EVALUATION OF COMMUNITY EYE OUTREACH PROGRAMME FOR EARLY GLAUCOMA DETECTION IN SOUTH WEST NIGERIA.

BY

OLUSOLA OLUYINKA OLAWOYE

M.B.B S, FWACS, FMCOph

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CERTIFICATION

We certify that this project was carried out under our supervision by Dr. O.O Olawoye in the Department of Epidemiology, Medical Statistics and Environmental Health (EMSEH), College of Medicine, University of Ibadan.

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Dr. O.I FAWOLE

M.B.B.S(Ib.),M.Sc (Epid & Biostat)

F.M.C.P.H (Nig), F.W.A.C.P

Reader,

Epidemiology Unit,

Faculty of Public Health.

College of Medicine.

University of Ibadan.

.....

Professor O. Ayeni

BSc (Ib), MSc (Med Stat) (Lond)

Ph.D (Lond)

Professor,

Medical Statistics Unit,

Department of EMSEH,

Faculty of Public Health.

College of Medicine.

University of Ibadan.

DEDICATION

This dissertation is dedicated to the Almighty God, my teachers, my husband and children.

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ABSTRACT

Background: Glaucoma describes a group of eye diseases in which there is progressive damage to the optic nerve, leading to impaired vision and possibly blindness if untreated. Glaucoma is the commonest cause of irreversible blindness worldwide, and in Nigeria. It is known that the prevalence of glaucoma is highest in West Africa.

Objective: This study aims to evaluate the relevance of community outreach program in early case detection of glaucoma patients in South West Nigeria.

Methods: This is a retrospective, comparative, cross- sectional study with descriptive and analytical components. This study was conducted among glaucoma patients who presented to the Eye clinic of the University College Hospital (UCH) between January 2004 and December 2005 before the onset of the community outreach programs and those who presented to the same hospital between January 2009 and December 2010 after the onset of the community outreach program.

Results: A total of 990 patients were studied in both periods. In the post outreach period, the mean age was 56.3 ± 16.6 and a median age of 60. In the pre-outreach period however the mean age was 58.9 ±15.8 and a median age of 60. (p value < 0.03). Patients referred from the outreach were about two times more likely to have mild to moderate disease than patients referred from other sources (CI= 1.3-2.8, p<0.001). Patients seen in the post outreach period were more likely to be glaucoma suspects (p<0.001).

Conclusion: Community eye outreach is useful in the early detection of glaucoma in developing countries. Patients referred from the outreach were more likely to have earlier diseases.

KEYWORDS - Community Eye Outreach, Glaucoma, South West Nigeria

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CHAPTER ONE

INTRODUCTION

Glaucoma describes a group of eye diseases in which there is progressive damage to the optic nerve, leading to impaired vision and possibly blindness if untreated (Mowatt et al., 2008). Glaucoma is the commonest cause of irreversible blindness worldwide (Quigley et al., 2006; Resnikoff et al., 2004), and in Nigeria (Kyari et al., 2009). It is known that the prevalence of glaucoma is highest in West Africa (Ntim-Amponsah et al., 2004). This is consistent with the higher prevalence seen in people of West African descent living elsewhere in North America and the Caribbean (Leske, 1994). Most glaucoma in Africa is primary open angle glaucoma (POAG) and it often presents at an earlier age. It is associated with a higher intraocular pressure, more rapidly progressive, and patients usually present late with up to 50% of cases already blind in one eye at presentation (Ntim-Amponsah et al., 2004). Nearly half of those with glaucomatous optic nerve damage are undiagnosed in the developed world, while in developing countries, the rate of undiagnosed glaucoma ranges from 70% to 100%. (Gottlieb et al., 1983).

In the past, screening program for detection of glaucoma had been proposed, however due to high costs and unknown effectiveness it is not presently standard practice (Gottlieb et al., 1983). In 2005, the US Preventive Services Task Force and Fleming et al., 2005 concluded that there was still insufficient evidence to recommend for or against a screening program for glaucoma. In the last two decades however, new technologies have been introduced that permit earlier detection of structural and functional damage due to glaucoma. New treatments, such as hypotensive lipids and selective laser trabeculoplasty, allow for safer and more effective IOP reduction. Several well-conducted clinical trials showed the effectiveness of treatment. (Kass et al., 2002 ; Heijl et al., 2002). These new developments and the high prevalence of POAG in West Africa (Ntim Amponsah et al., 2004), bring along the necessity to re-evaluate screening.

Opportunistic case detection may be an appropriate alternative. Community eye outreach programs mainly designed for cataract screening can also be used to screen for glaucoma patients. Community eye outreach programs in Africa have been instituted as part of the Vision 2020 initiative for the elimination of avoidable blindness. About 50% of avoidable blindness is caused

by cataract and therefore the main thrust of these community outreach programs is cataract screening and detection. These outreaches provide the opportunity to perform basic eye examinations for all persons who attend. Patients with other ocular conditions are also seen and treated either at the outreach centers or at the base hospital depending on the severity of the ocular conditions. Glaucoma suspects are seen and sent to the base hospital for comprehensive examination and management. This study seeks to evaluate community eye outreach programs in early glaucoma case detection.

1.1 Statement of the Problem

Glaucoma afflicts more than 67million people worldwide of who about 10% are estimated to be blind. Glaucoma is the leading cause of irreversible blindness worldwide and it is second only to cataract as the most common cause of blindness overall (Quigley et al., 2006). Glaucoma is responsible for about 14% of blindness worldwide (Thylefors, 2000). According to the Nigerian National blindness survey (Kyari et al., 2009), glaucoma is responsible for about 16% of blindness in Nigeria. The prevalence of glaucoma varies greatly between racial and ethnic groups. Studies among black populations (Buhrmann et al., 2000; Mason, 1989) have shown a prevalence of 4.2-8.8%. The prevalence of glaucoma is highest among Africans (Ntim-Amponsah et al., 2004) and other black populations (Mason, 1989). POAG is the commonest type of glaucoma in Africa and its prevalence is highest in black populations, intermediate in Whites and lowest in Asian populations (Allingham et al., 2005). The Baltimore Eye survey found the prevalence of POAG in blacks to be four times greater than whites (Tielsch, 1991). POAG is asymptomatic before blindness therefore patients are usually unaware of their disease. In Africa the disease often occurs at an earlier age, it is rapidly progressive and it often presents late when patients are blind in at least one eye (Ntim-Amponsah et al., 2004). Glaucoma blindness therefore is a problem of global public health importance. Glaucoma blindness is preventable through timely diagnosis, effective treatment and excellent clinic follow- up.

1.2 Justification of the Study

The natural history of this type of glaucoma is divided into 3 phases (Allingham et al., 2005). The first is the latency phase during which the disease is symptomless and cannot be detected by diagnostic testing. The second stage is the detectable preclinical stage during which the disease is still symptomless but can be detected by diagnostic testing. This is still an early to moderate stage and patients detected and managed appropriately at this stage have better opportunity of a sighted life. The third stage is the clinical stage which is often late and advanced. Patients at this advanced stage have a higher risk for glaucoma blindness (Allingham et al., 2005). In developing countries, eye care services are limited often severely, therefore glaucoma patients usually present often with severe vision loss in one or both eyes (Cook, 2009). Glaucoma blindness however, is preventable through early diagnosis and treatment, hence reducing the huge socioeconomic cost of blindness to the patient, family and the community.

In much of the developing world, the tremendous scarcity of resources for eye care greatly limits the feasible interventions to prevent blindness from glaucoma through early detection. It has therefore been suggested (Quigley, 1997) that the best workable option to facilitate early detection and management may be to integrate glaucoma case finding into other blindness prevention efforts such as the community cataract outreach programs.

There is paucity of information on the value of the community eye outreach program in early glaucoma detection. This study would evaluate community eye outreach and provide useful information on this model for early glaucoma detection in developing countries.

1.3 AIMS AND OBJECTIVES

General aim:

This study aims to evaluate the relevance of community outreach program in early case detection of glaucoma patients in South West Nigeria.

The specific objectives are to determine

1. Trends in glaucoma case referral and patient presentation to the eye clinic of the University College Hospital Ibadan (UCH).
2. The proportion of glaucoma patients seen at the eye clinic of UCH referred from the community eye outreach.
3. If community outreach screening enhances early detection of glaucoma.
4. The proportion of advanced glaucoma cases referred to the eye clinic of UCH from the community outreach
5. The pattern of presentation of glaucoma patients' pre and post onset of the community eye outreach program by comparing the two periods.

Definitions of terms

1. Primary open angle glaucoma (POAG): This is a multifactorial optic neuropathy in which there is characteristic visual field defect with an intraocular pressure (IOP) consistently above 21mmHg in at least one eye, normal appearing open anterior chamber angle and no apparent ocular or systemic abnormality that may account for the elevated IOP.
2. Primary angle closure glaucoma (PACG): This is an optic neuropathy in which there is a characteristic visual field defect with an elevated IOP in at least one point during the course of the disease, a closed anterior chamber angle precluding drainage of aqueous humor.
3. Glaucoma suspect (GS): These are a group of patients who have one or more clinical features suggestive of early glaucoma. These patients need more comprehensive tests to confirm the diagnosis. They also need to be appropriately followed up to decide whether and when to commence therapy.
4. Cup to disc ratio (CDR): This is useful in estimating the severity of glaucoma. A cup to disc ratio (CDR) of less or equal to 0.6 is considered mild damage while CDR of 0.7-0.8 is considered moderate damage and CDR of 0.9-1.0 is considered severe damage.
5. Central visual field test (CVF) - This is used to test functional damage to the optic nerve. A mean deviation of <6dB on CVF test is considered mild damage, 6-12dB is considered moderate damage while >12dB is considered severe damage.

CHAPTER TWO

LITERATURE REVIEW

2.0 Prevalence of glaucoma

The prevalence of glaucoma has been studied extensively, but the case definition of glaucoma has varied widely and clinical classification has not been consistent between studies (Allingham et al., 2005). Intraocular pressure (IOP), the appearance of the optic nerve head and visual field abnormalities have been used in varying combinations to define glaucoma. These differences make it difficult to directly compare the prevalence findings of different studies. There is however a general consensus on the definition of glaucoma. Glaucoma is defined as a progressive optic neuropathy characterized by a typical damage to the optic nerve head (cupping) and associated visual field defects. Glaucomatous damage to the optic nerve is the final common pathway to the varying clinical subtypes.(Allingham et al., 2005)

2.1 Prevalence in Caucasian populations

Tielsch (1991) in the Baltimore eye study reported a prevalence of 1.3% among 2,913 adult Caucasians in the United States of America. Other population based studies have reported prevalence of glaucoma ranging between 0.9% and 2.1% (Klein et al., 1992; Bonomi, 2000; Coffey, 1993). Mitchell et al (1996), in the Blue Mountains eye study done in Australia found a higher prevalence of 3.5% among 3,654 adults aged >49years, while Roscommon et al (1993); found a prevalence of 1.9% in a population based study of 2186 adults over the age of 50 years in Ireland. More recent studies by Reykjavik, (2003) found a prevalence of 4.0% among 1,045 adults >50years in Iceland. This is the highest reported prevalence among Caucasian populations.

2.2 Prevalence in Asian populations

The prevalence of glaucoma appears to be similar to that of the Caucasians among Asians. Dandona and co-workers (Dandona et al.,2000) in the Andhra Pradesh eye disease study done among 1399 adults over 40 years reported a prevalence of 3.7%. Other investigators who conducted surveys among adults over the age of 40 years reported a prevalence ranging between 2.2% and 3.5% (Foster et al., 1996; Arkell, 1987; Shiose, 1991). Wu, (2000) reported a high prevalence of 4.7% among 1717 patients aged 40-79 years in Singapore.

2.3 Prevalence in African American and Caribbean populations

In the Baltimore eye study, Tielsch et al., (1991) reported a prevalence of 4.7% among 2,396 African American adults over the age of 40 years in the United States of America. They reported that the prevalence of glaucoma was about four times greater in blacks than Caucasians. Leske and co-workers in the Barbados eye study also reported a higher prevalence of 6.6% among 4,709 African descent adults studied in the Carribean Islands. Mason (1989) reported the highest prevalence of 8.8% among blacks in St Lucia West Indies.

2.4 Prevalence in Africa

Rotchford et al., (2003) reported a prevalence of 5.3% among 839 adult South Africans aged >40 years while Quigley (2000) reported a lower prevalence of 4.2% among adults >40 years in Tanzania. Ntim Amposah (2004) in Ghana reported a prevalence of 8.5% among adults aged 40 years and older. Although this is the only population based study from West Africa, it is generally accepted that the prevalence of glaucoma is highest in West Africa. This is consistent with the higher prevalence seen in people of West African descent living elsewhere in North America and the Caribbean (Ntim Amposah 2004).

2.5 Prevalence of Glaucoma Blindness in Africa

The proportion of Blindness owing to Glaucoma in Clinic-based Surveys in Nigeria ranges from 22.2% to 33.3% (Nwosu, 1994; Oluleye 2006 and Adegbehingbe 2007). In all these surveys, glaucoma was reported to be the second commonest cause of blindness. In Mali, Omgbwa (2005) reported that glaucoma was the second commonest cause of blindness with a blindness prevalence of 22.9%. Tabe (1993) reported that glaucoma was also the second commonest cause of blindness in Cameroon with a blindness prevalence of 20.4% while Kaimbo (1997) in Democratic Republic of the Congo reported a prevalence of 30%.

Table 2.1 Selected studies on the prevalence of glaucoma in different populations

Location	Age group	Number of participants	PREVALENCE		
			OVERALL (%)	POAG	ACG
Black					
Baltimore (Tielsch et al,1991)	>40	2396	4.7	NA	NA
Barbados (Leske et al, 1994)	40-84	4709	6.6	NA	NA
Kongwa (Buhrmann et al, 2000)	>40	3268	4.2	0.6	0.5%
St Lucia (Mason,1989)	30-86	1679	8.8	NA	NA
Temba (Rotchford et al, 2003)	>40	839	5.3	0.5	2.0
Hispanic					
Arizona (USA 2001)	>40	4774	2.1	2.0	0.1
Asian					
Alaska (Arkell,1987)	>40	1923	2.7	NA	2.7
Andhra-Pradesh (Dandona, 2000)	>40	1399	3.7	2.6	1.1
Singapore (Wu, 2000)	>40	1717	4.7	2.4	1.5
White					
Baltimore (Tielsch,1991)	>40	2913	1.3	1.3	NA
Beaver Dam	43-84	4926	2.1	2.1	NA
Blue mountains (Mitchel,1996)	>49	3654	3.5	3.0	0.3
Reykjavik (Jonasson, 2003)	>50	1045	4.0	4.0	NA

KEY: POAG- Primary open angle glaucoma, ACG- Angle closure glaucoma, NA- Not Available

2.6 Classification of the Glaucomas

The glaucomas have traditionally been divided into primary and secondary forms based on etiology. The primary and secondary glaucomas are then further divided into open angles or closed based on the anatomy of the angles. The primary open angle constitutes at least half of the glaucomas. They are more common in Africans. The angle closure glaucoma however are more common among South East Asians and Eskimos. (Allingham 2005)

2.7 Global burden of Blindness

The global estimate of the extent of visual impairment in 1975 indicated that there were 28 million blind people. (WHO 2005) The global population in the 1990's was projected to increase from 5.8 billion in 1996 to 7.9 billion by 2020. Most of this increase was expected to occur in the developing countries (WHO 2005). These population growth projections were also used to estimate the expected increase in the number of blind people. Estimates based on the 1990 world population indicated that there were 38 million blind people and almost 110 million with low vision worldwide (WHO 2005). This estimate was later extrapolated, first to the 1996 world population which found that there would be 45 million blind and 135 million people with low vision. The projection to the 2020 population found that there would be 76 million people blind. The estimated prevalence of blindness in 1990 ranged from 0.08% of children to 4.4% of persons aged over 60 years, with an overall global prevalence of 0.7% (WHO 2005).

The World Health Organization (2005) estimated that at least 7 million people become blind each year and that the number of blind people worldwide was increasing by 1–2 million per year. These estimates indicated that the global extent of visual impairment would double in the period 1990–2020, and this realization provided the impetus for the launch of VISION 2020 in 1999.

2.8 Vision 2020 Initiative

VISION 2020 is the global initiative for the elimination of avoidable blindness, a joint program of the World Health Organization (WHO) and the International Agency for the Prevention of Blindness (IAPB). It is an international membership of non-governmental organizations (NGO's), professional associations, eye care institutions and corporations. It was launched in 1999 with the twin aims of eliminating avoidable blindness by the year 2020 and preventing the projected doubling of avoidable visual impairment between 1990 and 2020. The ultimate goal of the

initiative is to integrate a sustainable, comprehensive, high-quality, equitable eye care system into strengthened national health-care systems.

Although there are many other causes of vision impairment, vision 2020 seeks to address the main causes of avoidable blindness, in order to have the greatest possible impact on vision loss worldwide. Up to 80 % of the world's blindness is said to be avoidable blindness (WHO,2005). Avoidable blindness is defined as blindness which could be either treated or prevented by known, cost-effective means. Target diseases for the vision 2020 are cataract, trachoma, refractive errors, childhood blindness, low vision, onchocerciasis, glaucoma, diabetic retinopathy and age related maculopathy (WHO 2005).

The mission of vision 2020 is to eliminate the main causes of avoidable blindness in order to give all people in the world, particularly the millions of needlessly blind the right to sight. The goal is to eliminate avoidable blindness by the year 2020. The objectives of the vision 2020 are as follows:

1. Raise the profile among key audiences of the causes of avoidable blindness and the solutions that will help eliminate the problem
2. Identify and secure the necessary resources around the world in order to provide an increased level of activity in prevention treatment and rehabilitation programs
3. Facilitate the planning development and implementation of the three elements of the vision 2020 strategic plan by national program.

The strategy of vision 2020 is built upon a foundation of community participation with 3 essential components or elements which are cost effective disease control interventions, human resource development, and infrastructure development (facilities, appropriate technology, consumables and funds).

In order to achieve the vision 2020 target of elimination of avoidable blindness by the year 2020, eye service programs have had to go to the communities to make their services available to the patient rather than wait for the patient in hospitals. This has been achieved through the outreach services in most of Africa and India. Eye units in Africa currently use a variety of outreach service approaches. A popular strategy is that a team goes out to examine large groups in the community,

provides basic ocular medical services, makes definitive selection of patients who will benefit from surgery, then brings those selected back to the base hospital for surgery. This is referred to as the "Aravind model.(Sundaram 2001)." A slight modification to this however is that patients who also are found to be glaucoma suspects are also referred to the hospital. They are counseled on the importance of keeping their hospital appointments.

This "Aravind model"(Sundaram 2001) has several advantages. Firstly, it does not take the surgeon and team from their base station for too long (as compared to sending a team to do surgery outside the hospital). Secondly, the quality of surgery provided at the base hospital is likely to be superior to that provided at a makeshift outreach clinic. Thirdly, a team with skills enough to diagnose early operable cataract accurately should encourage patients to have surgery before they become blind and avoid the common testimony – "I was told to wait and come back when my vision was worse." Moreover, a team with skills enough to diagnose and treat a number of causes of visual impairment as well as basic eye diseases brings the service into the community. This avoids needless trips to the hospital by patients who are merely "screened."

2.9 Rationale for the community outreach

Despite the magnitude of the problem of cataract blindness in developing countries, studies (Sundaram, 2001) have shown that only a small percentage of the people needing cataract surgery actually seek treatment. In order words it is necessary to generate demand for the services of institutions whether a hospital, eye clinic, or private ophthalmlogy practice through community outreach. Outreach activities can increase productivity, quality of care and cost effectiveness through cataract programmes.

The purpose of community outreach in eye care are:

1. Community outreaches contribute to the society by reducing the amount of needless blindness
2. It helps to facilitate community involvement and health education
3. Social marketing and demand generation through public relations and publicity
4. Staff training and development

The specific objectives of community outreach programs are to identify people with cataract and provide surgery, detect other eye problems and provide appropriate treatment or referral, develop and maintain a relationship with local community and outlying villages, educate patients and communities about eye care, create awareness of the institutions facilities and services, generate demand for the institutions facilities and services, and to provide an opportuinty for medical staff to develop their interpersonal and leadership skills.

Outreach programs for eye care aim at reaching the unreached. Many health care institutions organize outreach activities to create awareness in the community, to educate the community on health and to provide possible medical intervention. There is a need to extend health care facilities to rural masses in order to cover the vast majority of the population. Reaching the undeserved can be done effectively by organizing outreach programs in rural areas and following a base hospital approach. Once the quality of care reaches a high standard the community will be more aware and open, making the task of eye care providers much easier.

Health education is an integral part of all community outreaches. Health education is a process of bringing about a social change, which in this instance relates to changing attitudes towards eye health and eye health behaviors. It is a process of generating awareness of and demand for health care services in the community by those who need health intervention but are not seeking it. Health education is also a process that enables families and the communities to improve their health and in this case their eye sight by improving or increasing their knowledge attitudes and skills. This is one of the fundamental principles of primary health care as spelled out by the world health organization.

Recent studies have found that no test or group of tests was clearly superior for glaucoma screening (Mowatt, 2008). Therefore community-based screening for glaucoma is not recommended and is not used anywhere (Ivers et al., 2001; Quigley et al., 2002; Munachonga et al., 2007). However, opportunistic case detection may be appropriate, by screening of people at risk (those aged 40 y and older) who are seen for whatever reason in community outreach centers (Cook 2009)

There are no published reports of glaucoma screening in Africa. In a study carried out at Groote Schuur Hospital in Cape Town on African patients aged 40 years and older (Cook 2009), testing the pinhole visual acuity using a cut point of 6/18 in 1 or both eyes was found to be suitable for case detection of both cataract and glaucoma, with a sensitivity and specificity over 90%, a positive likelihood ratio greater than 10.0, a negative likelihood ratio less than 0.1, and an accuracy greater than 90%. This test may be suitable for use by clinic nurses working in primary care clinics. Examination of the optic disc with a lens-free direct ophthalmoscope using a cut point of 0.7 for the vertical cup: disc ratio combined with testing for an afferent pupil defect was, similarly, found to be suitable for case detection of glaucoma alone. This combination of tests may be suitable for use by ophthalmic nurses/assistants working in community health centers and district hospital. Case detection of cataract and glaucoma could be carried out in primary level clinics by testing the visual acuity, and case detection of glaucoma in secondary level clinics by using a combination of examination of the optic disc and testing of the pupil (Cook 2009)

CHAPTER THREE

METHODOLOGY

3.0 Study Design:

This is a comparative, retrospective, cross- sectional study with analytical component. The descriptive component of the study includes the prevalence of glaucoma in the clinic and at the outreach, types of glaucoma while the analytical component includes the determination of factors associated with source of referral.

3.1 Study Location:

This study was conducted among glaucoma patients who presented to the Eye clinic of the University College Hospital (UCH) between January 2004 and December 2005 before the onset of the community outreach programs and those who presented to the same hospital between January 2009 and December 2010 after the onset of the community outreach program.

Community Eye Health Program

Pre outreach period:

The community eye outreach program was initiated in September 2006. Prior to this period, patients were in the eye clinic only if they were referred from the general outpatient department or from other eye clinics within and outside UCH.

Transition period (Post outreach period 1):

The period between 2006 and 2008 was a transition period when the community eye outreach had problems of sustainability, co-ordination and record keeping.

Post community outreach program period (Post outreach period 2):

In 2009, a community eye health program co-coordinator who is also an ophthalmologist was employed to effectively plan, supervise and organize standard community outreach programs. Although UCH started its community eye outreach program officially in September 2006, it was not well co-ordinated until the employment of the community eye health program coordinator and supervisor in 2009. Therefore, the period from January 2009 to December 2010 shall be studied as

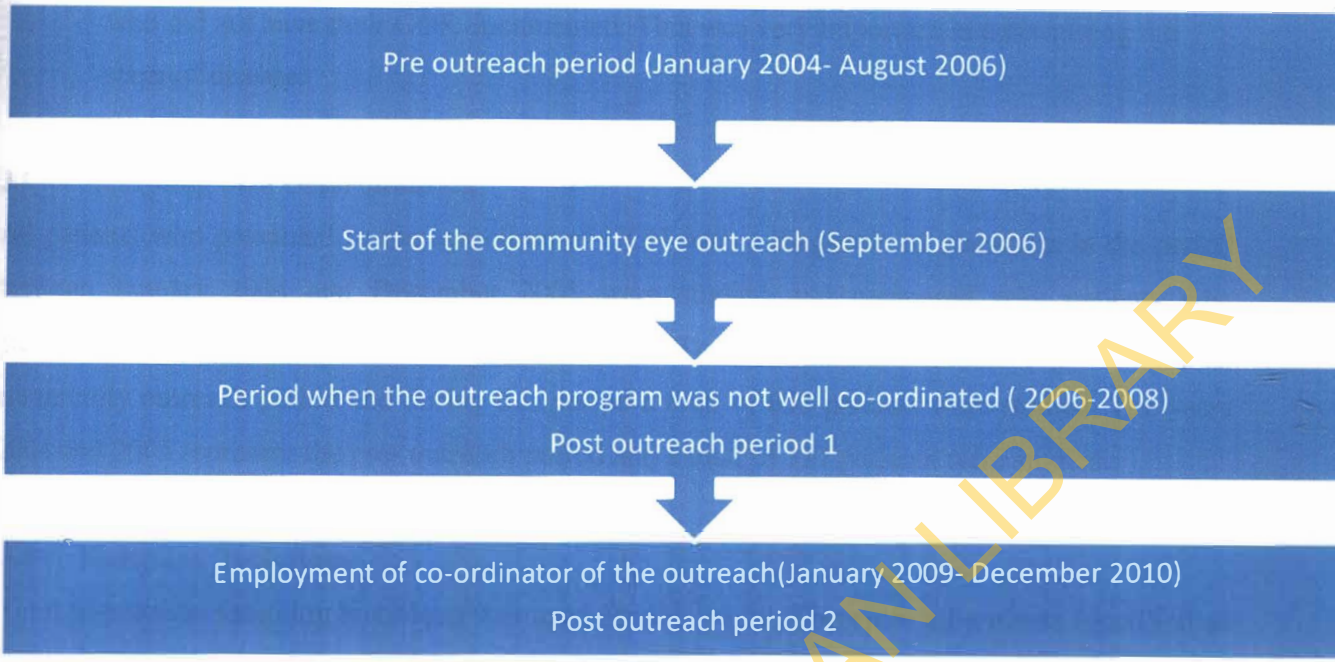
the post community outreach period. The outreach team in UCH presently comprises a community eye outreach specialist (ophthalmologist), one ophthalmology resident doctor, one optometrist, one public health nurse, one trained nurse, one eye clinic aide, one record staff and an outreach team manager. The team reaches out to neighboring communities within and outside the state at least twice a week. These communities include Ibadan metropolis, other towns and villages in Oyo state, Osun, Ogun and Lagos states. There are four permanent outreach centres which are all located within Ibadan metropolis. These outreach centres are located at Ekotedo, Oja Oba, Aremo and Odo- Oba. There are also two permanent vision centres at Ido local government area of Oyo state. These are LEO and Odebode vision centres where outreach activities are also carried out. Other outreach programmes have been conducted at temporary sites. (Appendix B). All persons who attend the outreaches have basic eye examination comprising anterior and posterior segment examination, refraction, fundoscopy, and intraocular pressure measurement. Patients with cataract, glaucoma and other major eye diseases that cannot be managed at the outreach centers are referred to the base hospital (UCH) for further evaluation and management. However patients with simple refractive errors, allergic and infective conjunctivitis are treated at the outreach.

The University College Hospital Ibadan

The University College Hospital, Ibadan (UCH) is an 840 bed tertiary hospital which serves as a referral hospital for the South Western states and other parts of the country. The hospital was established by an Act of Parliament- the University College Hospital Ordinance of 1952. It was commissioned officially in November 1957. The Ophthalmology Department is one of the departments of the teaching hospital. The Eye ward has 28 beds (3.3% of the total number of beds in the hospital) dedicated exclusively for ophthalmology patients.

Prior to January 2006, patients were seen in the Eye Clinic only when referred from other clinics within and outside the hospital. However in response to the need to increase cataract surgical rates, community eye outreach programs were commenced in the Ophthalmology department in January 2006.

Figure 1: Chart describing events in UCH and the community eye outreach program



3.2 Study Population:

This study was conducted among patients who presented to the eye clinic with a diagnosis of glaucoma during the study period.

3.3 Inclusion Criteria

The inclusion criteria used in this study were:-

- All patients who presented to the eye clinic with a diagnosis of glaucoma in the period between January 2004 and December 2005 were studied and compared with patients who presented between January 2009 and December 2010.
- Only patients with complete key outcome variables were included.

3.4 Exclusion criteria

- Patients who presented to the eye clinic with other ocular diagnosis were excluded from the analysis.

- Patients who have incomplete data were excluded from the study. These were patients who did not have their CDR documented. This was very important in determining the stage of disease.

3.5 Sampling Size Determination

All patients who presented to the eye clinic of UCH with a diagnosis of glaucoma in the period between January 2004 and December 2005 were studied and compared with patients who presented between January 2009 and December 2010. The years 2009 and 2010 represents the post community outreach period and during this period a total of 653 patients were studied. The years 2004 and 2005 represent the pre- outreach period and a total of 337 patients were studied.

3.6 Sampling Technique

Total population sampling technique was used for this study. Therefore all patients identified as fitting the inclusion criteria were recruited and included in the study.

3.7 Data collection process

Patients with a diagnosis of glaucoma were identified from the clinic registers for the study period and their case records were retrieved from the Medical Records unit of the Eye clinic. With the use of a proforma (Appendix A), information was retrieved from the case notes of each glaucoma patient. This information included their source of referral, age at last birthday, sex, intraocular pressure, gonioscopic findings, cup to disc ratio (evaluation of the optic nerve head), and visual field test. All patients in the eye clinic had been seen either by the consultant ophthalmologist or a resident doctor.

The number of the outreaches, and the total number of glaucoma patients seen at the outreaches who were referred to the base hospital (UCH) between 2009 and 2010 were recorded into a data sheet from the community outreach register. The number who presented at the base hospital out of the total number referred was recorded. The proportion of patients that were glaucomatous of all the patients seen at the outreach and at the eye clinic were also recorded both from case records and the community eye outreach unit registers. The pattern and stage of disease at presentation was also compared between the two periods (pre and post outreach periods).

3.8 Study Variables

The exposure variable is the community eye outreach program while the outcome variables are patient factors such as the gonioscopic findings, visual field findings and disc findings. Other outcome variables are age and presenting intraocular pressure. Patient factors are important in determining the stage of glaucoma (mild, moderate or severe disease). Other outcome variables are the proportion of patients referred and seen in the eye clinic from the outreach centers. The outcome variables pre and post community outreach shall be compared.

3.9 Data management and analysis

Data collected were entered into a database on a personal computer and statistical analysis was performed with the aid of Statistical Package for Social Sciences version 16 software (SPSS Inc, Chicago IL., USA).

After data cleaning, results were analyzed by generating summary indices for the variables. These were in form of frequency distributions for categorical variables and measures of central tendency (mean, median) as well as measures of dispersion (standard deviation for numeric values). The frequency distributions were presented with the aid of tables and charts.

Bivariate analysis was conducted using cross-tabulations and chi-square test to evaluate associations between categorical variables such as between age and source of referral and gender and source of referral done. Bivariate analysis was also done to show relationship between source of referral and selected variables.

Multivariate analysis with the use of binary logistic regression was then performed to adjust for the effect of confounders in observed associations. A p value < 0.05 was considered significant.

3.10 Ethical considerations

Confidentiality was ensured by keeping the information under lock and restricted access. The private information and clinical data was treated as confidential.

3.11 Limitations

Incomplete information and missing records were encountered in the course of this study. Patients with relevant incomplete missing records were excluded from the study. Specifically the

information was not always recorded in a standard format and relevant data was occasionally missed out from the case notes. About half of the patients did not have a central visual field test done. This is likely due to financial constraints and unavailability of the machine for the test in UCH. The study in the post outreach period only spanned two years. A longer period of study of the community outreach is desirable.

CHAPTER FOUR
RESULTS

4.0 Eye Clinic, University College Hospital Ibadan (UCH)

A total of 348 patients presented to the eye clinic of UCH with a diagnosis of glaucoma between January and December 2010. A total of 328 had complete data (94.3%) and were included in the study. Between January and December 2009, 390 patients presented to the eye clinic with a diagnosis of glaucoma. Out of this number, 350 case notes were found out of which 325 patients (81%) had complete data and were included. The years 2009 and 2010 represents the post community outreach period and during this period a total of 653 patients were studied. Between January 1st and December 31st 2004, prior to the onset of the community eye outreach program, 255 patients presented to the eye clinic with a diagnosis of glaucoma. However, 177 patients (75.3%) had available, complete data and were included in the data analysis. From January 1st to December 31st 2005, 215 patients were seen in the glaucoma clinic. However only 160 patients (74.4%) had complete data and were included in the analysis. There was a 93.8% increase in the number of patient seen post community outreach period. Table 1 describes the prevalence of glaucoma patients seen in the eye clinic of UCH and at the outreaches.

4.1 Glaucoma disease burden at the community eye outreach

In 2010, 93 outreaches were carried out in and around Oyo state. A total of 6,498 patients were screened at the outreaches out of which 390 patients were glaucoma patients (proportional morbidity rate of 6%). These patients were referred to the eye clinic for comprehensive management and follow up. In 2009 however, 89 outreaches were carried out in and around Oyo state. A total of 9064 patients were screened at the outreaches out of which 370 were glaucoma patients referred to the eye clinic for follow up. (Table 1)

4.2 Referral from the Community Eye Outreach to the Eye Clinic of UCH

A total of 137 patients out of 390 patients (35.2%) were seen at the eye clinic referred from the outreach centers in 2010. In 2009 however, 136 patients were seen at the eye clinic who were referred from the outreach out of 370 patients referred (36.8%).

In the pre-outreach period in 2004, a total of 1,830 patients were seen in the eye clinic and out of this number, a total of 235 patients were diagnosed with glaucoma (prevalence of 12.8%). In 2005 however, a total of 1,727 patients were seen in the eye clinic and out of this number, a total of 215 patients were diagnosed with glaucoma (prevalence of 12.4%). In the post outreach period in 2009, 3,153 patients were seen in the eye clinic and out of this number, 390 patients had a diagnosis of glaucoma (prevalence of 12.4%). In 2010, a total of 2,734 patients were seen in the eye clinic out of which 348 patients had a diagnosis of glaucoma (prevalence of 12.7%) (Table 4.1).

Fig 4.1 shows a trend in the number of glaucoma patients seen in the eye clinic from the pre-outreach period to the post-outreach period. Fig 4.2 shows the trend in the total number of patients seen in the eye clinic from the pre-outreach period to the post outreach period.

Table 4.1: Number of glaucoma patients at the eye clinic of UCH and community outreach

Prevalence of glaucoma at the outreach and the eye clinic.	Pre outreach		Post outreach (1)		Post outreach (2)	
	2004	**2005**	**2007**	**2008**	**2009**	**2010**
Total number of patients with a diagnosis of glaucoma at UCH.	255	215	326	421	390	348
Total number with complete data.	177 (75.5%)	160 (74.4%)			325 (81%)	328 (94.3%)
Total number of outreaches in the post- outreach period.	-	-	56	103	89	93
Total number of patients seen at the outreaches in the post outreach period.	-	-	6745	9084	9064	6498
Number of glaucoma patients referred from outreach.	-	-	303	492	370	390
Number of patients who presented to the eye clinic from the outreach.	-	-			136 (36.8%)	137 (35.2%)
Total number of patients who presented at the eye clinic each year	1830	1727	2014	3734	3153	2743

Fig 4.1: Trends in number of glaucoma cases presenting at the UCH eye clinic in the pre and post- outreach periods

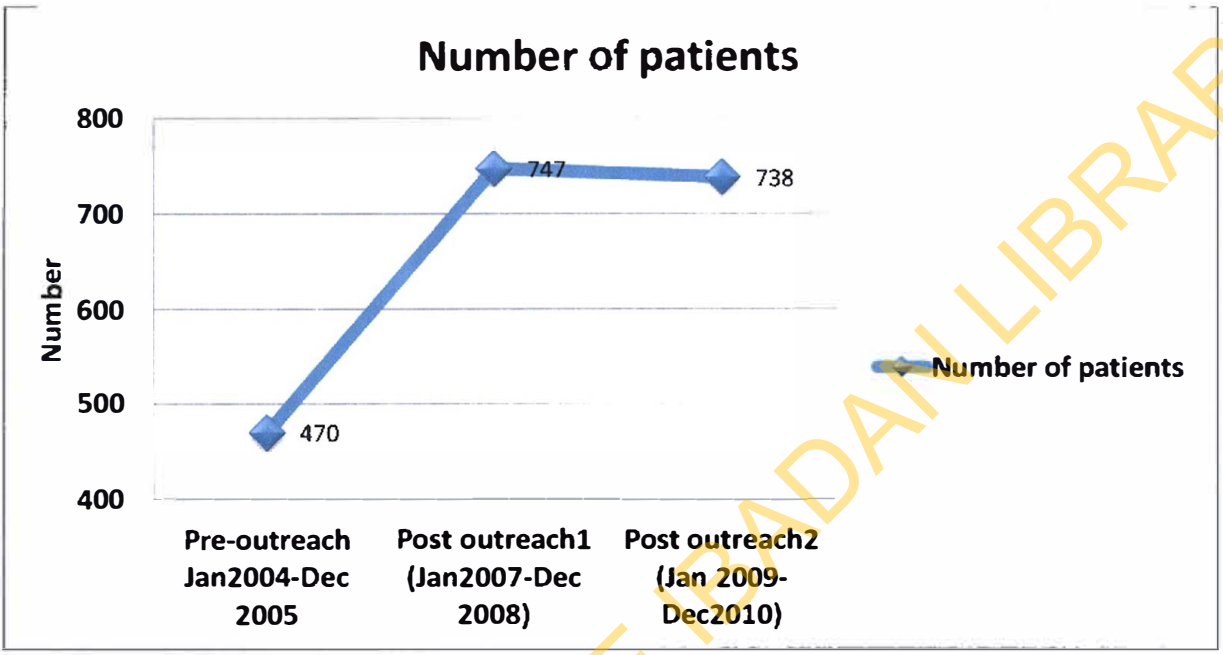
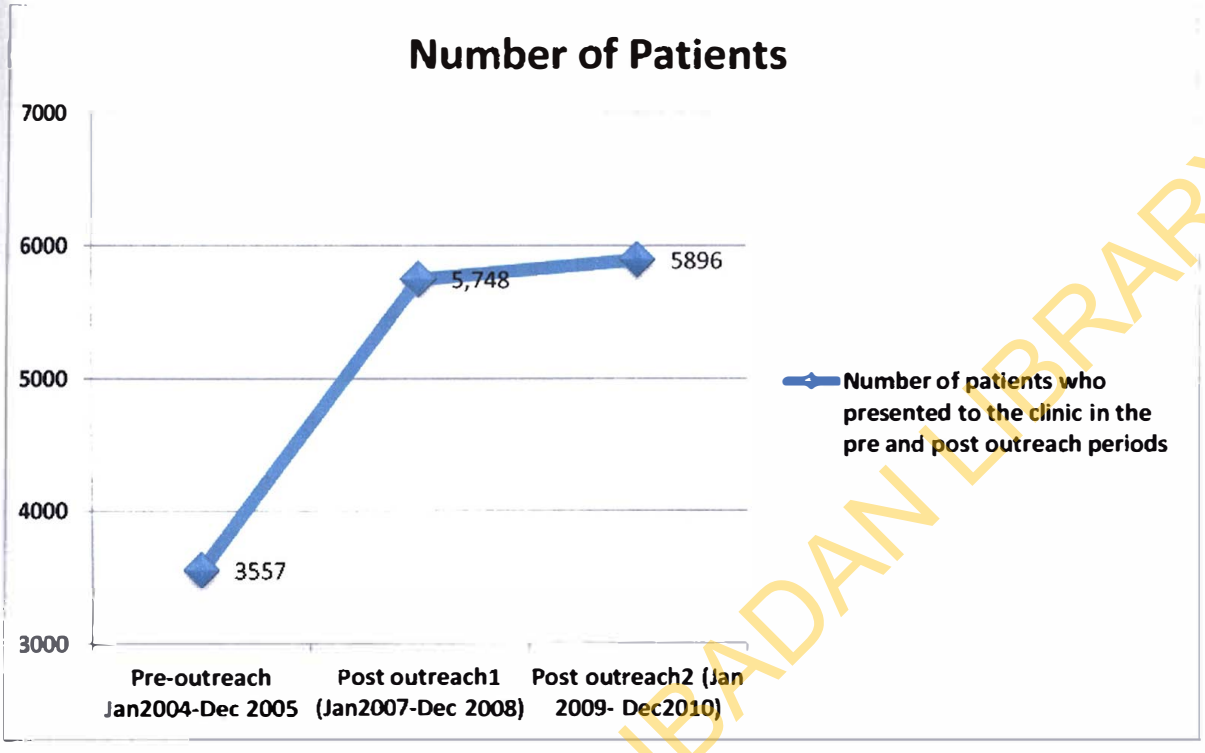


Fig 2-Trends in patient presentation pre and post outreach periods in the UCH clinic



4.3 Socio-demographic characteristics

In the post community outreach period (2009-2010), the ages of the patients studied ranged from 11 to 95 years with a mean age of 56.3 ± 16.6 and a median age of 60. The age range of patients studied in the pre community outreach period was from 21 to 102 years with a mean age of 58.9 ±15.8 and a median age of 60.

Table 4.2 shows the demographic characteristics of patients studied during both periods. There was a statistically significant difference in the demographic profile of the patients studied in both periods. The results show that younger people (≤ 60years) were diagnosed with glaucoma in the post-outreach period (2009-2010) compared to the pre- outreach period (2004-2005). This was statistically significant ($p < 0.03$, chi square 6.99, df =2). More females (44%) were also diagnosed in post-outreach period compared with the pre-outreach period (37.2%). This was statistically significant (p value < 0.019, chi square = 5.50, df =1)

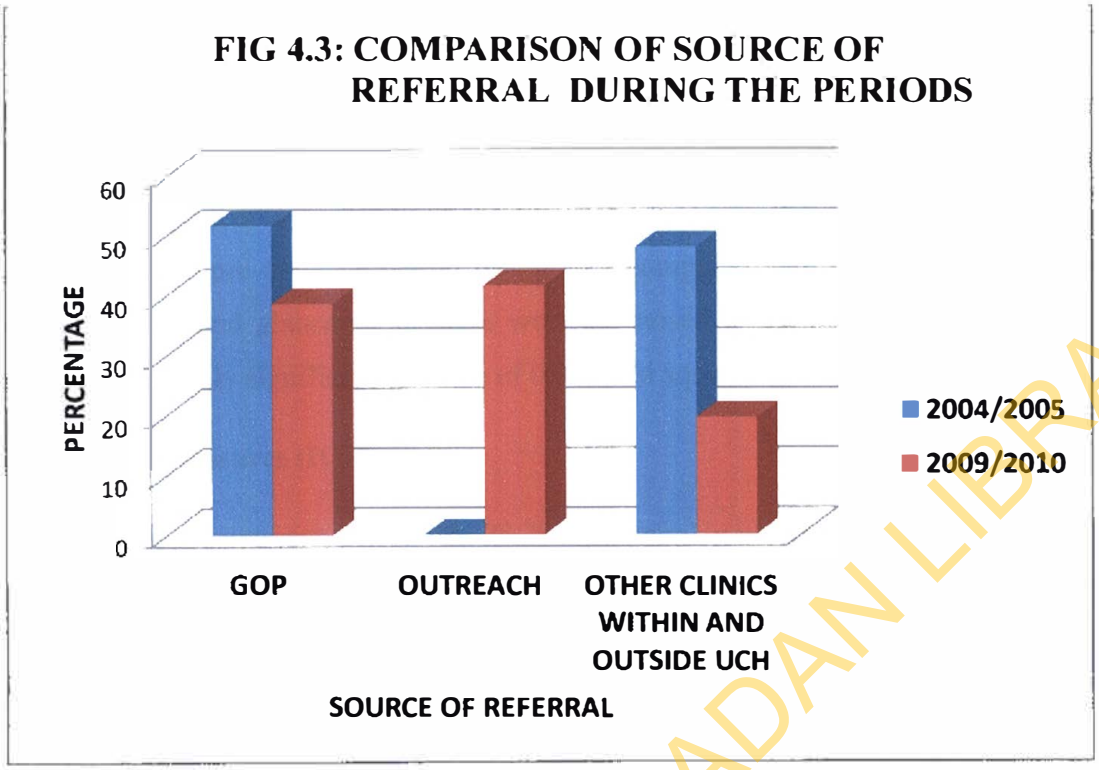
4.4 Source of referral

In the post outreach period, 41.7% of glaucoma patients seen in the eye clinic were referred from the community outreach. This is in contrast to the pre outreach period where over half of the patients (50.7%) were referred from the General Outpatient Department (GOP). Fig 4.3 shows the various sources of referral. There was a statistically significant difference in the sources of referral between the periods with more patients being referred from the community outreach in the post outreach period ($p< 0.001$, chi square =124.1, df =2).

Table 4.2: Socio-demographic characteristics of glaucoma patients in the pre and post outreach period

Characteristics	Pre-outreach period (2004-2005) N (%)	Post outreach period (2009-2010) N (%)
Age groups (years)		
10-30	24 (7.2)	66 (10.1)
31-60	144(42.7)	312(47.8)
61+	169(50.1)	275(42.1)
Total	337 (100.0)	653 (100.0)
p = 0.03, chi square = 6.99, df =2		
Sex		
Male	215 (63.8)	366 (56.0)
Female	122 (36.2)	287 (44.0)
Total	337 (100.0)	653 (100.0)
p= 0.019, chi square = 5.50, df =1		
Tribe		
Yoruba	304(90.2)	594(91.0)
Non-Yorubas	33(9.8)	59(9.0)
Total	337 (100.0)	653 (100.0)
p = 0.18, chi square 4.13, df=1		

FIG 4.3: COMPARISON OF SOURCE OF REFERRAL DURING THE PERIODS



p<0.001

KEY: GOP= General outpatient clinic.

4.5 Types of glaucoma

The types of glaucoma seen during the periods were primary open angle glaucoma (POAG), primary angle closure glaucoma (CACG), glaucoma suspects and secondary glaucomas. Table 4.3 shows the types of glaucoma seen during the two periods. From the results, the proportion of POAG seen during the pre-outreach period was higher compared with the post outreach period. More cases of PACG and glaucoma suspects were diagnosed in the post outreach period. This difference was statistically significant (p value of 0.001, chi square =15.51, df=3)

4.6 Intraocular pressures (IOP)

The mean IOP in the pre outreach period was 28.29±12.87mmHg in right eyes with a median of 27.00mmHg, and 27.14±11.65mmHg in the left eyes with a median of 26.00mmHg. In the post outreach period, the mean IOP was 23.11±11.55mmHg with a median of 20.00mmHg in right eyes and 22.92±11.26mmHg with a median of 19.00mmHg.

Table 4.4 shows the ANOVA table which compares the IOP between and within the two periods.

Table 4.3: Types of glaucoma seen during the pre and post outreach periods

TYPES OF GLAUCOMA	2004-2005 N (%)	2009-2010 N (%)
Primary Open Angle Glaucoma	271(80.4)	450(68.9)
Primary Angle Closure Glaucoma	14(4.2)	54(8.3)
Glaucoma Suspects	46(13.6)	133(20.4)
Secondary Glaucomas	6(1.8)	16(2.5)
Total	**337(100)**	**653(100)**

p=0.001, chi square =15.51, df=3

Table 4.4: Comparison of intraocular pressure between and within the periods

IOP	df	Mean squares	P-Value	F
Left eyes				
Between periods	1	5965.435	<0.0001	41.29
Within periods	142743	144.477		
Right eyes				
Between periods	1	3962.028	<0.0001	30.483
Within periods	128417	129.977		

4.7 Comparison of the Stage of disease between the two periods

Optic nerve head evaluation (optic nerve head cup to disc ratio)

The optic nerve head evaluation was examined and the cup to disc ratio was recorded. Table 4.5 compares the cup to disc ratio of patients during the 2 periods. There was no statistically significant difference between the two periods. In the right eyes, p value= 0.57, chi square =1.334, df = 2, while in the left eyes, it was weakly significant with a p value of 0.05, chi square = 5.864, df =2).

Central visual field(CVF)

About 502 (50%) out of 990 patients had central visual field recorded in their case notes. The result of the central visual field is reported on Table 4.5. There was no statistically significant difference in the CVF between the two periods. In the right eyes, the p value= 0.311, df =2, chi-square =2.33, while in the left eyes the p value = 0.162, df =2, chi square=3.63.

Table 4.5: Stage of disease using the optic disc head evaluation

Optic disc head evaluation	2004-2005 N=337 (%)	2009-2010 N=653 (%)
Cup to disc ratio(right eyes)		
Mild damage(≤ 0.6)	95 (28.2)	188 (28.8)
Moderate damage (0.7-0.8)	68 (20.2)	150 (23.0)
Severe damage (0.9-1.0)	174 (51.6)	315 (48.2)
p=0.57, chi square =1.3, df = 2,		
Cup to disc ratio (left eyes)		
Mild damage (≤0.6)	92 (27.3)	162 (24.8)
Moderate damage (0.7-0.8)	58 (17.2)	156(23.9)
Severe damage (0.9-1.0)	187 (55.5)	335(51.3)
p = 0.05, chi square = 5.8, df =2		

Table 4.6: Stage of disease using the central visual field test

Central visual field test	2004-2005 N=174 (%)	2009-2010 N=328 (%)	Total N=502 (%)
Central visual field of right eyes			
Mild damage (<6dB)	49(28.2)	110(33.5)	159(31.7)
Moderate damage (6-12dB)	30 (17.2)	62(18.9)	92(18.3)
Severe damage (>12dB)	95(54.6)	156(47.6)	251(50.0)
p = 0.311,df=2, chi-square=2.3			
Central visual fields of left eyes			
Mild damage (<6dB)	46(26.4)	99(30.2)	145(28.9)
Moderate damage (6-12dB)	26(14.9)	65(19.8)	91(18.1)
Severe damage	102(58.6)	164(50.0)	266(53.0)
p = 0.162,df=2, chi-square=3.63			

4.8 Correlation of source of referral with stage of disease using the optic nerve head evaluation

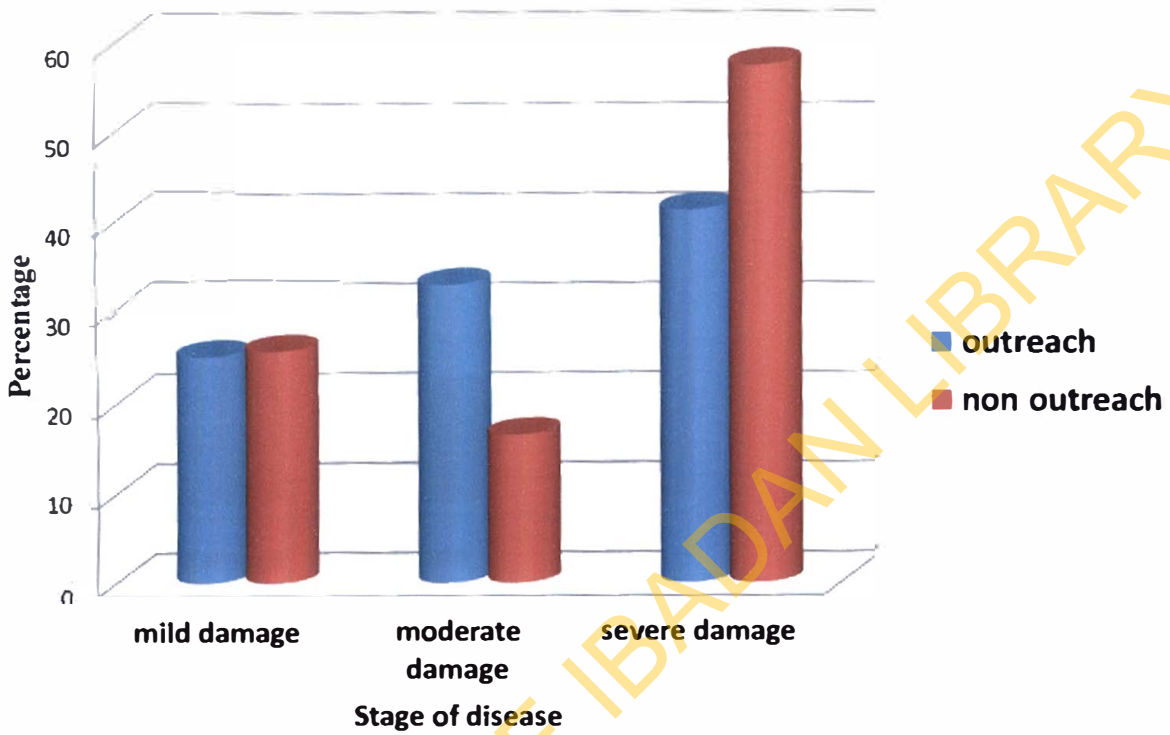
Figures 4.4 and 4.5 show the correlation between source of referral and stage of disease. Patients referred from the outreach were more likely to have mild to moderate disease when compared with patients from other sources of referral. This was statistically significant in the right eyes of patient ($p=0.034$, PCS=6.758, df=2) and in the left eyes ($p< 0.001$, PCS= 37.26,df=2).

4.9 Bivariate analysis correlating source of referral and specific variables

Bivariate analysis was done to compare source of referral (outreach or others) with specific variables such as age, sex, stage of disease using the optic nerve head evaluation, the central visual field, and the intraocular pressures. This analysis was done to determine whether patients from the outreach presented earlier when compared with patients from other sources of referral. From the analysis, age was not significant with reference to the source of referral. More females were referred from the outreach compared with other sources of referral and this was statistically significant as shown in Table 4.7. Patients who were referred from the outreach were more likely to have lower IOP ($\leq$ 21mmHg) compared with patients referred from other sources of referral. They were also more likely to present with mild to moderate optic nerve damage and mild to moderate central visual field loss. This was statistically significant as shown in Table 4.7. Source of referral did not affect the type of glaucoma. Glaucoma suspects were not more likely to be referred from the outreach (Table 4.7).

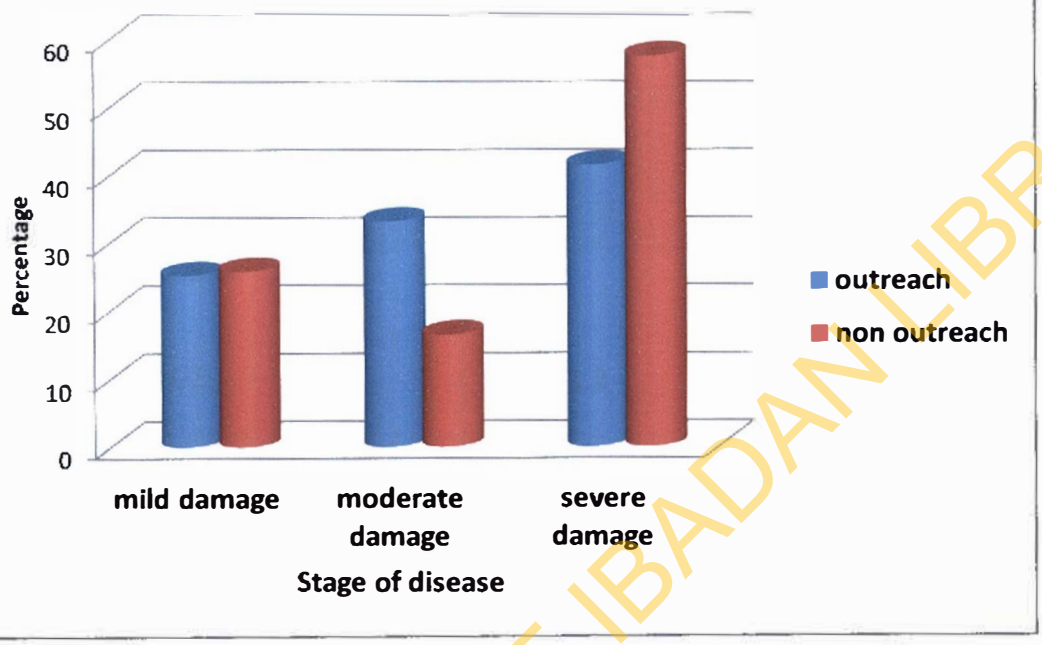
Multivariate logistic regression was done on the significant variables (Table 4.8). On multivariate analysis, patients with mild to moderate disease were two times more likely to be referred from the outreach clinic than from other sources of referral.

Fig 4.4: Comparison of source of referral with stage of disease in right eyes



p=0.034

Fig 4.5: Comparison of source of referral with stage of disease in left eyes



$p<0.001$

Table 4.7: Bivariate analysis showing relationship between source of referral and selected variables

Variables	Source of referral		Pearson chi square	P value
	Outreach	**Others**		
Age				
≤40	42	114	1.06	0.303
>40	259	575		
Odds ratio (95%CI)	0.81(0.6- 1.2)			
Sex				
Male	162	419	4.22	0.04
Female	139	270		
Odds ratio (95%CI)	1.33 (0.6-0.9)			
Intraocular pressure				
≤21mmHg	173	319	10.47	0.001
>21mmHg	128	370		
Odds ratio (95%CI)	1.56 (1.2 - 2.1)			
Cup to disc ratio				
0.2-0.8	176	293	21.36	<0.001
0.9-1.0	125	396		
Odds ratio (95%CI)	1.90 (1.4-2.5)			
Type of glaucoma				
Glaucoma suspects	61	113	2.160	0.142
Other types	240	576		
Odds ratio (95%CI)	1.29 (0.9-1.8)			
Central visual field				
≤12dB	90	146	15.08	<0.001
>12dB	60	209		
Odds ratio (95%CI)	2.14 (1.4-3.2)			

Others	1.00	
IOP		
Outreach	1.20 (0.8-1.8)	0.23
Others	1.00	
Sex		
Outreach	0.81(0.6-1.1)	0.81
Others	1.00	

CHAPTER FIVE
DISCUSSION

5.0 Prevalence of glaucoma at the community outreach programs and UCH

The prevalence of glaucoma in the eye clinic of UCH varies between 12%-13%, while the proportional morbidity rate from the outreach ranges from 4.1-6.0%. The clinic based prevalence in this study is much higher than the population based prevalence reported in Africa (Ntim Amposah., 2004; Rotchford., 2003). Studies conducted in the clinic are more likely to detect a higher prevalence of glaucoma because the base population is made of individuals with eye complaints and diseases who also have an increased possibility of having glaucoma. Individuals with a "felt" need seek help at the hospital. Although the proportional morbidity rate from the outreach cannot be compared directly with prevalence from population studies, they however do suggest that the prevalence of glaucoma in our population may be higher than the prevalence reported in Caucasian populations.(Tielsch, 1991)

5.1 Referrals from the outreach to the eye clinic

The number of patients who presented to the eye clinic increased in the post outreach period compared to the pre-outreach period. There were also a corresponding higher number of glaucoma referrals to the hospital in the post outreach period. This may be due to the numerous community eye outreach programs within and around Oyo State. These programs help in providing accessible, cheap and available health services to the rural and semi-rural communities. Hence all persons irrespective of socio-economic class can access these services. The Community eye outreach programs (Sundaram.,2001) ultimately generate awareness and demand for health care services in the community by those who need health intervention but are not seeking it.

5.2 Socio- demographic characteristics and glaucoma

About half of the patients seen in the pre- outreach period were above the age of 60 years. Younger patients were seen in the post outreach period and this was statistically significant. This suggests that the community eye outreach program enhanced the detection of glaucoma in younger people. In the pre-outreach period however, patients presented to the hospital only when they had

Studies have shown that women do not have equal access to health care services as much as men in many developing countries. Although there is evidence of a male predominance of glaucoma, reports by Doshe et al., 2008 suggest that more men access glaucoma treatment than women. This is often as a result of lower socioeconomic status of women, with associated lack of funds to procure health care, lower educational status hence more ignorance on health issues compared with their male counterparts. However community eye outreach may have enhanced access to health care for women. This is because free screening services are taken to people in their community and only those with major ocular diseases are referred to the hospital.

5.3 Sources of referral, type of glaucoma and IOP in the pre and post outreach period

More patients were referred to the eye clinic from the outreach than from other sources in the post-outreach period. These outreaches often provide easier access to the hospital, create awareness and educate the community on health. Community outreach help to generate awareness and demand for health care services in the community by those who need health intervention but are not seeking it. Services are made available to the patients at the grassroots and the community, instead of waiting for the patients to access services at the hospital. In the post outreach period, more glaucoma suspects were seen in the post – outreach period than in the pre-outreach period. These were mainly patients who had mild to moderate disease. They usually require more specialized care and tests to confirm their diagnosis since most of the clinical features are subtle.
Glaucoma suspects are often in their second stage of the disease. It is the detectable preclinical stage during which the disease is still symptomless but can be detected by specialized diagnostic testing (Allingham., 2005). This is an early to moderate stage and patients detected and managed appropriately at this stage have better opportunity of a sighted life.

5.4 Comparison of stage of disease in the pre and post outreach periods

Although the difference between the stages of disease in patients presenting during the two periods was not statistically significant, there was a trend towards the post outreach group of patient having earlier disease. It is expected that the earlier stage of disease in the post outreach period

symptoms or had complications from the disease. Therefore older patients were more likely to present in the hospital. Cook (2009) reported that glaucoma in Africans occurs at an earlier age. More females were also diagnosed during the post outreach period than in the pre-outreach period. Studies[29] have shown that women do not have equal access to health care services as much as men in many developing countries. Although there is evidence of a male predominance of glaucoma, reports by Doshe et al., 2008 suggest that more men access glaucoma treatment than women. This is often as a result of lower socioeconomic status of women, with associated lack of funds to procure health care, lower educational status hence more ignorance on health issues compared with their male counterparts. However community eye outreach may have enhanced access to health care for women. This is because free screening services are taken to people in their community and only those with major ocular diseases are referred to the hospital.

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Although the difference between the stages of disease in patients presenting during the two periods was not statistically significant, there was a trend towards the post outreach group of patient having earlier disease. It is expected that the earlier stage of disease in the post outreach period

would be significant however there were referrals from other sources during this period and many of the patients from these other sources had severe disease.

5.5 Comparison of stage of disease and source of referral in the post outreach period

The results show that patients referred from the outreach had early to moderate disease compared with those referred from other sources. Patients who are referred from other sources often have a felt need and are at the third stage of the disease which is often symptomatic and severe. However many patients from the outreach often come for routine eye checkup or have a refractive error. It is during routine ocular examination by the physicians/surgeons that the disease is often detected. A few patients with symptoms of glaucoma (third stage of the spectrum) however also seek health care at these outreaches because of their easier accessibility and availability.

The results show that the mean IOP was much lower in the post outreach period. This may also be related to the fact that many of the patients seen in the post outreach period were younger. Studies by Loewen et al., (1976) and Ruprech et al (1978) have shown that younger people have lower intraocular pressures compared with older people.

Bivariate analysis on the patients referred from the outreach showed that more females were referred from the outreach, their IOP was lower and patients had early to moderate disease compared with patients referred from other sources. However on multivariate analysis only the earlier stage at which patients are referred from the outreach was significant.

The post outreach period has recorded a higher proportion of patients seen in the eye clinic of UCH and therefore there have been more glaucoma referrals compared to the pre outreach period. Although there was no statistically significant difference in the stage of disease during the two periods, patients in the post –outreach period were more likely to be younger, and more likely to be glaucoma suspects than patients in the pre-outreach period.

5.6 Strengths of the Study

This study has evaluated community eye outreach program and has provided useful information on its relevance in early glaucoma case detection especially in developing countries.

CONCLUSION

Community eye outreach is useful in the early detection of glaucoma in developing countries. Patients referred from the outreach are more likely to have earlier diseases. In many developing countries where eye care services are often limited and many glaucoma patients present with end stage disease, community eye outreach may help in earlier diagnosis and prompt management to prevent blindness from the disease. This would help in achieving the objective of vision 2020 which is to eliminate the main causes of avoidable blindness in order to give all people in the world, particularly the millions of needlessly blind, "the right to sight"

The study also shows that community eye outreach is a useful model that can be used to make services available affordable and accessible to the rural and grassroots populations.

Further studies are needed to evaluate the long term benefits of community eye outreach program in early glaucoma case detection. A prospective study evaluating this program is also recommended.

RECOMMENDATIONS

There is a need to establish more eye outreach programs in the communities to reduce the burden of avoidable, needless blindness in developing countries. These programs should be instituted by secondary and tertiary health care facilities. In Nigeria, community eye outreach would help to improve awareness of glaucoma in the population, enhance earlier diagnosis and provide accessible available and affordable services to all peoples.

Patients referred to the eye clinic of UCH from the outreaches should be encouraged to keep their clinic appointments so that their eye diseases can be adequately and properly managed. This can be achieved by subsidizing the fees paid by outreach patients at the UCH eye clinic.

It is also important to keep proper and detailed health records. Efforts should be made to ensure that patient's case files are not missing.

Further research specifically a prospective long term study is necessary to further evaluate the role of community eye outreach in early glaucoma detection.

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APPENDIX A

QUESTIONNAIRE EVALUATION OF COMMUNITY EYE SCREENING FOR EARLY GLAUCOMA DETECTION IN A TERTIARY HOSPITAL IN NIGERIA

Serial No..... Year of presentation.....

A. SOCIODEMOGRAPHIC CHARACTERISTICS AND SOURCE OF REFERRAL TO THE HOSPITAL

1. Source of referral
    1) Community Outreach
    2) Other hospitals/clinics outside UCH
    3) Other clinics from UCH
    4) GOP UCH
    5) GOP eye
2. Age (last birthday) .....
3. Sex: 1. Male 2. Female

Examination findings

4 Intraocular pressure at presentation RE..... LE...

5 Gonioscopic findings RE open angle LE open angles
Closed angles closed angles
Narrow angles narrow angles

6 Cup to disc ratio RE..... LE.....

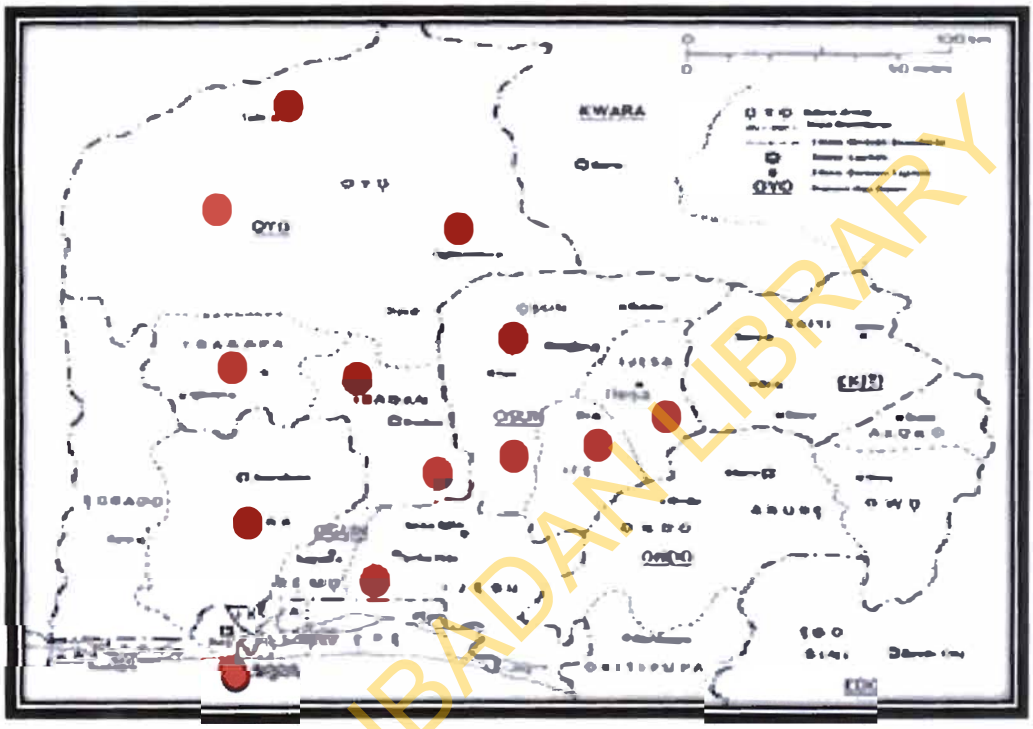
7 Visual field test- (using the mean deviation) RE LE

- Mild damage
- moderate damage
- severe damage

RE LE

APPENDIX B

MAP OF SOUTH WEST NIGERIA



KEY: Location of outreach sites are marked in red

OUTREACH SITES IN OYO STATE

- OKUKU
- OYO WEST LOCAL GOVERNMENT
- ODO-OBA
- TEDE
- AGO-AMODU
- OLUYOLE
- SEPETERI
- IBOKUN
- OJA-OBA
- EGBEDA
- SAKI
- AREMO PALACE
- EKOTEDO

- ILORA
- APETE
- ORITA CHALLENGE
- AYEGUN
- ODEBODE VISION CENTRE
- LEO VISION HOUSE
- AGBALA ITURA IBADAN NORTH LOCAL GOVERNMENT

OUTREACH SITES IN OSUN STATE

- OSOGBO
- ESA-OKE
- IJEBU- IJESHA
- IBOKUN

OUTREACH SITES IN LAGOS STATE

- YABA

OUTREACH SITES IN OGUN STATE

- ODEDA LOCAL GOVERNMENT

- ILORA
- APETE
- ORITA CHALLENGE
- AYEGUN
- ODEBODE VISION CENTRE
- LEO VISION HOUSE
- AGBALA ITURA IBADAN NORTH LOCAL GOVERNMENT

OUTREACH SITES IN OSUN STATE

- OSOGBO
- ESA-OKE
- IJEBU- IJESHA
- IBOKUN

OUTREACH SITES IN LAGOS STATE

- YABA

OUTREACH SITES IN OGUN STATE

- ODEDA LOCAL GOVERNMENT