Glaucoma in Nigeria – factors influencing late presentation of the disease

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Glaucoma in Nigeria – factors influencing late presentation of the disease is my own work.

A thesis submitted in partial fulfilment of the requirement for the degree of

Master of Public Health

By

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Where other people's work has been used (either from a printed source, internet or any other source) this has been carefully acknowledged and referenced in accordance with departmental requirements.

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Abbreviations

CHEWS	Community health extension workers
FCT	Federal capital territory
IOP	Intra ocular pressure
LGAs	Local government areas
LGCs	Local government council
NGOs	Non-Governmental Organisation
NDHS	Nigeria demographic health survey
NNBVIS	Nigeria National Blindness and Visually Impaired Survey
PHC	Primary Health Care
POAG	Primary Open Angle Glaucoma
SVI	Severe Visual Impairment
VA	Visual Acuity
WHO	World Health Organisation

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Special appreciation to my Family, thank you for the love, care and trust you all have in me without which I would not have been able to come this far. You all have a wonderful place in my heart.

To all my friends I hold you all dearly, to my fellow ICHD course mates thank you for making my year memorable. Special thanks to P, you are a friend that sticks closer than a sister.

I salute all my tutors and supervisors at Kit.

Introduction

My name is Livinus Martin and I am an Optometrist. I worked as the head of the eye care unit of Pro-health International, a Non-governmental Organisation with a vision of improving the health of Africa's people. I have volunteered with other non for profit organisations (Omega Cares and Faith Alive Foundation) where I also took charge of the eye care unit. Being an optometrist and leading eye care teams to medical missions across Africa influenced my choice of topic, Glaucoma in Nigeria – factors influencing delay in presentation. Most glaucoma patients I have come across in my time on the field travelling around Nigeria have been diagnosed late when vision has deteriorated in at least one eye. This was a source of worry to me personally because I knew that blindness from glaucoma is irreversible. I remember a situation in Taraba State where we have gone for a short term medical mission; a lady was diagnosed of glaucoma, prescribed and issued her medication. She was not yet blind but had severe visual impairment at the time of diagnosis. After some time we went back to a community close to hers and she came around but this time she was blind in one eye and severely visually impaired in the other. Upon inquiring from her, she had used the medication and since there was no improvement her relatives asked her to stop the use of the medication. She then decided to go back to using the traditional herbs given to her prior to being diagnosed with glaucoma. At this point there was little we could do for her but it really bothered me. This is the case for many people in Nigeria and that made me to embark on this study to identify and explore the factors that influences late presentation of the disease.

Abstract

Patients with glaucoma present late, most of the time when the patient is blind in at least one eye. The epidemiology of the disease shows that a high number of people are blind from glaucoma in Nigeria. This study aim at finding reasons why there is late presentations for glaucoma in Nigeria and make recommendations.

Using the Piot model, gaps were identified from the patients' side and the health service side that could cause delay in presentation. The reasons from the patients' side include; not aware of the disease, no available eye care facility to present and poverty. Unawareness of glaucoma is enhanced by lack of felt need due to the nature of the ailment which progresses quietly and known as the 'silent thief'. At the level of the health care sector, lack of resources (human and equipment) for detecting and diagnosing the disease are important factors.

The side with more gaps is the health sectors'. Mass awareness campaigns and mass screening cannot be initiated at the population level if there is nowhere to refer the patients to. This would be a futile effort if the eye care centres lack adequate professionals and basic equipment and supply to cater for them.

Recommendations: The eye care units should be equipped with the appropriate staff and basic equipment to be able to detect, diagnose and manage glaucoma. Opportunistic case detection should be enhanced so comprehensive eye examination should be carried out on all patients above 40 years who present for any complaint.

Key words:

Glaucoma, diagnosis, treatment, epidemiology, mass screening.

Chapter 1 Background information

1.1 Nigeria

Nigeria is a country with abundant resources and huge potential; it lies on the west coast of Africa [1]. Nigeria is bounded by the Atlantic Ocean to the south, the republic of Cameroon to the east, the republics of Chad and Niger in the north and the republic of Benin in the west [1]. Nigeria is the fourteenth largest country in landmass in Africa and thirty-two largest in the world. Its graphic landscape presentation is characterized by two main forms namely; the lowlands and highlands [1]. The highlands stretch from 600 metres to 1,300 metres in the Northcentral to the Eastern highlands. The lowlands are mostly in the coastal areas and are often less than 20 metres [1].

According to the 2006 population and housing census, Nigeria has a population of over 140 million people with a national growth rate which is estimated at 3.2% annually [1]. This population and annual growth rate make Nigeria the most populous nation in Africa and ranked it seventh in the world [2]. Nigeria is said to have reached 167 million people in population when the 167^{th} person was born in October 2011 [3]. Nigeria is classified by World Bank as a low middle income country with a gross domestic product of $568.5 Billion [4].

Nigeria operates a federal system of government and is divided into 6 geopolitical zones or administrative zones (figure 1) and has 36 states and a Federal Capital Territory (FCT). Each state is further divided into smaller administrative units which are known as the Local Government Authorities or Councils (LGAs or LGCs) [1]. Nigeria has a tropical climate with two main seasons, the wet and dry seasons. The temperature of the country moves forth and backward between $25^{o}C$ and $40^{o}C$. The rainfall ranges from 2,650 millimetres in the Southeast to below 600 millimetres in some Northern parts which are on the peripheral part of the Sahara desert. The vegetation zones that arise from the differences in these climatic conditions include the Delta zone, rainforest, and the savannahs in the northern part of the country [1].

Figure 1 Map of Nigeria (Source NDHS 2013)

According to the Nigeria Demographic Health Survey (2014), (NDHS) the level of education attainment among the males and the females is different [1]. The difference shows that 70% of the male at or above the age of 6 have ever attended school against 58% of the females age 6 and above [1]. About 21% of the males have primary school education, while 9% have more than secondary school education and 30% has no education. In the females, 19% have primary school education, 6% more than secondary education and 40% no education [1]. The men also stay longer in school

than the women according the report of the survey [1]. Education attainment is also not balanced between the rural and urban areas of the country. This is shown as 54% of females in the rural areas have no education compared to 22% of the females in the urban areas. For the males, 40% in the rural areas have no education compared to 14% in the urban areas [1].

Across the geopolitical zones, the Northeast and Northwest are behind the others in education. More than 60% of the females and about 50% of the males in these zones have no education [1].

The health system is decentralized in Nigeria. Health care is provided at three levels of care which are; primary, secondary and tertiary [5]. The primary levels provide preventive, curative, health promotion and rehabilitative nature of care to the general populace [5]. The primary health care level is the entry point of the health care system and is largely the responsibility of the LGCs and supported by the State ministry of health [5]. The secondary health care levels provide specialized services to patients referred from the primary health care level. The secondary health care level is the responsibility of the State Governments [5].

The tertiary health care level consists of highly specialised services and is the responsibility of the Federal Government [5]. Occasionally you see some overlap at the tertiary level of health care because some state governments have specialist hospitals which are an equivalent of the tertiary health care level and the LGCs can have secondary facilities but this is rarer. The private sector and Faith based organisations can be found at all of the levels of care [5].

At the level of the primary health care, the public facilities are staffed by nurses, community health officers, community health extension workers (CHEWS), junior CHEWS and environmental health officers. And the facilities include health centers, clinics, dispensaries and health posts [6]. The facilities in the secondary care include the general hospitals which are staffed by higher cadre of health workers. Medical officers, nurses, medical laboratory personnel, midwives, pharmacists and community health officers are the typical staff members that can be found in such setting. The tertiary level facilities form the highest level of health care in Nigeria. The tertiary level consists of highly specialized services and care for specific diseases [6].

The national health policy established the primary health care (PHC) as the framework to achieve improved health for the population [5]. The health sector in Nigeria is characterized by disparities across the regions in status, service delivery and resource availability [1]. This of course affects the quality and range of health service care rendered across the country, as the PHC system is said to cater for only less than 20% of the potential patients [7]. In fact most PHC are said to serve only about 5% to 10% of their potential patient load due majorly to consumers' loss of confidence in them [5]. The government is trying to address these problems, but issues of corruption and inefficiency is really weighing down on the system [8]. The wealth inequality is very evident in the country and is higher in the rural areas than in urban areas and varies across the geopolitical zones with it being more evenly distributed in the Southwest [1].

Health insurance policy has been in existence in Nigeria since 1999; only about 3% of the total population is covered by the insurance system. And the coverage is mainly among formal sector employees. Although the government funds the public health services, it is still inadequate and accessing them is a huge challenge as will be noted below. The public expenditure for health by government is less than $8 per capita, which is very low, compared to the $34 internationally recommended [5]. Private expenditures on health as part of total health expenditure is about 72% with about 68% of it coming as out of pocket expenditure in spite of the endemic nature of poverty in the country [5], [9]. This goes to show that there remain a huge number of individuals at risk of financial hazards from the use of the health care services due to wide inequality spread across the country [10].

1.2 Glaucoma

Glaucoma is the second leading cause of blindness after cataract in the world. About 8% of the 39 million blind people are said to be blind from glaucoma [11] [12]. In the year 2006 the population estimated to be blind in both eyes due to glaucoma worldwide was estimated to increase from 8.4 million in 2010 to 11.1 million by 2020 [13]. Although, when compared to this figure, there are much more people who are living with the disease and are at risk of becoming blind. It has been estimated that by 2020 about 80.5 million individuals will suffer from glaucoma [14].

In Africa 15% of the blind people in the region is attributed to glaucoma. And in addition Africa is the region with the highest prevalence of blind people due to glaucoma relative to other regions of the world. The black race also has a higher prevalence of primary open angle glaucoma than other races anywhere in the world. Glaucoma blindness in blacks was 0.37% and 6.6 times higher than the glaucoma blindness in the white which is 0.06%. [15], [16], [17], [18], [19], [20].

Glaucoma is a word used to describe a group of eye diseases which lead to the damage or destruction of the optic nerve. It is associated with an increase in the pressure of the fluid in the eye, the intra ocular pressure (IOP) [21]. Generally there are various classifications of glaucoma, but for this work we will limit our study to primary open-angle glaucoma (POAG). POAG is a painless optic neuropathy that tends to progress slowly over time and is the most common type of glaucoma in Africa. POAG hereafter referred to as glaucoma usually affects both eyes. Glaucoma is able to cause damage to vision in the affected eye(s), and it begins by affecting the peripheral aspect of vision by reducing the visual field from the temporal side until it has engulfed the whole visual field leading to blindness if untreated. This blindness caused by the damage from glaucoma is irreversible [22] [14].

1.3 Risk Factors for Glaucoma

The risk factors for glaucoma are high IOP, increasing age, low systolic blood pressure (BP) to IOP ratio, low mean diastolic ocular perfusion i.e. diastolic BP minus IOP. Positive family history for glaucoma has also been demonstrated as a risk factor for the disease [14], [23]. However, studies have narrowed down on increasing age, high IOP and positive family history as major risk factors. This is because high prevalence of glaucoma has been associated with these factors. [17], [23], [24], [25].

Other risk factors for glaucoma include, history of cataract surgery, prolonged steroid use, diabetes, ocular trauma, central retinal vein occlusion, uveitis and myopia [26], [27], [28], [29], [30], [31], [32].

1.4 Symptoms of Glaucoma and Management

Glaucoma at its early stage is asymptomatic, while symptoms only appear at the later stage when the disease is usually at an advanced stage. In glaucoma the peripheral visual field is gradually affected, but central vision remains intact until at a very late stage, therefore patients do not often realize the ongoing damage. Hence, it is referred to as "the silent thief of sight" because of its painless progression from the peripheral to the central vision [33]. The challenge lies in the early diagnosis and treatment of glaucoma, as the disease is asymptomatic in its early stages and very subtle when it manifests. It is usually a challenge to diagnose this very important ailment early [33], [34]. The challenges of diagnosis thus include late presentation by patients with this disease which according to Ahmad et al (2014) could make it difficult to manage. The ability of health workers to accurately diagnose it when presented at its early stages is also another challenge according to Verrey et al (1990) [35], [36].

The various options for managing glaucoma are medication, surgery or laser therapy or a combination of some of the options. In addition, management and follow-up of glaucoma is a lifelong procedure and can only at best, prevent progression of the disease but not cure [37]

Chapter 2 Statement of Problem and Objectives

2.1 Problem Statement:

According to the Nigeria national blindness and visual impairment survey (NNBVIS), conducted in 2005-2007 the proportion of blindness due to glaucoma in Nigeria has been estimated to be 16.9% of the total blindness in the country among those aged 40 years and above. This makes glaucoma the second cause of blindness in Nigeria after cataract and the number one cause of irreversible blindness. Nigeria has one of the highest numbers of people with glaucoma in the world [38], [39]. About 150,000 people are blind due to glaucoma and there are still many more people out there with glaucoma, who are not yet blind but are severely visually impaired or at a risk of getting blind.

Whereas blindness by cataract can be cured through surgery, blindness from glaucoma is irreversible. Cataract surgery can be done at any stage of the visual impairment with about 90% success rate unlike glaucoma whose surgery has to be before vision is adversely affected [40].

The consequences of this late presentation according to Abdull in a 2012 study, is often frustration for the health worker, the family is thrown into grief and the patient becomes blind that cannot be reversed [41]. Hence it is very crucial for early case detection and management of glaucoma before the disease causes any significant damage to the vision of the patient. The reasons for late presentation could be postponement of visit to health facilities by the patient which could be due to lack of felt need or a visit to the local herbal practitioners. The lack of felt need could be because of the, slow and silent progression of glaucoma. Others reasons could be due to self-medication by purchasing eye drops from the local medicine stores. These drops could contain steroids that could further elevate the IOP. Beliefs that whatever befalls one is from God even blindness, people confusing cataract with glaucoma and thus wait for the local quacks to perform couching on them are also possible reasons for late presentation. Couching is the local way to take care of cataract instead of going to the hospital for surgery. Couching is only done when the cataract is mature then there is ‘complete blindness’. The patient could have gone to the health facility on time but poor diagnosis and improper treatment or no diagnosis because of lack of qualified health workers and basic equipment for diagnosis. It could also be that the patients were prescribed the right medication after proper

diagnosis and after using the medication for a while and they don't feel any better they got discouraged and stopped using the medication. Or because of poverty they could not afford to continue with the medication as it is to be used for life.

Furthermore, the poor result of surgery on close relatives and friends could discourage others from presenting for glaucoma screening in another scenario. These reasons could make glaucoma progress unchecked and lead to blindness in the patient. The problem inherent in late presentation of the disease could be from the patient side (demand) and the health sector side (supply).

Glaucoma at any stage (not to say the least at the end stage) could have very negative effects for the patient as an individual, his/her family, the community, society, the state and the country at large. At the individual level, the quality of life (QOL) of such a patient is reduced as elicited by Onakoya et al (2012) [42] in their study in Lagos, Southwest Nigeria. They found that glaucoma at any stage has a negative impact on quality of life of a patient and that it further deteriorates as the disease progresses further undetected or unmanaged [42],[1].

2.2 Justification:

Not much is known about the factors influencing late presentation of glaucoma. The few studies that have been done looked at it separately either from the patient side or from the health sector side. This is an attempt to bring the two sides together (from both the patient side and the health sector side), and to make recommendations on how glaucoma services can be improved by adapting the culture of the best evidenced based practices that are feasible and applicable.

[1] Quality of life (QOL) is defined as an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. It is a broad ranging concept affected in a complex way by the person's physical health, psychological state, and level of independence, social relationships, and their relationship to salient features of their environment, [43].

2.3 General Objectives:

To identify the reasons why there is late presentation of glaucoma and to make recommendations to key stakeholders in service provision for glaucoma.

2.4 Specific Objectives

2.4.1 To describe the epidemiology of glaucoma in Nigeria
2.4.2 To explore the supply and demand side factors that influences the late presentation and diagnosis of glaucoma cases.

2.4.3 To elicit what evidence based practices in the care of glaucoma from other countries and the different regions in Nigeria to learn from.

2.4.4 To make recommendations to key stakeholders in service provision for glaucoma on the best evidenced based practices that are feasible and applicable in the Nigerian context.

2.5 Methodology

The method used for this dissertation is literature review. The search engine Google scholar and data bases PubMed/Medline and the VU library were used to access peer reviewed literatures relevant to the topic. The results were limited to the last 15 years except in few cases. The general Google search engine, government websites and World Health Organisation (WHO) websites were also employed to access gray literature. The key words used singly or in combination are: glaucoma, Nigeria, health, behaviour, epidemiology, prevalence, risk factors. See table below.

Table 1 Search strategy table

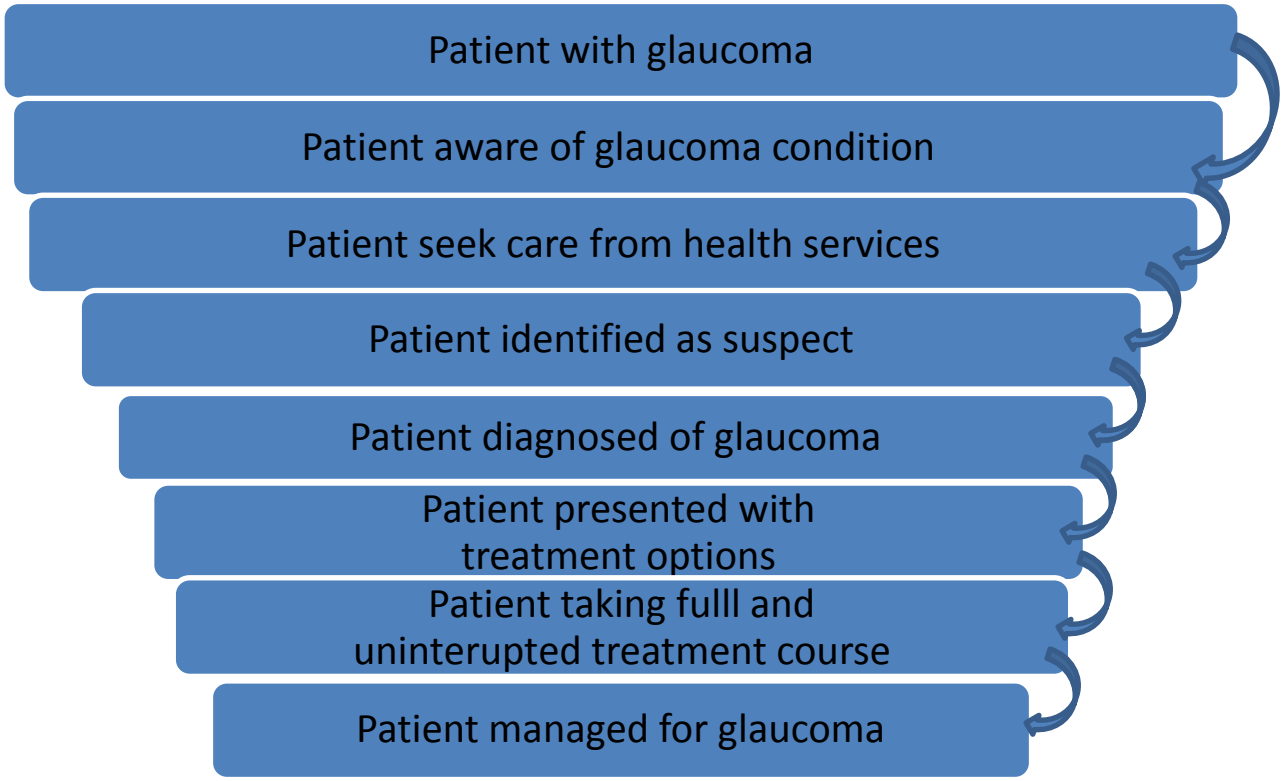
Type of document	source	Objective 1	Objective 2	Objective 3
		Key word used	Key word used	Key word used
Published peer review paper	Pubmed VU Library Google Scholar Google	Epidemiology, Glaucoma, Nigeria, Prevalence, risk factors. Key informant	Key informant, awareness, therapeutics, prevention, barriers, delivery of health care.	Key informant
Grey literature	Federal Ministry of Health, WHO, Glaucoma Foundation,	Glaucoma, health, Survey, Nigeria,	Key informant, Glaucoma blindness, health resources, mass screening, disease progression, disease management, diagnosis	Key informant

			therapeutics, prevention, barriers, delivery of health care	
Reports	WHO, Glaucoma Foundation	Glaucoma, care, Nigeria		

Piot analytical framework [44] is adapted for the data generation and analysis. The framework is originally developed by Peter Piot and gives a step by step process of analyzing critically the various problems affecting tuberculosis and the rate of cure among those infected in the society. The model has besides the tuberculosis control programmes, also been used successfully and proven useful for the analysis of other disease control programmes such as sexually transmitted infections and malaria [45], [46], [47]. It identifies major areas of problem where we can initiate courses of action. It guides the prioritization of the line of actions and looks at it from the two sides of the coin of the demand side (patient) and supply side (health service). It does not so much look at other factors like the socioeconomic factors, cultural factors, geographic location, individual and household characteristics, costs and prices of services. For these limitations another model, the Anderson framework [48], will be used to generate and analyse data on these factors that could also play a significant role in the late presentation of glaucoma not covered in the Piot framework. This would be done by integrating it into the Piot model.

2.6 Adapted Piot Model

Figure 2 Piot Model (Source Piot MA (1967) *A Simulation Model for Case Finding and Treatment in Tuberculosis Programme)*.



Chapter 3 Supply and demand for diagnostic and patient services for glaucoma

In this chapter, using the adapted analytical framework, (Piot model), the epidemiology of glaucoma in Nigeria is described. The various reasons and factors from both the demand and supply sides that influences the late presentation and diagnosis of glaucoma in Nigeria are explored.

3.1 Patients with glaucoma: Epidemiology of Glaucoma in Nigeria

The NNBVIS [49] the largest done in Africa (2005-2007) is the most comprehensive and truly representative of the whole country [14]. It is the largest and most comprehensive because before the survey was carried out, there was no national estimate of the causes of blindness and visual impairment available in the country. Furthermore, the work to get these data is enormous and took about 30 months to complete. A total of 13,599 individuals aged 40 and above were examined in the course of the survey across the country. Six collaborating institutions took part in the survey under the technical guidance of the International Centre for Eye Health, London. For the first time in the country scientifically valid data for the entire country are available. The data gotten provides epidemiological evidence needed for priority setting in eye care planning and also for measuring the impact of eye care service delivery in Nigeria. The data from the survey contributes to the global database for blindness which is used for global planning, for advocacy, resource mobilization and monitoring of the global Vision 2020 initiative [50].

The definitions of blindness used in the NNBVIS were those recommended by the WHO. The definition of blindness and visual impairment according to the world health body are thus; blindness is presenting a visual acuity (VA) of less than 3/60 (<20/400) in the better eye. The VA is with spectacles for distance vision if it is worn normally or unaided if spectacles for distance vision are not normally worn. Severe visual impairment (SVI), is presenting VA of less than 6/60 to 3/60 (<20/200 to 20/400) in the better eye [51]. These same definitions are applied in this work.

The prevalence of blindness found in the survey was 4.2% per 1000 (CI: 3.8-4.6%) among persons aged 40 and above and the prevalence of severe

visual impairment was 1.5% per 1000 (CI: 1.3-1.7%) in 40years and above. The prevalence of blindness caused by glaucoma is 0.7% per 1000 (CI: 0.6-0.9%) in persons aged 40years and above [49]. Glaucoma which is the second cause of blindness and the number one cause of irreversible blindness was reported by the survey to have a proportion of 16.7% of the total bilateral blindness among all persons aged 40years and above. [39], [49]. In 1995 a population based survey conducted in a LGC in Kano state, Northwest zone, among 3596 persons. The prevalence of blindness was 1.14% (CI: 0.8- 1.5%). Glaucoma was among the chief causes of blindness there with a proportion of 15% among those tested in this survey in Kano [52]. During the survey other causes of blindness were recorded also, like cataract and cornea ulcer. It is possible that glaucoma could be more than estimated from the study because cornea opacity and cataract make it difficult to impossible to carry out fundus examination. Thus cases of glaucoma could have been missed out. Cornea opacity could also be due to the use of herbal concoction on the eyes due to an initial eye ailment by the locals. The initial eye ailment could be glaucoma.

3.1.1 Geographical distributional

Across the ecological zones, glaucoma which according to the NNBIVS is one of the primary treatable causes of blindness is recorded thus; Sahel 23.5% of persons aged 40 and above, Sudan 13.2% of person aged 40 and above, Guinea transition savannah 23% of persons aged 40 and above, Rainforest 17.5% of persons aged 40 and above and Delta ecological zone, 13.6% persons aged 40 and above [39], [49], [53]. Glaucoma is therefore spread across the country causing blindness and is not limited by geographic boundaries. The difference in the figures could be due to the difference in education levels across the ecological zones. For instance the population in the Delta ecological zone is better educated than those in the Sahel. Education could have affected the people's awareness of glaucoma and subsequently their health seeking behaviour. Other possible reasons could be that the incidence of glaucoma blindness is more in the Sahel and Guinea ecological zones of the country. Or the disease progresses more aggressively in these ecological zones. It could also be that access to health care is lower in these zones with higher figures hence more people become blind from the disease than the areas with lower figure. Studies have also shown that geographical abode does not determine the spread of glaucoma [54]

3.1.2 Age

Different studies have been done to ascertain the age of onset of glaucoma. Increasing age is a risk factor as has already been pointed out [23], [24]. A hospital based study by Enock et al (2010) suggested that glaucoma peaks in the sixth decade of life [55]. In this study, of the 2,742 patients examined it was discovered that glaucoma increases with age as shown thus; 8.1% (<20 years), 11.2% (21-30 years), 14.9% (31-40 years) and 19.8% are in the age bracket 41-50 years. While 22.4% and 17.4% are in the age brackets 51-60 years and 61-70 years respectively. The glaucoma found in the younger age bracket could be as a result of trauma or abuse of drugs that contain steroid.

Adekoya et al (2013) found in their hospital based survey in Lagos state Southwest zone, the age range of 41-60 years the highest with 42.2% of newly diagnosed glaucoma patients. This is followed by the range 61-80 years with 32.2% of the total newly diagnosed glaucoma [56]. These are people that reported to the hospital since it is a hospital based survey. It gives account of only those who were able to make it to the hospital and they come usually after living with the disease for years and come after the disease must have advanced. And the population of people alive above 60 years of age is definitely less than lower age brackets in the country [1].

Other studies have also recorded similar results for the age distribution for glaucoma. Ashaye (2004) found the mean age at diagnosis in a hospital based survey to be 53.1 years [57]. Cook (2009) suggested a conservative prevalence of glaucoma in Sub Saharan Africa in persons 40 years and above of 4% solely for planning [58]. Cook estimate is conservative and dwelt on incident cases found in some countries of Sub Saharan Africa. Most of the studies were based on people that presented at the hospital or clinics as no visual screening was done but based on people with established central vision loss.

The quality of life of people with glaucoma has been shown to be decreasing as the age increases [42]. This could be possibly due to old age and incapacitation brought about by the disease. The older people usually stay alone in the rural areas with nobody to assist them most times. This could lower their quality of life.

Lawan (2007) discovered in a hospital based study in Kano State Northwest zone that out of 63 patients that presented with glaucoma 71% of them were above 40 years [59]. The rest 29% that are younger could be due to trauma or excessive use of steroid containing medication. Ekwerekwu and Umeh (2002) in a community based study in the Southeast zone, found the prevalence of glaucoma to be 2.1% (no CI given) in people from 30 years and above. Also in people that are 40 years and above, they found prevalence to be 2.78% (no CI given) [24]. The difference in the prevalence figure could be due to the difference in age chosen. Here it was 30 years and above while the NNBVIS put it at 40years and above. Another possible bias is the method chosen with the assessment of the optic disc done without dilating the eyes.

3.1.3 Sex

There has not been any reported case of statistical significant sex differences in glaucoma. Ashaye (2004) found in the clinical study in Ibadan in Southwest region, no statistical significant sex differential in glaucoma distribution. This is also supported by the study of Ekwerekwu and Umeh (2002), who also found no statistical significant sex differences, in glaucoma [57], [24].

3.2 Patients aware of glaucoma

The patients' awareness of glaucoma could be based on cultural and societal factors/beliefs, level of education and perceived needs of the patients.

3.2.1 Cultural and societal factors

According to studies in Bauchi, Northeast Nigeria by Abdull (2012) [41], the term glaucoma was not known by many people suffering from the disease including patients' relatives. Those who have heard about the term had different ideas about what it meant as there is no local word for the disease. To some they knew it as "black blindness" as opposed to "white blindness" (cataract). Abdull assertion is in line with a study carried out in a teaching hospital in Sagamu Southwest Nigeria in 2005. In this study, of the 96 patients 64 patients or 72.7% never heard of glaucoma before their diagnosis was made at the hospital [60]. Other studies done outside Nigeria have also shown that there is more knowledge of cataract among people in comparison to that of glaucoma as there was no local name for glaucoma[61], [62]. This is in line with what was discovered by Abdull in his studies.

Studies by Abdull (2012) in the Northeast geopolitical zone of Nigeria have also shown cases where people believe that whatever happens to them is from God. Even blindness they believe comes from God so they have to accept it [41]. This is also buttressed by Ashaye et al in their 2006 study in South-South Nigeria as they found that the peoples' cultural beliefs affect their perception of glaucoma. Some had superstitious beliefs about blindness and what causes it, and their reasons include witchcraft and germs among other cultural beliefs [63]. Nwosu (2002) in community based study in the Southeast zone of Nigeria also found that the general perception of the people is that eye diseases like glaucoma are caused by malevolent spirits or artful plot by an adversary [64].

In Osun State in the Southwest Nigeria a community based population study was carried out by Isawumi et al (2011) with 259 participants. More than 80% of participants have never heard of glaucoma, while just 15.8% of them have heard about it before [65]. Mbadugha and Onakoya (2014) in their hospital based study conducted in Lagos Southwest Nigeria found that 80% of the respondents from the total 120 persons knew they were being managed for glaucoma. They got to know after they were diagnosed of the

disease at the eye care facility while the remaining 20% did not know what they were being managed for at the hospital even after diagnosis [66]. This is also similar to that found by Odberg et al (2001) in their study in Norway. They discovered a high number of their glaucoma patients in Norway lacked the knowledge of glaucoma [67].

3.2.2 Level of education

The hospital based survey by Mbadugha and Onakoya (2014) that found that 80% knew they were being treated for glaucoma in the clinic, could have been influenced by the education level of the respondents as only 2.5% of them (the 80% that knew what they were being managed for) had no formal education of any sort [66]. Mbadugha and Onakoya (2014) also found that there is no significant difference between the mean ages of the people who were aware of what they were treated for and those who did not know (58.33years, SD 10.59) and (59.54years, SD 10.29) respectively ($p = 0.71$). From their studies they posited that half of the people in the study were not aware of the heritability of glaucoma and the increased risk to their first degree relatives [66]. This could also have been influenced by the education level of the people.

Other studies have also found that level of education is linked with the level of awareness of the disease been managed at eye care facilities either on patients themselves or in a relative [60], [68]. Even among the educated, it is when most of them went to the clinic and are diagnosed of glaucoma and are managed for it do they then have an idea of what it is all about. Nwosu (2002) in his hospital based study found lack of formal education associated with increased risk of being ignorant of glaucoma [64]. A good proportion of them (with glaucoma and treated at the hospital) would still use or recommend herbs; they could still consult herbalists, seers. Other options could include offering sacrifice to the gods [64]. The risk of blindness by the

disease is increased because the concoctions could include sugar solution, holy water, herbs and even salt solution [64]. However, he also found that whether the patients attained higher level of education or lower education level did not enhance their chances of getting reliable information about glaucoma [64].

3.2.3 Perceived need:

For a patient to seek care at an eye clinic most times there would be a felt need by the individual. This felt need could be in form of symptoms felt by the individual to propel such a visit to the health facility. Studies by Abdull (2012) and Ebeigbe & Ovensiri-Ogbomo (2014) have shown that perceived needs or symptoms of glaucoma (which is absent) could be key to determine if patients seek care from eye facilities or not [41], [69]. Abdull in his study discovered that this lack of felt need or symptoms for glaucoma hinders patients from seeking help at the eye care facilities.

Felt need was also reported by Arinze et al (2015) in their community based study in rural Southeast Nigeria as a major reason why people seek care in eye care facilities [70]. In their study, of the 549 respondents, 46.4% who sought help in orthodox medicine (eye care services) were those who reported a change in their vision [70]. They felt a need and that motivated them to visit the clinic. As central vision remains intact until late in glaucoma and visual field loss progresses only gradually, the patient is unaware of any problem until the central vision is affected. Only then do they begin to think of seeking care and then it may be too late as vision could have been lost irreversibly.

Ebeigbe & Ovensiri (2014) also made similar findings in their study in Edo State South-South Nigeria. Where reduced vision is not seen as a problem, since no pain is present and they (the patients with the reduced vision) can still go about their daily businesses [69]. They (the patients with the symptoms of reduced vision) do not feel the need to visit the eye clinic [69]. Glaucoma is painless and tends to progress slowly and thus the patient only becomes aware of the danger when vision is significantly diminished in the affected eye(s) [33]. Keefee et al (2002) reported that the chance of going to an eye facility to seek help is higher when there is presence of symptoms [71]. According to Palagy et al (2008) individuals with gradual deterioration

of eye sight would likely not seek medical care. Unlike those with sudden onset or that experience accompanying pains with the eye ailment [72].

Because of the seemingly lack of symptoms inherent in glaucoma progression, there are many late presentations. This is usually when one eye is already blind and the other is also severely visually impaired. This scenario is reported by Lawan (2007) and Omoti et al (2006) [59], [73]. Lawan (2007) revealed in his study in Kano Northwest Nigeria that most patients already had significant visual field loss from glaucoma disease at the time of presentation [59]. Omoti et al (2006) in their hospital based study in Benin City, South-South Nigeria, also discovered similar issues. They discovered that out of the 154 patients studied 119 or 77.3% had visual loss in one or both eyes at the time of presentation [73]. This is because they did not feel bothered by the ailment at first, so they did not feel any need to come earlier to the hospital to seek help [73]. Enock et al (2010) found in their hospital based study in Irua, Edo state also in the South-South that 51.5% of glaucoma patients were blind at least in one eye at presentation [55].

3.3 Patients seek care from eye care services

There are various factors that influence patient's health seeking behaviour. Andersen (1968), states that the utilization of health care services is determined by a tripod of factors. These are individual factors, societal factors and the health services factors [48]. The individual factors include the need (felt need), the enablement factor and the predisposing factors of the individual before the said illness in this case glaucoma [73]. Felt need have been discussed above; the other factors will be elicited under the sub headings below for easy discussion. And they are:

Availability
Accessibility
Affordability
Acceptability

3.3.1 Availability

The WHO defined availability as the adequate supply and suitable stock of health workers, with competencies and skill-mix to meet up with the health needs of the people in a population [74]. Onakpoya et al (2007) in their community based study in a rural village in Southwest Nigeria discovered that the community lacked any form of eye care services. The primary health centre which is the only health facility in the community is not geared towards eye care services. This is so as there is no eye care professional or staff with eye care competencies to offer the much needed eye care services at the health centre [75]. Eye care services could be integrated into the primary health centre, since that is the only health facility in the community. Given that the nearest health facility to the community which offers eye care services is the tertiary health facility. And it is located in the city very far away from this rural community. This case is similar to the report by Adegbehingbe and Majengbasan (2007) in a study in another rural dwelling in the Southwest of Nigeria. They reported the same scenario in their own study where the health centre lacked the health workers with the competency and skill-mix to meet up with the eye health needs of the people in the community [76]. Muhammad and Adamu (2012) found that in Sokoto state, Northwest Nigeria, the required eye care services for effective glaucoma care is not available at the primary and secondary level of health care. This is because of lack of suitable stock of health workers with the required competencies to treat the ailment and lack of adequate supply of drugs and equipment for the diagnosis and treatment of glaucoma [77]. Omoti et al (2006) found in a hospital based study that unavailability of adequate eye care services and competent staff in the secondary health care facilities made patients present to non-ophthalmic health workers who were not able to diagnose for glaucoma on time [73].

Knowledge of the existence of eye care services is another factor which could cause late presentation. Arinze et al (2015) [70] discovered in their study that 38.1% of the 549 respondents in a community based survey did not know that there was a health facility that offered eye care services in the locality and so didn't use it. This agrees with the results of the study by Ekpenyong and Ikpeme (2009) in Calabar Cross River State in the South-South zone. They discovered that the people in the community were not aware of eye care services in the health facility in their locality and thus didn't make use of it instead resorted to consulting the traditional healers for their eye care problems [78].

3.3.2 Accessibility

Silva et al (2002) described access by the measure of the time it takes to travel by public transportation to get to an eye care facility [79]. They also identified lack of good public transportation, isolated areas like in interior villages in the rainforest or mountainous regions, poor road networks as prime reasons why blindness by eye diseases such as glaucoma remains high [79]. Ashaye et al (2006) discovered in a study in the Southwest region of Nigeria that the distance of the eye care facilities located in cities like Lagos from the rural areas form a barrier to the people living in the rural areas. This is because of the time it takes one to reach the health facility which could be several hours to a whole day [63]. Travelling from the villages to the cities might take the whole day and by the time they get there, the clinic might have closed. They might have come when seeing the doctors is impossible because of long queues or the doctors might have closed for the day [63]. This was also an issue discovered by Fafowora (1995), many in the rural areas cannot access the eye care centres in the city because of the distance of the eye care centres from the people in the rural areas [80]. Ogwurike and Pam (2004) discovered from their study in Kaduna in the Northwest geopolitical zone, that the distance between the nearest western styled eye care facility to the rural dwellers is very far. This is unlike the herbal traditional practitioners who are close by and easily reachable [81]. This also is in consonant with the different studies by Abdull (2012) and Fafowora (1995), they noted in separate studies that the distance between the nearest eye care facility and the bad nature of the road make the people resort to traditional healers who they feel are closer to them and easily reachable. They could even go to visit the patients at home to offer their services to them [41], [80]. Omoti et al (2006) also discovered that the reason why there was late presentation of glaucoma was because the people have been patronizing local herbal native practitioners long before they decided to come to the eye care facility. They do so usually because they don't feel any better and then the vision may have even worsened. The reason is that the herbal practitioners are closer and more accessible to them than the eye care centre which is located in the city [73]. Di Stefano (2002) identified the lack of accessible eye care services globally as a key barrier to the effective elimination of avoidable blindness. According to him there is need for people to be able to reach eye care services so that asymptomatic ailments like glaucoma can be detected early when it is still at

the stage where it can be managed effectively [82]. Wang et al (1997) found that the main hindrance to presenting early for glaucoma was the inability of the people to easily get through to the eye care facilities. This made people present late when vision has deteriorated [83]. If the people can get through easily to the eye facility they would have been going regularly to the eye facilities than they are presently. This would increase the chances of detecting the disease earlier before significant damage is done to the eyes.

3.3.3 Affordability:

Robin et al (2004) stated that financial power affects how people are able to use the services that eye care facilities offer [84]. Abdull (2012) noted that the cost of visits for follow up is a big obstacle for the people to use the facilities. Unlike the herbal practitioners who, according to Abdull could even offer services on credit to the people [41]. These could cause delay in presenting on time or seeking help at the appropriate eye care facilities [41]. The people would prefer to go where they will be offered cheaper but not necessarily better services. Some of these traditional healers are known by the families and they can even pay not only with money but also with farm produce and livestock. This is usually easier for the people. This is similar also to what Arinze et al (2015) found in their study. They reported the people citing lack of funds as reasons why they patronize the traditional healers as they provide cheaper services than the orthodox eye care providers [70]. Onakpoya et al (2009) found in their community based study that the eye care facilities are mostly situated in the cities. Due to the distance between the rural areas and the eye care facilities in the cities, most cannot afford the means of transportation to go there. They couldn't afford to pay for themselves and or their escorts [85].

Omoti (2008) discovered that in Nigeria, most patients pay directly for their health care services. Those who are of lower socioeconomic status (in this case many Nigerians) are likely to present late due to their meagre earnings [54]. Omoti et al (2006) discovered in another study, that the poor and less privileged people are most likely to be concerned with other issues of

survival rather than going for the desirable but expensive eye care examination [73]. The cost is not only in direct paying for the health services but also in indirect cost. Such as transportation costs, and travel time which will take some of them off work and their daily wages. The person accompanying them also has costs to incur which is also indirectly adding up. These could also play significant roles in determining if people seek care at the health facility or not.

3.3.4 Acceptability

Dissatisfaction on the part of the patients could be a major reason for late presentation of glaucoma to the eye care facilities as noted by Ashaye et al (2006) [63]. This is also reported by Abdull (2012) where the relatives and neighbours of patients had critical view of the eye centres after their perceived wrong treatment by the health workers [41]. Furthermore, Abdull (2012) reported that waiting time was also an issue for the patients. Unlike the traditional healers and quacks that offer treatment at the patients' homes and at their own convenient timing, the health facilities make them wait long hours and sometimes even after waiting they are unable to see the doctor [41]. Another issue is the way they are treated by the health workers who they view as very rude to them and inconsiderate of their conditions [41]. Ebeigbe and Ovensiri (2014) also alluded to the waiting time as a huge factor causing late presentation for the people [69]. The people did not fancy the idea of spending all their day at the health facility when they could be at their farms or various businesses.

Arinze et al (2015) pointed at the perceived quality of the people about the health facilities as some are seen as not capable of diagnosing them correctly [70]. This could be because they know the practitioners or they have a certain way they want to be treated by the health workers.

3.4 Patients identified as glaucoma suspect:

A glaucoma suspect is a person with a normal visual field, a normal intra ocular pressure and suspicious optic nerve(s) or a normal visual field, an elevated intra ocular pressure and normal optic nerve heads. For this patient, vision loss has not been detected because the visual field is intact [86]. The patient though needs to be monitored closely and in some cases treated with prophylactics to prevent glaucoma developing subsequently. Diagnosis of glaucoma suggests detectable damage has happened either on optic disc or on the visual field or on both [83]. Treatment at this instance is necessary and must be initiated to halt any further damage or vision loss. It remains difficult to decide the right moment to start treatment, as progression of the disease should first be established. Any treatment for glaucoma including surgery has to be lifelong [87]. The ability of glaucoma suspects to be identified early is one key to early treatment and reducing the blindness caused by the disease [83].

As pointed out earlier the primary health care level of the health system is the entry point of the community into the health care system [5]. However, Muhammad and Adamu (2012) in their hospital based study in Sokoto State Northwest Nigeria discovered the inefficiency of the referral system whereby the primary and secondary health care levels are unable to refer patients to the tertiary level facility [77]. And this problem stem from the lack of either well-trained health work force or inadequate equipment or both. Thus, these levels of health facilities are incapable of adequately detecting glaucoma and subsequently cannot efficiently refer [77]. Most referrals are orally done just telling the patient to go and try another facility. There is no way to track the patients or any documentation done to follow up such a patient.

Another study done in the Southeastern zone of Nigeria in 2009 showed inadequate health care workers in most rural areas for eye care services in primary and secondary level of health care facilities. The distribution of the eye care workers is not even across board so some places especially the rural areas are the ones without the eye care workers. And diagnostic equipment was mostly inadequate even in the tertiary level in government facilities [89].

The report from the study by Omoti et al (2006) is in supported of this. They asserted that the measures in place for the identification of glaucoma patients are grossly insufficient. From the capacities of the health care workers in place for early identification of glaucoma which are grossly

deficient in terms of quality to the lack of basic equipment for the identification of the disease. Therefore causing a further delay in the early detection of the glaucoma when patients' make it to the health facility on time [73]. This could lead to late presentation.

Mahdi (2014) in a study in Bauchi State Northeast Nigeria stated that some patients self-refer themselves to the health facilities and most times at the late stage [90]. They (ophthalmic nurses) who are mostly at the secondary level health facilities also refer patients to the tertiary level health facility. This means that if the ophthalmic nurses miss them early at the secondary level health facilities they might come back as late presentation [90]. It has also been reported in some studies that there is at best minimal level of awareness of glaucoma among non-ophthalmic health care workers and staff of health facilities [91], [92].

A study in Northern Nigeria show weakness in knowledge in primary level care workers for glaucoma [93]. Another study about the level of awareness of glaucoma show need for constant refresher of the knowledge base and skills of all health workers and non-health workers as well in a health institution about the dangers that glaucoma poses [94].

3.5 Patients correctly diagnosed for glaucoma

It has been shown by studies that most glaucoma is diagnosed very late as patients present with severe visual impairment and significant vision loss [41], [54], [59], [73]. Mbadugha and Onakoya (2014) hinted that prompt diagnosis before significant loss of vision is most times difficult in Nigeria [66]. This could be due to late presentation or because of failure to correctly diagnose the ailment on time before significant damage is done to the vision. At its early stages the diagnosis is difficult as evidenced by the study of Muhammad and Adamu (2012). They discovered that patients have to be referred for proper diagnosis when they got to the state specialist hospital in Sokoto [77]. The State specialist hospital is a tertiary hospital but lacked the necessary manpower and basic equipment to handle cases of glaucoma in patients. They have to resort to referring patients to another tertiary hospital in the state. This is not usually easy on the patients who are the ones to bear the brunt of this further hardship. Some patients do not even

understand it all and thus might not make it to the place they were referred to. Patients are therefore lost in this process and many might end up becoming blind as the disease progresses unchecked [77]. Competent and well equipped health work force at the tertiary level are every essential to receive referrals at the tertiary level of eye care [95]. Mahdi evidenced this when he talked about the job being done in Bauchi [90]. He narrated of the glaucoma care at the tertiary hospital in Bauchi State Nigeria where he heads. The eye care unit of the tertiary hospital is well equipped and staffed with well-trained workforce ready to receive the referrals from the secondary eye care facilities [90].

3.6 Patients presented with treatment options

The treatment options for glaucoma are surgical therapy, medical therapy and laser therapy or a combination. Each one of them has its disadvantages and advantages [96], [97]. A hospital based study by Nwosu in 2010 indicated that the knowledge of treatment options by patients who have glaucoma was very minimal and below expectation [98]. Though the participants have been diagnosed of glaucoma in a period ranging from 6 months to 8 years and have been on some form of medication they still didn't know of other options [98]. This could be that they just rely on the option the doctor chose for them as 23.1% of the 52 patients interviewed said they would opt for any treatment option chosen by their doctor. This could make the doctor not to divulge any further information on other options. Or they were told of the other options but just held on to the one they chose or forgot during the interview.

Another study in India has shown low level of awareness and knowledge of treatment options for glaucoma among the patients. The community based study which had 1480 participants in south India showed the awareness of variable therapies for treating glaucoma [99]. Those aware of only a single therapy are; eye drops 66 or 4.5%, surgery 21 or 1.4%, laser surgery 34 or 2.3%. Aware of two therapies; eye drops and surgery 6 (0.4%), eye drops and laser 10 (0.7%), surgery and laser 10 (0.7%). Aware of more than two therapies; eye drops, surgery and laser 15 (1%) [99]. It might be that patients are not always presented with the knowledge of treatment options. It could also be that they were presented with all treatment options but they forget or they couldn't remember during the interview session of the survey.

It has been found that ophthalmologists prefer medication as a treatment option to surgery. This could be due to inadequate surgical skills to perform trabeculotomy which is the standard of glaucoma surgery today in West Africa, or due to the absence of equipment to perform surgery or laser treatment [77], [100]. This is similar to the findings of Abdull (2012) in Bauchi where he also cited this problem. According to Abdull most ophthalmologists are wary to operate on patients eyes when presented with advanced glaucoma because of fear of wiping out the remaining vision [41]. This fear by these ophthalmologists may be valid as patients come with high expectations that the vision will be restored fully after surgery. If the patients' expectation is not met or complications arise, they may attribute it all to the surgery and not to the severity of the disease or lack of turning up for follow up. Peter Egbert in 2002 cited frustration on the part of the ophthalmologists as the reason why they decline or avoid surgical treatment of glaucoma [100]. The frustration is because patients' acceptance of the surgery is poor and they (the patients) feel disappointed of the procedure if their vision does not improve after it is carried out on them. Thus word of mouth referral would be missing or used to castigate the person of the ophthalmologist. This could damage the reputation of the ophthalmologist. Furthermore, the difficulty in the post-operative care and uncertain results make them (the ophthalmologists) wary of surgery on glaucoma patients [100]. Most patients do not report for post-operative care and this could further make management difficult. Post-operative complication might occur and it might be blamed solely on the surgery notwithstanding whether the surgery was good or not. Egbert went further to assert that ophthalmologists build their successful practice rather by cataract surgery than by trabeculectomies (glaucoma surgeries) [100]. This is supported by a study done among UK ophthalmologists where they are shown to offer medical option instead of surgery [101].

3.7 Patients taking full uninterrupted treatment

The treatment of glaucoma is aimed at the reduction of the intra ocular pressure by daily life long eye drops (medication), trabeculectomy (though newer surgical techniques have been brought up) and laser treatment [87], [97].

There have been studies that have reported cases of poor adherence to glaucoma medication in Nigeria. These studies have shown that most patients never take full uninterrupted treatments. Omoti & Waziri (2003) reported a non-compliance rate as high as 63% in their study of Benin, South-South region [102]. In another study Omoti (2005) put the reasons for non-compliance and poor follow up to clinic attendance to include high cost of drugs, unavailability of the drugs, cultural beliefs, difficulty instilling eye drops and the fact that people want cure [97]. Abdull (2012) also cited high cost of the drugs and the poverty level of the people as the main reason for non-adherence to treatment regime by patients [41]. According to a hospital based study by Adio and Onua (2012), an average glaucoma patient on medical treatment who's average monthly earnings is USD211.8 spends an average of USD105.4 per month on glaucoma drugs [103]. This is equal to 49.8% of the monthly earning of such individual almost half of the individual monthly earnings. Using the calculation this translates into USD1265 per year if the prices stay the same without any increment [103]. This calculation is for the average civil servant in Rivers State South-South Nigeria. There are other people of lower cadre in the civil service with the ailment and the petty trader and local farmer also somewhere with the glaucoma.

Egbert (2002) submitted in his study that treatment of glaucoma is only able to succeed in very few individuals. He listed the lack of supply of medicines, which are generally exorbitant when compared to the income of the patients that need them, as one of the reasons for his submission. Other reasons by him include inability to refrigerate the drugs due to lack of constant power supply and the long distances patients had to travel to attend follow-up sessions [100].

According to Bodunde et al (2008), interruption is high among glaucoma patients and they attributed it to the belief by most patients that glaucoma is curable with medication [60]. There have also been reported cases of non-adherence in high income countries as well. Non-adherence is reported in the United Kingdom by Lacey et al (2009) [104] while Rees et al (2014) in

their study found self-reported adherence rate for glaucoma medication between people of diverse cultures to be thus; 65.4% for white Americans, 61.7% for Australians, 56.9% for African Americans and 47.5% for the Singaporeans [105]. Olthoff et al (2009) determined the adherence rate among Dutch glaucoma patients, and reported a self-reported non-adherence rate of 27.3% [106]. They found that the risk of non-compliance was higher among the younger patients of less than 55 years. They also identified unavailability of drugs, forgetfulness as some of the most cited reasons for non-adherence [106]. Another study by Olthoff et al (2005) found that non-adherence rate among glaucoma patients could be as high as 80% [107]. Surgery has been refused by patients because of fear of surgical procedure, although knowing that there might be improvements. Cost has been put as reasons for non-complying with surgery by patients [108]. Lawan (2007) also cited frustration on the part of the ophthalmologists as the reason why they decline or avoid surgical treatment of glaucoma [59]. Laser trabeculoplasty is not a very common form of treatment in Nigeria right now as only a few centres offer that form of medication according to Omoti (2005) [97] Nwosu (2010) cited the low level of knowledge of glaucoma as having negative effect on the level of compliance or adherence with either surgery or medication options for glaucoma [98].

3.8 Patients managed for glaucoma

Glaucoma as has been discussed is distinguished by its feature of chronic and progressive damage to the optic nerves. This condition, as also discussed earlier, lead to blindness if treatment is not instituted on time. A study in Glasgow by Smith (1985) suggested that blindness in glaucoma could be delayed for a very long time (as long as 33 years) if treatment is initiated at the proper time and kept steady [109]. Surgery has been recommended as first line treatment for glaucoma especially in the very high pressure instances [55], [110]. In developed nations there has been a reduction of surgical procedures as more effective drugs which are better tolerated are readily available [111]. Many people present with visual impairment of varying degrees due to glaucoma and coupled with the fact that medication is for life make glaucoma very difficult to manage. The move to more expensive drugs increases the non-compliance rate especially to the patients who are not economically able to purchase these medications [111].

Most Nigerians live below the poverty line, therefore, getting this medication regularly coupled with indirect costs such as regular visits to the clinics for constant pressure check make it a difficult disease to manage [103].

Glaucoma cannot be cured as have been explained earlier, it can only be managed, and therefore, the treatment options that has also been outlined above and must be taken seriously. Olthoff et al stated that non-compliance to glaucoma treatment leads to insufficient reduction of intra ocular pressure and advancement of visual field loss in glaucoma patients [107]. These means that many patients are hardly managed effectively for glaucoma as they turn up blind at least in one eye at the hospital [55]. They refuse surgery and compliance level with medication for the second eye is low [108]. Laser surgery is seldom done in Nigeria [97].

Table 2 showing summary of results

Causes of late presentation.			
Patient side		Health sector side	
	Lack of awareness about glaucoma and the danger it poses		Lack of qualified eye care professionals
	Low level of education of patient		Lack of equipment to detect and diagnose
	Lack of perceived need		Lack adequate supply and high cost of drugs
	Unavailable eye care services		Lack of technical knowhow to operate equipment
	Inability to access eye care services		Lack of surgical skills
	Poverty		
	Perceived low quality of eye care services		

Chapter 4 Evidence Based Practices for Detection and Diagnosis of Glaucoma

There are no standard detection, diagnosis and treatment guidelines for glaucoma in Nigeria as at present. Though professionals in the field has made recommendations of standard clinical procedure to detect, diagnose and manage glaucoma. Prominent among them is Collin Cook, Kyari and Ravi Thomas [112], [113], [114].

Cook proposed that all primary health care workers who work in the primary care clinics at the community should be made to be involved in case detection for glaucoma. He advocated that all persons who are 40 years and above who are seen by primary health care workers should be screened for glaucoma at least once in 2 years. The health workers at the primary level should be trained to be able to carry out VA tests and examine the colour of the pupil. Once reduced visual acuity in one or both eyes is noted, coupled with a "black pupil" as against a white pupil as in cataract, the patient should be referred to the secondary care level [112].

At the secondary level of the health care system Cook proposed that ophthalmic nurses and ophthalmic medical assistants could carry out case finding at this level. He suggested, as part of their efforts to find cases of glaucoma, their training could include discoscopy (or fundoscopy is examination of the optic disc) and measurement of the vertical cup disc ratio. They should also be trained to measure IOP and carry out tonometry either with schiotz or applanation tonometers [113]. Cook suggested that all persons 40 years and above should be screened for glaucoma with this equipment as standard routine practice once they present at the secondary level eye care facility for whatever reason. This routine should be done on every individual once every 2 years. Any case with an IOP of over 28mmHg and CD cup ratio of over 0.6 should be considered confirmed case and should be referred to the tertiary level of eye care [112]. IOP of 28mmHg is high but it is to avoid false positives and also the reason it is limited to people visiting the eye care facilities is to make it feasible and practicable. Some one cannot present for feverish conditions and he/she would be subjected to eye care tests. The individual may not be cooperative.

Cook went ahead and suggested that all suspect and diagnosed cases should be seen by the eye doctor at the tertiary level who confirms the diagnosis and then treatment commences. Visual field testing is recommended where applicable and where not feasible in some patients, tonometry and

discoscopy should be relied on [112]. There have not been any follow up studies on these recommendations by Cook.

Kyari (2104), proposed a top to down approach for glaucoma services so as to preserve the integrity of the eye care services to detect and treat for glaucoma [113]. Kyari advocated for the strengthening of the tertiary eye care units to be able to provide good standard glaucoma services. The eye units should be equipped with the needed equipment for diagnosis and therapeutic glaucoma services manned by skilled personnel. The eye care team should consist of glaucoma sub specialists, ophthalmologists, optometrists, ophthalmic nurses and technicians for the instruments with other allied eye care providers [113]. There should be adequate training and retraining of the team to enable them give accurate diagnosis and institute prompt management of the glaucoma using standard treatment guidelines. Kyari also advocated task sharing among the team so that there will be good utilization of everyone's skills. Information management system should be robust to assure follow up and monitoring of the patients' progress [113]. Secondary level eye care centres should be strengthened so that referral system should be enhanced and made very effective. The referral system according to Kyari should be such that it would be easier for referral to be made from the secondary level to the tertiary and vice versa. The tertiary should be able to refer patients back to the secondary level for long term care and follow up [113].

Going further Kyari made the suggestion for case detection centres to be developed at both the primary level and secondary level eye care centres. Every person visiting for any eye care related problem could be offered a thorough eye examination. The thorough eye examination would include assessing the optic disc, measuring the intra ocular pressure and visual field analysis [113]. Kyari also advocated for the integration of community based rehabilitation for those blinded by glaucoma into the glaucoma services provided [113]. Kyari strongly suggested that public health awareness campaign should only be initiated when there is a good glaucoma service in the place in the health system. And then it should be founded on the local beliefs, attitudes and behavior. And it should use suitable communication channels feasible in each setting [113].

Mahdi (2014) has made efforts to strengthen the eye care unit at the tertiary health facility of Abubakar Tafawa Balewa University Teaching

Hospital (ATBUTH) in Bauchi State Northeast Nigeria [90]. According to him the unit has the basic equipment and skilled personnel in place. The skilled personnel have the right education and training (some still undergoing training) for glaucoma care [90]. This according to him has encouraged the referrals of patients suspected of glaucoma from the secondary level eye care facility in the State which is manned by ophthalmic nurses [89]. This could be an example of top to down strengthening based on Kyari's recommendation.

Ravi (2012) using the Indian experience counselled that glaucoma services should be integrated into programs of eye care. He recommended case detection as the best approach to glaucoma services in developing countries like Nigeria [114]. Though Non-Governmental Organisations (NGOs) favour population based eye screening, he argues that such countries do not have the essential infrastructure for eye care to follow up on the aftermath of such hugely popular screenings. Like carrying further comprehensive tests to either determine the true positives or to conduct the population based screening regularly. This according to him makes it a poor choice for the detection of glaucoma in the developing countries [114]. He went further to state the importance of carrying out a comprehensive eye care examination on every person attending the eye clinic no matter the complaint. He listed the tests to include visual acuity test, slit lamp biomicroscopy, tonometry for which he preferred applanation. Gonioscopy and dilated fundus examination to focus more on the disc and optic nerve head [114].

He wrote that surgical training in most residency program or ophthalmology training programs is geared toward cataract surgery. As a result most ophthalmologists favour cataract surgery to glaucoma surgery. He advocated that staff training and provision of requisite equipment are required before setting up any initiatives for glaucoma detection and management. This is to say that glaucoma program should not be established until facilities for the detection and treatment are available [114].

A study in the United Kingdom on screening for glaucoma failed to demonstrate cost effectiveness [115], while another study in the United States of America discovered that evidence for effectiveness was absent in glaucoma screening in populations [116]. Mitchell and Ravi in 2014 evidenced that integrating glaucoma care into preexisting eye care program

remains the way to go for developing countries like Nigeria [117]. There have not been any follow up studies on these recommendations by Ravi.

Chapter 5 Discussion:

To identify out and analyse the reasons for late presentation for glaucoma the Piot framework was adapted. The fundamental principle of the Piot model is the illustration of the steps starting with the population with glaucoma up to the population managed. They have to go through the steps to get to the final point of being managed for glaucoma. It was found to be a useful model to analyse the situation of glaucoma in Nigeria.

5.1 Epidemiology of glaucoma

The NNBVIS which is a very comprehensive study in Nigeria put the prevalence of glaucoma blindness in the country at 16.7% of the total bilateral blindness for people aged 40 years and above.

The exact number of people with glaucoma in Nigeria may never be known. This is because of the nature of the disease (asymptomatic) which usually manifests late and by then visual loss must have occurred. Another reason could be the weak case detection and follow up structures in place in the country. The exact number of people in the population with glaucoma can only be estimated by using the proportion of blindness caused by the disease and maybe as high as 5 times more. Even at that, it would still be underestimated as some blindness attributed to other causes such as cataract and corneal ulcer could be caused by glaucoma. But because of the difficulty in assessing and examining the optic disc due to the opacity blocking the visual pathway it is not recognized as caused by glaucoma.

Not knowing the exact figures in this step makes it difficult to know how many patients did not make it to the next phase of the model.

5.2 Supply and demand side factors

The demand and supply side factors have to do with the patients' side and the health service side. Both sides have factors that can cause late presentation of glaucoma. On the patients' side, the awareness of glaucoma is one factor and this could be based on the level of education of the patients, the cultural and societal factors and even religious factors. Another factor is the felt need of the patients with glaucoma which most times is lacking due to the nature of the progression the disease tagged the silent thief of sight. These factors combined or individually could make an individual with the disease present late, and they often do when blindness has occurred at least in one eye and the other eye is severely visually impaired. Other factors that could also cause late presentation on the

patients' side include unavailable eye care facilities, the patients' inability to access eye care facilities, and their inability to afford eye care services.

On the health service side the factors that could lead to late presentation of glaucoma are the inability to identify patients' as suspects or accurately diagnose the ailment when the patients make it early to the health facility. This could be due to lack of qualified eye care personnel or lack of equipment to appropriately detect or diagnose glaucoma in its early stages. Thus the patients could have made it early to the health facility but was wrongly diagnosed until the disease reaches its end stage unchecked leading to irreversible blindness.

Although, the cause for delay is from both the patients' side and the health sector's, the side with the major areas of problem recognized where there is need for initiation of action is the supply side. In the Piot model, it is at the steps where the patient is identified as suspect and diagnosed of glaucoma.

It is important we fix the health sector side before we fix that of the patients'. That is the area with more gaps. Many patients do not have access to health facilities. There are no available eye care facilities in most rural areas of Nigeria. Even in most big towns the populace is left at the mercy of private practitioners for their eye care services. Most people are not able to afford the costs of visiting these private eye care centres due to the exorbitant charges there. Glaucoma seems not to be high in the list of priorities of most international and local programmes for eye care. Even the Vision 2020 'the right to sight' initiative does not have glaucoma on its agenda despite it being the second cause of blindness in the Nigeria and the world

If the blindness caused by glaucoma is to be avoided, it is very important that the disease be able to be identified early enough in the patients. This can only be possible if the health care facilities are staffed with the right kind of people and equipped with the basic equipment. We cannot embark on mass campaigns to create awareness or knowledge for the disease among the communities if we do not have where to refer them to. Nor can we embark on mass screenings of individuals for early detection of glaucoma when we do not have a place to satisfactorily further diagnose and manage them. It will be ethically unacceptable to carry out screening programs and

then unable to cater for the people because of inadequate eye care personnel in the health facilities and absence of basic equipment and treatment options.

Though the primary health care level is the entry point of the individual to the health care system in the country, it is not geared towards the eye care services. The problem inherent in the PHC system is more evident in the primary eye care delivery. Many of the eye problems have been neglected or receive minimal attention just like the greater primary health care service delivery. This is evident on the low level of eye care knowledge that the staff at this level of care possess. The categories of health workers at this level of health care due to the nature of their training have limited knowledge about the eye care in general and glaucoma in particular. They can do little to detect and diagnose for glaucoma. In addition, the primary health care level is poorly equipped for glaucoma detection. It might be said that the primary health care level as it is now is insufficient to detect for glaucoma.

Same thing is observed at the secondary level of health care. Hardly is an eye care professional other than the ophthalmic nurse or adequate equipment found at this level of care. It is at the tertiary level health care that most glaucoma cases are diagnosed and managed in the country.

The cadre of health workers that are found at the primary and secondary health facilities in public health facilities, reflect the fact that eye care is neglected to a very significant level. This is a dangerous trend for the population as such diseases like glaucoma that causes blindness that is irreversible continues to have its way. Yet this blindness is preventable.

The recommendations made above are feasible and applicable in the context of Nigeria especially that by Kyari. It is feasible and applicable because all there is a tertiary health care facility in all the states in Nigeria; at least a federal government tertiary health facility. The equipping of eye care units could start from there, then stepping it down to the secondary facilities which is present in all the states. It is also important to note that as pointed out earlier Abdull Mahdi of the ATBUTH in Bauchi has documented evidence based study based on implementing some of these recommendations [90].

Chapter 6 Conclusion and Recommendations

6.1 Conclusion

Glaucoma is a serious and complicated eye ailment that deserves more attention than it is actually getting now. The nature of progression of glaucoma makes it very important to be detected early so as to be able to manage and halt it causing blindness. Worldwide it is the number one cause of irreversible blindness. The number of people blind from glaucoma is high yet there are many more out there who are severely visually impaired or at a risk of going blind. This figure could be as high as 5 times or more the number already known to be blind form the ailment. Individuals who are blind may lose their self-esteem and feel different from the rest of the people in the community. They could also lose their career, vocational goal and job opportunities and finally financial security with the resultant poverty and its hardships. In Nigeria for every adult that goes blind, a child future may be mortgaged to take care of the adult, sometimes leading the adult to street begging. The child stays home and does not go to school thereby recreating the poverty cycle. The reason glaucoma which has the potential to cause blindness and trigger all these in the lives of people is not taken very seriously like other eye ailments like cataract and trachoma remains a question for another research. Even the Vision 2020 project 'the right to sight' the initiative to eradicate avoidable blindness glaucoma was neither included nor mentioned.

International and local programmes are always willing and allocating huge resources to cataract eradication while glaucoma is seldom talked about. This is a cause for worry for a public health issue like glaucoma. In Nigeria and indeed the West Africa region, the training of ophthalmologists places more emphasis on cataract surgery but very little on glaucoma. This is a huge setback for the curbing of glaucoma. Most patients present late sometimes when vision had been lost in one eye and the other is severely visually impaired. The knowledge level of the disease even among health workers is very low. Traditional beliefs and societal values do not make it any easier as the people resort to putting all manner of concoctions in their eye which worsens the already bad condition. It is important to revamp the eye care units in health facilities across the country to enable us curb the menace that glaucoma poses to the population.

How much good do free short term medical missions in the country do to enhance the plight of people living with the disease remains to be assessed. Though it is the only way most people are able to access health care in their community most times.

6.2 Recommendations

Policy makers should

- See to the applicability of the revised guidelines recommended by Collin Cook, Fatima Kyari and Thomas Ravi in Nigeria as a new model.
- Assess the present curricula on glaucoma training and practice at the different levels of health care. To be able to develop a better guideline.
- Improve training of Ophthalmologists and Optometrists and focus also on glaucoma care and treatment and not just on cataract.
- Establish a comprehensive glaucoma care programme in the eye care units starting from the tertiary level of care down to the primary level of care.
- Establish effective referral and feedback system from the primary level of care to the tertiary and back. This should be strictly adhered to.

Interventions should

- Adopt established protocols and procedures for the examination, detection, diagnosis and treatment of glaucoma of all types and level of deterioration.
- Ensure routine measurement of IOPs in all patients 40 years and above attending eye clinics for whatever problem at the secondary level of care. To refer any established glaucoma case or suspect to the tertiary level care.
- Encourage relatives of confirmed glaucoma patients to have their eyes examined at least once in two years for glaucoma.
- Should enhance opportunistic case finding of glaucoma through comprehensive eye examinations rather than mass screening.

Research institutions

- Research should be done to ascertain the number of primary, secondary and tertiary eye care facilities that have basic equipment to

detect and diagnose glaucoma and skills to use them. The research should also extend to the facilities that provide training in glaucoma and offer advice on basic standard equipment.

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