The Evaluation of Nurses Trained in Specific Ophthalmic Skills in Sierra Leone

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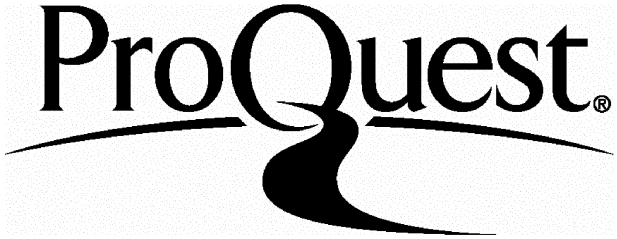

"The eye is the lamp of the body.
If your eyes are good,
your whole body will be full of light"

Matthew 6:22 (NIV)

To

Rachel

and

my three

children

for your

patience, understanding and care

ABSTRACT

In most of rural West Africa one can expect to find less than one ophthalmologist for every million people. The prevalence of blindness due to cataract, chronic glaucoma, onchocerciasis, trachoma and corneal diseases is high varying between 1 and 5%. With the present limited manpower and resources an adequate eye care service based on ophthalmologists alone is not possible in the foreseeable future.

This study looks at the results of training nurses in specific ophthalmic skills and functions, normally performed by ophthalmologists, with the objective being to use nurses to provide eye care services and help prevent unnecessary blindness in rural areas of Sierra Leone.

Ten State Enrolled Nurses being trained over a period of 18 months, as ophthalmic nurses, are compared with an expatriate eye trained doctor for their ability to accurately screen, diagnose, treat or refer 388 selected patients coming to the outpatient clinic at Lunsar Eye Hospital in Sierra Leone. Of these patients 231 were blind in at least one eye from various eye diseases. The study compares each student's clinical skill in assessing visual acuity, measuring intraocular pressure, diagnosing cataract, and assessing the cup to optic disc ratio by ophthalmoscopy. Computer analysis of the data includes weighted kappa statistics of inter-observer variation, sensitivity, specificity, and the range of individual performance.

Clinical judgments are assessed by each students' ability to correctly treat or refer patients with a variety of eye diseases, and to differentiate between treatable and non-treatable blindness compared with the eye doctor's assessment of the patient. The percentage of either correct, inconvenient, or unsafe judgments made by each student, is calculated for different clinical situations. The class as a whole correctly managed 81% of all eyes which they examined, 13% caused inconvenience to the patient, and in 6% the management was unsafe. This means that 94% of all eyes seen by the students were managed safely.

The conclusion reached is that in Sierra Leone the training of ophthalmic nurses in accurate diagnostic and management skills is feasible, within acceptable limits, and should be encouraged so as to develop widespread eye care services and a referral system for eye patients within the country.

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ACKNOWLEDGEMENTS

It has been my privilege to share this learning experience with the hard working, motivated students of the first ophthalmic nursing course to be offered in Sierra Leone. They have, in a real way, become friends to me. Frequently students have given valuable suggestions and innovative ideas for improving both the course and this particular study.

I am grateful for the co-operation of the dedicated staff and patients at the Lunsar Eye Hospital, in Sierra Leone. In particular I owe thanks to those course instructors with whom I have worked. Dr. Bill Wilson was the resident ophthalmologist and course director. Susan Ryckman, an ophthalmic nurse was the course coordinator and an instructor. Dr. Suzanne Wedner is an eye trained doctor who has been the standard observer for this study. Without Dr. Wedner's tireless effort and careful monitoring of the study and day to day examination of the patients this study would not have been possible.

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INTRODUCTION

During the past two or three decades health care providers in developing countries have increasingly recognised the imbalance between the distribution of health resources and the people who most need health care. Too often those who live in rural communities most affected by disease have no access to medical care while the few professionals in health care often migrate to cities where they usually find the standard of living to be more acceptable. Emphasis on community health care has attempted to maximise the skills of the few health professionals by having them train other levels of health care personnel to function in roles which traditionally have been held by specialist health providers alone, for example medical assistants work as general practitioners. This trend has entered the area of eye care. Ophthalmic assistants and ophthalmic nurses are being trained in Africa to provide eye care services for rural populations. In many areas of health care alternative levels of health providers function successfully as they bring health care to communities that would otherwise have little or none.

After several years involvement with health care in rural South India, Bangaladesh and Honduras, I became interested in community eye health. While preparing to teach on the Lunsar ophthalmic nurse training course, I turned my attention to finding measurable ways of assessing the progress of my students. I recognised that while alternative levels of health care

providers were being used extensively throughout the world, few objective studies had been undertaken to compare the results of their services with the professionals that they substituted. Anecdotal material is available which verifies that many of these trained health workers in fact give excellent care, however, it would be advisable to have objective parameters to demonstrate the level of service that could be expected and predicted from those completing training programmes.

The Lunsar course started in April 1989 and I being one of the instructors decided to use this opportunity to develop a method of assessing ophthalmic nurses being trained to provide eye care services, and follow the first ten students through their course. This thesis is the documentation of the study. It is my intention to document the assessment of paramedical ophthalmic workers in training with a view to improving the training so that eye care services can be provided and improved for people living in rural areas of Africa.

CHAPTER 1

SETTING

SIERRA LEONE

KEY

TOWNS (capital letters) - Provincial capitals
Towns - Eye units
- - - - - - - - Provincial boundaries
= = = = = = - International boundaries
———— - Roads

Scale 1:200,000

The setting of this investigation is in rural West Africa in the country of Sierra Leone. The study was carried out at the Lunsar Eye Hospital located in the town of Lunsar which is about two hours drive north east of the capital city, Freetown.

1.1 Sierra Leone background information

1.1.1 Physical

Sierra Leone lies between the latitudes of 7°and 10°north and is bordered on the north and east by Guinea and on the southeast by Liberia. The three major land divisions are the coastal strip of swamp land about 100 kilometres wide, the central forested area and to the north and east mountains. The single rainy season from May to October bring heavy rains which cause many fast flowing rivers across the country. Most of the roads are either dirt or gravel. Many of these become impassable during this season. The only public transportation in the country is privately owned motor carriers. The few railways once operated by mining companies are no longer functional. Freetown is a major port in West Africa. [1]

1.1.2 Social and economic

The population of Sierra Leone is four million with an annual growth rate of 2.5%. Over two thirds of the people live rurally and work in agriculture. Forty three percent of the people are under the age of 15 years, and 3% over 65 years old. [1]

English is the official language, however, Krio is the more commonly used

trade language. There are many ethnic groups, of which the Temne and Mende account for one third of the population. Freetown, the capital has a population of 500,000. National communication is mostly through radio, though there are newspapers and television. Only 15% of the people are literate. [1]

The country has mineral resources which include diamonds, iron, rutile, non-ferrous metal ores and natural abrasives. [1] Most of these products are exported. The World market drop in price and demand for some of these products, coupled with political instability, has caused a struggling economy in Sierra Leone. [1]

1.1.3 Health care

Life expectancy in Sierra Leone is 40 years, which is one of the lowest in the world. This is due in part to an infant mortality rate of 180 per 1000 live births. This figure is as high as 300 in some rural areas, which is among the world's highest rates. One third of the children die before they are five years old. The crude death rate is 25 per 1000 people. [1]

The staple food is rice cooked with palm oil and vegetables. Sometimes meat and often fish is included in the diet. The daily caloric intake for much of the population is less than required. Only 16 percent of the people have access to safe drinking water. [2]

There is one physician per 20,000 people. [1] There is no medical school in the country and those who have been trained elsewhere frequently do not stay in Sierra Leone, but migrate to better paying countries.

The national referral hospital, Connaught Hospital, is in Freetown. There are 12 other government hospitals. Three of these are provincial hospitals and 9 are district hospitals. Each controls a network of rural health centres in their district. Beside the government hospitals there are 7 mission hospitals which are located in the more remote areas. The government health service is free, but due to the struggling economy there is often insufficient funds for needed equipment and drugs.[2]

Eye services are based in 5 locations in the country. These are located at Freetown, Kissy, Lunsar and Segbwema and Bo. The units at Segbwema and Bo are covered by the same ophthalmologist. At present there are four resident ophthalmologists, two of whom are expatriates.

1.1.4 Language and health care

Patients at the Lunsar Eye Hospital come from at least 11 different language groups. A large majority of these patients are also illiterate. These two factors often make communication with the patient extremely difficult. A relatively simple procedure such as taking the patients visual acuity or intraocular pressure often becomes almost impossible because the patient does not understand what is expected or what is being done to him. The patients anxiety is greatly increased and he refuses to cooperate with the examiner. Further attempts at explanation frequently add to the confusion. Sometimes a procedure is explained by the examiner through other patients, to whom the procedure is also new, in two or three different languages before it finally gets to the patient. Attempts to get adequate patient histories are often futile.

1.2 Lunsar Eye Hospital

Lunsar is located in the Northern province with good road connections to the capital and several other large towns. The Eye Hospital is a 50 bed mission hospital that is exclusively for eye care. It provides the only eye service for the northern half of the country. Patients come from most areas of Sierra Leone as well as from the neighbouring countries of Guinea, Liberia, Senegal and Mali. Between 15,000 - 20,000 patients are seen each year, and 2,000 operations are done annually by the two expatriate ophthalmologists and trained surgical assistants. There is a well developed optical department which supplies most of the country's spectacles. Regular mobile teams made up of one or more ophthalmic nurses, and trained assistants visit several outlying locations on a regular basis. The work of the hospital is supported by the Christoffel Blindenmission (CBM) through the Baptist Convention of Sierra Leone, with help in the form of an ophthalmologist from the Southern Baptist Mission. Near to Lunsar there is a project for rehabilitation of the blind, which is also supported by CBM through the Baptist convention of Sierra Leone, and closely related to the eye hospital. This project works in various rural areas of the country, locating people with irreversible blindness and training them in mobility and agricultural skills.

1.3 Ophthalmic Training Programme

Aware of the high prevalence of blindness in the country and severe shortage of ophthalmologists, the National Prevention of Blindness Committee of Sierra Leone recognised the need to train another level of health worker in ophthalmic skills. The relative expense and time involved

to train a Sierra Leonian in ophthalmology meant it would be several more years before another ophthalmologist would be ready to give needed eye care. Several short courses (1-3 weeks) in basic eye care had been previously taught to a few nurses and technicians at Lunsar. Most of these nurses were trained on an individual basis by ophthalmologists who had been at Lunsar and could only work at Lunsar since they had no recognised qualification in eye care. It was decided by the committee to train state enrolled nurses in eye care and send them to various locations throughout the country. Their role was to be a link between the community and the few ophthalmologists. It was planned that they would have training in basic diagnosis and treatment of common eye infections and disease and be able to refer patients who needed eye surgery. It was hoped that patients with blinding eye disease would be treated much earlier and the "burden of avoidable blindness" (blindness which could be prevented or cured) therefore reduced.

The Ministry of Health in Sierra Leone together with several non-governmental organisations organised the first ophthalmic nurse training programme. Ten students were selected from around the country and, in April 1989 the 18 month programme began. The main teaching of the course was done at Lunsar Eye Hospital. Clinical experience was provided for the students at eye units in Lunsar, Kissy and Segbwema.

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CHAPTER 2

BLINDNESS AND EYE CARE IN AFRICA

In 1978 at the first general assembly of the International Agency for the Prevention of Blindness, a new awareness of the devastating effects that blinding disease had on many parts of the world, was recognised. Professor Jones [1] expressed it as the "over-burden of avoidable blindness". At this conference the need to identify communities with blinding eye disease, and to develop programmes for preventing blindness in these communities, was recognised. Plans were initiated to bridge the gap between the available ophthalmic resources, in developed countries, and the areas of greatest ophthalmic need in the developing world. Since that time, training and control programmes have been started to try to meet the needs of areas of the world where the levels of avoidable blindness are unacceptable.

2.1 DEFINITION OF BLINDNESS

Category of Visual Impairment		Visual acuity with best possible correction	
NORMAL	0	Can see equal to or better than 6/18	
LOW VISION	1	Cannot see 6/18	Can see equal to or better than 6/60
	2	Cannot see 6/60 (count fingers at 6 metres)	Can see equal to or better than 3/60
BLINDNESS	3	Cannot see 3/60 (count fingers at 3 metres) or fields 10° or less	Can see equal to or better than 1/60 or fields more than 5°
	4	Cannot see 1/60 (count fingers at 1 metre) or fields 5° or less	Can see light perception or better
	5	No light perception	
	9	Undetermined or unspecified	

Fig 2.1

Blindness in this study is based on the internationally recognised World Health Organisation's (WHO) criteria.[2] It is defined as a person having a bilateral visual acuity below 3/60 (in metres) using a standard Snellen chart. This can be described in more practical terms as a person who is unable to count another person's upheld fingers at a distance of three metres. WHO divides visual acuity into various categories to aid examiners in determining the degree of visual impairment (fig. 2.1). If the extent of the visual field is taken into account, patients with a visual field radius not greater than 10° but more than 5° around central fixation should be placed in category 3 and a field of 5° or less in category 4 even if central acuity is not impaired. In this study every reference to blindness presumes the WHO criteria unless otherwise stated.

2.2 MAGNITUDE OF BLINDNESS IN AFRICA

The World Health Organisation estimates that 27 to 35 million people in the world are blind by WHO criteria. Approximately 11% of the world's population lives in Africa, but 20% (6 million) of the blind are from this continent. Data from most of the African countries and in particular those in West Africa have prevalence of blindness which is close to or exceeding 1% of the population. These prevalences of blindness represent approximately five times the prevalences that are to be found in the western countries of Europe and North America.[3]

The study by Stilma and Bridger[4] indicates that Northern Sierra Leone has a 1.3% prevalence. This study suggests that in the

heavily endemic onchocerciasis areas this prevalence is much higher. This figure is supported by Foster and Johnson [5] in their review of some of the various surveys for the prevalence of blindness that have been done worldwide.

Prevalence of Blindness from Population Based Surveys in Africa [3,5,6,7,8,9]

Year	Country	Prevalence %	Common causes of blindness
1981	Kenya	0.7	Cataract 67% Trachoma 33%
1983	Malawi	1.3	Cataract 40% Corneal 30%
1982 to 1986	Togo (4 areas)	0.6 - 1.1	Cataract 39 - 70% Corneal 7 - 22% Onchocerciasis 4 - 29%
1985	Chad	1.5 - 3.1	Cataract 48% Trachoma 23%
1986	Gambia	0.7	Cataract 55% Trachoma 17%
1988	Congo	0.3	Cataract 81% Glaucoma 9%
1990	Benin	0.6	Cataract 54% Glaucoma 15%

Fig 2.2

2.3 CAUSES OF BLINDNESS IN AFRICA

The major causes of blindness, by country are listed in the World Health Organisation's prevalence of blindness data. [3] Statistics in this report show that most of the blindness in West Africa is either preventable or curable. Many people in these countries suffer unnecessarily from the effects of cataracts, trachoma, glaucoma, and onchocerciasis. Cataract is the major cause of treatable

blindness and accounts for approximately half of the blindness in Africa. Corneal scar, some of which is due to trachoma is the second most frequent cause of blindness (Fig. 2.2) This is preventable. [5] Glaucoma is the third most common cause of blindness. In areas where onchocerciasis is found it is often the first or second cause of blindness. [10] The prevalence of blindness from onchocerciasis varies greatly depending on the local situation.

A study done in 1981 of 7,286 new patients at Lunsar Eye Hospital in Sierra Leone showed the causes of blindness to be [4]:

Cataract	39%
Onchocerciasis	30%
Primary glaucoma	8%
Corneal scars	5%
Trachoma	3%
Measles Keratitis	3%
Other	12%

The prevalence of blindness in the general population is probably around 1%. This figure may be much higher in some areas of the country where a high prevalence of onchocerciasis exists. Studies by Conran [11] in 1956 and Koeth [12] in 1980 suggest that 60-90% of the adult population in the Northern Province of Sierra Leone are skin snip positive for onchocerciasis.

2.4 CONTROL OF BLINDING DISEASE IN AFRICA

The control of blindness in Africa focuses on the major causes of blindness, since 85% of these could be either treated or prevented with available resources. [5]

2.4.1 CATARACT

The prevalence survey in the northern province of Sierra Leone indicates that 39% of blindness there is due to cataract, being the major cause of blindness. [4] Other surveys in Africa indicate that cataract accounts for approximately 50% of the blindness. [3,5,6,7,9] The lower figure for Sierra Leone is probably due to the presence of onchocerciasis. In a review of cataract blindness in Africa, Steinkuller [13] finds that 85% of cataract blindness is due to age related cataract. The remaining 15% consists of 6% congenital abnormalities such as caused by rubella. Another 6% is accounted for by trauma due to perforating injures of the eye. The remaining 3% is due to secondary cataract from other disease processes. The problems incurred in the management, and control of blindness from cataract are due to inadequate ophthalmic personnel to operate, inadequate materials, and the distance that the patient has to travel. [14]

The focus of this study in Sierra Leone is on the need for accurate diagnosis and selection by ophthalmic paramedics. It is, therefore, essential that the criteria for determining operable cataract be well defined. The definition used in Sierra Leone has been taken from literature developed by the World Health Organisation. [15] These recommendations are:

1. A visual acuity less than 3/60 bilaterally.
2. A grey or white pupil.
3. The pupil should react to light.

The World Health Organisation report [15], emphasise the need to recognise the problems of patient motivation and screening. For patients who live many miles from eye services, the referral rate is very low because of travel expense, low income, lack of knowledge, and fear of the unknown. Creation of an adequate referral system must look at the following areas which are set out in the World Health Organisation report:

1. Assessment of the problem.
2. Identification of cases.
3. Creation of awareness in the population.
4. Motivation of those blind to utilise service.
5. Development of a referral system.
6. Provision of cost effective surgical services to deal with large numbers.
7. Provision of optical correction at an affordable cost.

In Sierra Leone the attempt to create an adequate referral system is being initiated by the training of State Enrolled Nurses in ophthalmic care. This is to maximise the use of the very few ophthalmologists (4 for 4 million population) for surgery, while the nurses do the diagnosing and referral.

2.4.2 GLAUCOMA

The prevention of further loss of vision leading to eventual blindness in patients with chronic glaucoma depends on early detection and adequate treatment. The literature reviewed for this study focused on the need for simple screening methods which will be the most practical and accurate, in areas of the world where resources and manpower are limited and patient presentation often late. Many of the screening facilities used in Europe or the United States are not available in Africa. The racial differences of the disease and the lack of follow up by patients make glaucoma control very difficult. [16,17,18,19]

Stilma [4], found that 8% of eye patients at Lunsar eye hospital, had chronic glaucoma. Ocular onchocerciasis was found in 30% of those with glaucoma. The relationship between onchocerciasis and glaucoma is not clearly defined. [10,20]

In a retrospective study by Verrey [18] in Ghana of 397 patients, 52% of the eyes with glaucoma were already blind (visual acuity of less than 3/60) on presentation to the hospital. Of the patients in the study 26% were under 40 years old. After 6 months only 19% of the patients put on treatment were attending for follow up. Of these only 17% had an intraocular pressure less than 22 mmHg. The rest of the patients were treated surgically, and 84% of those seen in 6 months had an intraocular pressure below 22 mmHg. This article states that 20% of blindness in parts of West Africa is due to chronic glaucoma. All those in the study had intraocular pressures of 28 mmHg and pathological cupping of the optic disc.

Sarkies [19], in Ghana, studying chronic glaucoma in 1956 described the disease as it is still seen in West Africa today. He emphasises the insidious onset, late presentation with extensive visual loss and poor follow up. Wormald and Foster [16] report chronic glaucoma in West Africa as a common cause of blindness, which presents at an early age, often with complete loss of vision in one eye. The factors involved in glaucoma blindness, they suggest, as poor ophthalmic services, and that cases are not diagnosed early enough to prevent loss of vision. They point out that the four ways of identifying patients at risk of having chronic glaucoma are:

1. measurement of intraocular pressure
2. examination of the optic disc
3. examination of visual fields
4. a combination of the above

Several studies in developed countries as well as from West Africa, have found that approximately one third of patient's on initial diagnosis of chronic open angle glaucoma are already blind. [18,20,21,22,23] This emphasises the need of screening methods to detect the disease at an early stage. The use of perimeters for measuring visual fields is difficult in Africa because of communication difficulties, patient cooperation and the amount of time needed for the test in relation to the high volume of patients.

The use of intraocular pressure (schiotz) alone has been shown to be neither sensitive nor specific. Eddy [24] discusses the use of Schiotz tonometry in the detection of glaucoma in asymptomatic patients. He makes the observation that 9% of adults over 40 years of age will have elevated intraocular pressure, but only 1 in 50 of those with an elevated pressure, on a single measurement

with a Schiotz tonometer, will in fact have glaucoma.

Hitchings [25] considers screening methods for glaucoma. He discusses the use of intraocular pressure measurements, visual field testing, and assessment of optic disc appearance and changes. The use of intraocular pressure in the determination of glaucoma is unreliable according to his opinion. He states that 10% of patients presenting with ocular hypertension will have glaucoma at the time of screening, and another 10% will develop glaucoma in ten years. The risk, however, increases with increased intraocular pressure. This is particularly so with pressures above 28 mmHg.

Goldberg [26] reiterates that the use of tonometry alone is inadequate in detecting early damage from glaucoma. He encourages the use of optic disc changes, particularly noting optic disc cup size changes and notching as important. This being particularly true for vertical axis increase of the cup size. He describes haemorrhage at the disc and change in optic cup size as essential indicators in the initiation of therapy for glaucoma.

Assessment of the cup to disc ratio is suggested as a good simple test for screening of glaucoma. Cupping is often marked in Africa as patients frequently present late in the disease process so that the diagnosis is obvious. [16]

Hitchings [25] observes in regard to optic disc changes, that loss of visual field can be suspected when enlargement of the optic cup occurs. The normal limit for the cup diameter is greater in West Indians than whites. He notes that the concentric enlargement of the cup occurs with those with early glaucoma, and the size of the cup differs between the two eyes. This article

concludes that the major risk factors in determining glaucoma are:

1. a positive family history
2. an intraocular pressure exceeding 28 mmHg
3. a cup to disc ratio exceeding 0.6
4. increasing age

The concept of the cup to disc ratio was developed by Armaly [27] in 1967 as an indicator for changes of the optic disc, and he recorded the measurement as a ratio. The measurement is made on the basis of central pallor of the disc, as well as deviation of the vessels crossing the disk, to mark the edge of the cup and its depth.

Cooper et al. [28] look at screening for glaucoma by optic disc evaluation and tonometry. This study of 12,156 subjects over the age of 40 found screening by optic disc evaluation to be much more likely to detect cases of glaucoma than tonometry.

The relationship between cupping of the optic disc and visual field loss in chronic simple glaucoma was demonstrated by Gloster [29]. He studied 300 patients with either ocular hypertension, and suspected or established chronic simple glaucoma. This study showed that the vertical cup to disc ratio increased with the incidence of field defect increase. It was found that a ratio of 0.7 or greater was of particular use in determining the presence of visual field loss. It was also found that the vertical ratio showed a better correlation to the presence of visual field defects than either horizontal or disc rim measurements. It was found that when the cup to disc ratio was between 0.7 and 0.8, the risk of glaucoma was 2:1 to a normal looking disc.

The ratio between 0.8 and 0.9 had a risk of 20:1, and when the ratio exceeded 0.9, there was certainly glaucoma. In comparison to intraocular pressure measurements, it was found that the cup to disc ratio compared much more closely to loss of visual function, than the intraocular pressure measurement.

The use of the optic cup to disc ratio as a screening method has been minimised due to criticism of inter-observer variation in making the assessment. Litcher [30] discusses the variability between expert observers, making observations of the optic disc in the diagnosis of glaucoma. The study looks at the cup to disc ratio measurements, as well as other disc changes in patients with glaucoma. This article gives the historical development of the understanding of disc changes in relationship to glaucoma. The optic discs examined in the study were examined both stereoscopicly, as well as non-stereoscopicly. The accuracy of cup to disc measurement as opposed to pallor of the disc was found to show more agreement between the observers. The non-stereo view of the pallor and cup to disc ratios were found to be more consistent than the stereoscopic views. Reliability of measurement was greater with the vertical cup to disc ratio than the horizontal ratio.

Wood and Bosenquet [31] found that the use of direct ophthalmoscopy in the screening of glaucoma was limited. In a study of 34 ophthalmologists using direct ophthalmoscopy in the diagnosis of glaucoma, they found that 40% failed to recognise early and moderate cases of glaucoma. It is suggested that the cause for this degree of inaccuracy is due to poor visibility of the optic disc, since it is a movable target. The implication of the article is that assessment of optic disc must be used in conjunction with other testing

methods for glaucoma.

The practical accuracy of assessing the optic cup to disc ratio was shown by Foster and Wormald et al. [16] who measured the inter-observer agreement between two ophthalmologists, a medical doctor, and a nurse in Ghana, West Africa. They used measurable criterion for assessment, and compared their agreements with kappa statistics. (This statistic is described in chapter 3). The agreements between them were found to be reliable, and a useful measure in the assessment of chronic glaucoma.

Masinde et al. [32] at the International Centre for Eye Health compared the estimation of cup to disc ratio by 14 ophthalmologists and two paramedics. They were given one hour of instruction on the assessment of the vertical cup to disc ratio. They were then asked to independently assess the cup to disc ratio of 100 non-stereoscopic retinal photographs. They had to determine whether the disc was either normal or abnormal. Inter observer agreement was measured using kappa statistics. The two non-ophthalmologists were the only ones that showed poor agreement. All of the others showed good to excellent agreement. The test was done again one week later and only one observer showed poor agreement on this occasion. The most frequent disagreement was over disc that had a cup to disc ratio of 0.5.

The cases of glaucoma seen in Africa usually present late enough in the disease process to make the disc changes obvious. This means that the accuracy of detecting later cases should be better than Wood [31] experienced. This is verified by the inter-observer studies that have already been mentioned and the results of this study in Sierra Leone.

Foster and Johnson [17] review diagnosis of open angle glaucoma made by doctors and medical auxiliaries, particularly in developing countries. The aim of the paper is to define the important signs which would allow these workers to screen for glaucoma cases. These are as follows:

1. optic nerve damage
2. intraocular pressure
3. visual field testing
4. visual acuity measurement

Visual field testing was considered difficult, and not practical in most rural settings of the developing world. Nerve damage was assessed by the optic nerve appearance which included the cup to disc ratio vertically, the pupillary response to light, and the swinging light test. The intraocular pressure was thought to be best measured by Schiotz tonometry, in view of cost and practice needed in using the instrument. For ophthalmic paramedical level of health care worker it is suggested that the intraocular pressure be considered abnormally high when the reading on the Schiotz scale with a 5.5 gram weight is 2 or less (29 mmHg or more). A reading of 3 or above (24 mmHg or less) should be considered a normal level of intraocular pressure. It is pointed out, however, that intraocular pressure alone, is not a reliable measure of glaucoma, since some patients seem to be able to withstand pressures above 30 mmHg without loss of function, and others are found to have established glaucoma with pressures below 22 mmHg. This article discusses the management of glaucoma in developing countries and suggests that in view of the cost of medications and the poor follow up, that surgical intervention (trabeculectomy) is the first line of treatment in most patients.

In summary Foster and Johnson [17] recommend that training for the screening and diagnosis of glaucoma include:

visual acuity measurement
Cup to disc ratio assessment
Schiotz tonometry
swinging light reflex test

Routine examination of patients at risk of developing glaucoma should be performed. These include those over the age of forty and those with a positive family history of glaucoma. Patients with abnormal findings should be referred to an eye specialist for further investigation. These include:

unexplained loss of visual acuity
cup to disc ratio of 0.6 or greater
any other finding suggesting pathological cupping of the disc
an abnormal pupil light response
an intraocular pressure greater than 28 mmHg

It is believed that these measures will facilitate early detection of glaucoma and greatly reduce the numbers of people who go blind unnecessarily from this disease.

2.4.3 CORNEAL BLINDNESS

The causes of corneal blindness in Africa can be divided into those which effect adults and those which effect children. Prevention in this area focuses on these causes. Corneal grafting is impractical and largely unsuccessful in the context of rural Africa today, therefore, control of

blindness from corneal disease is focused on the prevention of disease leading to bilateral corneal scar. [33]

Among adults the major cause is trachoma. While the active disease is most frequent in children the blinding disease from trichiasis and subsequent scarring is found in adults, especially, women. Prevention is aimed at two areas. The first is to reduce the pool of active infection in the community, by improving living conditions, encouraging face washing and treatment with tetracycline ointment. The second is to prevent blindness from trichiasis by performing lid rotation operations, so that corneal damage will not result.[34,35,36,37]

In children corneal scarring is often associated with measles which may lead to corneal damage from xerophthalmia and harmful eye practices. [38,39] Ophthalmia neonatorum is also a cause of neonatal corneal blindness. [40] Foster [41] in a review of childhood blindness world wide notes that corneal scarring is the major cause of childhood blindness. It is noted that the results of measles and related pathology is one of the major reasons.

In Sierra Leone corneal scarring is a major cause of blindness. Stilma [4] in the review of patients attending the Lunsar Eye Hospital found that of the patients who were blind 5% were from various corneal opacities, and a further 3% from measles keratitis, and 3% from trachoma. This makes a total of 11% of the blindness being due to corneal causes. Most of these are preventable with better health teaching and early detection of the causes.

2.4.4 ONCHOCERCIASIS

Sierra Leone is one of the endemic areas of West Africa for onchocerciasis. The use of Ivermectin drug therapy in the treatment of onchocerciasis is revolutionising the control of this disease. Its widespread use in Sierra Leone has come since the initiation of this study. This change means that treatment can be given to those suffering from the effects of onchocerciasis, who may have otherwise gone blind. The ophthalmic nursing students at Lunsar have been involved in screening for onchocerciasis. Many of the patients included in this study had onchocerciasis.

The link between onchocerciasis and its vector Simulium Damnosum (black fly) was discovered by Blacklock [42] in 1927 in Sierra Leone. Conran and Conran [11] in a study of 1,993 person in the Tonkolili District of Sierra Leone found that 53% of the persons observed were skin snip positive, and of those that were indigenous to the area, and over 25 years of age, 85% were infected. In a survey by Mills [43] of four villages surrounding Lunsar in Sierra Leone, 48% of the 1,390 persons showed signs of onchocerciasis. In a review of 7,286 new patients coming to the Lunsar Eye Hospital in 1981, Stilma and Bridger [4] found that 762 persons (11%) were blind, and of this number 30% were blind from ocular onchocerciasis.

The disease process in onchocerciasis and the eye findings have been described by Buck [44]. In Ghana a study of 302 patients by Berghout [20] describes the ocular findings in patients with onchocerciasis who were skin snip positive. These include glaucoma, often found at an early age, microfilariae in the anterior chamber, keratitis, iritis, and iridocyclitis. There are also corneal lesions, cataract and chorioretinitis. In the posterior

segment, often optic atrophy and classic Ridley fundus were noted. This study also noted an unexpectedly high prevalence of glaucoma among young people.

Thylefors and Duppenthaler [10] conducted a study of intraocular pressure in an onchocerciasis endemic area. The study found that the intraocular pressure among those not infected with onchocerciasis or with only minor eye signs, which were reversible, had normal pressure distribution. Patients with irreversible onchocercal ocular lesions, however, showed lower and abnormally distributed intraocular pressures, but the prevalence of glaucoma in this group was also higher. In the discussion of these findings, it is suggested that anterior uveitis in onchocerciasis is probably the cause of secondary glaucoma. More males in this study had glaucoma with onchocerciasis, and the glaucoma associated with severe ocular lesions was found to be greater at a younger age in males. The finding of low intraocular pressure in eyes with severe onchocerciasis was considered to be caused from atrophy of the ciliary body, and therefore, a decrease in the production of aqueous. All of the articles on onchocerciasis in West Africa note that it is a major cause of both morbidity and blindness. It is generally recognised that the effect of onchocerciasis involves many different parts of the eye, and its effects are devastating. It is a major cause of blindness in Sierra Leone and in other parts of West Africa. With the use of Ivermectin a once devastating disease can now be controlled and blindness prevented.

2.5 MANPOWER

2.5.1 RESOURCES

The problem facing eye care in Africa today is who will give the needed eye care and develop the needed eye services in the rural communities? There are an estimated 6 million blind people in Africa today, 3 million of which are blind from operable cataract. There is however only one ophthalmologist for every one million people. Surgery is only provided for about 10% of the new cataract cases without touching the "cataract backlog". In comparison there is one ophthalmologist for every 20,000 people in the United States and western Europe. [45]

Steinkuller [46] discusses the development of programmes to address the eye care needs at the community level. In his opinion much of the work designed to develop community eye health has often met with failure, due to a variety of reasons. There has been progress where eye care training has been given to existing health care workers from other branches of primary health care. He also discusses the vast lack of eye trained personnel. He refers specifically to the lack of ophthalmologists and ophthalmic nurses in the rural areas where 80-90% of the population live.

The ophthalmic care in Sierra Leone is provided by 4 ophthalmologists and a few ophthalmic nurses. Most of the ophthalmic needs of this countries are not met. Many people come to Sierra Leone from neighbouring Guinea as well, where the prevalence of blindness is high and eye services scarce. Patients usually come from this country with very advanced ocular disease.

2.5.2 TRAINING

There are only 15 centres in sub-Saharan Africa which are training ophthalmologists. Fifty graduate from these programmes, with 20 of these being from Nigeria. There are insufficient surgeons being trained to meet the eye needs of most of the African continent. There is a critical need for the training of ophthalmic paramedics to carry out diagnosis and basic eye care treatment, as well as to further train selected paramedics in cataract surgery. [45]

There have been few studies to evaluate the results of ophthalmic assistants in Africa. The only study documented is by Whitfield [47] who looked at cataract surgery performed by ophthalmic clinical officers compared with ophthalmologists in Kenya.

Training in medical care in many developing countries in recent years has increasingly focused on community level and rural clinic health care workers. The reason for this focus is that in many of these situations the ratio of doctors and nurses per capita is very low. Most specialists and doctors live in the cities where salaries are higher, living conditions are more acceptable and better educational opportunities are available for their children. Pizzarello [48] speaking on the experience of Helen Keller International (HKI) says:

> "For patients to benefit from improved health care there must be a transfer of information to the worker who will provide that care. The information may be quite simple

> or may require a transfer of complex skills. This process is generic to all of medicine, and eye care is no exception. Advanced training in ophthalmology usually involves the ophthalmologist as the dispenser of care. This model is predominant in the West and certain developing nations. However, the emphasis on primary care in the developing world has necessitated the incorporation of nonphysician health care providers into the scheme of eye care delivery." [48]

Pizzarello continues by describing some of the essential components to the development of effective eye care programmes. Good planning based on a working knowledge of the local people and area is essential. Training must be given to local health care workers which is applicable and appropriate to their situation. To achieve this, the content to be learned must be presented simply with training materials. These must be carefully designed and tested for the level of worker that the material is targeted for. He points out the valuable role that private voluntary organisations have in developing such programmes.

Johnson and Foster [49] give a brief history of the development of training for various levels of eye care workers to meet the needs of rural areas of the world where there are very few ophthalmologists. The training of ophthalmic clinical officers was introduced to Kenya in 1954, where today there are 110 trained officers working throughout the country. Some of these have been trained as cataract surgeons. In Malawi similar training was begun in 1969, and more recently in Tanzania, Sudan, Bangladesh, and Nepal. The emphasis in all these programmes is toward meeting the ophthalmic needs of populations which have limited resources and little or

no eye care services available. The paper discusses eye care implementation at three levels. The primary level is basic knowledge of eye care and is integrated with the existing primary health care. The secondary level is at district or regional hospitals where in most cases, especially in Africa, nurses or clinical officers are trained to provide eye care. These people are usually full time eye workers who carry out a level of service normally provided by a doctor with eye training. The tertiary level of care is given at the major referral centres at large city hospitals by ophthalmologists for the treatment of the more complicated eye problems. Some of these centres have residency programmes in ophthalmology.

Ophthalmic nursing is a secondary level of training. Forty years ago a two year programme for nurses was begun in Bamako, Mali. More recently in West Africa a new programme for nurses was begun in 1989 in Accra, Ghana. The latest training programme to be developed in Africa is in Sierra Leone from where the present study has been carried out. [49]

In 1984 World Health Organisation produced guidelines, Strategies for the Prevention of Blindness [2], to be used in the development of eye services. In this document the primary, secondary and tertiary levels of eye care are described with the recommended functions for each level. The document deals with the major causes of blindness and recommends the needed training, skills and equipment required at each level for the control of these diseases.

In 1988 a workshop organised by the World Health Organisation in Accra, Ghana, [50] studied the question of manpower development for preventing blindness in Africa. Those attending were policy makers and programme

planners in the prevention of blindness from across the continent. In the report of the workshop is a summary of the eye care needs in Africa, as well as the workers, training and eye care facilities which are available. The three levels of health care workers are described as primary, intermediate and tertiary. In this document the job descriptions, training requirements, and equipment needed, as well as the clinical supplies are described in detail for each level. Details for the training periods, material to be taught, and skills to be mastered for each level is included. A summary for each of the main training locations in Africa is included in the document. The Lunsar, Sierra Leone programme is mentioned as well. Some of the conclusions reached in this workshop were, that the gross lack and maldistribution of ophthalmologists on the continent required the training and equipping of secondary levels of eye care workers to carry out many of the functions normally done by ophthalmologists in the developed countries.

> "It is emphasised that the ophthalmic assistant is the key person in providing eye care services in rural Africa. The ophthalmic assistant acts as the link between patients with eye problems in the villages and the ophthalmologist in the referral centres."

There is need for additional training programmes which focus on the acquisition of clinical and practical skills. West Africa is cited as an area of particular need in this regard. Stress is placed on the need for governments in Africa to recognise this level of health care worker, and to combine efforts with the available non-governmental organisations which are involved in this type of training.

2.5.3 AVAILABLE TRAINING MATERIALS

Training materials for use with the intermediate level of workers is limited. Most of the present training in many places is done by ophthalmologists or ophthalmic nurses who have developed their own materials for those whom they train. In the past few years, however, there is an increasing volume of printed materials available, which are appropriate to situations such as rural West Africa.

The World Health Organisation Programme for the Prevention of Blindness has developed several documents either on control of specific diseases or on programme design for eye health services and training. Individual expert committees report on specific diseases, including: Cataract [15], Trachoma [37], Onchocerciasis [44], Xerophthalmia [51] and childhood blindness [52].

"Eye Diseases in Hot Climates" [36] is a text which has been prepared for use by intermediate (secondary) level of eye health workers. It is an excellent resource for use in training. It deals with many of the developing world and tropical eye problems which are either omitted or only briefly discussed in general ophthalmological texts.

"Hanyane" [53] is a book designed to be used in training primary and secondary level health care workers. The first section of the book primarily discusses community aspects of eye care and is presented in story form. The second and third sections are in lecture note form to be used in teaching. The second section is largely for the primary eye care level given by community health workers. The third section is for the ophthalmic assistant / nurse for

use at the secondary level of eye care. The material is presented in a simple manner to make it understandable for those for whom English is their second language. This text was the primary source used for training the Sierra Leone ophthalmic nurse students, though at that time most of the material was still in manuscript form. The other texts mentioned above were also used.

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CHAPTER 3

METHODS AND MATERIALS

3.1 HOW STUDY RELATES TO TRAINING COURSE

This was the first ophthalmic nurse training course to be conducted in Sierra Leone. The Prevention of Blindness Committee of Sierra Leone initiated the course to provide paramedic ophthalmic workers in different locations throughout Sierra Leone. Their goal was to make eye care services more available to the people. There was a need to evaluate the effect that such a course would have on patient care when this intermediate level of eye care worker is used (reference 1988 WHO workshop in Accra [1]). The aim of this study was to assess each student's ability to perform specific key skills and judgments taught to them and used by them in giving patient care. This assessment provides a base line for use in planning and evaluating similar training programmes in the future in this area of the world. It indicates the effectiveness of the training programme in preparing the students for their future role in eye care.

3.2 STUDENT PROFILE

Ten students who were previously trained as state-enrolled nurses (SEN), with no previous ophthalmic experience, attended the 9 month ophthalmic nurse training course conducted at the Lunsar Eye Hospital. The students spent a further 12 months as interns before being sent to work alone. This was the first course of its kind to be offered in Sierra Leone. All the students had been trained in Sierra Leone at the same programme for training state-enrolled nurses. Nine of the students were males, and 1 female. They all worked in community health and rural clinics since the time they finished their basic nurse training. All of the students were similar in age from the mid twenties to early thirties. Each student saw an average of 38 patients,

with an individual range from 25 to 62 patients. During the training programme, many more patients were seen by each student, but due to the workload of the Hospital, only the above numbers of patients have comparison data with the standard observer for evaluation.

3.3 ETHICAL CONSIDERATIONS

The study proposal was submitted to the ethical committee of Moorfield's Eye Hospital, London, for review. Approval to carry out the study as planned was granted. Prior to the study, after consideration of the ethical implications involved, the medical committee of the Lunsar Eye Hospital also gave its approval.

These ethical considerations involved the regard for the patient's dignity, safety and right to decline involvement in the study. This was especially relevant for those patients who were blind and could not be treated, but were needed in the study to determine the nurses ability to differentiate between treatable and non-treatable blindness. A written consent form from the patient was not considered necessary as the procedures to be studied were already being performed by nurses at Lunsar Eye Hospital, where the study was done. These procedures which are a regular part of the examination for patients coming to the hospital were done by the students under careful supervision by an instructor until the student demonstrated sufficient accuracy and reliability to carry out the procedures safely alone. At all times an instructor was close by and monitoring student care of the patient. Particular attention was given to the measurement of intraocular pressure so as not to cause injury to a patient's eye or the eye of another student while learning to perform this procedure.

Each procedure was explained to the patient before carrying it out. All patients with treatable conditions were channelled through routine procedure at the hospital, where appropriate treatment was given. Any patient seen by a student was also examined by the eye doctor.

3.4 TRAINING

3.4.1 TIMETABLE OF TRAINING

April - May 1989	1st module of classroom training *(data collection form and patient flow through clinic was tested with students and 50 patients)*
May - July 1989	1st clinical attachment *(students 1-5 evaluated at Lunsar)*
August - October 1989	2nd clinical attachment *(students 6-10 evaluated at Lunsar)*
November 1989	2nd module of classroom training *(evaluation of students 1-10 continued during daily clinic time)*
December 1989	Final exam
January - September 1990	Internship *(data entered into computer, analysed and document prepared)*

The ten nurses in this study were given ophthalmic training in three settings. Introduction to ophthalmic care and skills was given in the first six weeks of the course. This was largely done in a classroom setting, but did include some practical time each day in the clinic. The material covered

basic anatomy and physiology of the eye; causes, diagnosis, and management of eye disease; and fundamental diagnostic skills. The book most used in teaching these topics was *"Hanyane - A village struggles for eye health"*.[2] Toward the end of this six weeks the data collection forms, patient flow through the clinic and procedure for the study were tested with the students in the clinical area. The students made suggestions for changes to the form and patient flow through the clinic. On the basis of their input revisions were made.

During the following six months each student was assigned rotations through various aspects of eye care. These included outpatient clinic, hospital ward, operating theatre and the mobile eye care outreach. This time comprised the bulk of the clinical training.

Another six week block of classroom instruction preceded the final exam and nine months of internship. In this second six weeks of instruction, the students studied the implications of eye disease on the community and discussed ways of preventing blinding disease at the community level. Each student took part in conducting a short community based survey in a local village. Another section included training methods and the preparation of training materials. A review of essential principles, information and skills followed by the examination concluded this section of the course.

In the subsequent nine months each trainee worked under the supervision of an ophthalmologist at a clinic, or eye hospital. During this period each one gained further practical experience in both clinical care and management. At present all have graduated with satisfactory performance and have taken up positions in needy parts of the country to promote eye health and treat or

refer patients with eye disease to one of the ophthalmologists in the country.

3.4.2 OBJECTIVES OF TRAINING

1. The student should learn and understand after each class the theory, rationale and safety considerations for the ophthalmic skills and judgments to be practised.

   This includes learning basic physical principles of the instrument being used, why this particular procedure should be used, and when and how to use it. The student is warned of any risk to the patient which may be involved. Care and maintenance of the equipment being used is stressed.

2. Each student should be able to demonstrate each procedure and give a basic interpretation of the results before practising in the clinical area.

3. Each student should have practical experience with each procedure.

   i) Practice with fellow students under close supervision of an instructor in a specially set up environment.

   ii) Practice with patients in the clinical situation to improve their ability. Close supervision is maintained at first, but reduced depending on the reliability and competence of the student.

3.4.3 METHODS OF TRAINING

The theory, rationale and safety considerations of each procedure with a demonstration by the instructor was taught in the classroom. This was followed by observation of patients in the clinical area and supervised examination of patients by individual students. Group discussion of interesting cases and particular problems was ongoing throughout the training period. Students were encouraged to make suggestions for improving the learning process and where possible changes were made to classroom training and practical experiences. Frequent group and class discussion was initiated.

3.4.3.1 Classroom teaching

Classroom facilities were basic but the use of overhead projection and slides were available. As much as possible, training was carried out in the classroom with graphic illustration of each area of study. Flow charts were commonly used to aid the teaching of diagnosis and treatment, as well as the effect of disease on the community. Many of these have been adapted from tables and illustrations in the book '*Hanyane*' [2]. Other texts used were 'Eye Diseases in Hot Climates' [3] and several of the WHO special reports, such as onchocerciasis [4], trachoma [5], xerophthalmia [6]. The slide sets that were used came from several sources. These sets have been especially prepared for the training of health workers by WHO, International Centre for Eye Health, in London, Teaching Aids at Low Cost (TALC) and Helen Keller International. The sets covered a range of commonly seen diseases in tropical and developing countries. Materials from the listed resources were

compiled for this training programme by the instructors of the course.
The instructors consisted of one ophthalmologist, one eye doctor, two ophthalmic nurses and various external lectures who visited periodically. An ophthalmologist from The Gambia was the external examiner for the course and made periodic reviews of the progress being made by the students.

3.4.3.2 Practice of Skills

The practical skills that the students learned were practised with one another as far as possible, before they were allowed to use the skill with patients. This was done under the supervision of an instructor, and each student's progress was monitored carefully.

3.4.3.3 Clinical Experience

The majority of the students' practical training was in the clinic where they were given an opportunity to observe and develop the skills that they had been taught. The staff at the hospital were a valuable asset to the students by providing opportunities for experience and frequently giving guidance with problems of patient care. Supervision by an instructor was maintained on a one to one basis until a student demonstrated safety in examination and treatment. At any time that the students were in the clinical area, an instructor was close at hand. The diagnosis and treatment of every patient was double checked by a member of the clinical staff as well.

The variety and volume of pathology at this hospital provided students with extensive learning opportunities.

3.4.3.4 Role Play

Role play was frequently used during the training time [7,8]. We found the students to be excellent actors and utilised this ability in teaching. It was particularly useful in explaining community types of situations where the psycho-social aspects of eye health and treatment are important. A clinical or community situation was acted out by one or two people in front of the class. The instructor then asked the class to describe what they had seen and dialogue was then developed about the situation and changes that could be made or strengths that were observed. We found this to be a particularly effective way of teaching in this situation as it often brought out cultural aspects of the community that we were unaware of. It provided the instructor with feedback from the student as to what was being learned. Perhaps the greatest advantage was the class participation in the learning process that it stimulated.

3.4.3.5 Group Clinical Approach

In the context of the students training at Lunsar Eye Hospital, we found that the students learned well from evaluating a patient, then presenting the case history to the class for discussion. This approach seemed to stimulate accuracy in observation. It produced some positive pressure from peers and plenty of class participation which was productive in arriving at accurate management of the patients.

This method utilised the clinical time to its fullest without undue patient disruption in the clinical area. The students were divided into pairs or groups

of three and one or two patients were assigned to each group. They were given the results of the patient's visual acuity, tonometry and skin-snip results. Together, the group examined the patient with each member having an opportunity to look at the patient briefly. They wrote down the relevant aspects of the patient's history, and discussed the treatment or referral that they thought would be relevant for this patient. After the clinical time, each group had an opportunity to present to the class the patient's history and the management that they thought was appropriate. The class then discussed the decision of the group with occasional input from the instructor to guide the discussion. Any salient points of management or diagnosis that were overlooked by the group, were quickly pointed out by the members of the class who became constructively critical in their analysis of the patient management. We found this to be an excellent tool in stimulating accuracy in recording patient history and developing proper management skills.

3.4.4 AREAS OF TRAINING

Training was carried out with the students at two levels.

1 *Examination and treatment (that can be given by the student in the clinic) are clinical skills.*

2 *Diagnosis and patient management (decision whether to refer patient, give treatment himself or do nothing) are clinical judgments.*

For the purpose of this study I have limited the discussion of these to the areas listed below, though other diagnostic and treatment skills were taught

to the students. These areas of consideration have been selected as the most important in the detection and control of the common blinding conditions in Sierra Leone. (For further discussion see chapters 2 and 5.)

Each student had identical visual acuity chart, torch, tonometer and ophthalmoscope with which to examine the patient.

3.4.4.1 Clinical Skills

3.4.4.1.1 Visual acuity

The standard for testing visual acuity used throughout this study was the World Health Organisation (WHO) grading system for visual acuity. (fig.2.1) A modified Snellen 'E ' chart was used as many of the patients could not read. Often the patient was having his/her vision tested for the first time. Frequently the patient spoke a different language to the one doing the examination. The procedure, therefore, required much more than simply having a patient read the letters on a chart. The experience was often frustrating for the patient and exasperating for the examiner.

The students were given an explanation of the Snellen chart's function. This included the distances at which to use the chart, the letter sizes, and the significance of the results. The importance of this test was stressed, as this was the base line for the eye examination and treatment of the patient. Since there was a language or literacy barrier to obtaining good results in this test, patient teaching was essential. The chart was placed six metres from the patient where it could be seen clearly in good light. A large plastic or cardboard 'E ', similar to the printed ones seen on the chart was handed

to the patient. This was used to explain to the patient what he/she was to look for on the chart. It could be used by the patient to indicate the direction in which the 'E 'on the chart was pointing as the test was being done. The patient covered one eye at a time while testing the other eye. The patient indicated the direction in which the open ended lines of the 'E ' pointed. This was done for each eye starting at the largest letter 'E ' to the smallest letters that the patient could read. The student verbally encouraged the patient as he/she progressed with the test. Double checks on the results were made periodically to insure that the patient was not just guessing or not understanding. If the patient had insufficient vision to see the chart, then the examiner moved metre by metre closer to the patient, holding up differing numbers of fingers for the patient to count. If the patient could not count the fingers (CF metres) at any point, then a hand was waved in front of his/her eyes (HM or hand movements vision). If this failed, a torch was shone into the patient's eyes to try and determine if the patient had any perception to light (PL). The visual acuity was then documented for each eye by recording what was seen and the distance at which the best vision was achieved.

The skill was taught with classroom demonstration followed by the students practising with one another. Each student observed and then practised taking visual acuity with the patients in the clinic.

3.4.4.1.2 Intraocular pressure

The nursing students were trained to measure intraocular pressure using the Schiotz tonometer. This was considered the most appropriate method of tonometry for this situation. Each student was given a new standard Keeler

tonometer. Instruction was given on the theory of tonometry and the method in which the schiotz tonometer measures intraocular pressure. A demonstration of how to dismantle, clean, reassemble the tonometer, and to check its accuracy was shown to the students. Cleaning and disinfection of the instrument was performed with ether. The instrument was standardised with the metal stand supplied inside the tonometer case. An opportunity to handle, dismantle, and reassemble the tonometer was given. Each student was assisted until he/she was comfortable with the use of the instrument.

Students were cautioned that patient's eyes with staphylomas, acute redness, pus, trauma, corneal ulcers or foreign bodies, were not be tested. Children and patients who were uncooperative were also excluded. The whole procedure and its purpose were explained to the patient before beginning. The student was then given a demonstration of tonometry.

A drop of 1% amethocaine topical anaesthetic was put in the eyes a few minutes before the procedure was done. The patient laid down looking up at the ceiling with the patient's thumb raised above his face about 18 inches, giving a fixation point so as to keep the eye still while the procedure was being done. The patient was instructed to fixate on his thumb with the eye that was not being tested. The student kept his instrument and hands out of the line of vision of the eye which was fixating on the thumb. The patient was encouraged at this point to relax and cooperate with the examiner. Having made these preparations the eyelids were gently drawn back with the thumb and first finger against the orbital bones, so as not to increase intraocular pressure. The tonometer was carefully placed on the patient's cornea when the eye was no longer moving. The weight of the tonometer was allowed to gently rest on the centre of the cornea. The student was

taught that the sliding finger hold should move freely up and down on the shaft of the tonometer. At this point a reading on the scale was taken. If some pulsation of the cornea occurred, an average reading of the oscillation was taken. If the patient began to move his eye, the tonometer was removed from the cornea so as not to cause injury and the procedure was restarted when the patient had control again. After the procedure the patient was instructed not to rub his eye and avoid any possible source of injury to the eye while the anaesthetic was still in effect.

The actual reading on the tonometer scale (e.g. 3) was recorded as well as the calculated reading in millimetres of mercury (mmHg). If the reading, was at zero then more weight could be added in 2.5g increments to increase the initial loading weight of 5.5g, and get an appropriate scale range. A reading of 2,1 or 0 (28 mmHg or higher) on the tonometer with a 5.5g loading weight was to be considered abnormally high. The patient was to be suspected of having glaucoma and referred for further investigation.
After each use the instrument was carefully cleaned and disinfected with ether. Instructions were given that the ether must be fully evaporated before the tonometer was used on another patient.

First the students observed the procedure, then practised on the calibrating block. With supervision they carried out the procedure first on each other, then, with the assistance of one of the instructors, on a patient. When sufficiently competent they measured pressures alone.

3.4.4.1.3 Observation of cataract

The recognition of cataract was taught by having the student observe the

patient's pupil. The guideline was that if the pupil was black the eye did not have a cataract. If the pupil was white or grey then there was a cataract. They learned that an early cataract is visualised more readily by using the ophthalmoscope and observing the red reflex of the retina through the pupil. Lens opacities show up as dark areas against the red background. This procedure involved the simplest use of the ophthalmoscope, and therefore, an introduction to the use of this instrument was given. This confirmed the presence of cataract

Differentiation between a central corneal scar, or more rarely a retinoblastoma and a cataract were demonstrated with slides. Wherever possible the differences were shown to the student in the clinic with patients.

3.4.4.1.4 Cup to disc ratio assessment

Proper use of the ophthalmoscope is essential for this skill. Each student was given a new Keeler Medic ophthalmoscope. The theory, use, and care of the ophthalmoscope were discussed in class followed by a demonstration. Students were given time to practice looking into one another's eyes with help until they could see the retina and optic disc. This often took several attempts.

Once the student learned to focus on the optic disc, instruction was given to determine the cup to disc ratio. This ratio was described as the ratio of the vertical diameter of the cupped area of the optic disc to the total vertical diameter of the disc. Pallor of the cup and deviation of the vessels going into the optic disc give a guide to the edge and depth of the cup. With pathological cupping, the vessels are often pushed to the nasal side of the disc. Most importantly the student had to be able to distinguish between a

ratio that was greater than 0.5 and one that was 0.5 or less. They were instructed that if the ratio of the cup to disc diameter was over 0.5, the result was to be considered abnormal and the patient suspected of having glaucoma and to be referred for further investigation.

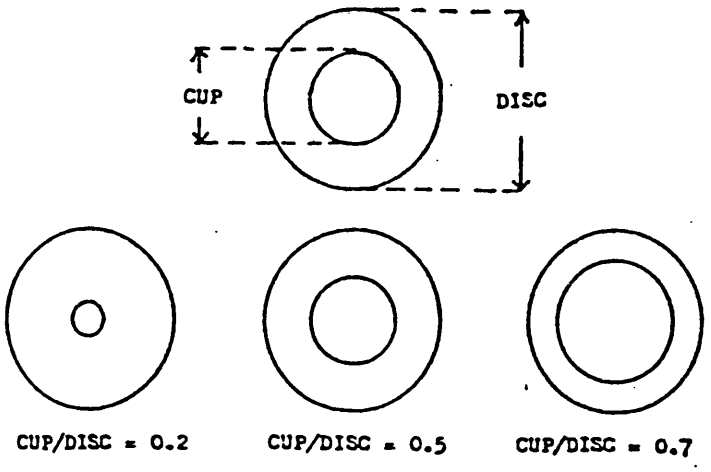


Fig. 3.1

In order to estimate this ratio, a slide set of various normal and abnormal discs were shown to the class. Each student wrote down what he thought the ratio was for each slide. The slides were reshown and compared with a standard. The results were discussed. To gain practice the students were encouraged to look at the discs of every patient they examined. The instructors were often able to show examples of abnormal discs as many patients come to Lunsar Eye Hospital with already advanced glaucoma.

3.4.4.2 Clinical Judgment

Clinical judgment in this study was defined as the decision making process that a student must learn to follow, to determine whether to treat the patient, refer to a specialist, or that the condition was not treatable. The

student's judgment was based on the findings of his/her examination of the patient and interpretation of the results. Flow charts were frequently used in teaching this process. (see fig. 3.2)

The use of the flow charts to arrive at a diagnosis or management decision was taught in class with clinical examples and case histories. Our aim in this section of training was that the student made the correct clinical decisions regarding management of the patient. While an accurate diagnosis by the student was hoped for, the correct management of the patient was most important, regardless of the diagnosis. The study was therefore designed to measure clinically significant differences in the student's management of the patient compared to the eye doctor's decision. In cases where eye conditions were compounded by multiple factors. The actual cause of the problem may not have been detectable with the instruments available to the nurses, but a decision could be made as to the need for primary treatment and/or referral, based on the findings of the tests that the nurse could do.

Practice in the clinical area with an instructor was essential for teaching these skills. The student examined a patient, with the instructor observing, then made a decision as to the diagnosis and management of the patient's eye condition. The instructor then discussed the decision with the student, pointing out aspects that may have been over looked by the student.

A more detailed discussion of the criteria for making these decisions is included in chapter two and under design of the study. The text, "*Hanyane*" used in the training course, has detailed descriptions, illustrations, and tables from which most of these criteria have been taught. [2] The following judgments have been chosen for this study.

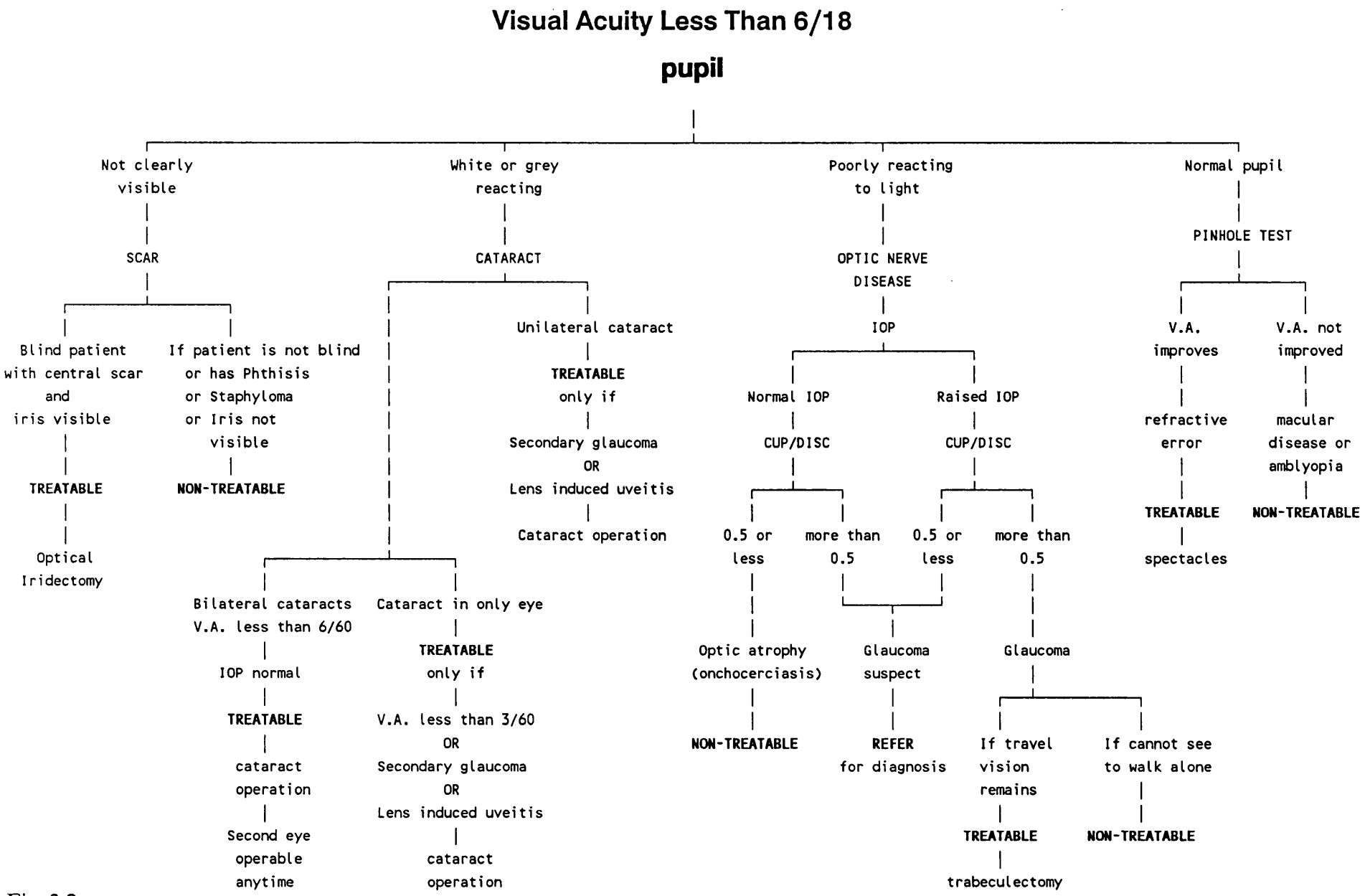

Visual Acuity Less Than 6/18
pupil
Not clearly visible
White or grey reacting
Poorly reacting to light
Normal pupil
SCAR
CATARACT
OPTIC NERVE DISEASE
PINHOLE TEST
Blind patient with central scar and iris visible
If patient is not blind or has Phthisis or Staphyloma or Iris not visible
Unilateral cataract
IOP
V.A. improves
V.A. not improved
TREATABLE
NON-TREATABLE
TREATABLE only if
Normal IOP
Raised IOP
refractive error
macular disease or amblyopia
Optical Iridectomy
Secondary glaucoma OR Lens induced uveitis
CUP/DISC
CUP/DISC
TREATABLE
NON-TREATABLE
Cataract operation
0.5 or less
more than 0.5
0.5 or less
more than 0.5
spectacles
Bilateral cataracts V.A. less than 6/60
Cataract in only eye
Optic atrophy (onchocerciasis)
Glaucoma suspect
Glaucoma
IOP normal
TREATABLE only if
NON-TREATABLE
REFER for diagnosis
If travel vision remains
If cannot see to walk alone
TREATABLE
cataract operation
V.A. less than 3/60 OR Secondary glaucoma OR Lens induced uveitis
NON-TREATABLE
Second eye operable anytime
cataract operation
trabeculectomy

Fig. 3.2

3.4.4.2.1 Diagnosis of glaucoma

Diagnosis of glaucoma, in this situation, is based on[9]:

a. Abnormal cup to disc ratio (C/D ratio greater than 0.5)
b. Raised intraocular pressure (28mm or greater)
c. Decreased pupil reaction
d. Reduced vision

The decision for the diagnosis and subsequent management of the patient with glaucoma were dependent on the students' ability to perform the diagnostic tests correctly. The decision was then a matter of following a simple process of elimination such as the one described on the flow diagram (Fig. 3.2). The best learning was achieved by having the student evaluate a patient, make a decision and then receive immediate feed back from an instructor who had also examined the patient and could help the student re-evaluate the decision. Group discussion of a patient seen by two or three students was also valuable.

3.4.4.2.2 Distinguish treatable from non-treatable blindness.

The decision as to whether blindness was treatable or not was based on the facilities available at the Lunsar Eye hospital. This was the best available centre for tertiary eye care in the country. These criteria are briefly given in the flow chart and further explained under the section on grading criteria. Again the decision rested on careful examination of the patient with accurate interpretation of the findings. The methods of teaching and feed back were similar to those used for Training students to diagnose glaucoma.

3.4.4.2.3 Recommend the appropriate treatment or referral

The decision between giving treatment and/or referring the patient for further investigation, treatment, or surgery was based on the student knowing his/her limitations. Training in this decision process focused on defining these limits. These can be divided into groups:

1 Limits of medication - the patient needs a medication which the nurse either does not have or may not administer without consulting an ophthalmologist.

2 Limits of equipment - the patient needs further investigation requiring more expensive equipment which the nurse does not have.

3 Limits of referral facilities - there is no facility in the area or country to treat the problem.

4 Limits of training / knowledge - the patient needs a surgical procedure which cannot be done by the nurse, or the diagnosis and treatment are complex beyond the nurse's training.

5 Limits of government - the government restricts the nurse from giving the required treatment to the patient.

3.5 INVESTIGATION

3.5.1 DESIGN OF STUDY

At the Lunsar Eye Hospital a large volume of patients attend the out-patient clinic each year. Many of these are already blind when they come to the clinic for the first time. There is a wide variety of pathology seen among the patients who are treated there. These factors made this location ideal for giving clinical training and experience to the students and then to evaluate their progress. This study looks at the management of patients with many eye diseases, but only deals specifically with three of the major causes of blindness cataract, glaucoma, and corneal scarring. In Sierra Leone, onchocerciasis is one of the major causes of blindness. In this study, it was not dealt with separately as are cataract and glaucoma. The reason for this is that onchocerciasis affects the skin and other parts of the body, as well as the eye. In the eye it presents in several different ways. These include sclerosing keratitis, anterior uveitis and optic atrophy. Many of the patients who came to the hospital for treatment of onchocerciasis with Ivermectin had no ocular involvement. Once a person is blind from onchocerciasis , there is no treatment to restore vision. Onchocerciasis is not routinely diagnosed by the eye findings but by a skin snip test. Chronic glaucoma is associated with onchocerciasis. This relationship is discussed in chapter two. Since the pathways to blindness vary considerably, it was not feasible to study onchocerciasis as a single unit, but it is well represented in the patients seen by each student and their management of these cases. It must be noted that if the clinical skills and judgments taught to the students and evaluated in this study were accurately carried out the effects of

onchocerciasis would be recognised by the student. The students had extensive training in recognising and diagnosing onchocerciasis as far as it was possible for them without the use of a slit lamp, which was not available to them. They have been taught how to do the skin-snip tests for onchocerciasis. For the purposes of this study, however, they were given the skin-snip results for the patients, which they examined. They were well acquainted with the more recent treatment of onchocerciasis with Ivermectin. Each student was involved with the mobile onchocerciasis control programme which distributes Ivermectin. This programme was based at the Lunsar Eye Hospital.

3.5.1.1 Data collection form

A data collection form (see Fig. 3.3) was given to the eye doctor (the standard observer) for every patient seen by a student in the study. An identical form was given to the student. Both the eye doctor and the student saw the patient separately from one another, and filled out the form independently. This allowed for an independent assessment of the student's skills and judgments against that of the standard observer.

The form that was used for this study has been adapted from the WHO Prevention of Blindness Survey form. Some of the sections have been changed to meet the requirements of this particular study. The design of the form encouraged a systematic examination of the patients' eyes. The form will be discussed in the order that the sections appear on the form itself.

Fig. 3.3

A

Pt. No._____ Date_____/_____/_____ language _____

Name:_____ Age:_____ male ☐ female ☐ Town/Area_____

B VISION

	R	L
CAN BE TESTED: Can see 6/18	☐	☐
VISION: cannot see 6/18 can see 6/60	☐	☐
cannot see 6/60 can see 3/60	☐	☐
BLIND: cannot see 3/60	☐	☐
CANNOT BE TESTED: BELIEVED BLIND*	☐	☐
BELIEVED NOT BLIND	☐	☐

REFRACTION (optional)	R	L
Low vision or blindness improves with pinhole or lens to 6/18 or better	☐	☐

C INTRAOCULAR PRESSURE

	R	L
Tonometer reading	☐	☐
IOP in mm Hg.	☐	☐
NOT EXAMINED	☐	☐

E PUPIL

	R	L
Normal pupil	☐	☐
Grey or white pupil	☐	☐
Large poorly reacting pupil	☐	☐
Constricted pupil	☐	☐
Irregular pupil	☐	☐
Not clearly visible pupil	☐	☐
Afferent pupil defect	☐	☐

D FUNDUS

Cup/disc	R	L
0.5 or less	☐	☐
0.6 or more	☐	☐

F BASIC EYE EXAMINATION

	R	L
NO LISTED ABNORMALITY	☐	☐
ABNORMALITY (all which apply):		
EYELID Inturned margin/trichiasis	☐	☐
GLOBE Phthisical/disorganized/absent	☐	☐
CORNEA Central corneal opacity Pterygium (corneal)	☐	☐
LENS NO VIEW OF LENS	☐	☐
Obvious opacity	☐	☐
Aphakia	☐	☐

SCREENING EXAMINER REMARKS (All *'s):

SCREENING EXAMINER NO. ☐☐

G TRACHOMA

NO LISTED SIGN

SIGN OF TRACHOMA:

	R	L
TF	☐	☐
TI	☐	☐
TC	☐	☐
NOT EXAMINED	☐	☐

H PREVIOUS EYE SURGERY

NO EVIDENCE OF SURGERY R ☐ L ☐

TYPE OF PREVIOUS SURGERY:

	R	L
Eyelid	☐	☐
Cataract	☐	☐
Glaucoma	☐	☐
Couching	☐	☐
Other*	☐	☐
NOT ASSESSED	☐	☐

I CAUSES OF LOW VISION OR BLINDNESS

DISORDERS: (All which apply)

	R	L
Phthisical, Disorganised or Absent Globe	☐	☐
Refractive Error	☐	☐
Cataract	☐	☐
Uncorrected Aphakia	☐	☐
Trachomatous Corneal Opacity	☐	☐
Other Corneal Opacity*	☐	☐
Anterior Uveitis	☐	☐
Glaucoma	☐	☐
Optic Atrophy	☐	☐
Vascular Retinopathy	☐	☐
Chorioretinitis	☐	☐
Macular Degeneration	☐	☐
Other* _____	☐	☐
NOT EXAMINED	☐	☐

UNDERLYING CAUSES: (all which apply)

No listed underlying cause	☐	☐
Trauma	☐	☐
Congenital/Neonatal Factor	☐	☐
Onchocerciasis	☐	☐
Measles/Vit. A Deficiency	☐	☐
Surgical Procedure	☐	☐
Couching	☐	☐
Other* _____	☐	☐

J CURRENT ACTION NEEDED

	R	L
NO CURRENT ACTION NEEDED	☐	☐
ACTION NEEDED (All which apply):		
Eyelid surgery	☐	☐
Cataract surgery	☐	☐
Glaucoma treatment	☐	☐
Spectacles	☐	☐
Meditation	☐	☐
Other*	☐	☐

K MANAGEMENT

	R	L
TREATMENT	☐	☐
REFERRAL	☐	☐

TREATMENT SUGGESTED _____

SPECIAL EXAMINER No. ☐☐

A Patient information

This section gave the patient's hospital chart number at the Lunsar Eye Hospital. This was followed by the date that the patient was seen by the student and standard observer. Then followed the patient's language, home area, name, age and sex.

B Vision

The visual acuity grades were based on the WHO criteria (fig. 2.1). The visual acuity of each of the patient's eyes was entered in writing first. Then the examiner marked the box for the corresponding WHO category for each eye. Both entries were given because there was only one category for blindness on the form. The degree of blindness became critical when the correct management of the patient was being considered. For example, a glaucoma patient who no longer has travel vision would not be operated on, while a patient who still has travel vision would be considered for a trabeculectomy.

The section for refraction was just a pin hole test to see if the vision improved while looking through a pin hole.

C Intraocular pressure

Tonometry was given 2 entries for each eye. The first one, the actual reading on the tonometer scale (0, 1, 2, or 3 ...etc.) and the other was in millimetres of mercury (mm Hg).

D Trachoma

This section was based on the WHO grading for trachoma.[5] Trichiasis, however, was recorded in section *F basic eye exam.*

E Pupil

The pupil observation section was separate from the basic eye examination, because the students had been taught to use the visual acuity and pupil characteristics as a basis for further investigation, diagnosis and treatment (see fig. 3.2 the flow chart for diagnosis of low vision).

F Basic eye examination

This section recorded the examination of the patient's eye with the use of a torch alone. The examination began with the eye lids and progressed systematically in a anterior to posterior direction as far as the lens. Any abnormality was marked in the appropriate box.

G Fundus

The fundus examination was primarily to look at the optic disc and differentiate between a cup to disc ratio of 0.5 or less, or a cup to disc ratio greater than 0.5. This observation was made through an undilated pupil.

H Previous eye surgery

The information about previous eye operations was from the patient's verbal statement and included traditional as well as modern medical practices.

I Causes of low vision or blindness

The diagnosis and underlying cause, if known, were given in this section by marking the appropriate boxes. The space allocated for the screening examiner's remarks was used to record the skin snip results, indicating a diagnosis of onchocerciasis. This space was also used for any other remark that the student thought to be important in the examination.

J Current action needed

The action to be taken for the management of the patient was given in this section. When the patient was examined and no further action considered necessary, this was recorded in the first block of the "action needed" section. The lines at the bottom of the form, "treatment and refer", were for both the student and ophthalmologist on their separate forms to state whether the student should treat the patient or whether the student should refer the patient to an ophthalmologist. When treating, the student should have written the treatment that they thought was appropriate.

The number by which the student was identified was randomly allocated. The examiner number identified the standard observer.

3.5.1.2 Standards for Comparison

The standard observer eye doctor was the gold standard by which the students were measured. For example, if the eye doctor said that the patient had glaucoma, then this was taken to be the true diagnosis for the purpose of this study. For the measurement of visual acuity and intraocular pressure, the students were compared with two experienced technicians. They have been trained, and do nothing else but these two procedures for the patients routinely coming to the clinic. These technicians have worked at Lunsar in this capacity for several years. The ophthalmologists at the hospital periodically check the results of these technicians.

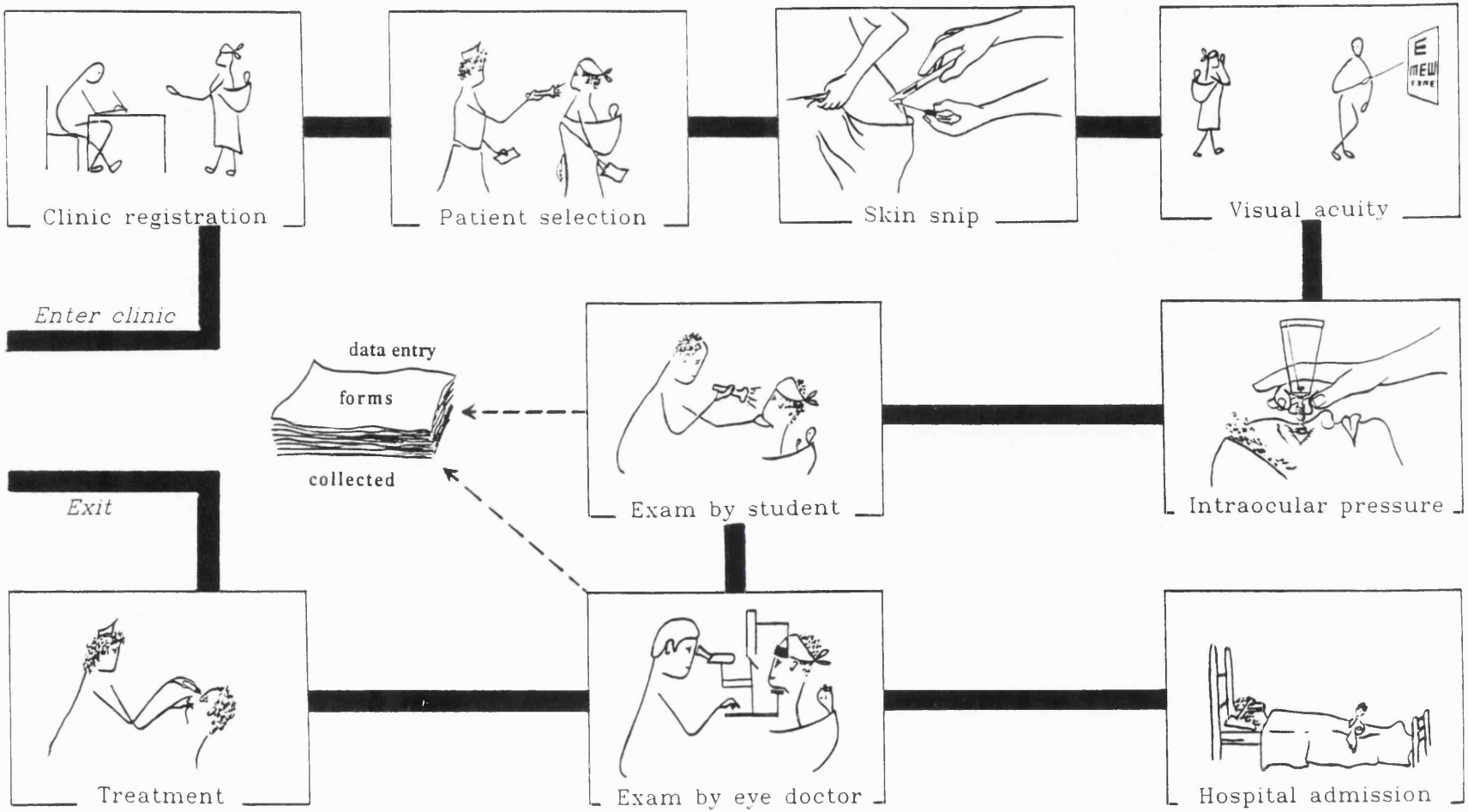
The comparison of the students was over a period of 9 months. During this time occasional holidays, heavy clinical loads and conflicting surgical schedules in the hospital, meant that some of the patients seen by the students were compared with a standard observer other than the eye doctor for comparisons of diagnosis and treatment. This observer was an ophthalmic nurse with 10 years of experience at Lunsar Eye Hospital. Many routine patients seen in the out-patient clinics were seen by her. The patients seen by this observer were 16% of the total number of patients seen by the students. This situation was not recognised in time to assess inter-observer variation between this observer and the standard observer.

3.5.1.3 Selection of Patients

The patients were drawn from all the out-patients who daily came to the Lunsar Eye Hospital for treatment. The selection of the patients was not done randomly, since it was the students' training that was being evaluated.

Fig. 3.4

Patient Flow Chart



From all out-patients, those with more severe eye problems, and especially those with blinding diseases, were selected by an independent nurse and referred for examination by the student and standard observer.

It must be noted that since most patients have two eyes, often there would be a normal eye and one eye with pathology or perhaps a different problem in each eye. Some patients had multiple eye conditions in one or both eyes. This meant that the students had a reasonable number of normal eyes which they were to examine without previous knowledge that they were normal. A very high proportion of the patients coming to this hospital was new cases who had severe visual loss or blindness on presentation to the clinic. While a selection of the patients was made for the students, it was noted from the patient numbers that many of them were consecutive numbers, indicating that much of the time there was no need to make a selection of patients, but to let the students take them in the order that they entered the clinic.

3.5.1.4 Patient Flow and Organisational Diagram

The patients selected for the study went through the clinic of the eye hospital as illustrated by the flow chart (fig. 3.4). The selected patients followed the flow of all patients coming to the out patient clinic through registration, skin snip test for onchocerciasis, visual acuity and intraocular pressure measurements. The selected patient's hospital chart was then sent to the standard observer with a form for the standard observer to fill in. The patient was then taken separately to another room by one of the students. All other patients went to be screened by a regular clinic nurse. The student repeated the visual acuity and intraocular pressure, and carried out the rest of the exam before sending the patient to where the standard observer was.

3.5.1.5 Control of Bias

Each student was given a randomly selected number from one to 10. The student's name was not known to the examiners or to the person entering the data. The forms had only the number that the student alone knew. Soon after registration, the patient was selected for the study by an independent nurse and then continued with all other patients for preliminary tests. The patient had a skin snip done, visual acuity and tonometry. These results were entered in the patient's chart, by the technician performing the procedure, and sent to the eye doctor (standard observer). The patient, however, went to see the student in another room, where the student did visual acuity and tonometry and entered the findings on the second sheet. When the student finished his examination and filled in the separate student form the patient was taken to see the eye doctor for final examination and treatment. The student form was then collected for data entry. The standard observer filled in an identical form for comparison with the student. After the examination of the patient this form was also collected for data entry. (See the patient flow chart Fig. 3.4).

3.5.2 MEASUREMENT TOOLS

The following measurement tools were used in the comparison of the patients' assessments by each student to the standard observer.

3.5.2.1 Weighted Kappa Statistics for Inter-observer variation

The kappa statistic is a means of measuring agreement between examiners

using a numerical scale of grading. It is calculated on the basis of the proportion of the total number of observations put into each category of the grading scale by each of the observers. The relative seriousness of disagreement between the reading of the two observers is reflected in the weighted kappa statistics, in which weights have been assigned dependent on the degree of observer variation. The standard error indicates the reliability of the measurement.

In 1960 Cohen [10] described the kappa statistic for use in measuring the agreement of observers who were examining the psycho-social status of their patients. This statistic was needed in order to determine the reliability of the findings being made by different observers of the same patients. The observations had to be recorded on a measurable numeric scale. The criterion for the observations and grading scale to be used are that :

1. The units are independent.
2. The categories of the nominal scale are independent, mutually exclusive, and exhaustive.
3. The observers operate independently.

The formula derived to determine the agreement between the two observers, uses the proportion of cases that the observers agree on, and subtract from it the proportion of agreement that would be expected by chance. This is divided by 1 minus the proportion attributable to chance, which will give the proportion of agreement after chance agreement is removed from consideration. This value was called kappa (K).

$$K = \frac{P_O - P_C}{1 - P_C}$$

P_O = the proportion of cases in which the observers agree

P_C = the proportion of cases for which agreement is expected by chance

In 1968 Cohen [11] noted that his previous calculation had treated all disagreements equally, so he elaborated on his calculation to give varying weights depending on the degree of the disagreement. This was termed the weighted kappa. The weights must be determined before an investigation, and prior to the collection of data. Cohen also added standard error calculations to the weighted kappa in order that confidence limits could be calculated.

In 1969 Fleiss, Cohen and Everitt [12] designed further calculations to determine the standard error when large samples were being investigated. This was deemed necessary due to previous errors in calculations of standard error, particularly for large samples. Fleiss continued to modify and improve the calculations over the next ten years. In his book on statistical methods [13], he records these improvements and summarises subsequent literature on the subject. Kappas have been used almost exclusively in psycho-social investigation.

An exception to the use of kappas in psycho-social studies has been in epidemiological studies in ophthalmology. Kappas have largely been used in prevalence of blindness studies to determine inter and intra-observer agreements between the ophthalmologists and nurses who examine the sample subjects. Some examples of these studies are the Nepal Blindness

Survey [14] done in 1981 (this study is discussed in more detail in later chapters.); and the Gambian prevalence of blindness survey [15] done in 1986.

Kappa statistics have been used in ophthalmology to assess the reliability of a grading scale for specific clinical observations, such as the grading of trachoma or grading of optic cup to disc ratios. It is also used to assess the reliability of non-ophthalmologists performing specific ophthalmic skills. [16,17]

In this study, the measurement of inter observer agreement is between the eye doctor (standard observer) and the student. Kappa statistics are given for the collective observations of the class compared with the eye doctor, as well as each individual student's observations. The grading scales that have been used for each test are described in the section on grading criteria. Kappa statistics are given for the following tests:

a. Measurement of visual acuity
b. Measurement of intraocular pressure
c. Assessment of cup/disc ratio
d. Observation of cataract
e. Diagnosis of glaucoma
f. Differentiation between treatable and non-treatable blind eyes.

Where the disagreements between grades are equally serious, un-weighted kappa statistics are used (for example observation of a cataract). However, where there is varying seriousness in the disagreements, weighted kappa statistics are used (for example, the measurement of intraocular pressure). Since the measurement of inter-observer variation is given as a proportion,

the range of results varies from 0 to 1, where 0 is no agreement above that which could be expected purely by chance, and 1 is total agreement between the observers. The following scale of agreement between observers is generally accepted for kappa statistics.

excellent agreement is	0.7 - 1.0
fair to good agreement is	0.4 - 0.69
poor agreement is	0 - 0.39

Intra-observer variation is the variation that an observer has with himself when making the same observation on separate occasions. In this study, the intra-observer variation was not measured. Due to the very poor follow-up rate of patients at the Lunsar Eye Hospital, and the variety in clinical experiences that the students had, it was virtually impossible to gather data on the intra- observer variation.

3.5.2.2 Sensitivity and Specificity of Screening

Sensitivity and specificity are used to determine the accuracy of a screening or diagnostic test in differentiating between true cases and non-cases of a specific disease. The test in question is compared, for accuracy, to a standard by which the true diagnosis is known. This standard is referred to as the "gold standard". In this study, it is applied to the nursing students accuracy in recognising those patients who have certain eye disease and those who do not. The gold standard is an experienced eye trained doctor. (In the case of visual acuity and intraocular pressure measurements the regular technician at the hospital was the gold standard.) While sensitivity

and specificity are not frequently used in this way, it is a valid use, because the reliability of the students' ability to pick up a disease using a certain skill or process was measured, rather than the accuracy of the clinical test that the student used. Fletcher et al. [18] make reference to a similar use of sensitivity and specificity. In their discussion of this topic an example of the diagnostic test used is that of the clinical impressions of house officers as to whether patients complaining of sore throats have a Group A ß-hemolitic streptococcus infection or not. The gold standard in this case is a throat culture, rather than an experienced clinician, but the actual 'test' in question is a person's clinical impression of the patient's condition.

The sensitivity of the student's screening indicated the percentage of positive cases (determined by the eye doctor) that the student recognised, using a particular procedure. The specificity is the percentage of cases (determined by the eye doctor) who did not have the disease, that the student also recognised did not have the disease. [19,20,21]

$$\text{Sensitivity} = \frac{\text{diseased eyes that student recognises}}{\text{total number of diseased eyes by gold standard}}$$

$$\text{Specificity} = \frac{\text{not diseased eyes that student recognises}}{\text{total number of not diseased eyes by gold standard}}$$

3.5.3 GRADING CRITERIA

3.5.3.1 Visual acuity (WHO categories)

The World Health Organisation (WHO) [22] grading criteria was used as the criteria in this study. A grade of 1 is "visual impairment", a grade 2 "severe

visual impairment" and grades 3,4,5 "blind". This grading system was used for distance vision. The grade as well as the actual visual acuity reading were entered on the form. If the visual acuity could not be taken, as in the case of a small child, this was noted on the form.

WHO Categories, using the modified Snellen 'E' Chart

0 = can see 6/18 or better

1 = can see 6/60 but cannot see 6/18

2 = can see 3/60 but cannot see 6/60

3 = can see Hand Movements but cannot see 3/60

4 = Perception of Light only

5 = No Perception of Light

3.5.3.2 Intraocular pressure

Grade 1 = 0 - 17

Grade 2 = 18 - 22

Grade 3 = 23 - 27

Grade 4 = 28 - 32

Grade 5 = 33 or more

none = IOP not measured

The grading criteria for intraocular pressure was based on the use of the Schiotz tonometer. A grade was given to every 5 mm Hg from 17 upwards. Grades 4 and 5 were considered an abnormally high pressure. This equated to a reading of 2 or less on the Schiotz tonometer, with a 5.5g weight. A cut off point, 28 mm Hg, was used for the purpose of sensitivity and specificity

measurements. Any pressure at this level or above was considered to be abnormally high.

3.5.3.3 Cup to optic disc

0 = Cup/disc ratio of 0.5 or less

1 = Cup/disc ratio of more than 0.5

9 = cannot determine the ratio

The students were trained to recognise the cup/disc ratio of the optic nerve on a scale of 0.1 increments from 0 - 1.0. No cup whatsoever was 0, and 1.0 was a totally cupped disc. (See training of cup/disc measurement.) For these nurses, the only clinical significance of calculating a cup/disc ratio to this extent of accuracy was to determine a difference of size between the left and right discs. In practice, the most significant factor in the cup/disc ratio was whether the vertical diameter of the cup was more than half of the diameter of the disc. If the ratio was over 0.5, the eye was suspected of having glaucoma. With this in mind, it was considered most appropriate for this study to determine whether the disc was more than 0.5 or not. (see fig. 3.1)

A grade of 9 meant that the patient's disc could not be observed for one reason or another. It was decided that this should be included in the weighted kappa statistic of the inter-observer agreement. A patient with a high pressure may have corneal edema from the increased pressure or perhaps a cataract. In such cases observation of the optic disc with an ophthalmoscope through an undilated pupil may be difficult or impossible. In these situations of marginal visibility a view of the disc in making a diagnosis can be

critical. Disagreement between the student and standard observer as to whether the disc could be seen or not had to be noted. For example, if the student said that the disc could not be seen, and the eye doctor could see the disc and noted that the disc had a ratio greater than 0.5, then this resulted in a missed referral by the student.

3.5.3.4 Observation of Cataract

The criteria for the observation of cataract was simply whether a cataract was absent or present in the right eye, left eye or both eyes. This was determined by observing the pupil colour to see whether it was white or black, and to observe the lens opacities against the background of the red reflex through an undilated pupil with an ophthalmoscope. This method of grading did not take into consideration a differentiation in the degree of the cataract. This, however, was not a clinical problem at this level, and was therefore not included. The clinical significance was whether the cataract was operable or not. This determined the student's management of a patient with cataract.

A patient with operable cataract has the following criteria:

1 Bilateral vision less than 6/60, or a patient with only one eye who cannot see better than hand movements.
2 No corneal scar obstructing the whole of the iris.
3 Grey or white pupils – confirmed by red reflex
4 Normal intraocular pressure
5 Patient can locate the direction of a light source

If both eyes have cataracts, and meet the above criteria, then the eye with the worst visual acuity may be operated first. The second eye can be operated after a week, if the first eye shows no sign of complications. If a patient who is already blind in one eye from a non-treatable cause, and the other eye has a cataract which would be operable, the surgery should wait until the patient has a visual acuity of hand movements or worse. If the patient is developing secondary glaucoma from the cataract, it should be operated on immediately.

Cataract surgery is contra-indicated when:

1 the eye has increased intraocular pressure with glaucoma.
2 the pupil is non-reactive (without mydriatics).
3 the eye has no perception of light.

3.5.3.5 Diagnosis of Glaucoma

The diagnosis of glaucoma in this setting was made on the findings of intraocular pressure and cup to disc ratio of optic disc. Poor pupil response, and decreased visual acuity were further causes for suspicion. Confirmation of glaucoma by visual field testing in this setting was unreliable at best and often impossible. This was due to illiteracy, language barriers, poor patient compliance and lack of equipment. Gross visual fields were checked by confrontation methods. The diagnosis of glaucoma was divided into two parts. These are 1) the presence or absence of glaucoma 2) whether it is treatable or non-treatable.

1 No glaucoma - would mean that the intraocular pressure was below 28 mm Hg, and the cup to disc ratio 0.5 or less.

Glaucoma suspect :-

i) intraocular pressure below 28 mm Hg, but have a cup/disc ratio of more than 0.5

ii) a cup/disc ratio less than 0.5, but an intraocular pressure equal to or greater than 28 mm Hg.

Glaucoma cases - A patient was considered to have glaucoma if the cup to disc ratio of the optic disc was more than 0.5 and the intraocular pressure was above 28 mmHg.

2 Treatable or non-treatable glaucoma:

Glaucoma was considered treatable, if the patient still had sufficient vision to get around on his own. Glaucoma was considered not treatable, if the patient had insufficient vision to walk by himself. This was referred to as travel vision.

A patient with glaucoma whose visual acuity bilaterally was less than 3/60 and therefore blind, but who still had travel vision, was considered treatable even though the visual acuity is unlikely to improve with surgery. Travel vision could be preserved.

3.5.3.6 Recommend the appropriate management

For this study, accuracy in the clinical area was determined by the management rather than the diagnosis for most diseases. For example, if a student made some mistakes in the diagnosis, but the management and/or referral of the patient was correct, then it would be considered as agreement. Differences of diagnosis showed up under the specific diseases that were dealt with. These were cataract, glaucoma, and corneal scar. A difference of diagnosis was reflected in a lower weighted kappa statistic for disease recognition. Management grades were as follows:

Grade 0 was agreement between the student and the eye doctor in the management of the patient.

Grade 1 was unnecessary treatment given to the patient which did not harm the patient but was an extra expense or inconvenience to the patient.

Grade 2 was unnecessary referral which meant that the patient had been referred to the Hospital for treatment or investigation when it was not necessary. For example, if the patient was sent to the Hospital when he had glaucoma but the visual acuity was only perception of light and hence had no travel vision, this referral was considered an unnecessary referral.

Grade 3 was missed treatment which meant that the patient should have been treated by the nurse, but was not. For example, if the patient should have had tetracycline but the nurse did not find the condition, and hence did not treat the patient, this was a missed treatment.

Grade 4 was a wrong treatment in which the nurse gave the wrong medication completely. For example, if the nurse should have given tetracycline ointment for infection, and instead gave steroid drops, this was considered a wrong treatment.

Grade 5 was a missed referral in which the nurse should have referred the patient, but did not. For example, if the patient had a cataract, and it was operable, but the nurse did not think it was operable, and did not refer the patient, this was a missed referral.

The management grades were divided into 3 groups so that the actual percentage of agreement between the standard observer and student could be calculated. This was a means of measuring the overall accuracy of the student's performance as it related to the outcome of the patient.

Correct management	- grade 0
Inconvenient management	- grades 1 and 2
Unsafe management	- grades 3,4 and 5.

Correct management meant that the student managed the patient the same as the standard observer. Inconvenient management meant that the patient was either asked to go to the hospital unnecessarily or had the expense of a medication which he did not really need, but which did him no harm. Unsafe management was when the patient should have been treated, or referred and was not. Any instances of the wrong medication or treatment were included here. It indicated detrimental care of the patient. Correct and inconvenient management were both considered safe in this study.

3.5.3.7 Distinguish Treatable and Non-treatable Blindness

Criteria for treatable and non-treatable blindness is found on the flow chart (see fig. 3.2). The grades for comparing the accuracy of the student against the standard observer in determining treatable and non-treatable blindness were the same as those used for management of the patients.

In every situation for the purpose of deciding, if a patient was treatable or non-treatable, referable or non-referable, the eye doctor was considered to be correct. In the context of eye care in Sierra Leone, very few posterior segment diseases could be rectified with the available facilities. For this reason, blindness due to a retinal cause was considered non-treatable. One exception to this was the case of glaucoma, which has been mentioned earlier. A patient with glaucoma and a visual acuity less than 3/60 was considered treatable for this study. This was not that the visual acuity would improve, but that progression to an even greater degree of visual impairment might be prevented, and retention of residual vision made possible. The preferred method of treatment in Sierra Leone for chronic open-angle glaucoma is surgical intervention by trabeculectomy. This choice is due to the very poor rate of patient return for on-going medical treatment. The extended use of eye drops in the control of glaucoma in this situation is both expensive and unreliable, given the poor patient compliance.

If the student asked a patient, who had operable cataracts to return several months later, such as in 3 months, this was considered a missed referral.

A case of simple uncorrected aphakia or simple presbyopia was considered to be treatable by the nurse, since the nurse had + 10 glasses or presbyopic

glasses available in the eye clinic. Other refractive errors which adversely effect the patient's daily living were to be referred.

An eye blind from corneal ulcer that had not yet scarred was considered treatable. Referral was indicated in the presence of hypopyon or some other disease.

Occasionally, a situation arose where the condition in one eye was referable, and the condition in the other eye was not referable. For the most part, single eyes were considered, and in such a situation, the referral was determined on each eye separately, except where the condition of the other eye made a difference, such as the management of cataracts. This was done for the sake of evaluating more clinical judgments per student. If the student indicated a correct referral of one eye, and the other eye should have been referred and was not, then this was counted as a missed referral in one eye and correct in the other, even though, in fact, the patient would have been referred. (This is the same for treatment.) If a patient was referred for one problem in an eye, but another referable problem was overlooked in the same eye, then the case was counted as a correct referral in that eye.

The inappropriate use of topical steroid drops was considered unacceptable and unsafe treatment.

If a need for evisceration or retrobulbar alcohol injection for a patient was indicated, this was not considered treatable blindness, but was an indication for referral. This was true for any other condition requiring hospitalisation which was needed, but would not change the patient's state of blindness.

The student's management of all blind eyes was included in the separate grading for blind eyes. The management was graded as either correct, inconvenient, or unsafe treatment. Correct and inconvenient management were considered safe treatment.

3.5.4 DATA ANALYSIS

The data was entered on a Del computer using SPSS (SPSS Inc.), a data base and statistical analysis software package. In conjunction with this programme, analysis of the data was done, using Quattro Pro (Borland International Inc.), and Kappa programme by D. Minassian and J. Evans (International Centre for Eye Health). The word processing for the text of this thesis was done with Wordstar 5.5 (Wordstar International Ltd.). Harvard Graphics (Software Publishing Corporation) software and a Xerox photocopier were used in the preparation of the illustrations and graphics pages. The final draft was printed on a Hewlett-Packard Laserjet printer.

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CHAPTER 4

RESULTS

Profile of Patients Seen by Each Student

PATIENT INFORMATION	STUDENT CODE NUMBERS												
	1	2	3	4	5	6	7	8	9	10	CLASS MEAN	CLASS RANGE	
Number of patients	25	48	40	38	62	28	40	47	32	28	39	25	62
Mean age of patients	42	44	45	50	42	46	45	45	42	50	45	42	50
% Males	60	65	70	55	71	54	60	70	72	79	65	50	79
% Females	40	35	30	45	29	46	40	30	28	21	34	21	46
% of blind eyes	30	40	40	47	44	55	46	39	30	45	42	30	55
Bilateral blind	5	9	9	14	16	9	12	9	4	7	9	4	16
Unilateral blind	5	20	14	8	23	13	13	19	11	11	14	5	23

Fig. 4.1

4.1 PATIENT'S PROFILE AND DIAGNOSES

The ten students saw a total of 388 patients (776 eyes) with a range from 25 to 62 patients per student. The class mean was 39 patients. Ninety four patients were bilaterally blind, and 137 unilaterally blind representing 41.9% of the eyes that were seen (WHO definition of blindness. fig.2.1). The bilaterally blind were 24% of the patients. Two thirds of the patients were male and one third female. This ratio was similar for all the students. Males and females with blind eyes followed similar ratios. The age of the patients ranged from 2 to 85 with a mean age of 45 years. The mean age for patients blind in at least one eye was 49 years.

CAUSES OF BLINDNESS OF PATIENTS SEEN BY STUDENTS

CAUSE OF BLINDNESS	Blind eyes		Bilateral		Unilateral	
	NO.	%	NO.	%	NO.	%
SCAR	26	8	2	2	22	16
CATARACT	134	42	42	45	50	37
GLAUCOMA	79	24	25	26	29	21
OTHER	86	26	25	27	36	26
TOTALS	325	100%	94	100 %	137	100 %

Fig. 4.2

In most cases the results refer to single eyes rather than patients since only one of a patient's eyes may be effected, or a different condition be found in each eye. Where both eyes were considered together this was indicated by the captions on the tables. A variety of eye diseases were seen by each

student. The most common blinding diseases which were seen were cataract, onchocerciasis, glaucoma and corneal scars from various causes. All of the students saw patients with cataract, glaucoma or a combination of both. Two of the students did not see any study patients who had corneal scars. The percentage of eyes with these conditions seen by each student ranged as follows:

DISEASE	STUDENT RANGES		MEAN	BLIND
	FROM%	TO %	%	%
CATARACT	14	32	25	75
GLAUCOMA	12	28	18	60
OTHER	44	70	52	19

Fig. 4.3

4.2 CLINICAL SKILLS

The clinical skills on which the students were assessed were:

1 Assessment of visual acuity

2 Measuring intraocular pressure

3 Assessment of the cup/disc ratio

4 Observation of cataracts

The comparisons with the standard observer were made using kappa statistics (with standard error for each), sensitivity and specificity. Generally for these comparisons, kappa statistics below 0.7 or sensitivity below 80% was noted, and is addressed further in the discussion section.

Student Results for Visual Acuity Assessment

ASSESSMENT TOOL	STUDENT CODE NUMBERS										CLASS		
	1	2	3	4	5	6	7	8	9	10	MEAN	RANGE	
WT. KAPPA	0.90	0.90	0.96	0.98	0.92	0.96	0.93	0.97	0.83	0.96	0.93	0.83	0.98
S.E.	0.18	0.12	0.08	0.06	0.09	0.12	0.12	0.09	0.21	0.09	0.11	0.06	0.21
SENSITIVITY	93	89	100	100	95	100	95	97	68	96	93	68	100
SPECIFICITY	94	93	98	98	91	100	86	100	98	97	95	86	100

Fig. 4.4

4.2.1 Visual Acuity

All the students had very good agreement with the standard observer with whom they were compared. Nine students had weighted kappa values of 0.9 or above. The sensitivity and specificity with one exception showed that all the students accurately differentiated between patient eyes that were blind or not, using the WHO criteria. Student no. 9 was not quite as accurate as the others in determining those who were blind, but was more accurate at determining the ones who were not blind. This was indicated by this student's specificity of 98.4%. Consequently his agreement was lower than the others, but was still good. Since this was a weighted kappa these findings indicated that most of the time the student was only one WHO grade different from the technician.

4.2.2 Intraocular pressure

Eight students had kappa values of 0.7 or better indicating good agreement with the standard observer for measurement of intra-ocular pressure. The other two students were 0.6 and 0.57 which still represented reasonably good agreement. The class mean was 0.77 indicating that generally this procedure was carried out well by the students. The sensitivity of four of the students was below 80% all of them in the 60-70% range. The specificity was very high for all of the students. This means that almost all cases recorded as normal, having normal pressure by the standard observer, were also recorded as normal by the students.

Student Results for Intraocular Pressure

ASSESSMENT TOOL	STUDENT CODE NUMBERS										CLASS		
	1	2	3	4	5	6	7	8	9	10	MEAN	RANGE	
WT. KAPPA	0.69	0.72	0.87	0.87	0.60	0.57	0.94	0.87	0.78	0.79	0.72	0.57	0.94
S.E.	0.19	0.15	0.13	0.16	0.05	0.09	0.09	0.09	0.16	0.16	0.18	0.09	0.06
SENSITIVITY	85	67	100	82	71	88	60	89	60	88	79	60	100
SPECIFICITY	100	98	100	100	93	100	96	99	98	95	98	93	100

Fig. 4.5

Student Results for Cup to Disc Assessment

ASSESSMENT TOOL	STUDENT CODE NUMBERS										CLASS		
	1	2	3	4	5	6	7	8	9	10	MEAN	RANGE	
WT. KAPPA	0.86	0.59	0.70	0.75	0.70	0.67	0.56	0.73	0.63	0.67	0.69	0.56	0.86
S.E.	0.05	0.08	0.07	0.08	0.07	0.10	0.10	0.07	0.10	0.11	0.08	0.05	0.11
SENSITIVITY	91	40	71	80	82	100	78	69	57	89	76	40	100
SPECIFICITY	77	93	84	100	88	90	95	89	94	90	90	77	100

Fig. 4.6

4.2.3 Cup to Disc Ratio

The mean kappa value for all the students was 0.69, which indicated that they agreed well with the eye doctor. Five, however, had kappa values between 0.5 and 0.7 indicating that they had slight difficulty in accurately assessing the cup to disc ratio, but still had good agreement with the eye doctor. The sensitivity of students 2, and 9, for recognising patients with abnormal cup/disc ratios was 40% and 57% respectively. This meant that they missed between 40-50% of the patients with abnormal ratios. Students 3 and 8 had sensitivities of 71% and 69% respectively, indicating that they had some difficulty recognising diseased discs as well.

4.2.4 Observation of Cataract

Nine students compared well with the eye doctor in the observation of eyes with lens opacity. This was indicated by their kappa values which were 0.7 or higher. Student no. 3 had a kappa value of 0.38 and sensitivity of 38%. This student's ability to recognise patients with lens opacity was poor. The specificity of 97% indicated that the student determined accurately those patients who did not have opacity.

4.3 CLINICAL JUDGMENT

The students' judgment skills were assessed on the diagnosis of glaucoma, differentiation of treatable and non-treatable blindness and their appropriate treatment or referral of individual patients.

Student Results for Observation of Cataract

ASSESSMENT TOOL	STUDENT CODE NUMBERS										CLASS		
	1	2	3	4	5	6	7	8	9	10	MEAN	RANGE	
KAPPA	0.81	0.78	0.38	0.76	0.77	0.69	0.80	0.84	0.84	0.93	0.72	0.38	0.93
S.E.	0.13	0.09	0.14	0.10	0.07	0.12	0.09	0.08	0.10	0.07	0.08	0.14	0.13
SENSITIVITY	85	82	38	96	85	100	92	100	89	92	86	38	100
SPECIFICITY	95	99	97	92	91	83	87	93	98	100	93	83	100

Fig. 4.7

Student Results for Glaucoma Diagnosis

ASSESSMENT TOOL	STUDENT CODE NUMBERS										CLASS		
	1	2	3	4	5	6	7	8	9	10	MEAN	RANGE	
KAPPA	0.72	0.26	0.68	0.78	0.50	0.67	0.72	0.84	0.84	0.78	0.68	0.26	0.84
S.E	0.15	0.19	0.14	0.12	0.13	0.14	0.18	0.10	0.15	0.14	0.14	0.10	0.19
SENSITIVITY	86	31	92	75	54	100	60	86	71	82	74	31	100
SPECIFICITY	92	94	93	100	95	87	100	100	100	98	96	87	100

Fig. 4.8

4.3.1 Diagnosis of Glaucoma

The class kappa mean for glaucoma diagnosis was 0.68. This was marginally below 0.7 which indicated that the students generally had good agreement. Students 1, 4, 7, 8, 9 and 10 had kappas of 0.72, 0.78, 0.72, 0.84, 0.84, and 0.78 respectively. These indicated good agreement between these students and the standard observer. Students 3, 5, and 6 had kappas of 0.68, 0.50, and 0.67 respectively. These indicated less agreement with the standard observer, but still good. Student 2 had 0.26 which indicated very poor agreement. This student had a sensitivity of 31% which indicated that the disagreement with the standard observer was largely in regard to eyes which were glaucomatous. This indicated that this student was poor in the diagnosis of patients with glaucoma. Students 5 and 7 had sensitivities of 54% and 60%. This indicated that these students had some difficulty in identifying eyes with the disease. Student 9, though higher than the students already mentioned, showed some difficulty indicated by a sensitivity of 71%. This student treated 38% of those eyes with glaucoma unsafely, which meant that even though agreement with the standard observer was high, the eyes were incorrectly managed. Student 2 unsafely managed 46% of glaucomatous eyes and student 5 managed 33% unsafely. Students 1, 4, and 6 managed all glaucomatous eyes safely.

4.3.2 Distinguish Treatable from Non-treatable Blindness

Most of the students had good agreement with the standard observer on which eyes were treatable, and which were not. Students 1 and 3 had kappas of 0.62. Most of student 1's disagreement however was with non-treatable blind eyes indicated by a low specificity. This student had only 5

Student Results for Distinguishing Treatable from Non-treatable Blindness

ASSESSMENT TOOL	STUDENT CODE NUMBERS										CLASS		
	1	2	3	4	5	6	7	8	9	10	MEAN	RANGE	
WT. KAPPA	0.62	0.69	0.62	0.84	0.80	0.70	0.85	0.73	0.73	0.79	0.66	0.62	0.85
S.E	0.22	0.11	0.16	0.08	0.08	0.16	0.09	0.13	0.17	0.14	0.12	0.08	0.22
SENSITIVITY	100	75	88	100	89	96	97	100	93	93	93	75	100
SPECIFICITY	33	80	71	93	80	60	75	63	50	73	68	33	93

Fig. 4.9

non-treatable blind eyes. All blind eyes, however, were managed safely by this student. Student 3 managed 18% of blind eyes unsafely. This was the highest of all the students. Students 2, 4, 5, and 9 had 12%, 13%, 17%, and 11% unsafe management, respectively. This indicated that these students had some difficulty in correctly managing treatable blind eyes.

4.3.3 Appropriate Management

Appropriateness of management was described by the proportion of correct, inconvenient, or unsafe management of eyes by the student. To facilitate the study, each eye was considered separately rather than patients. Fig. 4.10 shows the percentages and accuracy of each student's management for all eyes seen and for blind eyes seen. The confidence limits for the percentages are shown for the unsafe management of all eyes.

All the students, except student 5, managed more than 90% of the eyes safely. Student 5 was unsafe for 19% of the eyes seen. For blind eyes, students 2, 3, 4 and 5 had unsafe management above 10%. These were 16%, 13%, 11%, and 13%, respectively. This indicated that these students had the most difficulty with the management of blind eyes.

The management of cataract and glaucoma is shown by figures 4.11 and 4.12 for all cataract and glaucoma patients, as well as the blind. Ninety five percent confidence limits for unsafe management of all the eyes for both diseases are given. Most students managed eyes with cataracts well. Students 3 and 6, however, had 13% and 12% unsafe management of all eyes with cataract, and 17% and 36% unsafe with the blind eyes. Student 5 was 15% unsafe for all eyes with cataract, but only 10% unsafe with the blind.

Student Results for Patient Management

MANAGEMENT OF ALL EYES	STUDENT CODE NUMBERS										CLASS		
	1	2	3	4	5	6	7	8	9	10	MEAN	RANGE	
% CORRECT	90	71	73	91	66	82	88	81	75	95	81	66	95
% INCONVENIENT	10	20	19	4	16	14	8	18	17	2	13	2	20
% UNSAFE	0	9	8	5	19	4	4	1	8	4	6	0	19
MANAGEMENT OF BLIND EYES ONLY													
% CORRECT	87	76	74	86	75	81	89	86	86	92	83	74	92
% INCONVENIENT	13	8	13	3	11	13	5	14	7	4	9	3	14
% UNSAFE	0	16	13	11	13	6	5	0	7	4	8	0	16

95% CONFIDENCE LIMITS FOR CLASS MEANS OF EYE MANAGEMENT

ALL EYES		BLIND EYES	
CORRECT	78% - 84%	CORRECT	79% - 87%
INCONVENIENT	11% - 15%	INCONVENIENT	6% - 12%
UNSAFE	4% - 8%	UNSAFE	5% - 11%

Fig. 4.10

Student Results for Management of Cataract

MANAGEMENT OF CATARACT ALL EYES	STUDENT CODE NUMBERS												
	1	2	3	4	5	6	7	8	9	10	CLASS MEAN	CLASS RANGE	
% CORRECT	100	92	75	92	73	82	90	90	100	94	89	73	100
% INCONVENIENT	0	4	13	0	13	6	3	10	0	0	5	0	13
% UNSAFE	0	4	13	8	15	12	6	0	0	6	6	0	15
MANAGEMENT OF BLIND CATARACT EYES ONLY													
% CORRECT	100	87	83	89	80	64	96	95	100	90	88	64	100
% INCONVENIENT	0	7	0	0	10	0	0	5	0	0	2	0	10
% UNSAFE	0	7	17	11	10	36	4	0	0	10	9	0	36

95% CONFIDENCE LIMITS FOR CLASS MEANS OF EYE MANAGEMENT

ALL EYES		BLIND EYES	
CORRECT	85% - 93%	CORRECT	83% - 93%
INCONVENIENT	2% - 8%	INCONVENIENT	0% - 4%
UNSAFE	3% - 9%	UNSAFE	5% - 13%

Fig. 4.11

Student Results for Management of Glaucoma

MANAGEMENT OF GLAUCOMA ALL EYES	STUDENT CODE NUMBERS												
	1	2	3	4	5	6	7	8	9	10	CLASS MEAN	CLASS RANGE	
% CORRECT	79	46	67	88	62	82	80	71	25	82	68	25	88
% INCONVENIENT	21	8	25	12	8	18	10	21	38	9	17	8	38
% UNSAFE	0	46	8	0	31	0	10	7	38	9	15	0	46
MANAGEMENT OF BLIND GLAUCOMA EYES ONLY													
% CORRECT	80	56	63	100	69	78	60	88	33	89	71	33	100
% INCONVENIENT	20	0	38	0	15	22	20	13	33	11	17	0	38
% UNSAFE	0	44	0	0	15	0	20	0	33	0	11	0	44

95% CONFIDENCE LIMITS FOR CLASS MEANS OF EYE MANAGEMENT

ALL EYES		BLIND EYES	
CORRECT	60% - 76%	CORRECT	61% - 81%
INCONVENIENT	11% - 23%	INCONVENIENT	9% - 25%
UNSAFE	9% - 21%	UNSAFE	4% - 18%

Fig. 4.12

For glaucoma, student 2 was 46% unsafe , student 5 was 31% unsafe, and Student 9 was 38% percent unsafe in the management of all eyes with the disease. For blind glaucoma eyes, students 2, 5, 7 and 9 had unsafe management of 44%, 15%, 20% and 33%, respectively. This meant that students 2, 5 and 9 had particular difficulty in this area of management. Student 7 had some difficulty.

CHAPTER 5

DISCUSSION

5.1 DISCUSSION OF RESULTS

In 1981, Stilma and Bridger described the causes of blindness among 7,286 new patients who attended the eye clinic at the Lunsar Eye Hospital. Seven-hundred and sixty-two of these persons were bilaterally blind. Thirty-nine per cent of this blindness was due to cataract; 30% to onchocerciasis; 8% to primary glaucoma; 3% to measles; 3% to trachoma and 17% to other causes. Throughout the country, blindness due to these causes is widespread. The four ophthalmologists currently in the country are not nearly sufficient to cover the eye care needs that exist. To best utilise the existing ophthalmologists, and prevent unnecessary low vision and blindness, other levels of health care workers must be trained in ophthalmic skills. In Sierra Leone, the State Enrolled Nurse is an available intermediate level of health care worker who can be trained in many ophthalmic skills and clinical judgments. A brief history by Johnson and Foster [2] gives a summary of the training that has been done over the past 40 years in Africa. The first training course for this level of ophthalmic health care provider was started in Bamako, Mali. There have been several such courses throughout Africa. Though many nurses and ophthalmic assistants have been trained in these programmes, the accuracy of performance and outcome to patient care has rarely, if ever, been documented. The clinical skills and judgments of those trained have **not** been documented or compared to the doctors or ophthalmologists, who would usually perform these functions.

The Nepal blindness survey [3] used kappa statistics for inter-observer agreement of the measurement of visual acuity between 8 pairs of ophthalmologists. For 1008 eyes kappas for visual acuity measurement ranged from 0.75 to 0.82. For differentiating between blind and not blind

patients the kappa was 0.80.

A study yet to be published by Murdoch and Evans [4] looked at the results of 4 nurses doing visual acuity tests in Nigeria. The grading used for visual acuity was similar to that used in Sierra Leone with the nursing students. WHO grades 3, 4 and 5 (blind patients), however, were not sub-divided, but put as one grade of blind. Three nurses saw 126 patients, and were compared with the ophthalmologist. The weighted kappa for the comparison was 0.83.

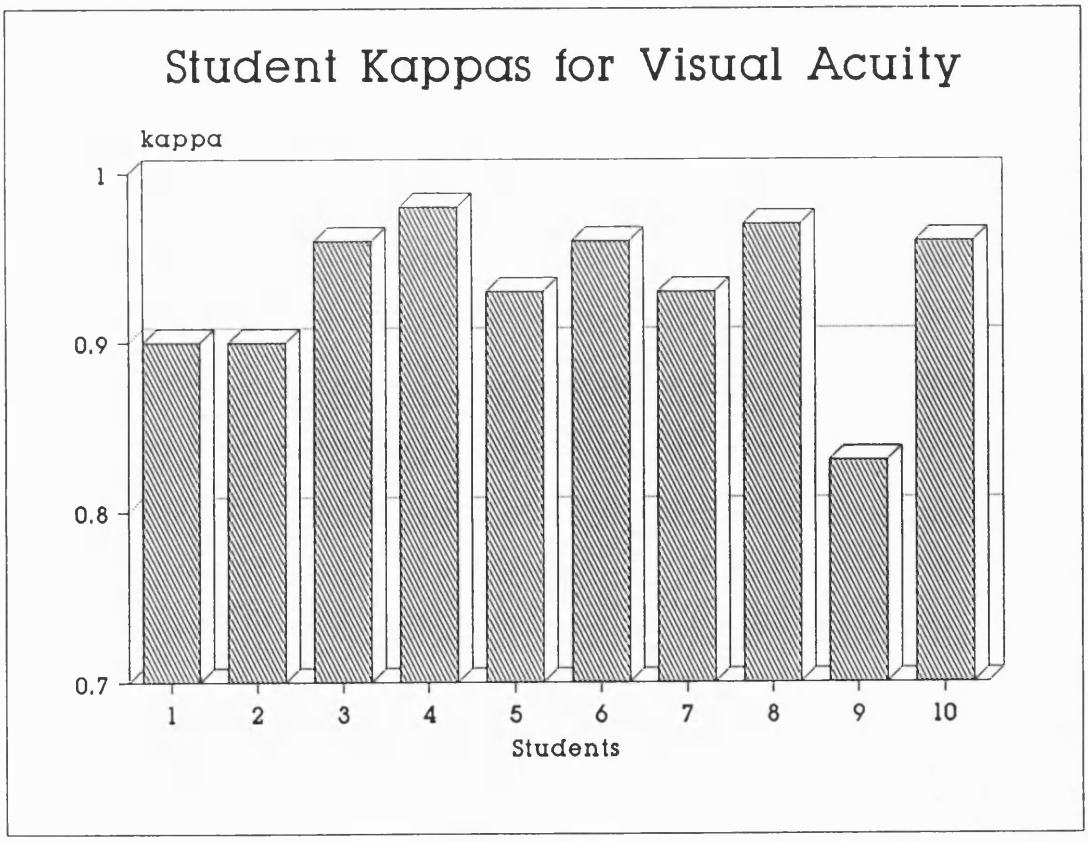

Fig. 5.1

In the Sierra Leone study, by comparison, one student had a kappa of 0.83, while all the rest were 0.9 or above. The mean for the class was 0.93.

The students in the Sierra Leone study were accurately measuring visual acuity and consistently differentiating between blind and not blind eyes. Visual acuity is an essential base line investigation for making subsequent clinical judgments of diagnosis and treatment.

The study by Murdoch and Evans [4] also looked at the measurement of intraocular pressure. No other comparative studies of intraocular pressure (IOP) agreement have been found.

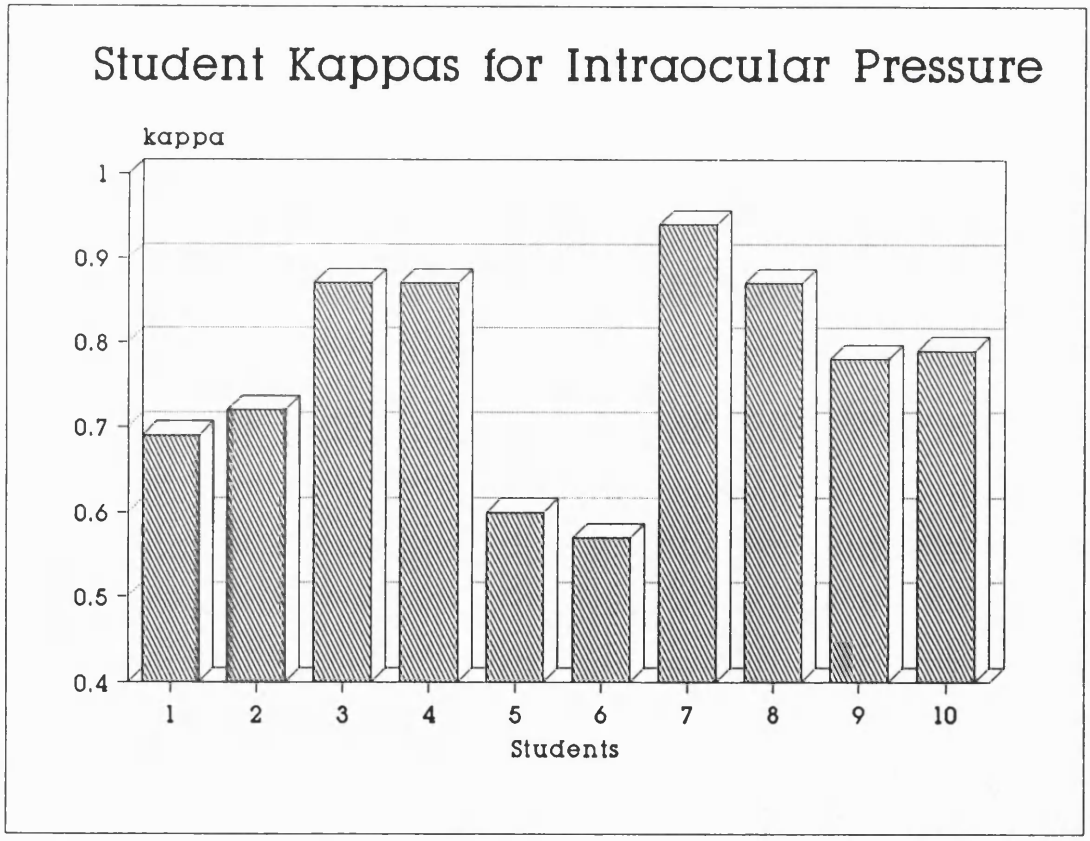

Fig. 5.2

The students in the Sierra Leone study were accurate in the measurement of intraocular pressure. Seven out of the ten students had kappa agreements above 0.7. The range was from 0.57 to 0.94 and the class mean 0.72. The

class IOP sensitivity mean indicated that almost 80% of the eyes with pressures above 28mmHg were screened using the Schiotz tonometer. The lower sensitivities shown by some of the students were possibly due to the fact that the patient was measured by the standard observer first, which would tended to decrease the pressure in the eye slightly, before the student then measured the patient. Another reason might be, that the students had the disadvantage of having the patient after the procedure had been done once, by the standard observer. With the constraints of poor communication due to language barriers and patient fatigue, the patient was often uncooperative. If the patient, were to be measured for the first time by the student, it would be expected that there would be a slight rise in these sensitivities. Intra-observer agreement, though desirable, was not possible on this study due to the distances that the patients travelled to the clinic and the poor return rate of most of the patients. Those with glaucoma normally had a trabeculectomy done the following day. In future studies of this kind, the intra-observer variation for each test would be desirable.

In 1989, a description of "evaluation of ophthalmoscopy by non-ophthalmologists and nurses in diagnosis of chronic glaucoma in West Africa" was described [5]. The grading criterion used was that cup disc ratios over 0.5 were considered abnormal. An ophthalmologist, a general doctor, and a nurse with ophthalmic training were compared to an ophthalmologist, who was the standard observer. Kappa statistics were used to measure the agreement between them. Between the ophthalmologists, the result was 0.92; for the doctor 0.74; and for the nurse 0.75. In comparison the similar assessment of the cup/disc ratio measurement for the nurses in Sierra Leone, showed marginally lower results. The range was from 0.59 to 0.86. The mean for all ten students was 0.69.

A study of students attending the International Centre for Eye Health [6] compared their agreement in assessing 100 photographs of optic discs. The agreement of cup/disc assessment was measured with kappa statistics. An experienced ophthalmologist was the standard observer for the comparisons. Of the 16 observers, two (12.5%) had agreement that was 0.75 or above. Thirteen observers (81.25%) had agreement between 0.4 - 0.75, and one observer (6%) had less than 0.4 agreement. Fourteen of the observers were ophthalmologists.

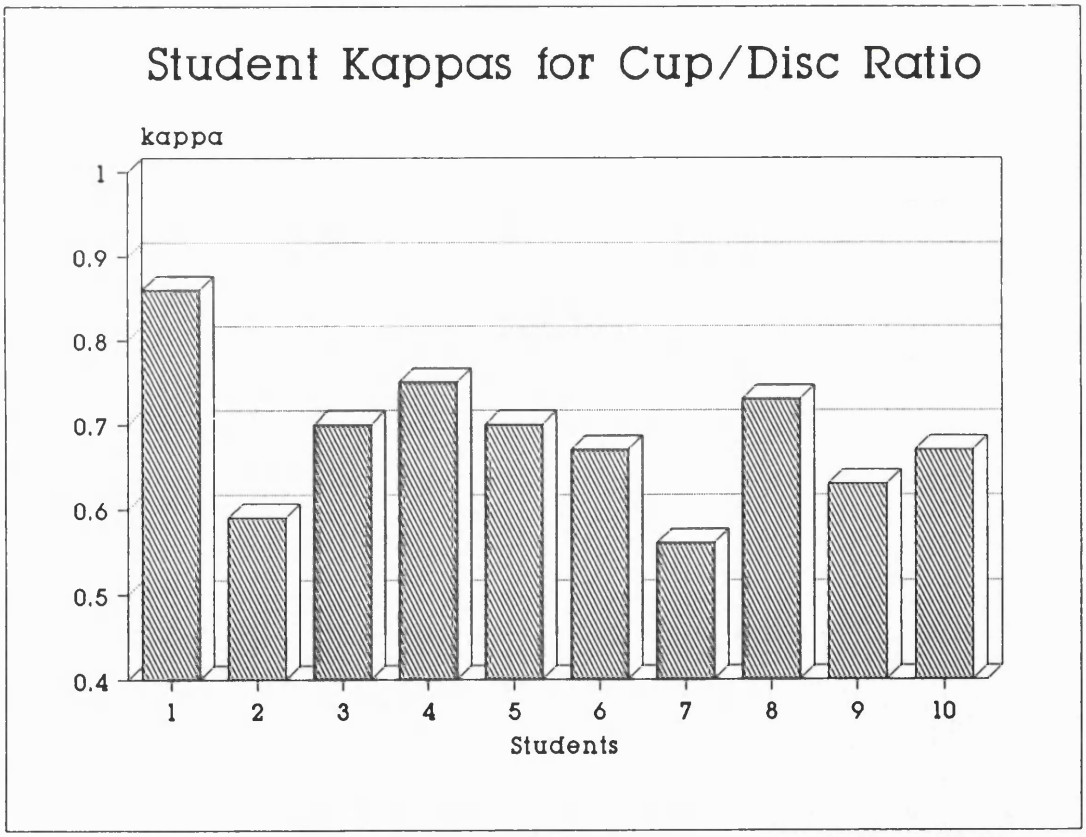

Fig. 5.3

The agreement for cup/disc ratio measurement in the Sierra Leone study was the lowest of the clinical skills. However, seven of the ten students had

sensitivity above 70% for selecting the abnormal discs. The disagreement reflected by lower kappa statistics were often due to the student's inability to get a clear view of discs which were actually normal. The eye doctor was able to view these discs. For example, if the patient had a cataract which was sufficiently dense to make visibility of the disc difficult, the student with less experience would be unable to focus on the disc. This showed disagreement with the standard observer. This clinical skill was one which needed much practice. As the course progressed, subjective observation by the clinical instructors was that the students were improving in this skill. It was therefore hoped that with more time and the observation of many more discs, that this clinical skill would show marked improvement among the students.

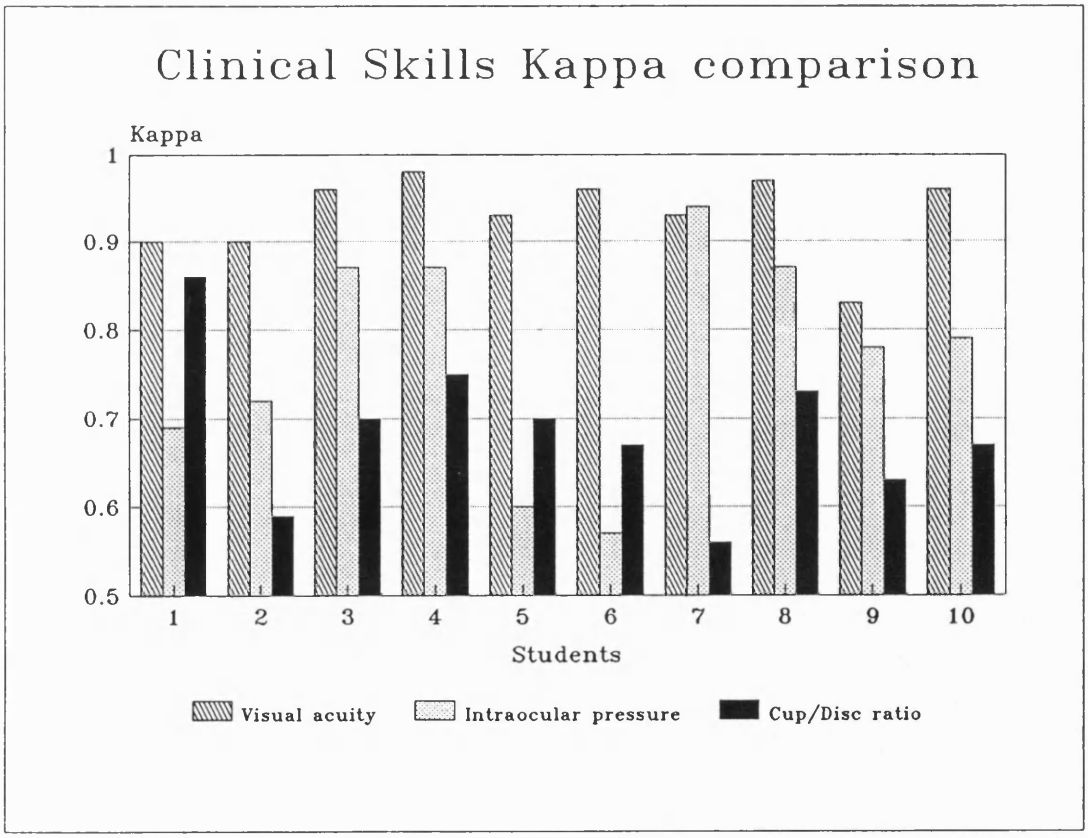

Fig. 5.4

The sensitivity for selecting eyes with cataract showed that all the students accurately observed eyes which had cataracts, with the exception of student number 3, who had a sensitivity of 38. All the kappa statistics except for student number 3 showed good agreement with the standard observer.

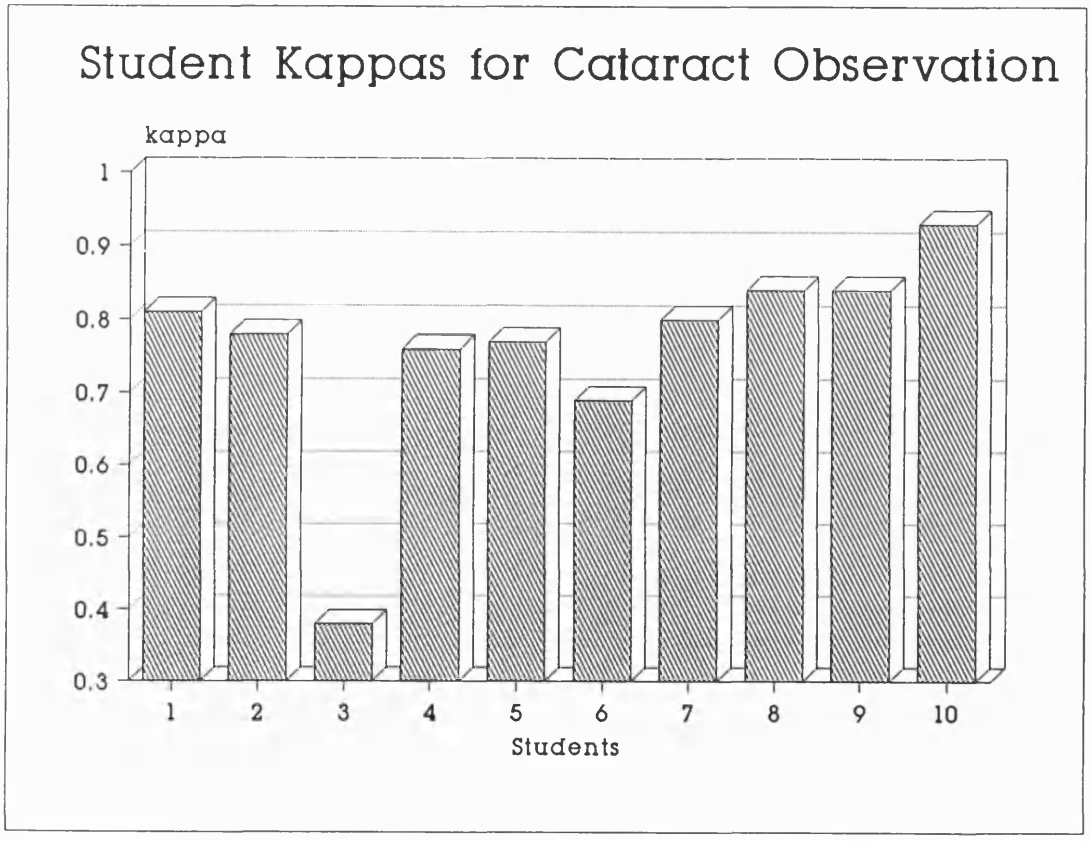

Fig. 5.5

Looking at the results of the class as a whole, it was noted that most of the disagreement was where the students said there was a cataract, when in fact there was not. This would only cause inconvenience to the patient as he might be referred to the hospital, before the cataract was ready to be operated. Students 3, 5 and 6 had unsafe treatment of 13%, 15% and 12%,

respectively. These would be missed referrals. In these cases the student frequently observed the cataract, but thought the criterion for operable cataract were not met at that time, when the standard observer thought it was operable. The patient was instructed to return in several months. This judgment was classified as unsafe.

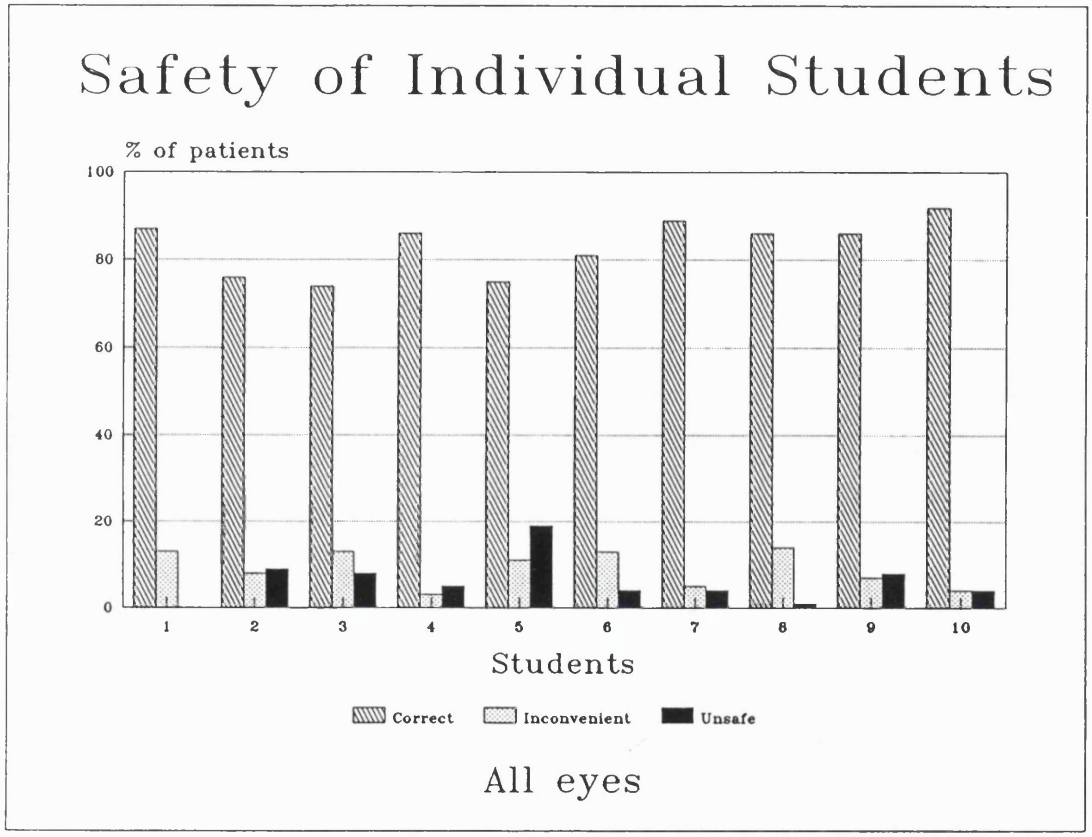

Fig. 5.6

The clinical judgments made by the students showed overall safety. All of the students, except student number 5 (81%), showed safety in treatment of more than 90% of the eyes. Six students were above 95%. Some of the safe treatment, however, was an inconvenience to the patient in terms of extra expense or time. (Travel to the hospital or unnecessary medication.) This

margin of inconvenient treatment was not of great concern as it showed some over-caution in treatment of the patient which was more desirable than under treating, or not referring the patient when there was a problem.

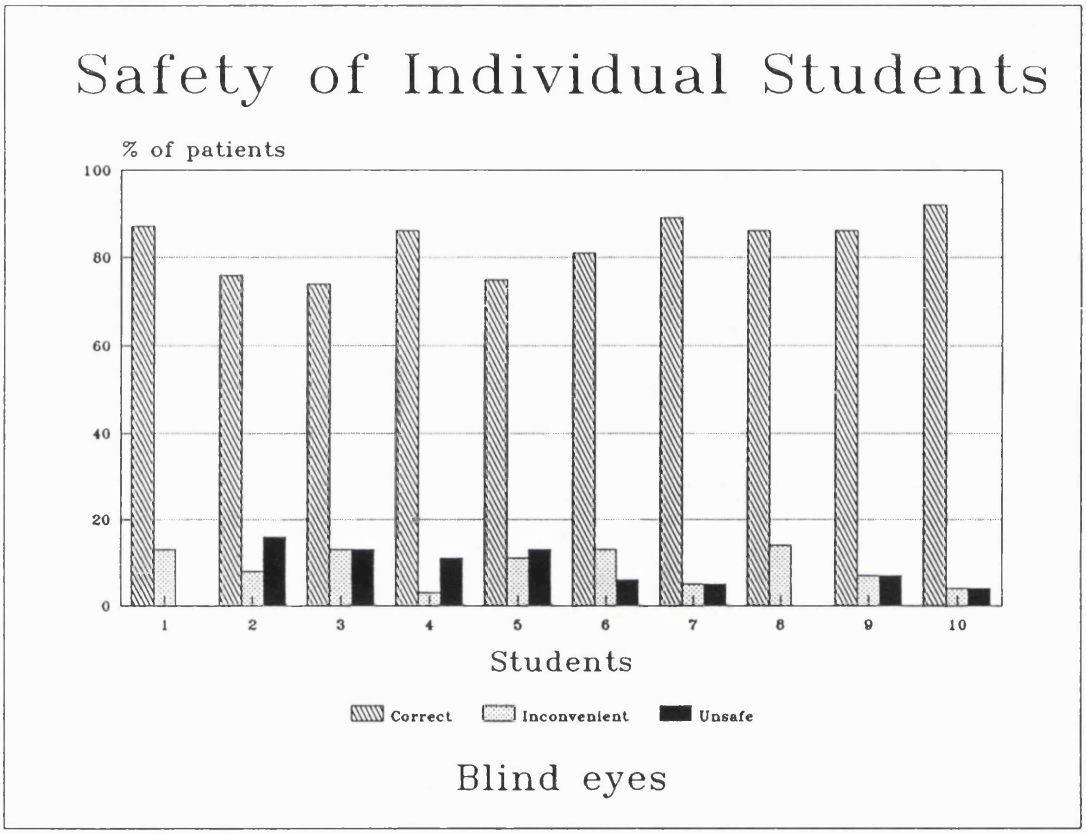

Fig. 5.7

The group of patients who were most frequently managed unsafely were the blind patients. Of these, the patients with treatable blindness had slightly higher levels of unsafe care, than the non-treatable blind. Kappa statistics for distinguishing between treatable and non-treatable blind, range from 0.62 to 0.85, with a class mean of 0.66. The sensitivity for selecting treatable blind patients range from 75% to 100%, but the unsafe levels of treatment or referral for students 2, 3, 4 and 5 are 12%, 18%, 13% and 17%, respective-

ly. This showed that these students selected the treatable blind patients, but then had trouble knowing the correct management. Students 3, 4 and 6 showed difficulty in treating those blind with cataract, while students 2, 5, 7 and 9 showed more difficulty treating or referring correctly those blind with glaucoma.

It should be noted that students 2, 3, 5 who most frequently had results lower than the other students, also appeared to have more difficulty entering the data on the form, correctly. This may have resulted in slightly higher percentages of unsafe management for these students. This factor , however, can only account for a small proportion of the unsafe management that was recorded.

The diagnosis of glaucoma is affected by two things:

1 The accurate performance of intraocular pressure and cup to disc ratio measurements.
2 Interpretation of the findings.

The intraocular pressure was generally accurately measured, though several students had some difficulty with the assessment of cup to disc ratio. The kappa measurements for glaucoma diagnosis did not follow a pattern similar to those for either the intraocular pressure or the cup to disc ratio. The sensitivity of these 2 tests did not follow a similar pattern from student to student either. The sensitivity for selecting those patients with glaucoma for each student, seemed to follow the higher of the cup to disc ratio or the intraocular pressure sensitivities. This would suggest that a student made the decision on one or the other of these tests, or both together. Each were

taught to diagnose glaucoma using first the visual acuity, then the pupil response, then the intraocular pressure, and then cup to disc ratio. (See fig.3.2) These results suggested that the student should use a combination of all 3 tests to make the most accurate diagnosis of glaucoma. The findings, however, suggested that the students needed more practice with this particular disease, which is generally recognised as difficult to diagnose.

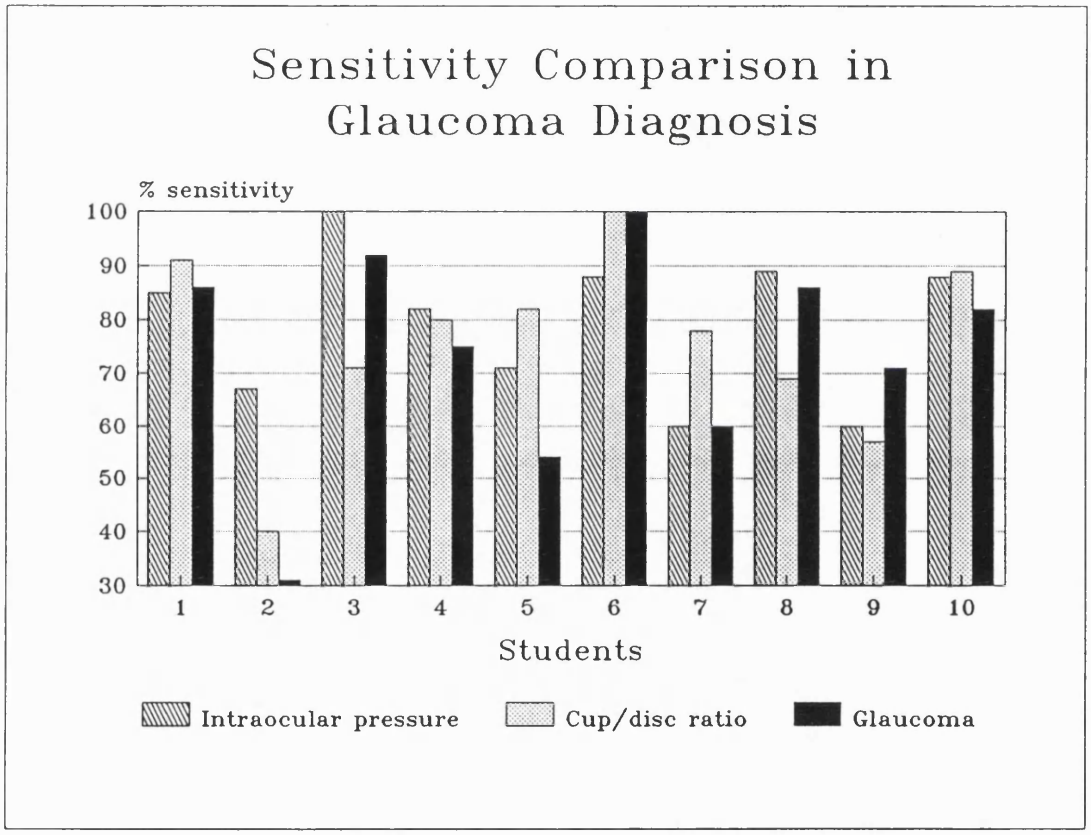

Fig. 5.8

5.2 IMPLICATIONS TO PATIENT CARE

The grading criterion of this study focused on clinical significance. For example, the cup to disc ratio could be described as 0.1, 0.2, 0.3, 0.4, or

0.5...etc. up to 1.0. However, clinical significant consideration was whether it was over 0.5 or not. Therefore, for the purpose of this study, the was result was described as either above 0.5 or 0.5 and less. The same was done for intraocular pressure where 28 mm Hg was used as the cut-off point between normal or pathological pressures. A major hindrance to the control of treatable blindness in Sierra Leone was that many patients who were loosing visual acuity or were already blind never reached an eye care facility, or arrived after it was too late to treat them. The goal of this training course was to increase the number of eye care workers in the hope that better screening and referral throughout the country would eventually be made available.

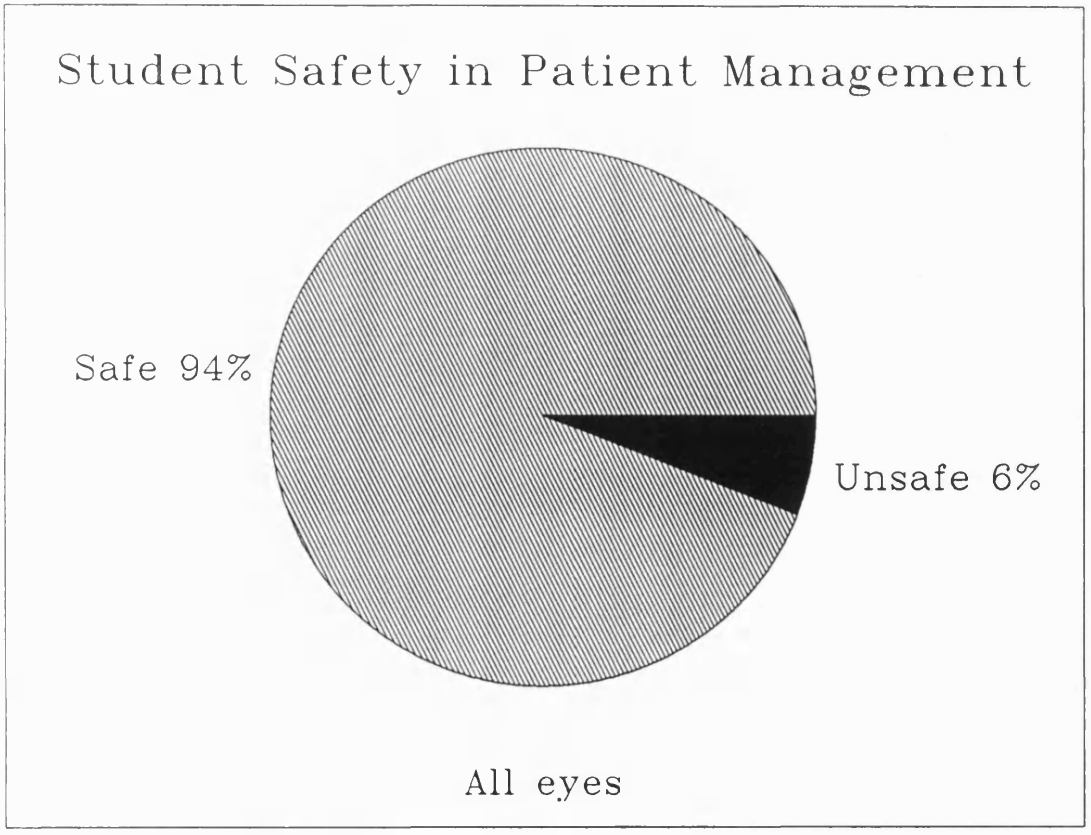

Fig. 5.9

Ninety-four per cent of the treatment given by the class was considered safe using the criteria described in this study. Most of the management (6%) that was considered unsafe was missed-referrals of treatable eyes. These figures indicated that the nurse trained in ophthalmic skills and judgments who was placed in a rural clinic would be likely to accurately screen and treat or refer to the ophthalmologist, patients that otherwise would have no opportunity for eye care. While a few patients were not referred correctly, most of the patients were more likely to receive eye care much more quickly, reducing the chance of blindness. Since the study looked primarily at the treatment or referral of single eyes, the actual correct referral of patients might be slightly higher than the figures show. For example, if the student, missed a referral of one eye, but correctly referred the other eye, the result would be that the patient would be referred and the ophthalmologist would review both eyes. It would be ideal, if at a later date, an assessment could be made of the treatment or referral of treatable eye disease in the communities in which the nurses work, compared to the prevalence of those cases which were actually in the population.

It would be expected that patients suffering from visual loss or blindness due to cataract would benefit most by the use of nurses in the screening treatment and referral of disease in Sierra Leone. Eighty-six per cent of the cataracts (including early cataracts) were recognised by the students, and 90% of cataracts were treated in a safe manner by the class as a whole. (Many of the early cataracts missed by the student would not need to be referred anyway which meant that the student still managed the case correctly.)

Glaucoma, which would present, either as a separate disease or in combina-

tion with onchocerciasis, would be the most difficult for the students to manage correctly. However, from this study, it was shown that 74% of the glaucoma cases were picked up correctly by the class as a whole. Eighty-five per cent of the glaucoma cases, however, were managed correctly, even though not all of them were recognised as glaucoma. For example, the student might have put the cause of low vision or blindness down to some other diagnosis, but still referred the patient correctly to the ophthalmologist. This study indicated that 15% of the glaucoma patients would be missed by using nurses at this level of patient care. While this might seem like a high level of patient mis-management, it must be considered in the light of the present situation in Sierra Leone, where a large proportion of the patients who presented to the clinic with glaucoma were already blind. Many of these no longer had travel vision. From this prospective, this study suggests very optimistic outcomes for the future compared to the existing levels of eye care in Sierra Leone. It suggests that many of the patients with glaucoma could be recognised earlier by having a nurse trained in ophthalmic skills at more accessible locations around the country. The expected result would be the delay or arrest of the progression of glaucoma to blindness. It must be noted that while the nurses had the most difficulty with the assessment of cup to disc ratio of the clinical skills, that in combination with intraocular pressure and visual acuity measurements, their chances of recognising glaucoma cases were greatly increased.

This study showed that most of the treatable blindness was correctly managed by the students. The patient with non-treatable blindness was more likely to be managed in a way that would cause him inconvenience or extra expense than the patient who was treatable. This, however indicated over caution on the part of the student rather than careless or incompetent prac-

tice. Even though the patients with treatable blindness were more frequently treated unsafely, the overall safe management of treatable blindness by the class was still 92%. It was unfortunate that 8% of the treatable cases missed proper treatment, but in view of the total lack of facilities and care in much of the country, this must be considered an acceptable range. However, future training programmes should look at this area of difficulty with a view to improving the nurses results.

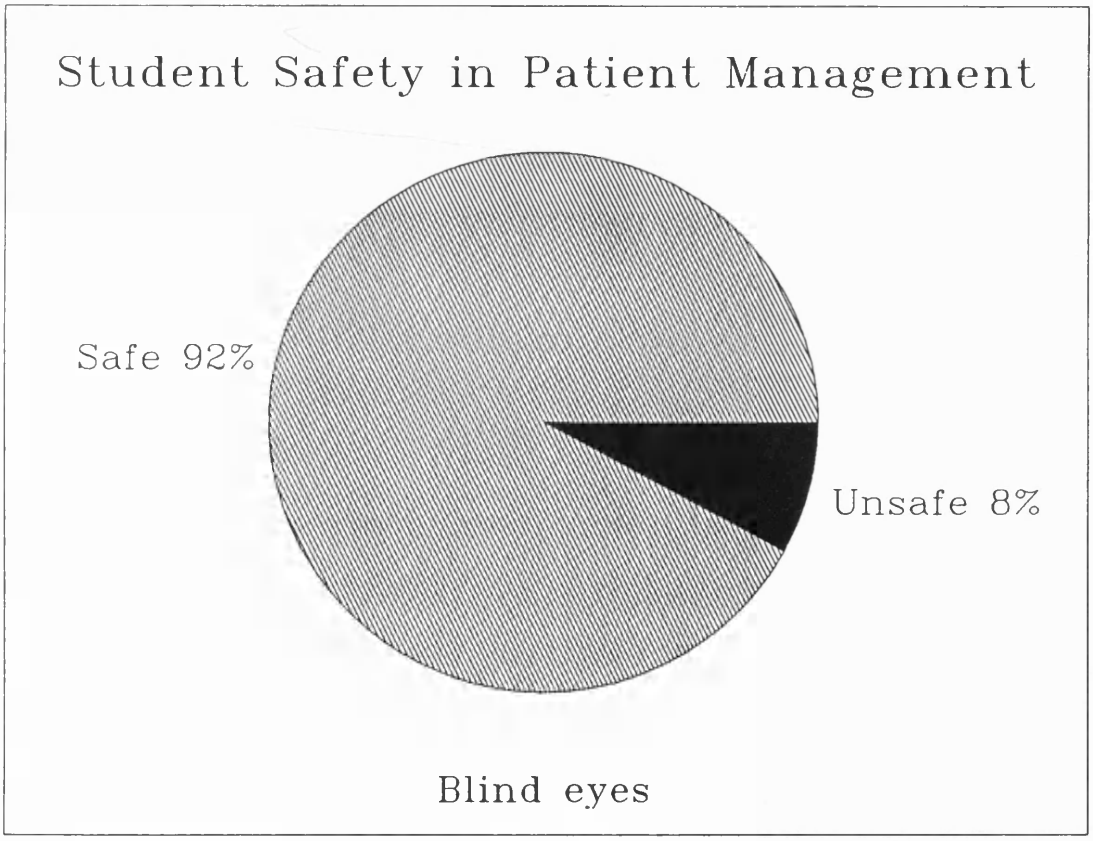

Fig 5.10

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CHAPTER 6

RECOMMENDATIONS

The findings of this study suggested that nurses at the SEN level can be taught to do the discussed clinical skills well. There was somewhat more difficulty in making a clinical judgment. The range for each skill or judgment showed that some students were accurate and reliable in certain areas, but in some others they were not. Most of the students were considered competent enough to work in a rural area with periodic supervision from an ophthalmologist. Student number 5 showed particular overall weakness. All of the students passed the course, but in retrospect it probably would have been advisable not to have passed student number 5. Students number 2, 3, and 4 probably should work under the direct supervision of an ophthalmologist until they develop increased proficiency in the clinical skills and judgments at a later date. Student 9 showed weakness with glaucoma diagnosis, and in the differentiation and management of treatable and non-treatable blindness. Additional experience under supervision in these areas was recommended for this student.

It is recommended that in future training and evaluation of nurses in ophthalmic clinical skills and judgments, consideration be given to the following areas.

6.1 TRAINING METHODS FOR WEST AFRICA

The methods used for training ophthalmic nurses at Lunsar Eye Hospital were effective in producing nurses who could accurately and safely carry out many ophthalmic skills which are generally performed by an ophthalmologist. Much of the literature describing the training of health care workers in situations like Sierra Leone is anecdotal. There is a need for objective evaluation of many of these training methods in a controlled situation. This

study focused largely on the clinical accuracy of the procedures which were taught, as well as the outcome to patient safety and care, rather than the evaluation of the training methods themselves.

The experience of the instructors on the Lunsar ophthalmic nurse course suggest that the use of role play and group clinical approach, as discussed in the methodology chapter, were effective training tools in situations like Sierra Leone. In this culture, people rely heavily on peer opinion, group interaction and group identity. Decisions were more frequently made on a collective basis rather than on individual preference. This made the use of group discussion and decision making, as well as the use of drama, much more applicable in this area of the world than in Europe. There was a need to investigate how this type of decision making process can be more fully utilised in the clinical and community approaches to better eye care.

The use of flow charts was introduced to the students on this training programme. In retrospect, it is questioned how well the flow chart was actually used by the student in the clinical area. Frequently, the investigations made by the student were done correctly with correct results, but when it came to making a decision as to the patient diagnosis, the student made the wrong diagnosis. This indicated that the procedures were carried out correctly, but that the flow chart was not followed for decision making. If flow charts were to be used in future, it is suggested that more stress be placed on their use, and that the student be frequently reminded of the chart. Careful design, simplicity and ophthalmic accuracy are of utmost importance in the development of these charts. The decision making process needs to be monitored more closely.

Fig 6.1

Pt. No._____ Date_____/_____/_____ language _____

Name:_____ Age:_____ Sex:_____ Town/Area_____

VISUAL ACUITY

Right _____ Left_____

	R	L
BLIND: cannot see 3/60	☐	☐
CANNOT BE TESTED:		
Believed blind	☐	☐
Believed not blind	☐	☐
PINHOLE: Low vision or blindness improves	☐	☐

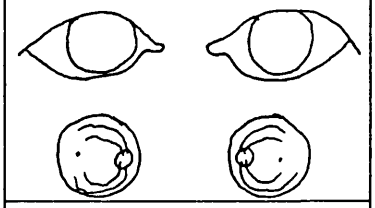
INTRAOCULAR PRESSURE:

	R	L
IOP in mmHg	☐	☐

CUP TO DISC RATIO:

	R	L
0.5 or less	☐	☐
0.6 or more	☐	☐

RIGHT LEFT



PUPIL

	R	L
Normal	☐	☐
Grey or white	☐	☐
Large or mid dilated	☐	☐
Constricted pupil	☐	☐
Irregular pupil	☐	☐
Not clearly visible	☐	☐
poor or no reaction	☐	☐
Afferent defect	☐	☐

BASIC EYE EXAMINATION

	R	L
Normal eyes	☐	☐
Eyelid swelling or lesion	☐	☐
Conjunctiva red	☐	☐
Central corneal opacity	☐	☐
Iris not visible	☐	☐
Obvious lens opacity	☐	☐
No lens (aphakia)	☐	☐
Eye disorganised or absent	☐	☐
Other _____	☐	☐

PREVIOUS SURGERY

	R	L
Eyelid	☐	☐
Cataract	☐	☐
Glaucoma	☐	☐
Other_____	☐	☐

SCREENING EXAMINER REMARKS:

SCREENING EXAMINER NO. ☐☐

CAUSES OF LOW VISION OR BLINDNESS

DISORDERS:

	R	L
Phthisical, Disorganised or Absent Globe	☐	☐
Refractive Error	☐	☐
Cataract	☐	☐
Uncorrected Aphakia	☐	☐
Corneal Opacity	☐	☐
Trauma	☐	☐
Anterior Uveitis	☐	☐
Glaucoma	☐	☐
Optic Atrophy	☐	☐
Vascular Retinopathy	☐	☐
Chorioretinitis	☐	☐
Macular Degeneration	☐	☐
Congenital/Neonatal Factor	☐	☐
Onchocerciasis	☐	☐
Measles,'Vit. A Deficiency	☐	☐
Surgical Procedure	☐	☐
Other _____	☐	☐

RED EYE:

	R	L
Infectious	☐	☐
Allergic	☐	☐
Inflammatory	☐	☐
Trauma	☐	☐

TRACHOMA:

	R	L
Follicles (TF)	☐	☐
Inflammation (TI)	☐	☐
Trichiasis (TT)	☐	☐
Scar (TS)	☐	☐
Opacity (CO)	☐	☐

CURRENT ACTION NEEDED

	R	L
No action	☐	☐
Eyelid surgery	☐	☐
Cataract surgery	☐	☐
Glaucoma surgery	☐	☐
Spectacles	☐	☐
Meditation	☐	☐
Rehabilitation	☐	☐
Other _____	☐	☐

MANAGEMENT

	R	L
TREAT	☐	☐
REFER	☐	☐

TREATMENT SUGGESTED : _____

	R	L
Tetracycline oint.	☐	☐
Cyclopentolate	☐	☐
Atropine	☐	☐
Pilocarpine	☐	☐
Zinc sulphate	☐	☐
Strong Steroid	☐	☐
Weak Steroid	☐	☐

	R	L
another antibiotic	☐	☐
Vitamin A capsule	☐	☐
Alcohol injection	☐	☐
Eye pad	☐	☐
Other _____	☐	☐

STANDARD EXAMINER No. ☐☐

Other areas of clinical experience and training which need to be stressed are the taking of a careful history, and more emphasis placed on systematically examining the patient. The student should be encouraged not to jump to conclusions when unsure of a diagnosis or correct management of the patient. This appeared to be one reason for the students' management errors.

Future training should be problem oriented and concentrate particularly on clinical skill and experience in judgment and management. Less emphasis should be placed on the repetition of facts from memory.

6.2 CHANGES TO THE DATA COLLECTION FORMS

The data collections forms needed to be simplified. Occasionally, a student managed the patient correctly, but it was not recognised as such at the time of data entry, because the student failed to fill in the form correctly. Simplification to the data entry form is shown in fig. 6.1

The basic eye exam section on the form has been changed to more closely follow the pattern of examination indicated on the flow diagram. The section on underlying cause of disease has been simplified to show less differentiation in various diseases of the posterior segment. These causes of blindness and low vision are usually not treatable in the context of West Africa.

6.3 OPHTHALMIC SKILLS CARRIED OUT BY NURSES

This study suggested that all of the clinical skills and judgments could be performed by nurses at varying levels of acceptable accuracy. This does not assume that all students who begin this type of training will be able to accu-

rately carry out the procedures. The fact that student 5 passed this training course indicated that there was a need to re-evaluate the academic and clinical testing criteria that determined the pass or fail of a student on the course.

The clinical skills of measuring visual acuity, measuring intraocular pressure, observation of cataract, and assessment of cup to disc ratio were satisfactorily done by the students. As may be expected, the cup to disc ratio assessment was the most difficult for the students. It suggested that more attention be given to the training of this skill in future similar courses. Many nurses carry out this procedure well, but for those who have particular difficulty, it is suggested that their results not be relied upon for patient management of glaucoma.

The clinical judgments of the 10 students were good, though several of the students showed particular weaknesses in one or two areas of judgment. The results of this study suggested that half of the students could be used reliably to make patient management decisions in remote areas of the country where an ophthalmologist is not available. The 2 areas of most difficulty were in the proper management of treatable glaucoma and of treatable blind patients. While many of the students functioned accurately in these 2 areas, it is suggested that more clinical attention and time be given to these areas of decision making.

6.4 ROLE OF OPHTHALMIC NURSES IN WEST AFRICA

The scarcity of ophthalmologists in the country makes the use of alternate levels of health practitioners essential. The results of this study suggest that nurses trained in specific ophthalmic skills could function reliably within

limits to give the needed treatment and referral in areas where an ophthalmologist is not available. The use of ophthalmic nurses will potentiate the time and surgical output of the few ophthalmologists that exist in this part of Africa. Those students who were weakest in training, should not be used in areas of the country where they are the sole ophthalmically trained person available to that population, unless there is no other alternative. In such cases, it must be recognised that what care they give is far superior to no care at all, the case in many parts of Africa.

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