ASSESSMENT OF AWARENESS, ATTITUDE AND PRACTICE TOWARDS OBSERVATION OF RETINOBLASTOMA AMONG MOTHERS OF UNDER-FIVE CHILDREN IN KADUNA STATE, NIGERIA

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A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY ZARIA, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER DEGREE IN HEALTH EDUCATION

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DECLARATION

I Longji Hassan declare that, the dissertation entitled ASSESSMENT OF AWARENESS, ATTITUDE AND PRACTICE TOWARDS OBSERVATION OF RETINOBLASTOMA AMONG MOTHERS OF UNDER-FIVE CHILDREN IN KADUNA STATE, NIGERIA has been written by me in the Department of Human Kinetics and Health Education under the supervision of Dr. Umar Musa and Prof. (Mrs) V. Dashe. The information derived from the literature has been duly acknowledged in the text and a list of reference provided. No part of this dissertation was previously presented for another degree or diploma at any university.

_____ Date_____

Longji Hassan

CERTIFICATION

This dissertation entitled ASSESSMENT OF AWARENESS, ATTITUDE AND PRACTICE TOWARDS OBSERVATION OF RETINOBLASTOMA AMONG MOTHERS OF UNDER-FIVE CHILDREN IN KADUNA STATE, NIGERIA by Longji Hassan meets the regulations governing the award of the master's degree of Ahmadu Bello University, and is approved for its contributions to knowledge and literary presentation.

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DEDICATION

This dissertation is dedicated to God Almighty, the Giver of life and all good things; to Him be all the glory forever.

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ABSTRACT

This study assessed awareness, attitude and practice towards observation of retinoblastoma among four hundred (400) mothers of under-five children in Kaduna State, Nigeria. The study employed descriptive survey research design. The population of the study comprised of all mothers of under-five children in Kaduna State which are 2,050,608. Three specific purposes, research questions and hypotheses were formulated to guide the study. A multi-stage sampling technique comprising of systematic, simple random, purposive and proportionate sampling technique was used in selecting the required number of respondents for the study as stated above. Four hundred (400) copies of the researcher-developed questionnaire were distributed using simple random sampling technique, of which 374 (93.5%) were retrieved and considered valid for the study. Data collected was analyzed using the Statistical Package for Social Science (SPSS) version 20. Frequency and simple percentages were used to describe the demographic characteristics of the respondents, while mean and standard deviations were used to answer the research questions. Inferential statistics of one-sample t-test was used to test the formulated hypotheses at 0.05 alpha level of significance. The findings of the study revealed that awareness of retinoblastoma among mothers of under-five children in Kaduna State was significant (t=29.730, p= 0.001), Attitude towards observation of retinoblastoma was also shown to be significant (t=19.327, p=0.001) and practice towards observation of retinoblastoma among mothers of under-five children was also significant (t=22.498, p=0.001). In conclusion, the study showed that mothers of under-five children are aware of retinoblastoma, have positive attitude towards observation of retinoblastoma and also have adequate practice towards observation of retinoblastoma. It was therefore recommended that health care workers should at all time give health talks on retinoblastoma to mothers of under-five children during their usual ante and post-natal days so as to further enlighten and help sustain their awareness of the disease. It was furthermore recommended that administrators of crèche and nursery schools should conduct periodic eye examination and screening in their schools as part of their school health services. This is for the purpose of screening for retinoblastoma since the age group predisposed to this cancer are mainly pre-school age children.

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ABBREVIATIONS

AAO	American Academy of Ophthalmology
ACS	American Cancer Society
BL	Blindness
CTS	Computer Tomography Scan
HIC	High Income Countries
IARC	International Agency for Research on Cancer
LMIC	Low-Medium Income Countries
NCI	National Cancer Institute
NHCRN	National Headquarters of Cancer Registry in Nigeria
NRCT	National Registry of Childhood Tumour
NSCR	Nigerian National System of Cancer Registry
RB	Retinoblastoma
ROP	Retinopathy
SEER	Surveillance Epidemiology and end Results
SVI	Severe Visual Impairment
UCH	University College Hospital
UICC	Union of International Cancer Control
VI	Visual Impairment
WHO	World Health Organization

OPERATIONAL DEFINITION OF TERMS

Awareness: ability of mothers of under-five children to identify or recognise retinoblastoma.

Attitude: the particular behaviour in which mothers of under-five children performs when they notice eye cancer.

Practice: those set of things done by mothers of under-five children in seeking help or remedy to eye cancer.

Retinoblastoma: is a cancer of the eye that mostly affects under-five children.

Mothers of under-five children: these are women with children who are below the age of five in Kaduna state.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The eye is one of the five major sense organs of the body, which makes vision possible. Problems associated with early development of the eye results into diverse eye problems including retinoblastoma. Retinoblastoma (eye cancer) is a cancer of the eye that starts in the retina, the very back part of the eye (Boyd & Maturi, 2016). The retina is the inner layer of cells in the back of the eye. It is made up of special nerve cells that are sensitive to light. These light-sensing cells are connected to the brain by the optic nerve, which runs out the back of the eyeball. The pattern of light (image) that reaches the retina is sent through the optic nerve to an area of the brain called the visual cortex, allowing us to see. The eyes develop very early as babies grow in the womb. During the early stages of development, the eyes have cells called retinoblasts that divide into new cells and fill the retina. At a certain point, these cells stop dividing and develop into mature retinal cells. Rarely, something goes wrong with this process. Instead of maturing into special cells that detect light, some retinoblasts continue to divide and grow out of control, forming a cancer known as retinoblastoma. Retinoblastoma is the most common type of eye cancer in children of ages 0-5 years and represents 3% of all childhood malignancies. It is a cancer of the very young; two thirds of the cases are diagnosed before 2 years of age, and 95% before 5 years of age (American Academy of Ophthalmology (AAO), 2013).

Retinoblastoma is a cancer of the very young and mostly found among under-five children, this cancer has another name that is “eye cancer”, the disease can affect people of any age but commonly affects children aged less than 5 years (American

Cancer Society (ACS), 2015). According to Broaddus, Topham and Singh (2009), the mean age-adjusted incidence of retinoblastoma in the United State of America was 11.8 per million children aged 0-4 years. They also confirmed that the incidence was similar to the rates reported in Europe. However, the incidence of retinoblastoma is not distributed equally around the world with 8000–9000 new cases recorded annually (AAO, 2013). It appears to be higher in Africa, India, and among children of Native American descent in the North American continent (Ward, DeSantis, Robbins, Kohler, & Jemal, 2014; Bunin, & Orjuela, 2015). Whether these geographical variations are due to ethnic or socioeconomic factors is not well known. However, the fact that even in industrialized countries an increased incidence of retinoblastoma is associated with poverty and low levels of maternal education (De Camargo, de Oliveira Ferreira, de Souza Reis, Ferman, de Oliveira Santos, and Pombo-de-Oliveira, 2011: Fajardo-Gutierrez, Juarez-Ocana, Gonzalez-Miranda, 2007) proves a point that awareness is requisite to early detection of the disease.

Awareness according to Merriam-Webstar Dictionary (2017) is having or showing realization, perception or knowledge of something. Therefore, awareness can be said to be knowledge. Zagzebski, (2017) stated that knowledge is a highly valued state in which a person is in cognitive contact with reality. Awareness in the context of this study is the knowledge of retinoblastoma, which is the ability of the subjects to identify the disease in their children or ability to recognize signs and symptoms of retinoblastoma in its early stage and form. In Nigeria today lack of proper awareness and mass media campaigns on evolving health issues is a major challenge to knowledge and awareness of evolving health issues. Cancers are a major cause of deaths in our society today, but major emphases are not made to help tackle the menace. Retinoblastoma is a rare and life-threatening condition, but when it is managed

optimally by a competent health team there is excellent prognosis for survival and good visual outcomes. But management of retinoblastoma continues to be a major challenge to health care providers as it is in most cases presented late in the healthcare centres, when eye salvage is not possible (Owoeye, Afolayan, & Ademola-Popoola, 2005). The ability to detect the disease while it is still in its earlier stage (intra-ocular) makes it possible for treatment and preservation of vision. Owoeye et al, (2005) reported that 65% of the cases died before completing the course of chemotherapy in Ilorin. Presumably this might be due to the poor awareness and attitudes towards health seeking which results to delays in reporting cases of retinoblastoma until it has spread to other parts of the eye.

According to a cross-sectional survey carried out by Ayanniyi, Jamda, Badmos, Adelaiye, Mahmoud, Kyari, and Nwana, (2010) on awareness and knowledge of ocular cancers in a resource-limited economy, it was reported that, awareness of ocular cancers compared to other cancers is low. Out of 280 respondents, 41.1% based their knowledge of patients having ocular cancers on sources other than hospital diagnosis. However, education was associated with awareness of ocular cancers and cancers in general. Epee, (2015) reported a limited knowledge of retinoblastoma among general practitioners in Cameroon. The study also revealed that a posting in ophthalmology during the training improve the awareness and practice pattern of general health practitioners. Latha, Chitralakshmi, Ravindran, Angeline, Kannan, and Scott, (2015) reported poor awareness of childhood malignancies among undergraduate students from all over South India in a undergraduate paediatric clinical training. This was attributed to the poor interest in pursuing paediatric oncology as their career, never had encountered any paediatric oncology patients in the ward and not having any lecture classes on paediatric oncology. An analytical cross-sectional study conducted by Atipo-

Tsiba, and Itoua (2015), to assess the level of knowledge of this tumour by midwives in two hospitals (Talangaï and Makélékélé) in Brazzaville. The study reported that there was a poor level of knowledge among the midwives as only 40% of them were able to define retinoblastoma, and 10% had associated leucocoria and strabismus as two early signs of this cancer. In contrast to the above studies Ibrahim, Aseel, and Yacoub, (2017), conducted a research to study the impact of awareness of retinoblastoma in the affected families on the management and outcome of familial retinoblastoma patients. The study reports that, awareness of families of the possibility of retinoblastoma and adequate screening led to a significantly higher rate of eye salvage in patients with familial retinoblastoma. Thus the study sought to assess the awareness of observation of retinoblastoma disease among mothers of under-five children in Kaduna state.

Attitude, according to Wood (2000), is a state of moderately intense emotions that prepares or predisposes individuals to respond consistently in a favourable or unfavourable manner when confronted with a particular object. Eagly and Shallz (1998) defined Attitude, as mental and neutral state of readiness organised through experience exerting a direction or dynamic influence upon the individual's responses to all objects and situations to which it is related. This has to do with the responses or feelings towards retinoblastoma disease, which mothers of under-five children have towards the disease, and ways to go about it when noticed on the child.

Epee, (2015), in a study on Knowledge, attitudes and practices of general practitioners on blinding eye diseases of children in Cameroon reported that, an average half of the general practitioners have a salvaging attitude especially in trauma and neonatal conjunctivitis with respective and with exposure in posting right attitude increases. Patenaude, Basili, Fairclough, and Li. (1996) conducted a study to assess attitudes toward testing for cancer susceptibility genes; they interviewed mothers of

paediatric oncology patients and realised a significant attitude by mothers of paediatric oncology patients. The study reported that, if genetic cancer predisposition tests were available, 51% of mothers would test themselves and 42% would test healthy children, even with no medical benefit. This study sought to assess the attitudes towards observation of retinoblastoma disease among mothers of under-five children in Kaduna state.

Practice can be defined as the act of doing something customarily, or habitually, or to do something regularly or constantly as an ordinary part of your life (Merriam-Webster, 2017). Practice is also defined as a way of doing something regularly (Duvivier, 2011). In relation to this study practice is referred to as practice towards observation of retinoblastoma and health seeking. This is the practices in which mothers of under-five children perform in terms of finding remedy for the infected child, that is, either going to a health facility, applying local herbs, visiting spiritualist/native doctors and many more.

Nkansah, (2018) assessed the knowledge, attitude and practice of infant ocular health among midwives in the Bosomtwe District. Level of knowledge was categorized using Blooms cut-off points into good (> 80%), moderate (60 - 80%) and poor (< 60%). Results of the study revealed that, out of 62 respondents, 50.7% were knowledgeable in infant ocular conditions. Poorest level of knowledge was recorded in retinoblastoma (6.5%) whiles level of knowledge in Ophthalmia neonatorum (100%) was the best. Thirty-six (58.1%) of the respondents performed ocular examination on infants. Majority of the respondents (85.5%) referred all abnormalities detected. Education of mothers was done by 82.3% of respondents and only 29% indicated receiving some form of in-service training with regards to infant ocular health. Attitude of respondents was positive with 74.2% of respondents disagreeing that infant ocular health

monitoring should only be done by an eye care professional. In conclusion respondents had poor level of knowledge in infant ocular conditions. However level of practice was satisfactory and there was generally positive attitude toward infant ocular health.

Despite the great paucity of epidemiological data's on cancer in Nigeria, some studies reported retinoblastoma to be the commonest childhood intraocular malignancy (Abdu, & Malami, 2011: Ochicha, Gwarzo, & Gwarzo, 2012). Retinoblastoma remains one of the major predominant cancers and second only to lymphoma as reported in most studies (Akang 1996; Mandong, Angyo, & Zoakah, 2000; Tijani, Elesha, & Bayo, 1995). Therefore since early detection of the disease is paramount to eye salvage and saving of the child's life, this study therefore, intends to assess the awareness, attitude and practice towards observation of retinoblastoma disease among mothers of under-five children in Kaduna State.

1.2 Statement of the Problem

It is estimated that, in almost half of the 1.4 million children who are blind today (WHO, 2017), the underlying cause could have been prevented, or the eye condition treated to preserve vision or restore sight (Gilbert, & Foster, 2001), thus emphasizing the critical role of early diagnosis and appropriate treatment in preventing childhood blindness, a role that should involve primary care physicians including paediatricians and parents. Childhood blindness poses educational, occupational and social challenges with affected children being at higher risk of behavioural, psychological, emotional difficulties, impaired self esteem and poorer social integration (Jan, 2005).

Globally, about 1 in 15,000 children develop retinoblastoma, and it is estimated that 8,600 – 9,000 children are newly affected each year. Due to global population distribution, 90% of these children live in developing countries (Gilbert & Foster,

2001). The number of children with retinoblastoma is increasing. This is not an increase in incidence, but a result of the growing global population and decreasing infant mortality in many developing countries (Gilbert, et al, 2001). Even though only a small proportion of children with retinoblastoma in developing countries are seen at hospitals that keep records of cancer diagnoses. Gilbert, et al, (2001) stressed that, where registers do exist, many cases of retinoblastoma are excluded for reasons such as lack of pathological diagnosis or treatment by ophthalmology or neurology – rather than oncology. As a result, global statistical data about retinoblastoma is inconsistent and incomplete. Kruger, Reynders, Omar, Schoeman, Wedi, and Harvey, (2014), report that, there is generally poor outcome in children with retinoblastoma at a single institution in South Africa, reflecting its late diagnosis. Overall survival was only 33 - 43%, compared with the 95% achievable in developed countries. Lack of effective screening and early diagnosis leads to this unacceptably high mortality rate, this can be significantly reduced through early detection of retinoblastoma that may be achieved by ensuring that the 'red reflex' is tested for on all newborns and toddlers.

In Nigeria, there is great paucity of epidemiological data on ocular cancers among Nigerians, but studies have shown retinoblastoma to be the commonest childhood intraocular malignancy (Abdu, & Malami, 2011: Ochicha, Gwarzo, & Gwarzo, 2012). Almost all studies on ocular tumours in Nigeria are hospital-based and are concerned with the pattern especially, clinic-pathological reports of oculo-orbital tumours (Owoeye, Afolayan, & Ademola-Popoola, 2006). The researcher discovered that no study has been done or published anywhere in the world based on the knowledge of the researcher on awareness, attitude, and practices towards observation of retinoblastoma disease among mothers of under-five children. Most studies conducted on retinoblastoma are mostly on its Clinic and pathological pattern. A few

studies were done on awareness and knowledge of retinoblastoma, which in terms of scope, population and location is different from this study.

In Kaduna there seems to be lots of children who have lost their lives because of retinoblastoma, some have been permanently impaired visually and their chances of becoming future leaders shattered due to this disease. Many had to be withdrawn from schools after the loss of sight and blurry vision. Reluctance on the part of the mothers who often ignore unusual noticeable signs seen in the eye of the child when nursing them have also lead to the escalation of the disease which often at times cannot be treated and leads to the loss of sight through enucleation and even death of the child. In some cases where the child might complain of blur sight or inability to see objects properly parents' failure to take their children to the hospital for proper diagnosis and possible treatment may be due to lack of knowledge of the disease.

The researcher observed that apparently there seem to be a wide gap in the awareness of eye cancers among the general public, compared to the clinical advances made in the pathology of eye cancers in children. Most studies conducted on retinoblastoma were more on the clinical presentations and histology of the disease or among medical practitioners, no study has been conducted on the study of awareness, attitude and practice towards observation of retinoblastoma disease among mothers of under-five children in Kaduna state. Thus this study intends to fill the gap of identifying the level of knowledge of mothers in regards to eye cancer, their attitudes towards eye cancer and their practices towards retinoblastoma disease. Most studies identified late presentation of cases with retinoblastoma which suggests that there would be need for awareness on eye cancer. Therefore the researcher is encouraged to conduct the study on assessment of awareness, attitude and practice of retinoblastoma among mothers of under-five children in Kaduna state, Nigeria.

1.3 Purpose of the Study

The main purpose of this study was to assess the awareness, attitude and practice towards observation of retinoblastoma (eye cancer) among mothers of under-five children in Kaduna State. The specific objectives are to assess:

i. awareness of mothers of under-five children towards observation of retinoblastoma in Kaduna State.
ii. attitude of mothers of under-five children towards observation of retinoblastoma in Kaduna State.
iii. practice of mothers of under-five children towards observation of retinoblastoma in Kaduna State.

1.4 Research Questions

This research answered the following questions:

1. Are mothers of under-five children in Kaduna State aware of retinoblastoma?
2. Do mothers of under-five children in Kaduna State have the right attitude towards observation of retinoblastoma?
3. Do mothers of under-five children in Kaduna State practice observation of retinoblastoma?

1.5 Hypotheses

On the basis of the structured research questions, one major hypothesis and three sub-hypotheses were formulated for the purpose of this study.

Major Hypothesis

There is no significant awareness, attitude and practice towards observation of retinoblastoma among mothers of under-five children in Kaduna state.

Sub-Hypotheses

1. Mothers of under-five children will not significantly be aware of observation of retinoblastoma in Kaduna State.
2. Mother of under-five children will not have significant positive attitude towards observation of retinoblastoma in Kaduna State.
3. Mothers of under-five children will not significantly practice observation of retinoblastoma in Kaduna State.

1.6 Significance of the Study

The findings of this study will hopefully be of benefit to all mothers and women of childbearing age in Kaduna and even beyond. It will benefit them by providing them with information and awareness on retinoblastoma, its dangers and the need to observe and diagnose their little infants for retinoblastoma during their early stage of life. The study would help correct poor attitudes and practices of mothers of under-five children towards health seeking.

Also the findings of this research would be of benefit to health educators; it will provide them with the information on awareness, attitude and practice of mothers of under-five children towards retinoblastoma in Kaduna State, which would help them to structure their educational/sensitization efforts thereby creating awareness of retinoblastoma.

The findings will also benefit healthcare workers such as; nurses, physicians, and community health extension workers. It would provide them with information regarding the level of awareness, attitude, and practice of mothers of under-five children towards retinoblastoma in Kaduna State; thereby, helping them intensify efforts in their encouragement of mothers about the disease signs and symptoms during children clinics or health talks during post-natal care since they happen to be in close contact with mothers and their children (either for immunization or healthcare).

The findings would also be of benefit to health-related agencies such as; Ministry of Health, and Non-governmental organizations. It will provide them with information on the level of awareness of retinoblastoma disease among mothers in Kaduna State, and the practices carried out by these mothers in terms of health seeking for the disease. These will help them focus their intervention efforts and direct their campaigns towards creating awareness and developing new policies to help improve lives and reduce the chances of sight loss.

Lastly, the findings would benefit fellow researchers with relevant literature for further studies on retinoblastoma.

1.7 Basic Assumptions

On the basis of research evidence and professional opinions, the following assumptions were made for the purpose of this study.

1. Awareness of retinoblastoma would help in early detection of the disease, preservation of sight and survival of children under the age of five.
2. Poor attitudes and practices of parents towards screening and healthcare seeking could lead to loss of sight and death of children with retinoblastoma.

3. Delays in diagnosis and time of presentation would increase mortality globally in less-developed countries.

1.8 Delimitations of the Study

This study was delimited to the assessment of awareness, attitude, and practice towards observation of retinoblastoma among mothers of under-five children in Kaduna state.

It is also delimited to;

i. awareness of mothers of under-five children towards observation of retinoblastoma in Kaduna State.
ii. the attitude of mothers of under-five children towards observation of retinoblastoma in Kaduna State.
iii. the practice of mothers of under-five children towards observation of retinoblastoma in Kaduna State.
iv. It is also delimited to six (6) local government areas in Kaduna State, Nigeria.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This research assessed the awareness, attitude and practice towards observation of retinoblastoma among mothers of under-five children in Kaduna State. In order to make the research meaningful and reliable, relevant professional and scholarly research findings related to this study were reviewed and presented in the following sub-headings:

2.2 Conceptual Framework

Knowledge, attitude, and practice (KAP) study fundamentally assume a linear association between knowledge, attitude, and behavioural change. Therefore public health information systems informed by KAP data target knowledge through awareness campaigns with the expectation that this would promote good attitudes and ultimately lead to the positive change in behaviour (World Health Organization (W.H.O), 2008). To fundamentally bring about a sustainable attitudinal change regarding KAP, the World Health Organization recommends that an evidence-based intervention should be developed (W.H.O, 2010). The framework of awareness, attitude, and practice (AAP) below has been exploited for this purpose in this study.

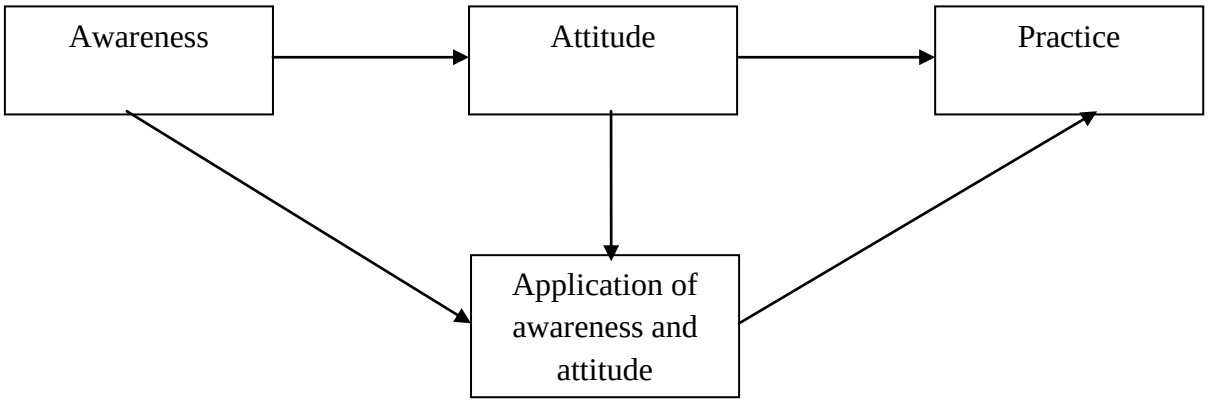

Figure 2.1: a conceptual framework of the awareness, attitude, and practice of retinoblastoma

The above conceptual framework of the awareness, attitude, and practice of retinoblastoma represents the linear relationship through which healthful practices can be formed by adjusting attitudes through awareness. Bennett, (1975) proposes that when participants apply their awareness and attitude, this leads to practice change and from practice change comes end results. It is based on the assumed linear

relationship between awareness, attitudes, and practices that this framework explores how the independent variables in the study affect the practice of health-seeking and self-examination among mothers of under-five children. The lack of awareness assessed as a function of knowledge or familiarity of retinoblastoma disease is assumed to influence motivation for self-examination on health issues. It is, thus, expected that such a scenario would be characterized by attitudes centred on a lack of specific expectations and can only be reversed by creating awareness on the public health issue in question. This intervention is then expected to produce desirable actions and is the fundamental basis of this framework.

2.2.1 Concept of Cancer

Cancer is the name given to a collection of related diseases. Cancer can start almost anywhere in the human body, which is made up of trillions of cells. Normally, human cells grow and divide to form new cells as the body needs them. When cells grow old or become damaged, they die, and new cells take their place. When cancer develops, however, this orderly process breaks down. As cells become more and more abnormal, old or damaged cells survive when they should die, and new cells form when they are not needed. These extra cells can divide without stopping and may form growths called tumours (National Cancer Institute (NCI), 2015).

There are more than 100 types of cancer. Types of cancer are usually named for the organs or tissues where the cancers form (NCI, 2015). For example, lung cancer starts in cells of the lung, and brain cancer starts in cells of the brain. Cancers also may be described by the type of cell that formed them, such as an epithelial cell or a squamous cell. Many cancers form solid tumours, which are masses of tissue. Cancers of the blood, such as leukemias, generally do not form solid tumours. Cancerous

tumours are malignant, which means they can spread into, or invade nearby tissues. In addition, as these tumours grow, some cancer cells can break off and travel to distant places in the body through the blood or the lymph system and form new tumours far from an original tumour. Unlike malignant tumours, benign tumours do not spread into, or invade nearby tissues. Benign tumours can sometimes be quite large, however. When removed, they usually don't grow back, whereas malignant tumours sometimes do. Unlike most benign tumours elsewhere in the body, benign brain tumours can be life-threatening (American Cancer Society, 2015).

Cancer cells differ from normal cells in many ways that allow them to grow out of control and become invasive. One important difference is that cancer cells are less specialized than normal cells. That is, whereas normal cells mature into very distinct cell types with specific functions, cancer cells do not. This is one reason that, unlike normal cells, cancer cells continue to divide without stopping. In addition, cancer cells are able to ignore signals that normally tell cells to stop dividing or that begin a process known as programmed cell death, or apoptosis, which the body uses to get rid of unneeded cells. Cancer cells may be able to influence the normal cells, molecules, and blood vessels that surround and feed a tumour—an area known as the microenvironment. For instance, cancer cells can induce nearby normal cells to form blood vessels that supply tumours with oxygen and nutrients, which they need to grow. These blood vessels also remove waste products from tumours. Cancer cells are also often able to evade the immune system, a network of organs, tissues, and specialized cells that protects the body from infections and other conditions. Although the immune system normally removes damaged or abnormal cells from the body, some cancer cells are able to "hide" from the immune system. Tumours can also use the immune system to stay alive and grow. For example, with the help of certain immune system cells that

normally prevent a runaway immune response, cancer cells can actually keep the immune system from killing cancer cells (NCI, 2015).

Cancer is a genetic disease—that is, it is caused by changes to genes that control the way our cells function, especially how they grow and divide. Genetic changes that cause cancer can be inherited from our parents. They can also arise during a person's lifetime as a result of errors that occur as cells divide or because of damage to deoxyribonucleic acid (DNA) caused by certain environmental exposures (Del Monte, 2015). Cancer-causing environmental exposures include substances, such as the chemicals in tobacco smoke, and radiation, such as ultraviolet rays from the sun (AAO, 2013).

Each person's cancer has a unique combination of genetic changes. As cancer continues to grow, additional changes will occur. Even within a same tumour, different cells may have different genetic changes. In general, cancer cells have more genetic changes, such as mutations in DNA, than normal cells. Some of these changes may have nothing to do with cancer; they may be the result of cancer, rather than its cause (NCI, 2015).

Cancer that has spread from the place where it first started to another place in the body is called metastatic cancer. The process by which cancer cells spread to other parts of the body is called metastasis. Metastatic cancer has the same name and the same type of cancer cells as the original, or primary, cancer. For example, breast cancer that spreads to and forms a metastatic tumour in the lung is metastatic breast cancer, not lung cancer. Under a microscope, metastatic cancer cells generally look the same as cells of original cancer. Moreover, metastatic cancer cells and cells of original cancer

usually have some molecular features in common, such as the presence of specific chromosome changes (NCI, 2015).

2.2.2 Concept of Retinoblastoma

Retinoblastoma is a malignant (cancerous) tumour of the retina, the thin nerve tissue that lines the back of the eye which senses light and forms images (Del Monte, 2015). It may be compared to the film in a camera that perceives images and sends these to the brain for interpretation. Although retinoblastoma may occur at any age, it most often occurs in younger children before the age of five years. Retinoblastoma affects one in every 18,000 births (Union for International Cancer Control (UICC), 2014), with an estimated 250 to 500 cases diagnosed in the United States each year. A tumour may be in one eye only or in both eyes. Retinoblastoma is usually confined to the eye but, if left untreated, is capable of metastasis or spreading to other parts of the body. A similar tumour, called a pinealoma, can occur in the pineal gland at the base of the brain in some patients with a hereditary form of retinoblastoma resulting in a condition called trilateral retinoblastoma.

The chain of events inside cells that leads to retinoblastoma is complex, but it almost always starts with a change (mutation) in a gene called the retinoblastoma (RB1) gene. The normal RB1 gene helps keep cells from growing out of control, but the change in the gene stops it from working as it should. Depending on when and where the change in the RB1 gene occurs, two different types of retinoblastoma can result. (1) A bilateral or multifocal, heritable form (25% of all cases), characterized by the presence of germ-line mutations of the RB1 gene; and (2) a unilateral or unifocal form (75% of all cases), 90% of which are non-hereditary. The most common

presenting sign of retinoblastoma is a white colour in the centre circle of the eye (pupil) when light is shone in the eye, such as when taking a flash photograph, it is commonly called cat eye reflex (leukocoria), and some patients may have eyes that appear to be looking in different directions (strabismus or squint) (Mayo Clinic, 2015). As the disease advances, patients present with orbital, and metastatic disease. Therefore, early diagnosis, while the disease is still within the confines of the eye, that is intra-ocular, is key; and cancer control initiatives aimed at early recognition of signs of retinoblastoma have the potential of a great impact, both improving cure rates and minimizing the need for intensive treatments (UICC, 2014).

Stages of Retinoblastoma

Disease stage correlates with a delay in diagnosis; growth and invasion occur as a sequence of events, and extraretinal extension occurs only once the tumour has reached large intra-ocular dimensions. Although retinoblastoma is very curable when diagnosed early and treated appropriately, the prognosis is dismal when the basic elements in diagnosis and treatment are lacking. While in high-income countries (HIC) retinoblastoma typically presents intraocularly, in Low-middle income countries (LMIC), 60-90% of children present with the extra-ocular disease because of late detection. Lack of education, limited access to health care facilities, and complex and deficient socioeconomic environments result in delayed and underdiagnosis in LMIC. However, the magnitude of the problem is difficult to ascertain given the paucity of population-based cancer registries in Nigeria and Kaduna state respectively. According to studies conducted by Leander, Fu, and Pena (2007); Rodriguez-Galindo, Wilson, and Chantada (2008) revealed that Retinoblastoma educational and public awareness campaigns have been shown to increase referrals, decrease rates of advanced disease, and improve outcomes in LMIC.

To plan treatment for retinoblastoma, the doctor needs to know the exact size and location of a tumour(s) to determine the stage of the disease. Although there are several staging systems currently available, the most common method is staging by intraocular (inside the eye) and extra-ocular (extending outside the eye) disease.

- **Intraocular retinoblastoma**: Cancer is found in one or in both eyes but does not extend beyond the eye into the tissues around the eye or to other parts of the body.
- **Extra-ocular retinoblastoma**: cancer has extended beyond the eye, usually by way of the optic nerve. It may be confined to the tissues around the eye, or it may have spread to other parts of the body.
- **Trilateral retinoblastoma**: In some patients with bilateral retinoblastoma a related tumour develops in the pineal gland at the base of the brain. The presence of these tumours can result in other neurological symptoms and require neuro-imaging of the brain for diagnosis. Trilateral retinoblastoma must be diagnosed promptly when present, as its presence requires different treatment approaches.
- **Recurrent retinoblastoma**: Recurrent disease means that cancer has come back or progressed after it has been treated. It may recur in the eye or elsewhere in the body. (Del Monte, 2015)

Leal-Leal, Dilliz-Nava, Flores-Rojo, and Robles-Castro, (2011) highlighted that, the level of awareness of the first contact health provider in identifying the problem and making the appropriate referrals is critical; the lack of knowledge by first contact physicians has been shown to be a significant barrier, thus they stressed the importance of targeting primary health care providers, parents especially mothers,

caregivers, and their likes, so as to help them become able to identify retinoblastoma in its early stage.

Symptoms of Retinoblastoma

Patients with retinoblastoma have four common presentations: leukocoria (56%), strabismus (24%), poor vision (8%) and family history (7%) (Leiderman et al., 2007). A child with retinoblastoma mainly presents a white pupillary reflex (Goldberg, 2000). The white pupillary reflex (leukocoria) is a white tumour in the retina that grows forward behind the lens and thus reflecting light out through the pupil (Rhee and Pyfer, 1999). The second most common sign is strabismus (squint) which may accompany or precede leukocoria (Carter, 2009; Lohmann, 2010). Jamalia, Sunder, Alagaratnam, & Goh, (2010) observed that in a cohort of 84 Malaysian patients with retinoblastoma, leukocoria was the primary ocular presentation of the disease (80%) followed by strabismus (14%), proptosis (10%) and other signs (10%). In addition, leukocoria was found to be the most common presenting sign among 50 Malaysian patients with retinoblastoma.

Causes of Retinoblastoma

Retinoblastoma is cancer of the retina. The retina is the light-sensitive lining at the back of the eye. During the early stages of a baby's development, retinal eye cells grow very quickly and then stop growing. However, in rare cases, one or more cells continue to grow and form cancer called retinoblastoma (Del Monte, 2015). Medi Resource (2016), also share the same view saying, “The body's cells reproduce themselves throughout a lifetime – tissues wear out and cells are replaced in a controlled manner. Retinoblastoma, like all cancers, occurs when that control is lost

and cells begin to divide at an unusually high rate". About 90% of children with retinoblastoma have no previous family history of the disease. Meanwhile, children who have a parent with the disease only account for less than 10% of all diagnosed cases (Medi Resource, 2016).

In about 4 out of 10 (40%) of cases, retinoblastoma is caused by a faulty gene, which often affects both eyes (bilateral). The faulty gene may be inherited from a parent, or a change to the gene (mutation) may occur at an early stage of the child's development in the womb. It's not known what causes the remaining 60 percent of retinoblastoma cases. In these cases, there's no faulty gene and only one eye is affected (unilateral). However, while less common, retinoblastoma may occur in only one eye and may still be hereditary and passed on to children, or inherited in siblings. The presence of multiple tumours in the affected single eye raises the chance that the disease may be hereditary. Because of the hereditary factor, brothers and sisters of children with suspected hereditary retinoblastoma should be examined as early as possible to find out if they may have or develop the disease (Del Monte, 2015).

Risk Factors of Retinoblastoma

Family history is the main risk factor for retinoblastoma. Children who inherit the altered gene have a 90% risk of developing retinoblastoma. (Medi Resource, 2016). If your child has retinoblastoma, particularly the hereditary type, there is an increased chance that he or she may develop second cancer in later years. These cancers are usually unrelated to the eye and may affect any organ in the body, but particularly the bone, soft tissue, or skin (Del Monte, 2015). Parents should continue taking their child for medical check-ups even after cancer has been treated.

Diagnosis of Retinoblastoma

A child's prognosis (chance of recovery and of retaining sight) and choice of treatment depend on the extent and location of the disease within and outside of the eye. Diagnosis of retinoblastoma is made by examination of the fundus of the eye (Retcam) under general anaesthesia using indirect ophthalmoscopy (Dimaras, Kimani, Dimba, Gronsdahl, White, Chan, & Gallie, 2012). Other diagnostic tools such as computer tomography scan (CTS), magnetic resonance imaging (MRI) and ultrasonography are used for differential diagnosis and staging, whereas histopathology or analysis of tumour material confirms retinoblastoma (Albert, Feldmann, Potter, & Kumar, 2003). The average age at diagnosis is 12 months for bilateral and 18 months for unilateral cases of retinoblastoma. Patients with either form of retinoblastoma have an overall 85% to 95% survival rate if diagnosed earlier but a worsening survival with increasing age at diagnosis. In infants with a positive family history of retinoblastoma, the disease might be diagnosed early upon investigation performed shortly after birth or periodically by an ophthalmologist (Dimaras, et al, 2012; Shields, Schoenberg, Kocher, Shukla, Kaliki, & Shields, 2013). A delay in diagnosis is often contributed by the retinoblastoma's usual localization in the posterior pole of the eye (Alvarez, Urgelles, & Gomez, 2005).

Jamalia Sunder, Alagaratnam, and Goh, (2010) had stated that timely diagnosis and improved treatment methods vastly improved prognosis for vision and survival. They also highlighted that late presentation with the advanced stage is a common and a major problem in developing countries. The prognosis is said to be worse for children in developing countries because their cancer is usually advanced by the time it is discovered (Aerts, Rouic, Villars, Brisse, Doz, & Desjardins, 2006; Jamalia, et al.,

2010). Intraocular disease beyond that of prognostic value is commonly seen in patients at time of diagnosis in developed countries (Abramson, Beaverson, Sangani, Vora, Lee, … & Hochberg, 2003).

Treatment and Drugs of Retinoblastoma

Retinoblastoma is a highly curable disease when diagnosed early. The treatment of retinoblastoma is multi-disciplinary, it aims at saving lives and preserving vision, and needs to be adapted to laterality and to the extent of disease or its stage (UICC, 2014). For patients with unilateral intra-ocular disease (NHS choices, 2016), enucleation may be curative, although approximately 20-30% of those patients may have high-risk pathology and require adjuvant chemotherapy. The long-term outcome of this group of patients is excellent; more than 80% survive. The outcome for patients with unilateral disease that has been enucleated is excellent, with good functional results and minimal long-term effects (Ross, Lipper, Abramson, & Preiser, 2001). The treatment of patients with bilateral retinoblastoma treated in state of the art treatment centres and on whom ocular salvage is intended incorporates up-front chemotherapy, which is intended to achieve maximum chemo-reduction of the intra-ocular tumour burden early in the treatment, followed by aggressive focal therapies. This approach has resulted in an increase in the eye salvage rates and in a decrease (and delay) in the use of radiation therapy. For patients with advanced intra-ocular tumours, ocular salvage rates can be above 60-70%, with survival rates in excess of 90% (Shields, Honavar, & Meadows, 2002: NHS choices, 2016).

There are many treatment modalities for children with retinoblastoma, and most children can be cured. The type of treatment depends on the extent of the disease within the eye, whether the disease is in one or both eyes, and whether the disease has spread

beyond the eye. Treatment options consider both cure of the cancer and preservation of sight or the affected eye, and include the following:

- **Enucleation** — surgery to remove the eye
- **Cryotherapy** — the use of extreme cold to destroy cancer cells
- **Photocoagulation** — the use of laser light to destroy blood vessels that feed the tumour or to heat the tumours so that chemotherapeutic drugs will be more effective.
- **Internal or external-beam irradiation therapy** — the use of high-energy radiation from x-rays and other sources to destroy cancer cells and shrink tumours. Radiation may come from a machine outside the body (external-beam radiation therapy) or may be administered by placing radioactive material into or very near a tumour (internal plaque radiation therapy or brachytherapy).
- **Chemotherapy** — the use of drugs to destroy cancer cells. One form of chemotherapy, called chemoreduction, is used to shrink the size of a tumour(s) so that even if not curative; the smaller tumours will be more amenable to other treatment modalities. Chemotherapy may be administered systemically (by mouth, with injections, or through a vein). In children with retinoblastoma, chemotherapy drugs may also be injected: 1. Directly into the fluid that surrounds the brain and spinal cord (intrathecal chemotherapy). 2. Directly into the artery that feeds the eye (intra-arterial) for local treatment that has fewer systemic side effects. Intra-arterial chemotherapy would be administered with the help of interventional radiologists and is used only for tumours that have likely not spread beyond the eye. (Del Monte, 2015).

Martin, Abdulkareem, Banjo, Anunobi, Daramola, and Nnoli (2011) conducted a study on the commonest orbito-ocular tumours of children in Lagos State. The study was carried out as a ten (10) year review (January 1991 – December 2000). A total of two hundred and ten orbito-ocular tumours were diagnosed, reviewed and analyzed at the Department of Morbid Anatomy of Lagos University Teaching Hospital Lagos, Nigeria. The study presented the total number of malignant orbito ocular tumours as one hundred and forty (67%) and the benign orbito-ocular tumours 70 (33%). Among the malignant tumours, retinoblastoma was found out to be the commonest orbito-ocular tumour and accounting for 55 (26.2%), with the disease more common in females than males with a ratio of 1.2:1.

Risk of Secondary Malignancies of Retinoblastoma

Wilson (2009) estimated that majority of patients with retinoblastoma (approximately 30%) die from second, third and fourth malignancies rather than from retinoblastoma itself (only 5%). Since the 1970s, numerous reports have been documented on the high risk of second malignancies among survivors of retinoblastoma (Nale, 2009). In parallel with these findings, a recent review by Lewis (2012) highlighted that mutation in the *RB1* gene as causing other cancers. Many children with retinoblastoma survive into adulthood and are prone to other non-ocular cancers (Serrano et al., 2011). Retinoblastoma gene (*RB1*) mutation carriers have a lifelong predisposition to non-ocular cancers, namely, osteosarcoma, melanoma and brain tumours (Abramson & Frank, 1998). Similarly, Genuardi and associates (2001) and Lohmann (1999) discovered second primary neoplasms, including bone and soft tissue sarcomas, malignant melanoma and neoplasms of brain and meninges in carriers of an *RB1* gene mutation and highlighted the increased risk of mortality from these second malignancies in patients with bilateral retinoblastoma. In an investigation of

second malignancies among 14 patients with a history of bilateral retinoblastoma, Rubin, Rosenfield, Abramson, Abramson, and Dunkel, (1997) identified 17 locally aggressive tumours such as osteosarcoma, malignant fibrous histiocytoma, high-grade spindle cell sarcoma, malignant mesenchymoma, leiomyosarcoma and angiosarcoma in various parts of the body, particularly in the facial structures and in the lower extremities. This was in accordance with Carter's (2009) statement that a second primary tumours may develop in any part of the body.

Approximately 60% of retinoblastoma cases are non-hereditary. In addition, almost all non-hereditary cases present as a unifocal tumour in a single eye. These unilaterally affected patients are not at increased risk of developing second cancer later in life (Albert et al., 2003). On the contrary, patients with heritable retinoblastoma possess a high risk of developing second new malignancies, namely, osteosarcoma, fibrosarcoma and chondrosarcoma (Turnpenny & Ellard, 2012). Nevertheless, these second neoplasms arise only in some patients and thus it was speculated that second tumours were induced by specific germ-line mutations (Genuardi et al., 2001). Furthermore, genetic predisposition and environmental factors also lead to an increased risk of second malignancies among survivors of retinoblastoma (Serrano et al., 2011). Valverde, Alonso, Palacios, and Pestana, (2005) recapitulated the increased risk for development of second primary tumours in an individual with a *RB1* germ-line mutation, with a cumulative incidence of 22% at the age of 25 years.

Dommering, Marees, Hout, Imhof, Heijboer, and Ringens, (2012) pioneered the study of the relation between specific *RB1* germ-line mutations and the risk of second primary malignancies in a cohort of patients with retinoblastoma. In numerous studies, parallels between predisposing *RB1* mutation and incidence of the second neoplasm have been observed. Concluding from these findings, Valverde et al, (2005) illustrated

that most of the second primary tumours were osteosarcomas (37.0%), other sarcomas (16.8%) and melanomas (7.4%), while brain tumours (4.5%), leukaemia (2.4%) and non-Hodgkin lymphomas (1.6%) were less frequent. They also highlighted that survivors of hereditary retinoblastoma have a lifetime risk of developing common epithelial cancers. Pinkerton, Plowman, and Pieters, (2004) and Sampieri, Hadjistilianou, Mari, Speciale, Mencarelli, and Cetta, (2006) stated that patients with familial *RB* mutations are prone to retinoblastoma only in early life and in adolescence are at increased risk of osteosarcoma. In other words, the occurrence of second cancerous tumours accelerates with time (Gera, Gera, Advani, & Manish, 1996). Based on past findings and research review, Pauser and Grimm, (2008) found that patients had a tumour free survival of about three decades between retinoblastoma and second malignancies. Gallie and Moore (as cited in Braggio, Bonvicino, Vargas, Ferman, Eisenberg & Seuanez, 2004) explained that patients with constitutional mutations exhibited a higher frequency of secondary tumours in adult life.

The survivors of hereditary retinoblastoma have an increased risk for metachronous malignancy due to prior treatment and genetic susceptibility of Retinoblastoma gene (*RB1*) (Abramson, 1999). Several studies indicated that second cancer arises in patients who receive radiation therapy as part of their treatment. Zhang, Walsh, Wu, Edmonson, Gruber, Easton,... and Wilkinson,. (2015) emphasized that the risk of second tumours is enhanced within the irradiated tissues following radiation treatment. Hence, the risk is greater for patients with germ-line mutations in *RB1*. Bhagia et al. (2011) discovered three retinoblastoma survivors who received prior radiation therapy had developed sinonasal adenocarcinoma. Serrano et al, (2011) speculated that radiotherapy increases the risk of a second primary tumour by 3.1 fold, especially the development of sarcomas. They also demonstrated that it is essential to

consider the *RB1* mutations and genetic predisposition for bone and soft tissue sarcomas among carriers in the absence of radiotherapy treatment. When retinoblastoma is treated with external beam radiation (EBRT), the risk for second malignancies becomes greater than 50% by the age of 50 years (Chen, Suthers, Carroll, Rudzki, & Muecke, 2003; Shin, & Grossniklaus, 2011). Similarly, Lohmann, (2010) highlighted the enhancement of risk for second cancer among patients with hereditary retinoblastoma who receive external beam radiotherapy.

Nale, (2009) reported that overall risk of second cancer among hereditary retinoblastoma survivors was 20-fold higher than that in the general population. For this, the retinoblastoma gene offers a genetic basis for this prediction using molecular diagnostics as a platform. Irrespective of treatment, most children develop second malignant tumour owing to germ-line retinoblastoma (*RB*) gene mutations (Gera et al., 1996). Osteosarcoma is the most common second malignancy observed in survivors of retinoblastoma (Gera et al., 1996). A case report by Pauser and Grimm (2008) highlighted the occurrence of a secondary malignancy identified as intramucosal leiomyosarcoma in a 37-year-old man following hereditary retinoblastoma during childhood. The patient was diagnosed with bilateral retinoblastoma at the age of 1 year old and had his right eye enucleated and his left eye treated with laser. The retinoblastoma was due to a germ-line mutation and there was no further case of retinoblastoma in his family history. Although neither radiation nor chemotherapy was used in his case, the investigator explained that the secondary malignancy might be due to primary genetic or structural alteration in the *RB1* gene that would have conferred proto-oncogenetic effect on the development of secondary malignancy.

Nale (2009) also reported a possible risk of epithelial cancers such as breast, lung and bladder cancer in middle-aged survivors of hereditary retinoblastoma. It is

reported that retinoblastoma survivors with bilateral phenotype and with an inherited germ-line mutation stand a higher chance for the risk of second cancer especially melanoma which is a highly malignant tumour due to shared genetic aberrations when compared with those with a de novo germ-line mutation (Kleinerman, Yu, Little, Li, Abramson, & Seddon, 2012). Prior studies by Kleinerman, Tucker, Tarone, Abramson, Seddon, and Stovall, (2005) reported that long-term hereditary retinoblastoma (Rb) survivors were predisposed to many new cancers in the long run, with radiotherapy being an enhancer of the risk of developing tumours in the radiation field. Their observation showed hereditary patients were at a significantly higher risk for another cancer such as sarcomas, melanoma, and cancers of the brain and nasal cavities when compared to non-hereditary patients (Kleinerman et al., 2005). This work was supported by Chen et al, (2003) by correlating RB1 germ-line mutations to the 500-fold increased risk for sarcoma. They postulated that about 6% of young patients with an RB1 mutation will develop soft-tissue sarcoma by the age of 18 years.

In a retrospective study, Bhagia et al. (2011) acknowledged that the incidence of second cancers in survivors of both unilateral and bilateral retinoblastoma with RB1 germ-line mutations have been reported previously. Gera and his team diagnosed a peripheral nerve sheath sarcoma and a spindle cell squamous carcinoma in patients with unilateral and bilateral retinoblastoma respectively (Gera et al., 1996). Lewis (2012) explained that mutant retinoblastoma (RB) genes have been identified in patients with breast, lung or prostate cancers or acute myeloid leukaemia but not in patients who never had any eye tumours. She suggested that these occurrences could be due to the expression of the same genetic defect in different tissues.

Development of Retinoblastoma (Tumourigenesis)

Mutations in retinoblastoma gene (*RB1*) may result in either malignant retinoblastoma or benign retinoma (Hung, Lin, Lee, Chen, Lin, & Chao, 2011). A tumour spreads throughout the eye, back along the optic nerve, to the brain, through the scleral channels to the orbit and by metastasis to the brain, skull, viscera, bones and lymph glands (McConkey, 1993). In the event of loss of heterozygosity in the *RB1* gene, two copies of the weak allele are yielded. These alleles are regarded as considerably active to prevent tumourigenesis. On the other hand, tumour arises when the second mutation is a null, causing a completely inactivated allele (Hung et al., 2011). So, when both alleles of RB1 gene are inactivated in embryonal retinal cells, a tumour develops (Harrison & Flavell, 1993; Kumaramanickavel, Joseph, Narayana, Natesh, Mamatha, & Shanmugam, 2003). A tumourigenesis process involves subsequent genetic structural aberrations in pathways that control biological processes such as cell proliferation and cell survival. Pertaining to this, it is worth mentioning the key roles of Rb and p53 pathways: the former controls cell proliferation while the latter regulates responses to cellular insults such as deoxyribonucleic acid (DNA) damage or oncogenic stress. Nevertheless, these pathways may be inactivated by alterations in their respective tumour suppressor genes, RB1 and *p53* (also known as *TP53*) or in genes encoding modulators and/or effectors in these pathways (Laurie, Donovan, Shih, Zhang, Mills, & Fuller, 2006).

According to Dimaras, Kimani, Dimba, Gronsdahl, White, Chan, and Gallie, (2012), germ-line damage causes high susceptibility to cancer, and generally, the targets of damage are tumour suppressor genes. Because the second copy of the tumour suppressor gene usually remains normal and active, tumourigenesis is suppressed and the development of the embryo is normal, due to the recessive character of the

alteration. Tumourigenesis manifests when the genome of a somatic cell is affected (Dimaras, et al, 2012). Quah (2005) observed that approximately 60% of retinoblastoma cases were non-hereditary in origin while the remaining 40% were hereditary. The former requires two postzygotic mutations in the retinal cells for retinoblastoma to arise. Since it is rare to acquire two spontaneous somatic mutations affecting the same gene in a single cell, the tumours that occur are often unifocal and unilateral that appears later in life. In the case of unilateral and unifocal retinoblastoma where the eye is not removed, the frequency of the patient possessing a germ-line mutation is only about 15% (Rasheed, Vemuganti, Honavar, Ahmed, Hasnain, & Kannabiran, 2002). On the other hand, individuals with a hereditary form of retinoblastoma are predisposed to early onset and multiple retinoblastoma tumours in both eyes. Thus, almost all bilateral tumours are hereditary. Only 10 – 15% of hereditary cases have a family history, the rest being new germ-line mutations which may be transmitted to a future generation (Zhang, Walsh, Wu, Edmonson, Gruber, Easton,... & Wilkinson, 2015; Quah, 2005).

Types of Retinoblastoma

Retinoblastoma can develop either sporadically or in a hereditary manner (Dimaras, Kimani, Dimba, Gronsdahl, White, Chan, & Gallie, 2012). Both non-inherited and hereditary forms of the disease are caused by mutations in the retinoblastoma gene. In accordance with this, Antoniou, Beesley, McGuffog, Sinilnikova, Healey, Neuhausen,... and Isaacs, (2010) predicted that retinoblastoma develops in 90% of carriers with a mutated *RB* allele. It is estimated that approximately 60% of cases are usually sporadic and unilateral, 15% are hereditary and unilateral, while 25% are hereditary and bilateral (Tibben, 2010; Vogelstein & Kinzler, 2002).

Collectively, 40% of hereditary retinoblastoma is inherited in an autosomal dominant manner (Ashcraft et al., 2007; Naish, Revest, & Court, 2009).

A. Non-hereditary Retinoblastoma

A retinoblastoma case is classified as sporadic when no other case of retinoblastoma is known in the family medical history (Dimaras, et al. 2012). Most often, patients with unilateral phenotype have sporadic retinoblastoma (Carter, 2009; Lohmann, 2010). The sporadic form has a later onset of disease if compared with hereditary retinoblastoma (Turnpenny & Ellard, 2012). Approximately 60% of patients are affected by sporadic or non-hereditary retinoblastoma (Sachdeva & O‟ Brien, 2012). In these patients, both retinoblastoma (*RB1*) gene mutations are of somatic origins that occur during retinal development. The dual mutations arise spontaneously in somatic cells and thus not transmitted to succeeding generation (Lohmann, 2010; Serrano et al., 2011). This is illustrated by a study on 16 Moroccan patients with sporadic unilateral retinoblastoma where mutational screening demonstrated the absence of *RB1* germ-line mutations (Abidi, Knari, Sefri, Charif, Senechal, & Hamel, 2011). The mutations are thus not found in other somatic tissues such as peripheral blood lymphocytes but can be detected in tumour material (Macdonald and Ford, 1991). Quah (2005) explained that if either of the two mutations which were identified earlier in the tumour material is found to be absent in the blood, then most likely the child has the non-heritable form of retinoblastoma. In this case, the risk to relatives is likely to be the same as in the general population.

B. Hereditary Retinoblastoma

Retinoblastoma is one of the well-described cancer syndromes that have a hereditary component (Greene, Kratz, Mai, Mueller, Peters, Bratslavsky,... & Watkins, 2010). As such, a child inheriting the single gene predisposing to retinoblastoma will

almost certainly develop a tumour (Lohmann, 2010; Knapke, Zelley, Nichols, Kohlmann, & Schiffman, 2012). Hereditary form accounts for 40% of overall cases of retinoblastoma. Of all heritable retinoblastoma cases, approximately 25% accounts for the familial form while the remaining 75% represents the sporadic form (Sachdeva & O‟ Brien, 2012). The familial form of retinoblastoma tends to appear at an earlier age than the sporadic form (Canty, 2009; Turnpenny & Ellard, 2012). Dundar, Lanyon, and Connor, (2001) affirmed that about three-quarters of hereditary cases are often marked by new or *de novo* mutations.

Lohmann, (2010) speculated that the majority of patients with sporadic bilateral and almost all patients with familial retinoblastoma are heterozygous for retinoblastoma (*RB1*) gene mutations, resulting in predisposition to hereditary retinoblastoma. A child with hereditary Rb is heterozygous for an *RB1* mutation that is either inherited from an affected parent or occurred in one set of parental germ-line cells or occurred during embryonic development (Lohmann, 2010; Knapke, Zelley, Nichols, Kohlmann, & Schiffman, 2012). Although all the cells of an individual will be heterozygous for the mutation, not all the retinoblasts form tumours (Naish et al., 2009). Lohmann, (1999) predicted that in families with retinoblastoma, all members that have inherited the mutation are likely to develop bilateral retinoblastoma. In some rare cases or in exceptional families, unilateral retinoblastoma is frequent and some carriers remain unaffected owing to low-penetrance retinoblastoma (Lohmann, 1999). Greene, Kratz, Mai, Mueller, Peters, Bratslavsky,...and Watkins, (2010) described familial retinoblastoma as having high penetrance and high expressivity. Familial or germinal retinoblastoma is inherited in an autosomal dominant manner with high penetrance of over 90% (Aerts et al., 2006). In line with this, there is a 50% chance that a mutation of the retinoblastoma gene in the germ-line is passed on to a child (Lohmann, 2010;

Zhang, Walsh, Wu, Edmonson, Gruber, Easton,... & Wilkinson, 2015). Thus, patients inheriting RB1 mutation are prone to develop more tumours because they carry a large number of retinal cells prone to a second RB1 mutation. Since only one additional mutation is required in these cells and the chances of which are high, hereditary retinoblastoma is often characterised by the presence of a multiple tumour in one or both eyes (Aerts et al., 2006; Carter, 2009; Turnpenny & Ellard, 2012). However, Mastrangelo, Hadjistilianou, Francesco, and Lore, (2009) refuted that bilateral Rb is always hereditary as they found 50% unilaterally affected children were born to affected parents in their study cohort.

A child who inherits a susceptibility to the disorder will have one germ-line mutant allele for the retinoblastoma (RB) gene in each of his or her cells. Cancer develops in a somatic cell where the second copy of the RB gene mutates (Lohmann, 2010). As such, Lewis (2012) signified that hereditary retinoblastoma requires two point mutations or deletions, one germ-line and one somatic. As a result, the mutation is present in every cell of the body including all retinoblasts of the individual. Hence, the presence of a constitutional RB1 mutation in the blood signifies hereditary retinoblastoma (Quah, 2005). Mutation and deletion of the RB1 gene cause malignant transformation of a retinal cell. As such, the genotype of an individual with inherited retinoblastoma is either RB/rb or *RB/-*. On having the genotype RB/rb or *RB/-*, the risk of developing retinoblastoma is observed to be 100,000 times higher than the general population. In addition, the risk for other types of cancer, especially osteosarcoma is also increased simultaneously (Lohmann, 2010).

2.3 Awareness of Retinoblastoma

Awareness of ocular cancers compared to other cancers is low as reported by Ayanniyi, Jamda, Badmos, Adelaiye, Mahmoud, Kyari, and Nwana, (2010). According to the cross-sectional survey on awareness and knowledge of ocular cancers in a resource-limited economy, it was reported that, Out of 280 respondents, only 41.1% based their knowledge of patients having ocular cancers on sources other than hospital diagnosis. However, education was associated with awareness of ocular cancers and cancers in general. Epee, (2015) reported a limited knowledge of retinoblastoma among general practitioners in Cameroon. The study also revealed that a posting in ophthalmology during the training improve the awareness and practice pattern of general health practitioners. Latha, Chitralakshmi, Ravindran, Angeline, Kannan, and Scott, (2015). Reported poor awareness of childhood malignancies among undergraduate students from all over South India in an undergraduate paediatric clinical training. This was attributed to the poor interest in pursuing paediatric oncology as their career, never had encountered any paediatric oncology patients in the ward and not having any lecture classes on paediatric oncology. An analytical cross-sectional study conducted by Atipo-Tsiba, and Itoua (2015), to assess the level of knowledge of this tumour by midwives in two hospitals (Talangaï and Makélékélé) in Brazzaville also reported that there was a poor level of knowledge among the midwives as only 40% of them were able to define retinoblastoma, and 10% had associated leucocoria and strabismus as two early signs of this cancer. In contrast to the above studies Ibrahim, Aseel, and Yacoub (2017) research on the impact of awareness of retinoblastoma in the affected families on the management and outcome of familial retinoblastoma patients reported that, awareness of families of the possibility of retinoblastoma and adequate

screening led to a significantly higher rate of eye salvage in patients with familial retinoblastoma.

Demirbag, Kurtuncu, and Guven. (2013) reported in their study that knowledge of Turkish mothers about cancer was deficient. The study showed that 34.9 percent of the mothers were between the ages of 40-47, 73.8 percent had no experience with children with cancer, 45.9 percent said they learned about cancer on television, 39.7 percent stated that the primary reason for childhood cancer was the mother's smoking during pregnancy, 68.8 percent said that early diagnosis would save a child, and 98 percent wanted to learn more about childhood cancer. A retrospective review of familial retinoblastoma cases that presented at Alexandria Main University Hospital was performed by Soliman, ElManhaly, and Dimaras, (2016). Primary outcome measures were parental knowledge of familial retinoblastoma (disease, heritability) and subsequent action (early screening or not) and their impact on tumour burden (classification at diagnosis, a potential threat to vision, ocular salvage, and life), treatment burden, and treatment success (avoidance of enucleation and irradiation). Twenty-three eyes of 13 familial retinoblastoma cases were included. Probands were parents in 9 (69%) and older siblings in 4 (31%) cases. At the time of diagnosis of the first affected children, none (0%) of the parental probands knew that newborns should be screened, in contrast to all parents with a child proband (4/4, 100%; $p = 0.004$). Early eye screening was significantly associated with lower tumour burden ($p = 0.03$), lower treatment burden ($p = 0.04$), higher rate of ocular salvage ($p = 0.01$), and better visual outcome ($p = 0.01$). The study concluded that parental knowledge of retinoblastoma nature and heritability is crucial to good patient outcomes, but translating this knowledge into appropriate action (i.e. screening of at-risk children) is still deficient.

Leander, Fu, and Peña, (2007) conducted a study which revealed that delayed diagnosis is a common feature in paediatric cancer in Central America, where social, cultural, and economic barriers converge to adversely affect health care. Retinoblastoma, like paediatric cancer in general, is not a priority in developing countries, and support from health administrations for early diagnosis initiatives is unlikely. For this reason, the awareness campaign in Honduras was designed to be linked to yearly vaccination campaigns, which try to achieve greater than 95percent immunization coverage for young children. Since 2003, posters and flyers were distributed during the annual vaccination campaigns, and health care workers were educated about retinoblastoma. In total, 22,000 posters were distributed over a 2-year period, with access to all 1414 National Health Centres. It further revealed that an estimated 500,000 parents were informed. Primary care physicians and nurses were provided with educational materials. The effect of this campaign was tremendous, with an increase in the number of patients being referred to the paediatric oncology unit, a decrease in lag time (from 7.2 months to 5.5 months), and a significant decrease in the number of extra-ocular cases (from 73% to 35%)

Furthermore, between 1975 and 1985, as many as two thirds of patients nationwide presented with extra-ocular disease so Antonelli, Steinhorst, and Ribeiro, (2006) reported that strategies to improve early diagnosis were developed at three levels: 1) flyers and posters that were distributed in the main streets of São Paulo; 2) training of primary school teachers, with more than 1000 seminars presented in more than 100 schools over 5 years; and 3) specific training on retinoblastoma for medical students and primary physicians. After the initiative, extra-ocular retinoblastoma decreased from 56percent in 1985 to less than 10 percent in 2003. However, geographic differences remained. The greatest decrease of the extra-ocular disease occurred in the

richer states of the Southeast, but no dramatic effect was seen in the poorer Northeast, where close to 50 percent of the patients still presented with the extra-ocular disease. Non-white patients, age greater than 24 months were all significantly correlated with extra-ocular disease. Advances in the management of extra-ocular retinoblastoma by Brazilian investigators contributed greatly to these improvements (Antonelli et al, 2003). They further concluded that any public health strategy aimed at reducing retinoblastoma-related mortality should consist of education of health professionals and lay population, development of regional centres of excellence, and universal health care access.

Leal-Leal, Flores-Rojo, and Medina-Sanson, (2004) reported that The Grupo Mexicano de Retinoblastoma (RtbMex) program was created in January 2003, arising from the need to coordinate the efforts of organizations interested in improving care for retinoblastoma patients in Mexico. The group performed a retrospective review of the experience of 16 institutions from January 1997 to December 2002. A total of 500 retinoblastoma cases were diagnosed during that period. The median age was 28 months for patients with unilateral disease and 14 months for patients with bilateral disease. Approximately one-third of the patients had the extra-ocular disease at diagnosis. The estimated 5-year disease-free survival rate was 85 percent. A National Retinoblastoma Registry was created with the participation of 27 centres. Early diagnosis and education were priorities; a large public education campaign was developed with posters in public places, schools, and health care centres. A major initiative included the education of health care professionals, with seminars and printed materials. The group developed a national protocol with guidelines for the management of retinoblastoma. (Rivera-Luna, Cardenas-Cardos, & Martinez-Avalos, 2007). With

this initiative ("Seguro Popular"), RtbMex was able to make the national protocol and early diagnosis initiatives available to a wider population.

Abdu, and Malami, (2011), asserted that retinoblastoma, a treatable tumour is characterized by late presentation in Kano. They emphasized the need to create public awareness and educate mothers on this tumour so that there is an early diagnosis, appropriate referral, and prompt treatment. The goal is to increase the number of children successfully cured of this disease in our environment. According to a descriptive cross-sectional survey carried out by Ayanniyi, et al, (2010) of 1,887 Nigerians only but fewer respondents were aware of eye cancers (57.1%) compared to cancers in general (73.7%) (P<.001). Despite the male preponderance, there were no associations between gender and awareness of ocular cancers (P=0.07) and cancers in general (P=0.85). However, education was associated with awareness of ocular cancers (P<.001) and cancers in general (P<.001). 280 respondents, 41.1% based their knowledge of patients having ocular cancers on sources other than hospital diagnosis. Of 148 respondents, 16.2% were related to 'patients' they knew had ocular cancers.

In India, roughly 60,000 childhood cancer cases are diagnosed annually with only nearly 100 paediatric oncologists. So it's pertinent that the physicians and paediatricians are adequately equipped to recognize and refer them appropriately. Therefore, Latha, et al, (2015) conducted a study to assess the knowledge, attitude, and awareness of childhood cancer among undergraduate medical students in South India. The study was conducted among 240 undergraduate students from all over South India in an undergraduate paediatric clinical training. 65.5% felt that their knowledge of childhood cancer did not make them competent to suspect and refer appropriately

during their practice. 84% supported that there is a need to improve paediatric oncology teaching in their medical curriculum.

From the reviews above the researcher noticed that there is need to conduct this study on awareness, attitude and practice of mothers of under-five children towards observation of retinoblastoma so as to ascertain if the afore mentioned recommendations (public awareness campaign and education of mothers on retinoblastoma) by fellow researchers (Abdu et al, 2011: Leal-Leal, et al 2004) were carried out.

2.4 Attitudes Towards Retinoblastoma Disease

Patenaude, Basili, Fairclough, and Li. (1996), conducted a study to assess attitudes toward testing for cancer susceptibility genes, mothers of paediatric oncology patients were interviewed about their cancer causation theories, interest in hypothetical predisposition testing for themselves and their healthy children, and anticipated impact of testing. The subjects were 47 mothers of two or more living children, one of whom was 6 to 24 month's post-diagnosis of cancer. Potential risks and benefits of hypothetical genetic predisposition testing for cancer susceptibility were described. A semi-structured interview assessed the following: (1) recall of discussions with the paediatric oncologist about the possible role of heredity in causing the child's cancer, (2) mothers' personal theories of the aetiology of their child's cancer, (3) family cancer history, (4) interest in genetic predisposition testing for themselves and unaffected (cancer-free) children, and (5) expected sequelae of testing. It was reported that, if genetic cancer predisposition tests were available, 51% of mothers would test themselves and 42% would test healthy children, even with no medical benefit. With established medical benefit, an additional 36% of mothers would seek testing for

themselves and another 49% would test their healthy children. Interest in cancer predisposition testing among mothers extended far beyond those with significant family histories of cancer. Most mothers would consider minor children's wishes in the decision about testing and would tell children under age 18 their test results. The study concluded that, as increasing numbers of cancer susceptibility genes are identified, parents of paediatric oncology patients may be receptive to opportunities to test themselves and their healthy children. Counselling will be important to aid in decisions about testing. Research is essential to evaluate the long-term impact of predisposition testing.

Attitudes are basically the outcome of knowledge or perception towards an issue, an individual without the right knowledge would, therefore, have a poor attitude regarding an illness until the right information is passed across through health education.

2.5 Practices Relating to Retinoblastoma

Geta, and Bejiga, (2011), in their study to assess knowledge, attitude, and practice involving strabismus in Cheha District, Central Ethiopia reported that, knowledge was poor, 62.8% did not know the causes of strabismus and mentioned only misconceived causes like exposure to bright light. Attitudes were also reported to be insignificant as 225 (53.6%) believed that there is no treatment for strabismus and 51.4% did not want to marry or allow the marriage of relatives to a person with strabismus. When they were asked about what actions they would take if there was a case of strabismus in the family, 173 (41.2%) reported that they would not take any action since it cannot be treated, 134 (31.9%) said they would take to the hospital and 113 (29.9%) reported they would try modern medicine even though it cannot be treated.

In conclusion, a large proportion of the adult population of Cheha District was found to have poor knowledge, attitude and practice regarding the causes and management of strabismus. Health education and mass media campaigns were recommended to help correct these perceptions.

According to a study conducted by Wanyama, Marco, and Kariuki, (2016) to assess knowledge, attitude, and practice of childhood eye diseases among paediatricians working in Kenya. The results showed that, out of the 125 paediatricians who responded, 69.6% had a level of knowledge classifiable as poor, 28.0% moderate and 2.4% good. 69.6% of paediatricians have a good practice of carrying out eye examination in children, though this varied with each participant doing only the test they are familiar with. Their referral of children with eye diseases to an ophthalmologist was found to be generally appropriate. However, it was concluded that their attitude and practice was generally positive. Their knowledge could be boosted with regular continuous medical education on eye diseases.

According to a study conducted by Nyenze (2007), on knowledge, attitude, and practices on eye diseases among traditional healers in Kitui district, the study showed that there are however some prevailing practices in certain communities some of which have been associated with many side effects and delays in seeking appropriate health care, this was seen among traditional healers in Kitui district. Use of plant juices put into the conjunctival sac was the most preferred treatment modality and was practiced by 62 (71.3%) healers for none specific red eyes, 46(52.9%) for cataracts, 48(55.2%) for ocular injuries and 21(24.1%) for allergic conjunctivitis. The most performed surgical procedures included rubbing the underside of the upper lid with a specific leaf for allergic conjunctivitis with papillary reaction as performed by 43 (42.9%) healers, piercing chalazia with a thorn or needle by 11(12.6%) healers and making small

incisions and applying herbs for ocular swelling by 4(4.6%) healers. The most preferred treatment for chemical injury was breast milk from any breastfeeding mother as practiced by 29(33.3%) healers. Some healers mix traditional medicine with exorcism and rituals especially for squint as practiced by 14(16%) healers and ocular tumours by 9(10.3%) healers. The conditions the healers said they would refer included ocular tumours as reported by 48(55.5%) healers, cataracts by 34(52.9%) healers, ocular injury by 30(34.5%) healers and squint by 21(24.1%) healers. Only a few of the eye diseases including an ocular tumour and squint were the conditions few of the traditional healers report to refer when they are unable to treat. The least understood conditions were leucocoria and ocular tumours. Ill practices have been conducted over time as mostly herbal therapy has been trusted long before the advent of modern medicine. As Nyenze (2007) noted there are various practices conducted by different herbalist or healers, most of which are not proven to cure retinoblastoma or any ocular malignancy. It is therefore recommended that early diagnosis of a susceptible child (under-five) is the best form of preventive practice for retinoblastoma.

2.6 Incidence of Retinoblastoma Around the World

The worldwide incidence rate of retinoblastoma for children aged 0-4years varies from 3.4percent per million in Bulgaria (Bunin, & Orjuela, 2007) to a very high 42.5 per million in Mali (Parkin, et al 1998). Incidence rates vary greatly in some regions while it varies only slightly in some other regions as shown on the table below;

Table 2.1 Incidence of retinoblastoma around the world

S/No	Country	Incidence rate	S/No	Country	Incidence rate
1.	Australia	1.4	16.	Lithuania	1.4
2.	Belgium	1	17.	Malta	1.9
3.	Canada	2	18.	New Zealand	2.2
4.	Croatia	0.7	19.	Norway	0.7
5.	Czech Republic	0.7	20.	Poland	0.6
6.	Denmark	1.3	21.	Portugal	3.6
7.	Estonia	1.5	22.	Russia	1.3
8.	Finland	1.1	23.	Slovakia	1.5
9.	France	1.6	24.	Slovenia	1.0
10.	Germany	2.3	25.	Sweden	3.5
11.	1celand	1.1	26.	Switzerland	1.7
12.	Ireland	1.0	27.	The Netherlands	1.2
13.	Italy	1.4	28.	United Kingdom	1.3
14.	Latvia	0.2	29.	U. S White	1.4
15.	Nigeria	1.2	30.		

A large study in the USA (Broaddus, et al, 2009) covering a 30year period from 1975 – 2004 using the Surveillance Epidemiology and End Results (SEER) programme database of the National Cancer Institute found 658 of retinoblastoma cases over the period. The overall mean adjusted incidence was 11.3 for males and 12.4 for females. Seventy-two percent (72%) were unilateral while 27 percent were bilateral. In 1percent of cases, the laterality was unknown. With increasing age at diagnosis, the bilateral tumours decreased significantly. However, the percentage of unilateral tumours increased with increasing age at diagnosis. The overall incidence of retinoblastoma also reduced with increasing age. Bilateral new cases are not seen after the age of 3years.

The peak age of presentation for both bilateral and unilateral retinoblastoma in the USA is before one year of age. Thereafter, the incidence reduced steeply with age. The only 4.3 percent of new cases of retinoblastoma were seen between the ages of 5-9 years in this study.

According to a study conducted by Sang, Se and Kyu (2014), in Korea , the study found out that the overall incidence of retinoblastoma was 11.2 for children aged 0 to 4 years and 5.3 for children aged 0 to 9 years per 1,000,000 person-years, 5.9 per 100,000 live births, and 5.3 per 100,000 live births. Birth cohort analysis showed less variable results in incidence rates over 4 calendar-periods compared to the population-based analyses. The all-cause mortality rate was 7.9 percent at 5 years and 8.4 percent at 10 years. The rate improved from 12.5 percent for patients diagnosed from 1993 to 2000 to 4.5 percent for those diagnosed from 2001 to 2010. The study concluded that the incidence of retinoblastoma in Korea was found to be similar to that in the United States, Europe, and Asia.

In Great Britain, Pendagrass and Davis (2009), reported that retinoblastoma affects approximately 1 in 20000 children. The bilateral cases make up 36 percent of the total cases. In this study in the UK, using the National Registry for Childhood Tumours (NRCT), the peak incidence was in children below one year, similar to findings in USA studies. After the age of one year, the incidence reduced steadily. Children older than four years made up less than 5 percent of new cases. The peak age for unilateral cases is in the two year age group while that of bilateral cases is before the first birthday. British studies have shown that unilaterality does not rule out heredity. In this series reported by MacCarthy et al, (2009) almost 11 percent of the

unilateral retinoblastoma was heritable cases. All the bilateral cases are usually heritable.

A Swedish and Finish study by Seregard, Lundell, Svedberg, and Kivela (2004), covering 1958 to 1998 using data from cancer registries and corresponding national referral centres for retinoblastoma found 0-13 and 0-10 new cases per year in Sweden and Finland respectively. The incidence rates per million children under 5years in Sweden and Finland was 11.8 and 11.2 respectively. In this study 90-96percent of all retinoblastoma were diagnosed in children less than 5 years. In Pakistani studies by Arif, Iqbal, and Islam (2009), covering between 1999 and 2002, they found 70 retinoblastoma cases, with 93 percent of them in children below 5years; 67percent of the cases were bilateral. Bilateral cases became less prevalent with increasing age while the unilateral cases peaked in the 2-3year age group with a gradual decline thereafter. The mean at presentation is 28.17 months, unilateral cases having a mean age of 31.81 months. In China, Bai, Ren, and Shi (2010), in a study found that 1234 eyes were enucleated due to retinoblastoma in a specialist eye hospital from 1957 to 2006. The mean age was 2.8years with a range of 1 month to 14years. Bilateral tumours accounted 2.4 percent of cases, an interesting finding. This was attributed to the nature of their study.

In South Africa, a study by Somdyala, Bradshaw, Gelderblom, and Parkin, (2010) covering a 20-year period in a specialist eye Hospital found 71 cases out of which 82 percent were unilateral and the other 18percent bilateral. The average of the unilateral cases was 3½ years while for the bilateral, it was 3years, much higher than the findings in western industrialized countries; 80percent of cases were diagnosed before the age of 4years. In a Congolese study by Kaimbo, Kaimbo, Mvitu, and Missitten (2002), carried out in a teaching Hospital on Congolese blacks over a 58

month period found 21 percent bilateral cases. The mean age for all cases was 2.9 4years with a 4months to 6years. The mean age for the bilateral cases was 1.1 2years. The mean age in other African studies ranged from 24 months to 44 months (Akang, Ajaiyeba, Campbell, Olorin & Aghadiuno, 2000). The relatively advanced age of presentation in African series has been attributed to very late presentation. Ribeiro, and Antonelli (2007), found out that, the incidence of retinoblastoma in Brazil is not uniform, ranging from less than 2 cases per million children per year in the cities of Fortaleza and Belém (Northern Brazil) to more than 11 cases per million in Campinas (Southeast). Retinoblastoma-related mortality does not follow the same geographic variations. From 1980 to 2002, retinoblastoma mortality rates were lower in the city of São Paulo than in the states with a lower incidence, suggesting disparities in time to diagnosis and access to medical care.

Incidence studies in Africa put the incidence estimates at 20 cases per million in Malawi (Chasimpha, Parkin, Masamba, & Dzamalala, 2017) and 9.3 per million in Guinea Conakry (Akhiwu, & Igbe, 2012). These are much higher than rates in the USA. This has been attributed to some unknown environmental influences and the higher birth rates in Africa. In Nigeria, there is paucity of epidemiological data on ocular cancers among Nigerians, but studies have shown retinoblastoma to be the commonest childhood intraocular malignancy with a mean age at presentation of 29 months (Abdu, & Malami, 2011: Ochicha, Gwarzo, & Gwarzo, 2012) while the bilateral retinoblastoma which accounted for 13 percent of cases, the mean age at presentation was younger at 15 months (Owoeye, et al, 2005). Almost all studies on ocular tumours in Nigeria are hospital-based and are concerned with the pattern especially, clinicopathological reports of oculo-orbital tumours (Owoeye, Afolayan, & Ademola-Popoola, 2006).

2.6.1 Sex Distribution of Retinoblastoma

Most studies from different parts of the world suggest no sex discrepancy in the incidence of retinoblastoma. In the USA, studies by different workers (Broaddus et al, 2009: Nyamori, Kimani, Njuguna, & Dimaras, 2012; Akhiwu, & Igbe, 2012) have found an age-adjusted incidence of 11.3 for males and 12.4 for females suggesting a mild female predominance. This difference, however, was not significant. In Mexico, Lea-Leal, Flores-Rojo, and Medina-Samson, (2004) conducted a study in sixteen centres over a 5-year period which showed a nonsignificant mild male predominance of 1.1: 1.0 for all the cases seen. The study did not show any breakdown of the sex distribution between the age groups and between the unilateral, bilateral and other types of retinoblastoma. In Great Britain, the study by MacCarthy, Birch, and Drapper (2009), showed that overall, males and females had no difference in the distribution of retinoblastoma for all ages. However, for the 0-1year age group in bilateral retinoblastoma category, there is a 1.1: 1.0 male predominance. For the 1-2 year age group, the male: female predominance for the bilateral tumours is 1.3: 1.0 while for the 2-3year age group, it is 2.2: 1.0. All other age groups showed no significant M:F difference in the incidence of bilateral retinoblastoma. For bilateral tumours for all ages, the M:F ratio 1.3: 1.0. In Pakistan, Arif Mohamed et al (2009), found an equal sex distribution for retinoblastoma in childhood. There was also no gender difference between the unilateral and the bilateral cases. In China, between the years 1977 to 1996, there was a marked male predominance of 3: 2 and an insignificant overall male predominance of 2.6: 2.0 (Bai et al 2010). As in many other studies, the sex distribution between the unilateral and bilateral tumours is not stated. In Southern Africa studies, Freedom et al, (1976), confirmed that there is a marked male predominance over females (3:1) in the bilateral cases. However, for the unilateral cases, the ratio of males

to females (M:F) is 1.2: 1.0. For the1-2year age group, the M: F ratio is about 2: 1. Overall, however, the M: F ratio is 4:3. Studies from Congo Kaimbo, Wa Kaimbo, Mvitu, and Missotten, (2002), show an M: F predominance for all cases of retinoblastoma seen over a 6 year period to be 2:1. Some other African studies show a male: female ratio of 1.120,21

In Ilorin, Nigeria, Owoeye, et al (2005), reported that there was a mild female predominance of 1.2: 1 overall. The mean age for females and males was also not significant at 31 months and 27 months respectively. However, Akang, Ajaiyeba, Campbell, Olurin, and Aghadiuno, (2000), from Ibadan, Nigeria reported a female predominance of 3:2. In Nigeria, retinoblastoma is second only to lymphoma as reported in most studies (Akang 1996; Mandong, Angyo, & Zoakah, 2000; Tijani, Elesha, & Bayo, 1995). While survival rates in the United States are nearly 100%, they are much lower in developing nations including Nigeria. Survival rates range from 80-89% in more developed Latin American countries to as low as 20-46% in certain African countries (AAO, 2013). More than 90% of children with retinoblastoma live in low and middle-income countries (LMIC), but those countries have 90% of the cases presenting with metastatic disease, and virtually all the cases that abandon therapy (Chantada, Qaddoumi, & Canturk, 2011). As a result of lower survival rates, there are an estimated 3000 to 4000 deaths annually due to retinoblastoma. The discrepancies in survival rates emphasize the potential to reduce retinoblastoma-caused through timely diagnosis and proper treatment (Union for International Cancer Control, 2014).

2.6.2 Cancer Incidence in Nigeria

Nigeria like many other African countries lacked accurate data on cancer incidence and mortality. It was estimated that there were an estimated 102,100 new

cancer cases with 71,600 cancer deaths in Nigeria in 2012, representing 12% of the estimated 847,000 new cancer cases that occurred in Africa during the same period (Ahrens, Pohlabeln, & Foraita, 2014. These estimates were derived by extrapolating data from few population-based cancer registries in the sub-region. They were therefore inaccurate. Nigeria is marked by significant regional variation in environmental and genetic risk factors for different cancers and summary data for the entire country may mask regional variations that may have significant public health and resource allocation importance. Accounting for cancer incidence in Nigeria will make significant contributions to reducing the lack of data about cancer in Africa.

2.6.3 Cancer Registration in Nigeria

Cancer registration is a means by which information on all cancer cases is collected, coded and classified in order to produce statistics on the occurrence of cancer in a defined population, in a specific time period and to provide a framework for assessing and controlling the impact of cancer on the community (Fatunmbi, Saunders, Chugani, Echeazu, Masika, Edge, & Nwogu, 2018). There are three types of cancer registries. Population-based cancer registries monitor new cases of cancer within well-defined populations over periods of time and have been recognized as useful sources of information on the incidence, prevalence, and mortality from cancer in various populations worldwide (Mohammed, Edino, Ochicha, Gwarzo, & Samaila, 2008; Fatunmbi, Saunders, Chugani, Echeazu, Masika, Edge, & Nwogu, 2018; Parkin, 2006). The data they generate is particularly useful for cancer prevention, early detection, determination of cancer rates and trends, research and evaluation of cancer control efforts. Hospital-based cancer registries, on the other hand, collect data about diagnosis and treatment of cancer within a hospital or group of hospitals. They are therefore

suitable for comparison of cancer care infrastructure (personnel, resources, and logistics) and treatment outcomes. The third type of cancer registries is special cancer registries that are devoted either to specific cancers or groups of cancers, e.g. pediatric cancer registries, gastric cancer registries, etc. Such registries are valuable for research and public, patients and professional educational purposes.

National cancer control programs rely on data from cancer registries to guide the development of initiatives and strategies for cancer control (Parkin, 2008). Trends in cancer incidence are used to guide resource allocation by governments and in the development of prevention strategies for common cancers in specific populations. Nigeria put in place a national cancer control plan in 2008; it broadly aims to partner widely with stakeholders in the health sector to address cancer morbidity and mortality and to improve the quality of life of cancer patients. With many centers across the country actively collaborating, the plan also seeks to entrench population-based cancer registration as a foundation for sound cancer prevention and control (Nigeria Cancer Control Plan, 2008; Stefan, Elzawawy, & Khaled, 2013). Cancer registration in Nigeria experienced significant setbacks in the early seventies and eighties due to the economic and political challenges that the country experienced at this time. Data from the Ibadan Cancer Registry was no longer accepted for inclusion in CIV and no new population-based Cancer Registry data of sufficient quality was generated. There was, therefore, no reliable source of information on cancer incidence, prevalence, and mortality in the country during this period. Information about the epidemiology of cancer was published as case series from clinical, pathology and autopsy records which were often hospital-based, incomplete and reflected the resources and specialties available at the specific institutions. These sources of information were limited and could not provide information on cancer incidence, often over-represented cancers that were easy to

diagnose were biased by the resources at the specific institution and interests of the personnel reporting the data.

The Nigerian Federal Ministry of Health established the National Headquarters of Cancer Registries in Nigeria (NHCRN) in the 1990s to coordinate cancer registration and the activities of cancer registries in Nigeria. The pioneer executive Chairman of the NHCRN was Professor Toriola F. Solanke, Professor of Surgery at the University College Hospital (UCH) and the College of Medicine, University of Ibadan, Ibadan, Nigeria while Mrs. Bankole was the secretary and Professor (then Dr.) Clement Adebamowo was an associate. The Department of Radiotherapy, UCH headed by Professor O. B. Campbell and the Chief Medical Director of UCH at that time Professor Olajide O. Ajayi provided administrative and logistics support for the NHCRN. During the period of its existence, NHCRN implemented cancer registration training programs, conducted public advocacy and supplied resource materials to cancer registries in Nigeria. The NHCRN compiled and published data from various cancer registries in Nigeria in1998 and this publication remained the reference document for cancer statistics in Nigeria until recently (Solanke, & Adebamowo, (1998). Unfortunately, the death of Professor Solanke and inaction on the part of relevant authorities to appoint a successor led to a diminution in the activities of the NHCRN and the office became largely non-functional from 2002 onwards. Despite this, the activities of institutional cancer registries, notably the Ibadan Cancer Registry picked up at about this time and gained momentum with funding support from the International Agency for Research on Cancer (IARC). Other registries were subsequently formed or resuscitated throughout the country but there was no central coordinating body for their activities.

A second attempt at establishing a central coordinating body for cancer registries in Nigeria was initiated in 2009 when the Nigerian National System of Cancer Registries (NSCR) was formed as a collaboration between the Institute of Human Virology Nigeria (IHVN), the Federal Ministry of Health of Nigeria, the Society of Oncology and Cancer Research of Nigeria, and international organizations including the International Agency for Research on Cancer (IARC), the International Prevention Research Institute (iPRI), Institute of Human Virology and the Marlene and Stewart Greenebaum Comprehensive Cancer Center of the University of Maryland School of Medicine. NSCR's activities were funded by the research training grants from the Fogarty International Centre and the National Cancer Institute of the National Institutes of Health (NIH), the Marlene and Stewart Greenebaum Comprehensive Cancer Center of the University of Maryland School of Medicine and the Nigerian Federal Ministry of Health.

In recent times, information on cancer incidence, prevalence and mortality in Nigeria has been based on estimates from case series, medical records, mortality records, hospital based cancer registries and the Ibadan Population Based Cancer Registry (IBCR) (Parkin, Hamdi-Chérif, Sitas, Thomas, Wabinga, & Whelan, 2003). IBCR, located at the University College Hospital Ibadan and set up in 1962, is the first cancer registry in Nigeria. Cancer incidence data from this registry were published for the time periods 1960–1962, 1960–1965, and 1960–1969 in the first three volumes of Cancer Incidence in 5 Continents (CIV). However, due to logistic problems the registry suffered some setbacks from the 1970s to 2000s (Parkin, Ferlay, Curado, Bray, Edwards, & Shin, 2010). Since 2009, the Nigerian Federal Ministry of Health (FMOH) and the Institute of Human Virology Nigeria (IHVN) have initiated a program, the Nigerian National System of Cancer Registries (NSCR) to strengthen existing cancer

registries and establish new ones through provision of baseline training for newly established registries; continuing education for older registries; mentoring, computer hardware and software provision and support; data management and analysis. In this paper, we present estimates of cancer incidence in Nigeria based on data from 2 population-based cancer registries in the system. These registries cover defined populations and use multiple source reporting. The Ibadan Cancer Registry is located in one of the oldest cities in Nigeria, Ibadan, a small city in Oyo state, Southwestern Nigeria (Jedy-Agba, Curado, Ogunbiyi, Oga, Fabowale, Igbinoba, ... & Osinubi, 2012).

Professor Clement Adebamowo directs the National System of Cancer Registries (NSCR). The NSCR engages in establishing new cancer registries, strengthening existing registries, providing training and mentoring for cancer registries, and monitoring the data generated for completeness and accuracy. NSCR carries out regular site monitoring visits and provides technical and scientific support to cancer registries in Nigeria. The NCR has been involved in several research collaborations that have yielded publications in high impact journals (Jedy-Agba, Curado, & Ogunbiyi, 2012; Jedy-Agba, Oga & Odutola, 2015; al-Haddad, Jedy-Agba, & Oga, 2015; Akarolo-Anthony, Maso, Igbinoba, Mbulaiteye, & Adebamowo, 2014; Jedy-Agba, Curado, & Oga, 2012). Through the activities of the NSCR, data on cancer incidence in Nigeria is now available from 6 population-based and 18 hospital-based cancer registries in Nigeria.

2.7 Prevalence of Visual Impairment and Blindness in Children

Visual impairment (VI) has a significant impact on the affected child's psychological, educational and socioeconomic experiences, during childhood and beyond. As the disorders which cause VI in childhood are uncommon, the population

of children with VI is complex and heterogenous, but essentially comprises two main groups: those with isolated VI and those with VI in addition to, or associated with, another disorder or impairment. These two populations differ significantly with respect to their clinical management and their health, educational and social care needs (Solebo, & Rahi, 2014). Childhood blindness carries a high financial cost for the community as well as a high individual cost impacting normal motor, language and social development of the child. These factors are all compounded when the child enters the education system and adulthood (Crewe, Morlet & Lam, 2012).

Solebo, Teoh, and Rahi (2016) stated that an estimated 14 million of the world's children are blind. A blind child is more likely to live in socioeconomic deprivation, to be more frequently hospitalised during childhood and to die in childhood than a child not living with blindness. This update of a previous review on childhood visual impairment focuses on emerging therapies for children with severe visual disability (severe visual impairment and blindness or SVI/BL). For children in higher income countries, cerebral visual impairment and optic nerve anomalies remain the most common causes of SVI/BL, while retinopathy of prematurity (ROP) and cataract are now the most common avoidable causes. The constellation of causes of childhood blindness in lower income settings is shifting from infective and nutritional corneal opacities and congenital anomalies to more resemble the patterns seen in higher income settings (Solebo, et al, 2016). Improvements in maternal and neonatal health and investment in and maintenance of national ophthalmic care infrastructure are the key to reducing the burden of avoidable blindness. New therapeutic targets are emerging for childhood visual disorders, although the safety and efficacy of novel therapies for diseases such as ROP or retinal dystrophies are not yet clear.

The control of blindness in children is considered a high priority within the World Health Organizations (WHO's) Vision 2020. The Right to Sight programme (WHO, 1998). There are several reasons for this. Firstly, children who are born blind or who become blind and survive have a lifetime of blindness ahead of them, with all the associated emotional, social and economic costs to the child, the family, and society. Indeed, the number of blind years due to all causes of blindness in children is almost equal to the number of blind years due to cataract in adults. Secondly, many of the causes of blindness in children are either preventable or treatable. Thirdly, many of the conditions associated with blindness in children are also causes of child mortality (e.g. premature birth, measles, congenital rubella syndrome, vitamin A deficiency, and meningitis). Control of blindness in children is, therefore, closely linked to child survival (WHO, 2000). Reducing visual loss in children poses particular challenges which are different from the challenges of controlling adult blindness. Children are born with an immature visual system and, for normal visual development to occur, they need clear, focused images to be transmitted to the higher visual centres. Failure of normal visual maturation (amblyopia) cannot be corrected in adult life, so there is a level of urgency about treating childhood eye disease which does not necessarily apply to adult conditions. The assessment of vision and examination of the eyes also pose particular difficulties, which require time and experience on the part of the examiner. Furthermore, children's eyes cannot be considered as smaller versions of adult eyes, because they respond differently to medical and surgical treatment (Anhalt, Silverstein, Scharf, Mayro, Snitzer, Pond & Levin, 2018).

Prevalence and magnitude of Blindness in Children

As blindness in children is relatively rare, accurate prevalence data are difficult to obtain, because very large samples are required for population-based prevalence surveys. Some data are, however, available from population surveys that included children, from community-based rehabilitation programmes, and from registers of the blind. These sources suggest that the prevalence of blindness in children varies according to socioeconomic development and under-5 mortality rates. In low-income countries with high under-5 mortality rates, the prevalence may be as high as 1.5 per 1000 children, while in high-income countries with low under-5 mortality rates, the prevalence is around 0.3 per 1000 children (*2*). If this correlation is used to estimate the prevalence of blindness in children, the number of blind children in the world is estimated to be 1.4 million (*3*). Approximately three-quarters of the world's blind children live in the poorest regions of Africa and Asia, where the prevalence is high, and the child population large.

Bulgan and Gilbert, (2009) carried out a study to determine the prevalence and causes of severe visual impairment and blindness (SVI/BL) in children from a defined area of Mongolia, using several methods of identification. Children with presenting visual acuities of andlt;6/60 in the better eye who lived in 10 of the 18 provinces (Aimaks) were identified 1) by family doctors 2) in the school for the blind 3) by visiting eye departments in the capital. All eligible children were examined (or data extracted from hospital records) and the cause of visual loss determined using the WHO classification system. The study reported that sixty-four children with SVI/BL before refraction were identified who lived in the 10 study Aimaks. They were recruited by family doctors (52); by home visits (3); from hospital records (4); or from

the school for the blind (5). The prevalence of SVI/BL before refraction was 0.19/1,000 children (95% CI 0.16–0.22), decreasing to 0.16/1,000 after refraction (95% CI 0.13–0.19) but there was considerable variation from Aimak to Aimak. The major causes of SVI/BL were lesions of the lens (34%), central nervous system disorders (19%), lesions of the whole globe (e.g. microphthalmos) (14%), and retinal conditions (12.5%). Hereditary factors were responsible for 27% of causes, and 17% of children were blind following acquired conditions of childhood. The underlying cause could not be determined in 48%. The causes of SVI/BL was analyzed in a further 16 children who lived outside the study Aimaks to compare the causes in children in special education with those not schooling, and by age. The prevalence estimate obtained was lower than anticipated and possible reasons are discussed. The pattern of causes of SVI/BL is similar to that in children in schools for the blind in China but is very different from other Asian countries. Meningococcal meningitis was the most common preventable cause of SVI/BL, and immunization is being considered. Other preventable causes were rare, and the majority of children needing surgical intervention had already been identified and referred for treatment. The control of blindness in children could possibly be improved by better management of conditions requiring surgery, and by the provision of low vision devices.

Incidence of Retinoblastoma

The incidence of blindness in children is very difficult to ascertain, requiring very large longitudinal studies, accurate registers of the blind, or reliable active surveillance systems. Data from industrialized countries suggest that the incidence of blindness in children resulting from acquired conditions has declined over the last few decades, but there are no reliable data from developing countries. In the latter, a high

proportion of children who become blind die within a few years of becoming blind, either from systemic complications of the condition causing blindness (e.g. vitamin A deficiency, measles, meningitis, and congenital rubella syndrome), or because poor parents have more difficulty in caring for their blind children than their sighted siblings. Estimates of the number of prevalent cases of blindness in children therefore markedly underestimate the magnitude of the problem of blindness in children.

Steinkuller, Du, Gilbert, Foster, Collins, and Coats (1999), reported that five percent of worldwide blindness involves children younger than 15 years of age; in developing countries, 50% of the population is in this age group. By World Health Organization criteria, there are 1.5 million children worldwide who are blind: 1.0 million in Asia, 0.3 million in Africa, 0.1 million in Latin America, and 0.1 million in the rest of the world. There are marked differences in the causes of paediatric blindness in different regions, apparently based on socioeconomic factors. In developing countries, 30% to 72% of such blindness is avoidable, 9% to 58% is preventable, and 14% to 31% is treatable. The leading cause is corneal opacification caused by a combination of measles, xerophthalmia, and the use of traditional eye medicine. There is no national registry of the blind in the United States, and most of the schools for the blind do not keep data regarding the cause of blindness in their students. From those schools that do have this information, the top 3 causes are cortical visual impairment, retinopathy of prematurity, and optic nerve hypoplasia. There has been a significant increase in both cortical vision loss and retinopathy of prematurity in the past 10 years. There are marked regional differences in the prevalence and causes of paediatric blindness, apparently based on socioeconomic factors that limit prevention and treatment schemes. In the United States, the 3 leading causes of paediatric blindness are cortical visual impairment, retinopathy of prematurity, and optic nerve hypoplasia.

2.7.1 Determining the Causes of Blindness in Children

Over the last few years, much of the information on the causes of blindness in children has been collected using a methodology developed by the International Centre for Eye Health, London, England, in collaboration with WHO. This uses standard definitions and a reporting form, which allow comparison of the collected data (Anhalt, Silverstein, Scharf, Mayro, Snitzer, Pond & Levin, 2018); and the causes are classified according to the main anatomical site of the abnormality, as well as the underlying etiology (Kemmanu, Giliyar, Shetty, Singh, Kumaramanickavel, & McCarty, 2018; Huh, Simon, & Prakalapakorn, 2018). The main advantage of having two classification systems is that data on the anatomical site can be collected for all children, while etiological data, although more difficult to obtain, are more useful for planning relevant intervention programmes. Most of the available data on the causes of blindness in children from developing countries have been obtained from examining children in schools for the blind since the number of blind children identified in community surveys is generally very small. For example, in a population-based survey of blindness in India which included 4050 children aged 6–15 years, only two were blind and five were severely visually impaired (Gilbert & Foster, 2001). While studies of schools for the blind allow a large number of children to be examined over a short period of time by one observer using standard methods, the data are potentially biased. It is thought that in most developing countries only 10% of blind children are in special schools; if the causes of blindness are different in children that receive special education compared with those that do not, the data will be biased. Schools for the blind rarely admit children of preschool age or those with multiple disabilities. Blind children from poor, remote rural areas are also likely to be under-represented. Three studies in India (John, Paul, Kujur, David, Jasper, & Muliyil, 2017; Gudlavalleti, 2017; Mohan, & Kaur,

2017), Mongolia (Gilbert, & Foster, 2001), Ghana (Huh, Simon, & Prakalapakorn, 2018) and Uganda (Idro, Kakooza-Mwesige, Balyejjussa, Mirembe, Mugasha, Tugumisirize, & Byarugaba, 2010) allowed the comparison of the causes of blindness in blind children identified in the community, with children from the same geographical region who were at schools for the blind. The causes were broadly similar, except for optic atrophy and central nervous system disorders, which tended to be under-represented in children receiving special education. A further limitation of the method is that most children in schools for the blind were born 8 to 15 years ago, so the data cannot reflect the impact of recent interventions, such as greatly improved coverage of measles immunization.

Given the above limitations, the available data demonstrate that there is wide regional variation in the causes of blindness in children, and in the cause-specific prevalence of blindness. In the poorest countries of the world, corneal scarring due to vitamin A deficiency, measles infection, ophthalmia neonatorum, and the effects of harmful traditional eye remedies predominate. For example, in a study of children in schools for the blind in India, where 1318 children in nine states were examined, 26.4% of blindness was due to corneal scarring (principally attributed to vitamin A deficiency), 20.7% to congenital anomalies, 19.3% to retinal dystrophies, 12.3% to cataract, uncorrected aphakia, and amblyopia, and only 5.9% to optic atrophy. However, at the other end of the socioeconomic spectrum, a study of children in schools for the blind in the United States of America revealed that 19% of 2553 children were cortically blind, and 12% had visual loss from optic atrophy or optic nerve hypoplasia (Steinkuller, et al, 1999). In all regions of the world, cataract, retinal diseases (mainly hereditary retinal dystrophies), and congenital abnormalities affecting the whole eye are important causes of blindness. The patterns of disease by underlying

etiology also suggest that genetic diseases are important worldwide. Perinatal conditions (particularly retinopathy of prematurity (ROP)) and lesions of the central nervous system) are more important in high-income countries, while acquired conditions in childhood are more important in low-income countries. In middle-income countries the picture is mixed, but ROP is emerging as an important, potentially avoidable cause of blindness (Moshfeghi, 2018; Edy Siswanto, & Sauer, 2017).

Avoidable Causes of Retinoblastoma

The term "avoidable" encompasses preventable and treatable causes. Conditions amenable to primary prevention (i.e. where the condition causing blindness could have been entirely prevented) include measles infection, vitamin A deficiency, ophthalmia neonatorum, the use of harmful traditional eye medication remedies, and congenital rubella syndrome. Conditions that could have been treated early to prevent blindness (i.e. secondary prevention) include glaucoma and retinopathy (ROP). Causes of blindness where sight can be restored (i.e. tertiary prevention) include cataract and selected cases of corneal scarring. The provision of magnifiers and other low-vision devices is also important in restoring useful visual function. The available data suggest that, worldwide, corneal scarring is the single most important cause of avoidable blindness, followed by cataract and ROP. Control of these conditions is given priority in WHO's VISION 2020 programme, together with the correction of significant refractive errors and provision of services for low vision.

2.7.2 Control of Blindness in Children

Good primary health care and personnel trained in primary eye care are essential for the control of blindness in children. This applies particularly to developing

countries, where a high proportion of blindness in children is due to preventable conditions acquired during childhood. Many of the causes of corneal scarring in children would be prevented if the following eight essential elements of primary health care were in place: services for immunization; maternal and child health care; health education; good nutrition; essential drugs; clean water supplies and good sanitation; control of endemic diseases; and treatment of common conditions. In many countries, measles immunization programmes are reaching target coverage levels, and the number of measles cases has been dramatically reduced. There is anecdotal evidence that the success of the Expanded Programme on Immunization (EPI) is also reducing corneal ulceration and scarring in children (Foster, & Yorston, 1992). International efforts to control vitamin A deficiency in children, stimulated by evidence that vitamin A deficiency in childhood is associated with an increased mortality rate (Sommer, & West, 1996), are also likely to have an impact, thus reducing corneal scarring in childhood. Approaches to reduce vitamin A deficiency include the promotion of home gardening; health and nutrition education; fortification of commonly consumed foods; food supplementation programmes; and supplementation for at-risk populations with high-dose vitamin A in capsule or syrup form. Linking vitamin A supplementation to routine immunization programmes and by distributing vitamin A supplements on immunization days is a recommended strategy to increase coverage (WHO, 1998), and this policy is being adopted by many countries.

Primary eye care includes the promotion of eye health, action in the community to prevent conditions which cause blindness, and recognition and treatment of common eye diseases by trained community-level health workers. Primary eye care also includes the identification of children who need a referral for ophthalmological assessment and treatment — such as any blind child or a child with a white pupil or corneal ulcer.

Different cadres of primary health care worker have different roles: traditional birth attendants, for example, can prevent ophthalmia neonatorum and examine the eyes of the newborn for structural abnormalities. At the secondary level of care, an eye surgeon should be able to carry out a full examination and assessment, make a provisional diagnosis, manage corneal ulcers in children, and prescribe simple low-vision devices for children with less complex problems. School vision-testing programmes to identify children with significant refractive errors should also be organized and supported from the secondary level. For an effective referral, good communication needs to be established between staff working in the primary and tertiary levels.

The management of conditions requiring surgical intervention is more complex in children than in adults and requires a team of well-trained and well-equipped personnel. Ideally, ophthalmologists providing services for children at tertiary centres need a child-centered approach, and they should also be trained in the required specialized surgical techniques and in postoperative management. Effective communication with parents to ensure their involvement is also essential. An anaesthetist will be required for young children, and trained nurses, refractionists, and paramedics are all essential members of the team. Tertiary centres should be able to provide surgical services of high quality for the management of cataract, glaucoma, and corneal scarring. Screening for retinopathy (ROP) in preterm infants, as well as the organization and provision of low-vision services, is also a tertiary-level function. Tertiary centres should take responsibility for research; the training of trainers for primary- and secondary-level programmes; and for supporting, supervising, motivating, and providing feedback to staff in secondary-level centres.

2.8 Empirical studies

Literature review reveals only three published study by Michel, Zelia, and Italo, (2003), on knowledge attitude and practice among paediatricians on childhood ocular diseases, Nkansah, (2018) who assessed the knowledge, attitude and practice of infant ocular health among midwives in the Bosomtwe District and Wanyama, Marco, and Kariuki, (2016), on assessment of knowledge, attitude and practice of childhood eye diseases among paediatricians working in Kenya.. A few others have focused mainly on knowledge of mothers about cancer awareness (Demirbag, et al. 2013) knowledge of ocular cancers (Ayanniyi, Jamda, Badmos, Adelaiye, Mahmoud, Kyari, & Nwana, 2011), and awareness of retinopathy (Sathjamohanraj, Parag, Senthilkumar, & Narendran, 2011).

Nkansah, (2018) assessed the knowledge, attitude and practice of infant ocular health among midwives in the Bosomtwe District. The Study type was Descriptive Cross-Sectional. The study was carried out among midwives practicing in the various neonatal units within hospitals in the Bosomtwe District. Data collection was by the use of a structured questionnaire hand delivered to all participants. Data was analyzed using the Statistical Package for the Social Sciences (SPSS) package version 20. Level of knowledge was categorized using Blooms cut-off points into good (> 80%), moderate (60 - 80%) and poor (< 60%). Results of the study revealed that, out of 62 respondents, 50.7% were knowledgeable in infant ocular conditions. Poorest level of knowledge was recorded in retinoblastoma (6.5%) whiles level of knowledge in Ophthalmia neonatorum (100%) was the best. Thirty-six (58.1%) of the respondents performed ocular examination on infants. Majority of the respondents (85.5%) referred all abnormalities detected. Education of mothers was done by 82.3% of respondents and only 29% indicated receiving some form of in-service training with regards to infant

ocular health. Attitude of respondents was positive with 74.2% of respondents disagreeing that infant ocular health monitoring should only be done by an eye care professional. In conclusion respondents had poor level of knowledge in infant ocular conditions. However level of practice was satisfactory and there was generally positive attitude toward infant ocular health.

A cross-sectional study conducted by Ayanniyi, et al, (2011), to determine awareness and knowledge of ocular cancers in a resource-limited setting revealed that: Awareness of ocular cancers compared to other cancers is low. Misconceptions on the causes of ocular cancers exist. And that public ocular cancers health education can enhance awareness. Out of 1,887 respondents, 55.6percent were males, and the mean age was 30 years, SD 9.5. Most respondents (77.8%) had at least secondary education. Fewer respondents were aware of eye cancers (57.1%) compared to cancers in general (73.7%) (P<.001). Despite the male preponderance, there were no associations between gender and awareness of ocular cancers (P=0.07) and cancers in general (P=0.85). However, education was associated with awareness of ocular cancers (P<.001) and cancers in general (P<.001). Ocular cancers were thought to be caused by corrosives 33.2 percent, trauma 21.4 percent, witchcraft 18.6percent, genetic transmission 15.7 percent, sunlight 8.0 percent, radiations 2.5percent and infections 0.6 percent (n = 883). Of 280 respondents, 41.1% based their knowledge of patients having ocular cancers on sources other than hospital diagnosis. Of 148 respondents, 16.2 percent were related to 'patients' they knew had ocular cancers. There were 202 respondents who indicated challenges to accessing orthodox medical eye care services by ocular cancer patients as high-cost 55.5 percent, long waiting period 23.3 percent, long distance 15.4 percent and poor attitude of health workers 5.9 percent.

A cross-sectional study conducted by Demirbag, et al. (2013), on knowledge of Turkish mothers about cancer revealed that mothers' knowledge of cancer was deficient. The study showed that 34.9 percent of the mothers were between the ages of 40-47, 40.5 percent had three children, 73.8 percent had no experience with children with cancer, 45.9 percent said they learned about cancer on television, 39.7 percent stated that the primary reason for childhood cancer was the mother's smoking during pregnancy, 68.8 percent said that early diagnosis would save a child, and 98 percent wanted to learn about childhood cancer.

A similar study was conducted by Wanyama, Marco, and Kariuki, (2016) to assess knowledge, attitude, and practice of childhood eye diseases among paediatricians working in Kenya. The results showed that, out of the 125 paediatricians who responded, 69.6% had a level of knowledge classifiable as poor, 28.0% moderate and 2.4% good. The mean score of participants in this study was 58.20%. However, participants showed varied levels of knowledge in different subject matters. Sixty-nine points six percent of paediatricians carries out eye examination in children, though this varied with each participant doing only the test they are familiar with. Their referral of children with eye diseases to an ophthalmologist was found to be generally appropriate. The attitudes of participants in the various subject areas raised were positive. Ninety-nine points two percent of participants agreed that eye examination by paediatricians could help with early referral of retinoblastoma. In conclusion, the participants had a poor level of knowledge of childhood eye diseases. However, their attitude and practice were generally positive. Their knowledge could be boosted with regular continuous medical education on eye diseases.

A similar study was conducted by Geta, and Bejiga, (2011), to assess knowledge, attitude, and practice involving strabismus in Cheha District, Central Ethiopia. A cross-sectional study was conducted from November 1 to November 28, 2007, in Cheha District in 10 randomly selected kebeles of the district. People aged 18 years and above from randomly selected households were interviewed about their knowledge, attitude, and practice in dealing with strabismus. The result of the study revealed that 198 (47.1%) were males and 222 (52.9%) were females. All participants reported having seen a case of strabismus or heard about it, the source of information being family members or neighbours. In assessing their knowledge, 62.8% did not know the causes of strabismus and mentioned only misconceived causes like exposure to bright light. Of the total study population, 225 (53.6%) believed that there is no treatment for strabismus and 51.4% did not want to marry or allow the marriage of relatives to a person with strabismus. When they were asked about what actions they would take if there was a case of strabismus in the family, 173 (41.2%) reported that they would not take any action since it cannot be treated, 134 (31.9%) said they would take to the hospital and 113 (29.9%) reported they would try modern medicine even though it cannot be treated. In conclusion, a large proportion of the adult population of Cheha District was found to have poor knowledge, attitude and practice regarding the causes and management of strabismus. Health education by health professionals and mass media is thus recommended.

Another study was done by Sathjamohanraj, et al, (2011), on awareness of retinopathy (ROP) of prematurity among paediatricians in a tier two city of South India showed that 54(65.1%) of paediatricians were aware of ROP. Thirty-three respondents (39.8%) answered that ROP is preventable and only 43 (51.8%) paediatricians were sure that ROP is treatable. The study also revealed that paediatricians in private

hospitals were more aware of ROP compared to their counterparts in government (P = 0.006).

A study of 140 paediatricians done in Brazil by Michel *et al* (2003), on what paediatricians know about childhood ocular illnesses revealed that 28(20%) of respondents did not know the best age to start treatment of a child with visual impairment. Seventy four (53%) knew the correct time of ophthalmologic evaluation in retinopathy of prematurity. In the same study 88(63%) could not remember that retinoblastoma and retinopathy of prematurity are causes of leukocoria while 14 (10%) did not know that retinoblastoma is malignant. A further 73(52%) did not know that the classic symptom triad of congenital glaucoma is photophobia; lacrimation and blepharospasm while 21(15%) of respondents did not know the proper management of children with strabismus.

2.9 Summary

The review stated above with respect to retinoblastoma depicts a general situation of the disease in Nigeria, Africa and around the world. References were made to awareness, attitudes, and practices towards retinoblastoma in general. Retinoblastoma is a malignant (cancerous) tumour of the retina, the thin nerve tissue that lines the back of the eye which senses light and forms images. Retinoblastoma is a rare form of cancer. It is considered a childhood cancer since it mostly affects children less than 5 years of age. There seems to be an equal chance of the condition occurring in either eye, in either boys or girls and regardless of race. About 75% of cases occur in one eye, and about 25% of cases occur in both eyes. Retinoblastoma, like all cancers, occurs when body cells reproduce uncontrollably, that is when cells begin to divide at an unusually high rate.

The worldwide incidence rate of retinoblastoma for children aged 0-4years varies from 3.4% per million in Bulgaria to a very high 42.5 per million in Mali. Incidence rates vary greatly in some regions while it varies only slightly in some other regions around the world. Sang, et al (2014) concluded that the incidence of retinoblastoma in Korea was found to be similar to that in the United States, Europe, and Asia. While the case was found to be different in Africa, incidence studies put the incidence estimates at 14-20 cases per million in Malawi and 9.3 per million in Guinea Conakry. These are much higher than rates in the USA. This has been attributed to some unknown environmental influences and the higher birth rates in Africa. Most studies from different parts of the world suggest no sex discrepancy in the incidence of retinoblastoma.

A similar study conducted by Demirbag, et al. (2013) on knowledge of Turkish mothers about cancer revealed that the mothers' knowledge of cancer was deficient. so to help improve knowledge of the disease, Antonelli, et al, (2006) reported that, strategies to improve early diagnosis were 1) flyers and posters that can be distributed; 2) training of primary school teachers, with more than 1000 seminars presented in more than 100 schools over 5 years; and 3) specific training on retinoblastoma for medical students primary physicians and parents. After applying this initiative in Brazil, Antonelli et al (2006) reported that extra-ocular retinoblastoma decreased from 56percent in 1985 to less than 10 percent in 2003. Literature review reveals only one published study by Michel, Zelia, and Italo, (2003) on knowledge attitude and practice among paediatricians on childhood ocular diseases. A few others have focused mainly on awareness and knowledge of ocular cancers, and awareness of retinopathy.

This study is unique because it attempts to assess the awareness, attitude, and practices towards observation of retinoblastoma disease among mothers of under-five children in Kaduna State. The researcher discovered that no study has been done or published anywhere in the world based on the knowledge of the researcher on awareness, attitude, and practices towards observation of retinoblastoma disease among mothers of under-five children. Most studies conducted on retinoblastoma are mostly on its Clinic and pathological pattern. A few studies were done on awareness and knowledge of retinoblastoma, which in terms of scope, population and location is different from this study.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The purpose of this study was to assess the awareness, attitude, and practices towards observation of retinoblastoma among mothers of under-five children in Kaduna State. To achieve this purpose, research design, population, sample and sampling techniques, instrumentation, validation of instrument, procedures for data collection and data analysis were described and presented in this chapter.

3.2 Research Design

For the purpose of this research, a descriptive survey research design was adopted for the study. The design was chosen because it describes the responses of the respondents and cannot be manipulated by the researcher. Shuttleworth, (2008) stressed that descriptive research design is a scientific method which involves describing the behaviour and situations of a subject without influencing it in any way. Descriptive survey research design is also useful where it is not possible to test and measure a large number of the population needed (Hale, 2011) and also because it is a non-experimental design.

3.3 Population of the Study

The population for this study comprised of all mothers of under-five children in Kaduna State, Nigeria. According to the National Bureau of Statistics (2016), the projected population of women of reproductive age in Kaduna was 2,050,608. The target population for this study consisted of 477,040 mothers' of under-five children within the six (6) sampled Local Government Areas of Kaduna State, Nigeria.

3.4 Sample and Sampling Techniques.

The sample size for this study consisted of four hundred (400) respondents which were drawn from the population of mothers of under-five children from six (6) randomly selected local government areas.

Table 3.1 The list of zones, selected L.G.As, health facilities to be used, the population of women and sample size.

Zones	**L.G.A's**	**Health facility selected**	**The population of mothers of <5**	**Sample size**
Kaduna Central	Kaduna	Barau Dikko specialist hospital Kaduna	98,420	83
	Igabi	Comprehensive health centre Jaji	116,300	98
Kaduna North	Makarfi	General hospital Makarfi	39,580	33
	Sabon-gari	Railway hospital Sabon-gari	78,660	66
Kaduna South	Kachia	General hospital Kachia	68,180	57
	Jama'a	General hospital Kafanchan	75,900	63
Total	6	6	477,040	400

Source: Annual Abstract of Statistics, (2017)

To obtain the sample size from the total population, the researcher employed the sample size procedure proposed by Yamane (1967). Yamane stressed that in a finite population, the correct sample size can be determined using the following formulae.

$$n = \frac{N}{(1 + Ne^2)}$$

Where;

n= correct sample size

N= population size

e=margin of error *e*=0.05

Therefore, for the purpose of this study, the sample size is 400.

A multi-stage sampling procedure was employed by the researcher for this study. First, the researcher stratified Kaduna State into the three (3), already existing senatorial zones, namely; Kaduna North, Kaduna South, and Kaduna Central respectively. From each of the senatorial zones, two local government areas (LGA) was randomly selected using the dip-hand method, three containers were used, one container representing each senatorial zones of the state. The name of each LGAs from each senatorial zone was written on pieces of paper folded and dropped into the corresponding container, after which the researcher shook each container well before asking one of the research assistants to dip his hand and pick one folded piece of paper at a time and the name of the LGA picked was written down. This procedure continued until two LGAs were selected from each senatorial district.

After selection of the representative LGAs from the senatorial districts, the researcher now randomly selected one healthcare facility from each LGA using the dip hand method, where names of the healthcare facilities in the LGA was written on pieces of paper and dropped in a container. The researcher shook the container vigorously and asked one of the research assistants to dip his hand and pick a piece of paper at a time. The name of the health facility picked was then written down, this procedure continued until the total number of health facilities needed for the research was gotten. The six (6) health facilities selected were then used to get the respondents for the research.

To determine the proportion of respondents per LGA, proportionate sampling procedure was used by the researcher. The researcher divided the population of the women at each LGA by the total population from all the LGAs and multiplied it by the sample size (400).

Proportionate sampling procedure $= \frac{n}{N} \times 400$

Where;

n= is the population of women of reproductive age in a LGA

N= is the total population of women of reproductive age from all selected LGAS

To get the respondents for the research, a purposive sampling procedure was employed by the researcher; the researcher and his assistants purposively selected the mothers of under-five children present at the health facility to serve as respondent for research.

3.5 Research Instrument

The instrument the researcher used was a researcher-developed questionnaire and it consists of four sections (A-D). Section A consisted of six (6) items on demographic characteristics of the respondents. Section B consisted of thirteen (13) items on awareness of the respondents about the observation of retinoblastoma. Section C consisted of thirteen (13) items on the attitude of the respondents towards the observation of retinoblastoma. Section D contained thirteen (13) items on practices towards observation of retinoblastoma by the respondents. All the following sections constituted the questionnaire. To score the respondents, as based on what they felt towards a particular item, 4-point Likert scale rating was used as follows;

Strongly agree (SA) = 4 points

Agree (A) = 3 points

Disagree (D) = 2 points

Strongly Disagree (SD) = 1 point

Hence, the mean score of any response was considered positive, if it was 2.5 and above, while any mean score of any response less than 2.5 was regarded as negative or not acceptable.

3.6 Validation of Research Instrument.

In order to establish a face and content validity of the research instrument, the questionnaire was vetted by three (3) experts in the Department of Human Kinetics and Health Education, one (1) from the Department of Nursing Sciences of Ahmadu Bello University Zaria and one (1) from the paediatric unit of the Ahmadu Bello University Teaching Hospital Shika. Thus, every correction, criticism, and suggestions made by these experts was effected by the researcher on the final draft of the questionnaire which was used for collection of data in the field from the respondents.

3.7 Procedure for Data Collection

First, the researcher collected an introductory letter from the Department of Human Kinetics and Health Education, Ahmadu Bello University, Zaria. The researcher trained three research assistants one from each senatorial zone of Kaduna State who assisted in the distribution and collection of the questionnaire in the field. The researcher briefed the research assistants on how to administer and retrieve the

questionnaire. The research assistants also served as interpreters of the content of the questionnaire when such a case arose for a better understanding of the items within it.

A purposive sampling technique was used by the researcher to draw the respondents at every health facility selected for the study. The researcher and the research assistants purposively selected the mothers of under-five children present at the health facility as they come into the facility. The researcher and his 3 research assistants then administered copies of the questionnaire to the respondents for filling and retrieve them immediately after they have been filled.

3.8 Procedure for Data Analysis

Descriptive statistics of frequency and simple percentages was used to describe the demographic characteristics of the respondents. Mean and standard deviations (SD) was used to answer the stated research questions. One sample t-test was employed to test the formulated hypotheses on awareness, attitude, and practices of retinoblastoma among mothers of under-five children in Kaduna State, Nigeria. Statistical significance for this study was based on $p<0.05$ level of significance.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

The purpose of this study was to assess the awareness, attitude, and practice of retinoblastoma among mothers of under-five children in Kaduna state, Nigeria. To achieve this purpose, the data collected were analyzed using the Statistical Package for Social Science (SPSS) version 20. A total of 400 copies of the questionnaire were administered to mothers of under-five children in Kaduna state, and 374(93.5%) were valid and analyzed.

4.2 Results

Table 4.1: Demographic Characteristics of the Respondents.

VARIABLE		Frequency	Percent
Age Range in years	15-19	24	16.6
	20-24	68	27.8
	25-29	116	31.0
	30-34	104	18.2
	35 and above	62	6.4
	Total	**374**	**100.0**
Marital status	Married	338	90.4
	Single	22	5.9
	Widowed	6	1.6
	Divorced	8	2.1
	Total	**374**	**100.0**
Educational Level	Non-Western edu.	68	18.2
	Higher Degree	0	0
	B.Sc/B.Ad HND	46	12.3
	ND/NCE	66	17.6
	Sec Sch Cert.	130	34.8
	Primary Cert.	64	17.1
	Total	**374**	**100.0**
Number of children	1	122	32.6
	2	76	20.3
	3	68	18.2
	4	52	13.9
	5 and above	56	15
	Total	**374**	**100.0**
Occupation	None	78	20.9
	Civil servant	74	19.8
	Farmer	8	2.1
	Trader	114	30.5
	Student	100	26.7
	Total	**374**	**100.0**
Economic Status	low income (#1000-#20000)	270	72.1
	Middle income (#21000-#79000)	78	20.9
	High income(#80, 000 above)	26	7
	Total	**374**	**100.0**

Observation on Table 4.1 with regards to age range, the majority (116; 31%) were between age 25-29, while ages 20-24 years were 104(27.8). furthermore, the result showed that more respondents (68; 18.2%) were between ages 30-34 years. The remaining respondents in their various age range were not as many as those earlier mentioned. Concerning the marital status of the respondents, Table 4.1 shows that many of the respondents (338; 90.4%) and the remaining were either single (22; 5.9%), widowed (8; 2.1%), or divorced (6; 1.6%). Table 4.1 further reveals that most of the mothers of under-five children (130; 34.8%) had their secondary school certificates.

The table also reveals that, most mothers of under-five children have one child (122; 32.7%), 76 (20.3%) of the respondents have two children, 68 (18.2%) have three children, 52 (13.9%) have four children, while 56 (15%) of the respondents five children and above. The occupation of the respondents on the table shows that 114 (30.5%) were traders, 100 (26.7%) were students, 82 (21.9%) had no occupation, as such they can be regarded as being housewives, while only 8 (2.1%) of the respondents are farmers. The economic status of the respondents shows that majority of the mothers of under-five children are low-income earners 270(72.1%), 78 (20.9%) are middle-income earners while only 24 (6.4% are high-income earners.

4.2.1 Answering Research Questions

Research Question One

Are mothers of under-five children in Kaduna state aware of retinoblastoma?

Table 4.2: Mean score of responses on awareness of mothers of under-five children towards observation of retinoblastoma.

S/No	Items	Mean	Std. Deviation
1	A child with whitish pupil indicates that he/she has retinoblastoma	3.0642	.75826
2	Eyes that appear to be looking at different directions (Squint) can present retinoblastoma later in life.	2.9519	.74879
3	Retinoblastoma can occur in one or both eyes.	3.1818	.83431
4	Retinoblastoma can be inherited.	2.8342	.89641
5	Early detection of Retinoblastoma can save the vision and life of the child.	3.3369	.75310
6	Blurred vision is an indication of retinoblastoma.	3.0856	.81747
7	Retinoblastoma is a curable disease if it is detected in its early stage.	3.2620	.71806
8	Retinoblastoma can lead to permanent impairment in children.	3.1551	.82359
9	Food rich in vitamin A can prevent retinoblastoma.	3.2246	.77690
10	Immunization against measles can prevent retinoblastoma.	3.2246	.77690
11	Eye hygiene is a factor for improving the health of the eye.	3.2246	.76297
12	Eye medical check-up provides early detection of retinoblastoma.	3.2742	.75954
13	Traditional medicine can prevent retinoblastoma.	2.3476	.86767
Aggregate Mean Score		**3.0800**	

Table 4.2 above reveals the mean score of responses on awareness by the respondents towards observation of retinoblastoma in Kaduna state, Nigeria. The aggregate mean score of the items is 3.08. Thus, indicating a positive awareness of retinoblastoma among the respondents. This can be concluded that most of the mothers of under-five children have a significant level of awareness regarding retinoblastoma, except for the use of traditional medicines in preventing retinoblastoma which has a mean score of 2.35. Hence, it can be deduced that the respondents do not believe in the effectiveness of traditional medicines in preventing or curing retinoblastoma.

Research Question Two

Do mothers of under-five children in Kaduna state have the right attitude towards observation of retinoblastoma?

Table 4.3 Mean score of responses on attitudes of mothers of under-five children towards observation of retinoblastoma.

S/No	Items	Mean	Std. Deviation
1	I feel a child with a whitish pupil has retinoblastoma.	2.9519	.91624
2	I feel eyes that appear to be looking at different directions (squint) can develop retinoblastoma later in life.	2.8663	.78750
3	I feel retinoblastoma can occur in one or both eyes.	3.0749	.87550
4	I feel retinoblastoma can be inherited.	2.7807	.96037
5	I feel early detection of retinoblastoma can save the vision and life of the child.	3.2032	.79637
6	I feel blurred vision is an indication of retinoblastoma.	3.0321	.86582
7	I feel retinoblastoma is a curable disease if it is detected in its early stage.	3.1658	.77446
8	I feel retinoblastoma can lead to permanent impairment in children.	3.1070	.84085
9	I feel eating foods rich in vitamin A helps in preventing retinoblastoma.	3.2139	.79355
10	I feel immunization helps in preventing retinoblastoma.	3.3280	.78735
11	I feel eye hygiene can help in preventing retinoblastoma.	3.2086	.83125
12	I feel visiting an eye specialist periodically helps in early diagnosis of eye problems in children.	3.0214	.94320
13	I prefer local remedies as they are best for eye problems in children.	2.3155	1.01566
Aggregate Mean Score		**3.0205**	

Table 4.3 above shows an aggregate mean score of 3.02 which reveals that, there is a positive attitude towards the observation of retinoblastoma among the

respondents. The table shows a score of 3.33 on the respondents' attitude towards immunization, followed by attitude (3.21) towards eye hygiene. The attitude (2.32) towards a preference of local remedies was not positive. The attitude towards a preference of local remedies indicates that local remedies are not generally preferred among mothers of under-five children in Kaduna state. The positive attitudes of mothers of under-five children towards observation of retinoblastoma in Kaduna state can be attributed to the significant level of awareness among the respondents.

Research Question Three

Do mothers of under-five children in Kaduna State practice observation of retinoblastoma?

Table 4.4 Mean score of responses on the practice of mothers of under-five children towards observation of retinoblastoma.

S/No	Item	Mean	Std. Deviation
1	I check my child's eye for whitish pupils as it indicates whether a child has retinoblastoma.	2.9893	.77487
2	I regularly check my child's eye for squint (eyes that appear to be looking at different directions) as it can present retinoblastoma later in life.	3.0481	.79058
3	I screen both eyes during a child's eye examination because retinoblastoma can occur in one or both eyes.	3.2032	.76196
4	I take my child for periodic screening since eye problems can be inherited.	2.8824	.83300
5	I take my child for screening regularly since early detection can save the child's vision and life.	3.2513	.74383
6	I report to the physician when my child complains of blurry vision.	3.2460	.78417
7	I take my child for treatment immediately I notice an eye problem because retinoblastoma is curable when treated in its early stage.	3.2888	.80350
8	I take preventive measures on my child because retinoblastoma can lead to permanent impairment.	3.5187	2.78514
9	I give my child foods rich in vitamin A to prevent eye diseases.	3.3529	.74209
10	I take my child for immunization regularly to prevent diseases.	3.5882	2.22259
11	I practice eye hygiene on my child to prevent eye diseases.	3.3422	.84795
12	I take my child to the hospital for eye examination when I notice something wrong with the child's eyes.	3.2941	.90522
13	I use the following traditional medicines a. Herbs b. Bitter leaf c. Moringa d. Eye make-up e. Breast milk when my child has an eye problem.	2.2299	1.21013
Aggregate Mean Score		**3.1719**	

Table 4.4 shows that, the practice of mothers of under-five children towards observation of retinoblastoma in Kaduna state is positive as most of the items responded are above 2.5. They practiced taking children for immunization regularly as reflected by the mean score of 3.59. Positive practice (3.35) of giving their children foods rich in vitamins A, and checking of the child's eye for the whitish pupil, (2.99), regular checking of child's eye for squint (3.05), and taking of child for periodic screening (2.88). However, the practice of using traditional medicines (2.23) was not quiet acceptably practiced by mothers of under-five children. Looking at the table generally, it reveals that mothers of under-five children have significant practice towards observation of retinoblastoma.

4.2.2 Hypotheses Testing

Sub-Hypothesis one

Mothers of under-five children do not have significant awareness towards observation of retinoblastoma in Kaduna state.

Table 4.5: One-sample t-test on awareness of mothers of under-five children towards observation of retinoblastoma

	Mean	Std. Deviation	t-value	df	P-value
Aggregate mean	3.0800	.37731	29.730	373	.001
Constant mean	2.5	0.00			

$t(373)=1.972$, $p<0.05$

Table 4.5 reveals that awareness of retinoblastoma among mothers of under-five children in Kaduna state was significant with t-value of 29.73 and Df of 373 at p-value 0.001. Therefore, the null hypothesis which stated that mothers of under-five children do not have a significant awareness of observation of retinoblastoma in Kaduna state

was rejected. This means that mothers of under-five children in Kaduna state are aware of retinoblastoma.

Sub-Hypothesis two

The attitude of mothers of under-five children towards observation of retinoblastoma is not significantly adequate.

Table 4.6: One-sample t-test analysis on the attitude of mothers of under-five children towards observation of retinoblastoma

	Mean	Std. Deviation	t-value	df	P-value
Aggregate mean	3.0205	.52086	19.327	373	.001
Constant mean	2.5	0.00			

t(373)=1.972, p<0.05

Concerning the attitude of mothers of under-five children towards observation of retinoblastoma, Table 4.6 shows that mothers' attitude was significant at a p-value of 0.001 with t-value of 19.33 at Df of 373. Thus, mothers of under-five shared a significant positive attitude towards observation of retinoblastoma in Kaduna state. Thus, the formulated hypothesis which stated that the attitude of mothers of under-five children towards observation of retinoblastoma is not significant was not accepted. This means that mothers of under-five children in Kaduna State have the right attitude towards observation of retinoblastoma.

Sub-Hypothesis three

The practice of mothers of under-five children towards observation of retinoblastoma is not significantly adequate.

Table 4.7: One-sample t-test analysis on the practice of mothers of under-five children towards observation of retinoblastoma

	Mean	Std. Deviation	t-value	df	P-value
Aggregate mean	3.1719	.57761	22.498	373	.001
Constant mean	2.5	0.00			

t(373)=1.972, p<0.05

Table 4.7 reveals that the practice of mothers of under-five children towards observation of retinoblastoma is significant at a p-value of 0.001 with t-value of 22.49 at DF of 373. Thus, the formulated hypothesis which stated that practice of mothers of under-five children towards observation of retinoblastoma is not significantly adequate was not accepted, meaning that the mothers of under-five children in Kaduna State practiced observation of retinoblastoma.

4.3 Discussion

Retinoblastoma (cancer of the eye) is a disease mostly found among children who are below five years of age. This study was conducted to assess the awareness, attitude, and practice of retinoblastoma among mothers of under-five children in Kaduna state, with the possibility to proffer solutions to this health problem. With regards to awareness of observation of retinoblastoma by mothers of under-five children, the finding revealed that mothers were aware of this disease (cancer) of the eye. This finding, therefore, supports a study conducted by Wanyama, Marco and Kariuki, (2016) which assessed knowledge, attitude, and practice of childhood eye diseases among paediatricians working in Kenya. The study revealed that out of the 125 paediatricians who participated in the study 69.6% have significant knowledge of childhood eye diseases. This study also agrees with a study conducted by Sathjamohanraj, et al (2011) which revealed that paediatricians in India are aware of retinopathy and agrees that it is

treatable. The findings of this study are in contrast with a study conducted by Ayanniyi et al, (2011) who reported that knowledge of ocular cancers is low among Nigerians from resource-limited settings. This study is also in contrast with Atipo-Tsiba, & Itoua, (2015), who reported that only 40% of midwives could define retinoblastoma and only 10% could associate leucocoria and strabismus as two early signs of this cancer. This study is also in contrast to a study conducted by Demirbang, et al, (2013) which revealed that knowledge of Turkish mothers about cancer is deficient. This study is also in contrast with a study done in Brazil by Michel, et al. (2003) who revealed that 14(10%) did not know that retinoblastoma is malignant, 28(20%) of respondents did not know the best age to start treatment of visual impairment, 88(63%) did not remember that retinoblastoma, retinopathy of prematurity and exudative retinal diseases are causes of Leucocoria. The study is also in contrast with the study conducted by Nkansah, (2018) who reported that, poorest level of knowledge was recorded in retinoblastoma (6.5%) among midwives.

With regards to the attitude of observation of retinoblastoma by mothers of under-five children, the finding of this study revealed that mothers have a positive attitude towards observation of retinoblastoma. These findings therefore support, Wanyama, Marco and Kariuki (2016) who revealed that attitudes of paediatricians are positive, 99.2% of them agreed that eye examination could help with early referral of retinoblastoma. This study also supports a study conducted by Patenaude, et al. (1996), which assessed attitude towards testing for cancer susceptibility gene among mothers of paediatric oncology patients. The study revealed a significant attitude (51%) towards testing themselves and their unaffected children. This study is in disagreement with a study conducted by Geta, and Bejiga, (2011), which reported that a large proportion of

the adult population of Cheha district were found to have a poor attitude regarding the causes and management of strabismus. 225 (53.6%) believed that there is no treatment for strabismus and 173 (41.2%) reported that they would not take any action since it cannot be treated. This can be attributed to the varying misconceptions the general populace have in regards to causes and management of eye diseases.

With regards to the practice of observation of retinoblastoma among mothers of under-five children, the finding of this study revealed that mothers practice observation of retinoblastoma. This finding is in consonance with the finding of a study conducted by Wanyama, Marco, and Kariuki, (2016), which revealed that paediatricians practice regarding childhood eye diseases was significantly positive. Misconceptions have been the underlining factor responsible for the relatively poor practice relating to ocular cancers including retinoblastoma as stressed by Ayanniyi, et al. (2010). The positive outcome of awareness, attitude, and practice towards observation of retinoblastoma among mothers of under-five children in Kaduna state can be attributed to the fact that, the respondents were met at the hospitals. More so, it is known that healthcare workers give health talk during ante/post-natal clinics to the mothers and pregnant women, these might have been the source of their information on this eye disease.

CHAPTER FIVE

SUMMARY, CONCLUSION, AND RECOMMENDATION

5.1 Summary

This study assessed awareness, attitude, and practice towards observation of retinoblastoma among mothers of under-five children in Kaduna state, Nigeria. Three specific purposes, research questions, and hypotheses were formulated and tested using appropriate statistical tests. Relevantly related literature including empirical studies were reviewed. The researcher used a self-developed questionnaire made up of close-ended statements for the purpose of data collection from mothers of under-five children who served as respondents. The study employed a multi-stage sampling procedure comprising of stratified, simple random, and proportionate sampling techniques for sampling the respondents from the targeted population. Four hundred (400) respondents were sampled and used for the study of which after administration and retrieval of the research instrument three hundred and seventy-four (374) copies of the questionnaire were valid and were used for the study.

Analysis of the data was done using the Statistical Package for Social Science (SPSS) version 20. Demographic characteristics of the respondents were analysed using descriptive statistics of frequency and percentage, research questions were answered using mean and standard deviation, while one-sample t-test was used to test the formulated hypotheses at 0.05 level of significance.

5.2 Major Findings

1. The awareness towards observation of retinoblastoma among mothers of under-five children in Kaduna state was significantly adequate (p=0.001).

2. The attitude towards observation of retinoblastoma among mothers of under-five children in Kaduna state was significantly positive (p=0.001).
3. The practice towards observation of retinoblastoma among mothers of under-five children in Kaduna state was significant (p=0.001).

5.3 Contribution to Knowledge

This study contributed to knowledge as follows:

1. Mothers of under-five children in Kaduna state are aware of retinoblastoma.
2. Mothers of under-five children in Kaduna state have positive attitude towards observation of retinoblastoma.
3. Mothers of under-five children in Kaduna state have adequate practice towards observation of retinoblastoma.

5.4 Conclusions

On the basis of the major findings of the study, the following conclusions were drawn.

1. Mothers of under-five children in Kaduna state are aware of retinoblastoma.
2. Mothers of under-five children in Kaduna state have positive attitude towards observation of retinoblastoma.
3. Mothers of under-five children in Kaduna state have adequate practice towards observation of retinoblastoma.

5.5 Recommendations

On the basis of the conclusion above, the following recommendations were made:

1. Health care workers should at all time give health talks on retinoblastoma to mothers of under-five children during their contact (ante and post-natal days) so as to further enlighten and help them sustain their awareness of the disease.
2. The State and Federal Ministry of Health should carry out a nation-wide campaign on awareness of retinoblastoma so as to create more awareness and help sustain the positive attitude towards observation of retinoblastoma among mothers of under-five children.
3. Administrators of crèche and nursery schools should conduct periodic eye examination and screening in their schools as part of their school health services. This is for the purpose of screening for retinoblastoma since the age groups predisposed to this cancer are mainly pre-school age children.

5.6 Suggestion for Further Studies

The following suggestions were made for further studies.

1. Assessment of knowledge, attitude, and practice of childhood eye diseases among mothers of under-five children Kaduna state, Nigeria.
2. Knowledge, attitude and practice of ocular cancers among rural dwellers in Kaduna state, Nigeria.

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APPENDIX I

QUESTIONNAIRE ON ASSESSMENT OF AWARENESS, ATTITUDE AND PRACTICE TOWARDS OBSERVATION OF RETINOBLASTOMA AMONG MOTHERS OF UNDER FIVE CHILDREN IN KADUNA STATE, NIGERIA.

Please tick (√) the option you think is most appropriate in the box provided in each section.

SECTION A: Demographic Characteristics of the Respondent

1. Age Range
   - (a) 15-19 ☐
   - (b) 20-24 ☐
   - (c) 25-29 ☐
   - (d) 30-35 ☐
   - (e) 35 and above ☐
2. Marital status
   - (a) Married ☐
   - (b) Single ☐
   - (c) Divorced ☐
   - (d) Widowed ☐
3. Educational Level
   - (a) Primary Cert. ☐
   - (b) Secondary Sch. Leaving Cert. ☐
   - (c) N.D/N.C.E ☐
   - (d) B.Sc/B.A/HND ☐
   - (e) Higher Degree ☐
   - (f) Non Western Education ☐

4. Number of children

   (a) 1 ☐

   (b) 2 ☐

   (c) 3 ☐

   (d) 4 ☐

   (e) 5- above ☐

5. Occupation

   (a) Student ☐

   (b) Trader ☐

   (c) Farmer ☐

   (d) Civil servant ☐

   (e) Non ☐

6. Economic Status

   (a) Low income (1,000-20,000 per month) ☐

   (b) Middle income (21,000,-79,000) ☐

   (c) High Income (80,000 above) ☐

Please tick (√) the option you think is most appropriate in the box provided in each section.

The keys are as follows:

Strongly Agree	=	SA
Agree	=	A
Disagree	=	D
Strongly Disagree	=	SD

SECTION B: Awareness of mothers of under-five children towards observation of Retinoblastoma

S/No.	Items	SA	A	D	SD
1.	A child with whitish pupil indicates that he/she has retinoblastoma.				
2.	Eyes that appear to be looking at different directions (Squint) can present retinoblastoma later in life.				
3.	Retinoblastoma can occur in one or both eyes.				
4.	Retinoblastoma can be inherited.				
5.	Early detection of Retinoblastoma can save the vision and life of the child.				
6.	Blurred vision is an indication of retinoblastoma.				
7.	Retinoblastoma is a curable disease if it is detected in its early stage.				
8.	Retinoblastoma can lead to permanent impairment in children.				
9.	Food rich in vitamin A can prevent retinoblastoma.				
10.	Immunization against measles can prevent retinoblastoma.				
11.	Eye hygiene is a factor for improve health of the eye.				
12.	Eye medical check up provides early detection of retinoblastoma.				
13.	Traditional medicine can prevent retinoblastoma.				

SECTION C: Attitudes of mothers of under-five children towards observation of Retinoblastoma

S/No	Items	SA	A	D	SD
1.	I feel a child with whitish pupil has retinoblastoma.				
2.	I feel eyes that appear to be looking at different directions (squint) can develop retinoblastoma later in life.				
3.	I feel retinoblastoma can occur in one or both eyes.				
4.	I feel retinoblastoma can be inherited.				
5.	I feel early detection of retinoblastoma can save the vision and life of the child.				
6.	I feel blurred vision is an indication of retinoblastoma.				
7.	I feel retinoblastoma is a curable disease if it is detected in its early stage.				
8.	I feel retinoblastoma can lead to permanent impairment in children.				
9.	I feel eating foods rich in vitamin A helps in preventing retinoblastoma.				
10	I feel immunization helps in preventing retinoblastoma.				
11	I feel eye hygiene can help in preventing retinoblastoma.				
12	I feel visiting an eye specialist periodically helps in early diagnosis of eye problems in children.				
13	I prefer local remedies as they are best for eye problems in children.				

SECTION D: Practice of mothers of under-five children towards observation of Retinoblastoma

S/No	Items	SA	A	D	SD
1.	I check my child's eye for whitish pupils as it indicates whether a child has retinoblastoma.				
2.	I regularly check my child's eye for squint (eyes that appear to be looking at different directions) as it can present retinoblastoma later in life.				
3.	I screen both eyes during child's eye examination because retinoblastoma can occur in one or both eyes.				
4.	I take my child for periodic screening since eye problems can be inherited.				
5.	I take my child for screening regularly since early detection can save the child's vision and life.				
6.	I report to the physician when my child complains of blurry vision.				
7.	I take my child for treatment immediately i notice an eye problem because retinoblastoma is curable when treated in its early stage.				
8.	I take preventive measures on my child because retinoblastoma can lead to permanent impairment.				
9.	I give my child foods rich in vitamin A to prevent eye diseases.				
10.	I take my child for immunization regularly to prevent diseases.				
11.	I practice eye hygiene on my child to prevent eye diseases.				
12.	I take my child to the hospital for eye examination when i notice something wrong with the child's eyes.				
13.	I use the following traditional medicines a. Herbs b. Bitter leaf c. Moringa d. Eye make-up e. Breast milk when my child has eye problem.				