important is that everyone is free to raise all ideas/opinions that they think or know and in the way they perceive it. The discussion will go this way: when a question is raised, one person will start with contribution while others follow with their own contributions one after the other. I look forward to your generous cooperation. Thank you in anticipation. We would be looking at the issue of telecommunication masts and the health risks associated with living close them. You all have been selected to be part of this discussion because you live close to at least one telecommunication mast. Now could you share with us how much you know of the health risks associated with living close to telecommunication masts due to the radiations emitting from them?

Participant No. 1: I'm aware that closeness to such masts entails some risk, health risk. I know for instance that it could lead to cancer due to radiation. I am sure there are as well other health hazards here which I may not be able to recall exactly.

Participant No. 2: Being close to telecommunication mast could lead to cancer because of the radiations. It causes heat and as well pollutes the environment due to the noise and smoke emanating from the station. All these are health risks.

Participant No. 3: There are about two telecommunication masts very close to my house; I don't think I have ever thought of their being dangerous to health. Of course, I am ignorant of this fact and so had never thought of that.

Participant No. 4: We live very close to a telecommunication mast. As a matter of fact, it is located within a church which shares a fence with my compound; so we are quite close to it such

that sounds emanating from it are very audible within my compound. You don't have to stress your ear to hear them. But I must confess that I never thought of this constituting any health risks

Participant No. 5: A telecommunication mast is located right inside my compound but at the backyard. The only risk I perceive is the possibility of it falling and causing harm. As for any health risks due to radiation, I am not aware of it.

Participant No. 2: I have up to three in my area but one is quite close, very close. Once you look out of my window you see it staring at you. Nevertheless, I wouldn't say I have seen any health risk in living close to it.

Moderator: Now let's consider this friends: would you say you have been worried or concerned by the fact that you stay close to a telecommunication mast?

Participant No. 4: In truth I have never felt concerned because I'm completely ignorant (laughs). You only fear what you know about.

Participant No. 2: I have not in truth felt really worried by the fact that I live close to a telecommunication mast. Even though I am aware of its health dangers, I have felt safe enough not to worry, but I know this shouldn't be the case; it is not a positive attitude.

Participant No. 1: Despite the fact that I am aware of the health risks, I have never felt really bothered. If you ask me whether I had given thought to packing out of the house due to closeness to mast, my answer will be categorical no. So, this is clear evidence that I as a person has never feared suffering any health consequences due to my proximity to a mast though I'm convinced the risks are real.

Participant No. 3: I have not felt concerned or worried about any health implication. I think I have gone about my business normally without minding any mast. I see the mast as just being there, while I am just there.

Participant No. 5: I have felt a little worried sometimes but not because of any health risks associated with radiation but because I feel the mast being inside my compound could expose one to the danger of electric shock. I have equally thought of it falling; in fact it had happened in my dream before.
(General laughter)

Moderator: Okay, thanks discussants for your cooperation so far. Now let me ask: how much have you been taking precautionary measures against the possible risks associated with living close to telecommunication masts?

Participant No. 3: But would one talk of taking action when you are not even thinking of any danger? Honestly, since I have felt no health threat, there is no talk of taking any precautionary action.

Participant No. 4: I think Participant No. 3 has hit the nail on the head; there is no action to talk about when one had nothing to fear. Before now, I never knew that one is exposed to health risks by living close to a mast.

Participant No. 5: I have never done any of those (medical check, avoiding closeness to mast) simply because I did not know of any risk. The mast in my area has been there for ages and it has never occurred to me to avoid them or to visit a hospital to see if I have been harmed; never.

Participant No. 6: I don't think I have taken any serious measure against any health risk. The truth is that I am not even informed of these risks. The only thing that I can say is that whenever I am approaching a mast, there is this phobia of the mast falling on me. I try to conquer it because I know it is a function of nervousness.

Participant No. 1: I have been mindful of how close I go to any mast irrespective whether it is located where I live or not. It's just that I have come to know about the danger through a friend and have gone ahead to read about it online, so I am somehow cautious, though can't say whether I have been cautious enough.

Participant No. 2: Just like Participant No. 1, I believe I have not been completely carefree in the way I go close to a telecommunication mast. I am always mindful of the risk, though I wouldn't deny that I sometimes fail to do this.

Moderator: You said you sometimes fail to do what? Could you elaborate Participant No. 2?

Participant No. 2: I mean I sometimes fail to apply caution in the way I stay close to masts. But much as I am at times carefree, I am not entirely off-guard.

Moderator: Okay, I think I got you now. Does anybody have anything to add on this? If not, let's proceed to discuss the regulatory framework and regulatory agencies for erection of telecommunication masts in the country; how much do you know about the regulations and the agencies that enforce them?

Participant No. 1: I know that we have Nigerian Communications Commission who supervises the GSM companies but I never knew they also regulate where and how they set up their masts. My feeling was that people erect masts indiscriminately without getting approval; honestly, that has been my impression.

Participant No. 6: I am unaware of any regulations or authority that enforce them.

Participant No. 3: I am equally unaware that erection of masts is regulated.

Participant No. 4: I didn't know this.

Participant No. 5: My answer is no; I don't think I am informed here.

Moderator: Participant No. 2 you haven't said anything?

Participant No. 2: I am not knowledgeable on this.

Moderator: Participant No. 1 you mentioned NCC – the Nigerian Communications Commission; haven't you also heard about NESREA?

Participant No. 1: What's the meaning?

Moderator: National Environmental Standards and Regulations Enforcement Agency.

Participant No. 1: I believe that I have heard of them; but I honestly don't know they have a role in regulating erection of masts.

Moderator: Now do you believe that NCC and NESREA have been doing their work efficiently and do you think the telecommunication companies have been complying? I am aware you don't know much about the regulations and the enforcement agencies but you may try to guess based on what you have observed regarding erection of masts in the country.

Participant No. 1: I think from the way masts are scattered everywhere even inside people's residents, I would guess the agencies have not been trying. Maybe the rules are there but they don't follow them.

Moderator: What of the telecommunication companies – what do you have to say about them?

Participant No. 1: Once the authorities are not enforcing the rules, you don't expect the telecommunication firms to be the ones insisting on the rules. They are here to make their money and not help you enforce your laws.

Participant No. 4: I cannot say because I don't know the basis for assessment. I don't know what the standards are.

Participant No. 3: I'm not in a position to speak on this; I'm not knowledgeable enough to comment.

Participant No. 6: I would agree with Participant No. 1 that there seem to be problems with enforcing the regulations. It appears obvious from the look of things. I think the masts are so scattered that they even make our cities seem untidy at times.

Participant No. 2: I would choose not to comment.

Participant No. 5: I guess the regulatory agencies have more to do. They might be trying but of course there is always room for improvement.

Moderator: We have come to the end of this exercise. Thank you everybody for your time.

APPENDIX IIIB

FOCUS GROUPS DISCUSSION TRANSCRIPT

(GROUP II, CALABAR, CROSS RIVER STATE)

Moderator: Friends you are welcome to this focus group discussion session. I want to encourage everyone to participate in the discussion. No answer given is wrong or right; what is important is that everyone is free to raise all ideas/opinions that they think or know and in the way they perceive it. The discussion will go this way: when a question is raised, one person will start with contribution while others follow with their own contributions one after the other. I look forward to your generous cooperation. Thank you in anticipation. We would be looking at the issue of telecommunication masts and the health risks associated with living close them. You all have been selected to be part of this discussion because you live close to at least one telecommunication mast. Now could you share with us how much you know of the health risks associated with living close to telecommunication masts due to the radiations emitting from them?

Participant No. 7: I know of radiation which is said to emit from the mast. I don't know exactly how it affects the body, but all I know is that it is dangerous to our health; it is something we should expose ourselves to.

Participant No. 8: I don't know of any health risk linked to living close to a mast. While it seems to me that I have heard that it is dangerous for people to stay very close to masts, I don't think I am precisely aware of the said risk.

Participant No. 9: I am not aware that being close to a mast can harm someone. I'm hearing that for the first time. I wouldn't go close to a mast because of fear of electric shock and not because of any other risk (I have phobia for electricity).

Participant No. 10: I see telecommunication masts the same way I see electric poles; I never thought being close to them would constitute any health risk unless one is electrocuted. I

understand the masts to be for telephone reception and never saw them as capable of doing harm to anybody's health.

Participant No. 11: I have never been aware of the dangerous radiations coming from masts. A mast has been in my compound for about seven years not and I don't think I have ever seen it as a source of possible health problem.

Participant No. 12: I may not have been worried as to the health risk. I think I have not worried about the mast. I see the mast as just being there, while I am just there.

Participant No. 9: I believe I have never entertained such worries. I see the masts as just being there. I never associated them with any sickness.

Participant No. 10: I have phobia for tall structures – whether building or mast. That's just the only worry I have entertained about masts. Other than that, I don't worry about them.

Moderator: But would you say you have been worried or concerned by the fact that you stay close to a telecommunication mast?

Participant No. 12: I have never been worried. I didn't even know the masts are dangerous to health. I remember having stood there taking selfies without any feeling at all of being close to danger.

Participant No. 11: I don't feel worried at all. How would I, for God's sake being that I never thought of the masts being dangerous health wise?

Participant No. 10: I think one needs to know of a danger before being worried by it. I am ignorant of such (health risk) and so have nothing to fear naturally. I also think it's like that for most people, if not, we should be hearing people complaining and raising alarm because these masts are ubiquitous in residential areas; but we aren't seeing such complaints implying that people don't really care.

Participant No. 7: I must admit that I have felt worried or even afraid of the possible health hazards of the telecommunication mast that is right inside my compound. I know of the radiation and its effect and this has made me to nurse the fear at times that one might be subjecting himself to a serious danger.

Participant No. 8: I have not worried about the health implications because I did not know of this before now.

Moderator: Participant No. 9 say something; can we hear you?

Participant No. 9: My answer is no; I never hear such worries.

Participant No. 10: I believe I have never entertained worries about masts., maybe because I was not aware of their risk to health.

Moderator: Now let's consider this: how much have you been taking precautionary measures against the possible risks associated with living close to telecommunication masts?

Participant No. 8: I always feared that there one could be electrocuted going near the mast especially when the environment is wet. That is the same feeling I have of electric transformers, though when it comes to masts, I'm not sure how correct I am. As for any other health risks that have been mentioned here, I have not been aware of them talk more of taking precaution.

Participant No. 12: Since I have never seen my closeness to the mast as a health issue, I couldn't have bothered to go for medical check or even try to avoid the mast. The truth is that I have never seen as a matter to give attention to.

Participant No. 11: I even find the whole idea of going to see a doctor because I live close to a mask funny, though I may be wrong. However, why would I live close to something that would

make it necessary for me to be seeing my doctor periodically as a matter necessity? Why not move out of the place entirely? It's sounds like one choosing to live close to where mosquito breeds only to be treating malaria as a matter of routine. For me, I never saw the mast as necessitating my going to hospital, but once I see it that way, then the best thing, I think,, would be to pack out of the place.

Participant No. 10: To state it plainly, I have never thought of any precautionary measure because I never saw any risk in the first place, not to talk of preventing it.

Participant No. 7: I try to avoid being very close to the mast even though it's always close. Also, whenever for one reason or the other I can't avoid coming very close, I just try to reduce as much as possible the length of time I spend there. It has become ever present in consciousness that at times I don't even know when I do it. The mere thought of being vulnerable to cancer is enough for me to act this way.

Participant No. 11: I don't think I worry about my closeness to mast, as I said here before. I live my normal life.

Participant No. 9: I have heard people talk about masts being dangerous but I have not really put my mind on that; so I haven't done anything to avoid being harmed because I am not too sure of which is which.

Moderator: Now, people let's talk about the regulatory framework and regulatory agencies for erection of telecommunication masts in the country – how much do you know about them?

Participant No. 7: I had always thought that erection of masts ought to be regulated, but I don't think I have actually known who does this and the applicable regulations neither have I made any effort to know these.

Participant No. 9: I never knew of any agency. I am not even aware that it is regulated. But I know we have NCC which regulates the operations of the telecom companies.

Participant No. 8: I lack information on this.

Participant No. 11: I am simply unaware of the agencies or the rules they enforce.

Participant No. 12: I would say the same.

Moderator: Participant No. 10, we haven't heard you on this – are you also not aware of the regulations and the agencies?

Participant No. 10: I am, not; that's the truth of the matter.

Moderator: Do you believe these agencies have been doing their work efficiently and do you think the telecommunication companies have been complying? I know you are not knowledgeable about them and their activities, but from what you are seeing regarding erection of masts in the country, could you attempt to rate them?

Participant No. 9: Since I don't even understand the terrain, I don't know what to say. I have no understanding of how the regulations work and I don't know about the agencies involved, so can't say anything about their performance.

Participant No. 12: I'm not aware of the regulations and so cannot say how well they have worked or how well the people involved have performed.

Participant No. 11: I am not informed at all to make an evaluation here. I can only do so when I get adequately informed.

Participant No. 10: Though I don't know what the rules are, I would guess the agencies may not be doing their work well which may have encouraged the companies to be flouting the rules. I say this because I think the way masts are located suggest it is done arbitrarily.

Participant No. 8: I am not conversant with the guidelines but I would agree that the guidelines may not be working efficiently based on what we have seen so far. The masts at times seem indiscriminately located – that's my assessment anyway.

Participant No. 7: I am being persuaded to agree that the regulations are not just working. I am not in a position to know what is wrong, though. However, I believe that erection of masts seem uncoordinated as it is today,, I might be wrong anyway.

Moderator: We have come to the end of this exercise. Thank you everybody for your time.

APPENDIX IV

PANORAMIC PICTURES OF DAPPLING TELECOMMUNICATION MASTS IN SOUTH-SOUTH, NIGERIA

AKWA IBOM STATE

Figure 2: A street in Akwa Ibom State

Figure 3: Ikop Ekepan Quarters, Umana Compound

Figure 4: Obot Epkeme Quarters, Akpan Compound (Masts is 2 Meters to the house, 30 meters in height)

AKWA IBOM STATE CONT'D.

Figure 5: Edouru Quarters, Mr Etet compound

Figure 6: Etukapan Quarters, Etan compound (3 Meters to the house, 35 meters in height)

Figure 7: Ukot Itan quarters, Epkeme compound (3.5 meters to the house, 25 meters in height)

BAYELSA STATE

Figure 8: Entrance of Bayelsa State

Figure 9: Participant No. 12 Quarters; EbiParticipant No. 12 Compound (1 meter to the houses, 30 meters in height)

BAYELSA STATE CONT'D.

Figure 10: Ebis Quarters; MrsRomie-oki Compound
(4 meters to house, 30 meters in height)

Figure 11: Azikoro Quarters; Ebizimor Compound
(3 Meters to house, 30 meters in height)

Figure 12: Amarata Quarters; Tamarakero Compound
1 meter to houses, 30 meter in height

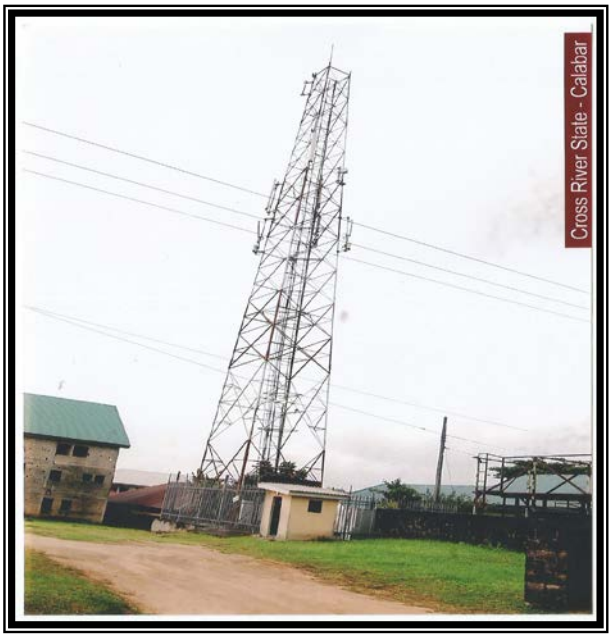

Figure 13: Ere Robison Quarters; Mac jaja Compound

CROSS RIVER STATE

Figure 14: Mayne Quarters; Mr Prince Compound (3 Meters to houses, 25 meters in height)

Figure 15: Etonka Quarters; Mr. David's Compound (2.5 meters to houses, 30 meters height)

CROSS RIVER CONT'D.

Figure 16: Sabongari Quarters; Edet Compound (2 meters to houses, 35 meters height)

Figure 17: Marian Quarters; Mrs. Bassey's Compound (3 meters to houses, 30 meters in height)

DELTA STATE

Figure 18: Entrance of Delta State

Figure 19: Amb. Leo Okogwu Quarters; Amaechi Agusi's compound (3 meters to houses, 25 meters in height)

Figure 20: Ndah F.C. Ekene Quarters; Ogbuesh A. C. Nwanze's Compound

DELTA STATE CONT'D.

Figure 21: Olishe Quarters; Micheal Esealuke Compound (1 meter to house, 25 meters in height)

Figure 22: Umuagu Quarters; Mrs. Dumebi Amaka's compound (2 meters to house, 35 meters in height)

Figure 23: Lady Stella Quarter; Amb. Okioko's Compound

EDO STATE

***Figure 24: Iyen Quarter; Mr. Abieyuwa's compound (*2 meters to houses, 25 meters in height)**

***Figure 25: Ikpobi Quarters; Chief Ehigiator's compound (*2 meters to house, 30 meters in height)**

EDO STATE CONT'D.

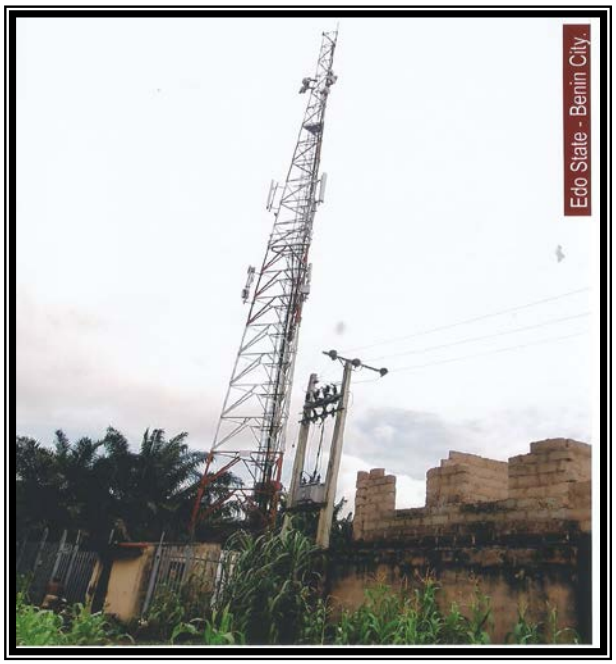

Figure 26: Ikpobi Quarters;
Chief Ehigiator's compound
(2 meters to house, 30 meters in height)

Figure 27: Isumwa Quarter;
Mrs. Esohe-Esosa Erharuvi's Compound
(2 meters to the house and 25 meters in height)

Figure 28: Akapakpwa Quarters;
Erharuyi Emwingharw's compound

Figure 29: Igun Quarters;
Imadeyunuagbon's compound

RIVERS STATE

Figure 30: Entrance of Port-Harcourt

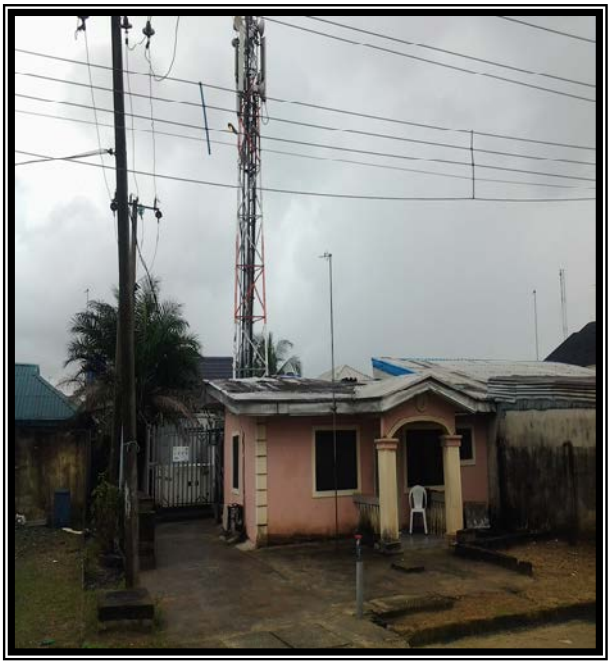

Figure 31: Agip quarters; Mrs. Charity's compound (half meter to the house, 25meters in height)

RIVERS STATE CONT'D.

Figure 32: Eliowahani quarters;
Ere Robinson compound

Figure 33: Mgbuoshimin Larry Quarters;
Mr. Peter Nyeso Ogunka's compound
(1 meter to the house, 20 meters in height)

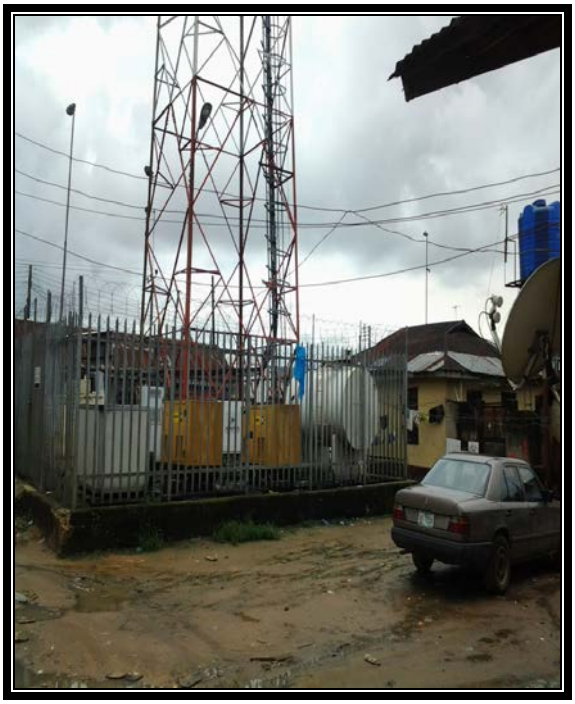

Figure 34: Rumukuta Quarters;
Mr. Temple's compound
(2meters to the house, 25meters in height)

Figure 35: Rumukoro Quarters;
Wikimor's compound
(1meter to the house, 20 meters in height)