Developing Eye Care and an Analysis of Eye Conditions in Papua New Guinea

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Developing Eye Care and an Analysis of Eye Conditions in Papua New Guinea

Abstract

Accessible and affordable eye care is only a dream for much of the population of developing countries. Strategies for improving the visual welfare of these people need to be appropriate to the local situation. In 1992 a proposal was devised to address the lack of eye care in Papua New Guinea. This thesis examines the outcome of this proposal and reports on the ophthalmic data collected by these trained eye nurses.

Method: In 1994, 11 National nurses were trained in a 3 month intensive course to become ‘eye nurses’. A basic set of equipment was provided to each eye nurse. Appropriate follow-up and annual conferences supported this initial training. A second group of 14 eye nurses were trained in 1997. Monthly eye clinic reports from the eye nurses provide significant data on eye conditions and visual welfare in PNG.

Results: After 6 years 80% of the eye nurses were still actively working in eye care. An analysis was made of the eye conditions of the 30,000 patients examined by the eye nurses over this 6 year period. The data is generally consistent with previous ophthalmic data from Papua New Guinea. The eye nurses were able to provide appropriate eye care for 80% of the presenting patients without Optometric or Ophthalmic assistance.

Conclusions: Training nurses to become ‘eye nurses’ functioning as basic optometrists is an effective strategy in improving eye care in developing countries. The eye nurses were able to deliver sustainable, accessible, affordable and appropriate eye care, independently treating and managing the most common eye conditions in Papua New Guinea.
Declaration

This is to certify that:

(1) The thesis comprises only my original work towards the MOptom(Res)

(2) Due acknowledgement has been made in the text to all other material used

(3) The thesis is less than 30,000 words in length, exclusive of tables, maps, bibliographies and appendices

John Farmer
Acknowledgements

Many people contributed to the PNG Eye Care Training Program in many ways. Where their contribution is material to the training it has been noted in the text of the thesis. Others provided vital encouragement and support. Some are listed below

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Chapter 1

Eye Care in Papua New Guinea prior to 1994

Introduction

“Why do I cry?…”
“Can you read?” I ask.
“Yes I can”, says the man, “but now my eyes don’t let me see the print”
…. he is only in his thirties!” (Beale 1992)

“For many Papua New Guineans, the loss of vision associated with age has been seen as simply an inevitable part of aging, one without possible remedy.” (Yominao, Mea, Winkley, Gern & Sloan 1989)

World blindness, the global situation

“Every 5 Seconds one person in the world goes blind … and a child goes blind every minute. If national and international efforts to avert blindness are not intensified, the number of people with severe visual disability will double by the year 2020” (WHO & IAPB 1999). Based on 1996 population estimates, over 45 million people in the world are blind, and a further 135 million suffer significant visual impairment. Eighty percent of the world’s blindness is avoidable (WHO & IAPB 1999; WHO 2000a; Thylefors 1990).

All these people suffer enormous personal, social and economic cost. They have lower life expectancy and limited life choices, and their impairment also affects their family and their community. The vast majority (90%) live in developing countries (WHO 2000a; Thylefors 1990). The greatest tragedy is that most need not be visually disadvantaged as their blindness and vision impairment is preventable or correctable.
Considerable effort by many individuals and organizations has begun to change this situation, but much more needs to be done. At an international level the Vision 2020 initiative, a cooperative venture by most non-government aid organizations (NGO’s) together with the health departments of many countries and other interested in-country organizations and individuals, is seeking to eradicate the 5 main causes of avoidable blindness and vision impairment by the year 2020. These are cataract, trachoma, onchocerciasis, childhood blindness (including vitamin A deficiency), and uncorrected refractive error (WHO & IAPB 1999; WHO 2000a).

Even Australia is not free from these problems with over 50,000 blind and 480,000 visually impaired people in Australia. Over 75% percent of this visual impairment is treatable (Taylor, Keeffe, Hien, Wang, Rochtchina, Pezzullo, and Mitchell 2005)

In the neighbouring Western Pacific Region, the situation is one for immense concern as it reflects the greater need for improved eye care suffered by all developing countries.

**The visual problems in Papua New Guinea (PNG)**

For many years eye care in Papua New Guinea (PNG) has been very limited and the needs of the 5 million people are at times overwhelming.

Papua New Guinea is a country of contrasts. It is a land of high mountains, dense forest, lowland swamps, coral islands, torrential rainfall, many rivers and beautiful flora and fauna. There are over 1000 people groups with more than 860 languages. Over 80% of the people live in a rural subsistence environment. There are also great contrasts in the many tribal groups with a vast variety of customs and cultural traditions (Johnstone & Mandryk 2001).
Papua New Guinea, although untouched for generations, is a young country trying to ‘walk’ and find its identity in a world dominated by ‘developed’ western nations and culture.

In this kaleidoscope country there has been a growing need for eye care. Literacy is approaching 50% (Johnstone & Mandryk 2001) resulting from half a century of widespread missionary sponsored education that is now becoming nationalized. The climate, diet and race mix in PNG advances aging and consequently the loss of near vision by the age of 40 and the development of significant cataracts by the age of 50 (Personal observation, Parsons 1991, Chapman-Hatchett and Wallace 1994). With these factors there is an enormous need for eye care, both for the recognition and treatment of common eye disease and frequent ocular trauma, and also to improve the accessibility and availability of low cost spectacles.

The major causes of visual impairment and blindness in Papua New Guinea are cataract, pterygium, untreated eye infections and refractive error (Parsons & Adams 1987, Parsons 1991, Verma 1996; and the eye nurse data reported in this thesis). This mix is in significant contrast to the other developing countries of the world. PNG is very fortunate that trachoma, onchocerciasis, xerophthalmia and primary glaucoma, which are amongst the major causes of blindness on the world stage (Pizzarello, Abiose, Ffytche, Duerksen, Thulasiraj, Taylor, Faal, Rao, Kocor, and Resnikoff 2004) do not cause significant problems for the population (Parsons & Adams 1987, Parsons 1991, Verma 1996). The effective absence of these eye conditions that attract much attention in blindness prevention and eye care personnel training in other countries highlights the need for a locally based specific strategy to improve eye care in PNG.

Prior to the first eye nurse training course conducted in late 1994, eye care in Papua New Guinea had only been available from three government ophthalmologists (one of whom was sponsored by the Christian Blind Mission International (CBMI) a non-government aid organisation), one private national ophthalmologist, and two private expatriate optometrists.
The Government ophthalmologists, located in three of the main towns were overworked. The private eye care services largely catered to the expatriates and the few national people able to access and afford their services. All three private providers were based in Port Moresby and two of them provided a visiting service to the other major centres in PNG.

It is worth noting that Port Moresby is not yet connected by road to any of the other major centres in PNG!

The great shortage of eye care providers was magnified by the difficulties of travel and communication and further amplified by the low level of urbanisation, with 86% of the population being rural (Johnstone & Mandryk 2001).

By any standard the 5 million people were without even adequate eye care. In 1993, Australia, PNG’s nearest neighbour to the south had one ophthalmologist per 30,000 people and one optometrist per 11,000 people (Access Economics 1993) compared to the less than 1 ophthalmologist per 1 million and 1 optometrist per 2 million people in PNG.

Perhaps it helps to comprehend the magnitude of the problem if we picture the state of Victoria in Australia, roughly similar in size and population to PNG. Imagine that there are only 4 ophthalmologists and 2 optometrists based in Melbourne. Complete the comparison by reversing the rural and urban populations, taking the transport infrastructure back 50 years, removing most of the private vehicles, and increasing the costs of eye care and glasses by 10 times. Attempting to obtain eye care in such circumstances provides some understanding of the difficulties faced by most of the people of PNG.

It was very clear that a gaping hole existed in PNG’s emerging and struggling health care system as it related to eye care.
Background (PNG prior to 1994)

In 1981 a colleague, Ewan Stilwell, left the optometry practice in which the author was a partner (Leunig and Farmer Eyecare) to take up a position teaching theology at PNG’s only tertiary theology college, located near Mt Hagen. Confronted by the enormous need for even simple glasses to assist the vision and learning of the students, Ewan wrote about the opportunity for optometrists to help. At the same time Ian Rowse, the director of the Evangelical Church of Papua Mission (a large non-denominational mission group in PNG), also mentioned the need for eye care. He had been involved in arranging dental visits to provide basic care to the rural people of PNG.

Leunig and Farmer Eyecare Visits to PNG 1981-1993

The private optometry practice of Leunig and Farmer Eyecare responded to the challenge to provide a similar service in basic eye care and sent an optometrist to PNG for a one month visit each year from 1981 to 1993 (In some years 2 trips were made with a total of 17 trips during this period). These one month visits were made on a tight schedule to some 15 rural areas during each trip thanks to a coordinated arrangement with many different mission and welfare groups, and over the years almost every region of the mainland was covered. Much of the travel was by light plane and flying in PNG means having to weigh everything including your hand luggage and yourself. The optometrists were required to travel as ‘light’ as possible in both personal luggage and eye examination equipment. Reasonable statistics from 14 of these visits were available and the data is presented in Table 1.

On average, during each trip over 300 people were seen for an eye examination with a further 200 eye screenings undertaken totalling almost 5,500 examinations and 3,500 eye screenings for the 17 trips made during this period.
<table>
<thead>
<tr>
<th>Visit Date</th>
<th>Expatriate Consultations</th>
<th>National Consultations</th>
<th>Total Consultation</th>
<th>Screenings if known</th>
<th>Total Eye Examinations</th>
<th>Custom made Glasses</th>
<th>Readymade glasses</th>
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<td>246</td>
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<td>Totals</td>
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<td>4526</td>
<td>2765</td>
<td>7291</td>
<td>67.65%</td>
<td>32.35%</td>
<td>1994</td>
<td>44.06%</td>
</tr>
<tr>
<td>% of Total</td>
<td></td>
<td></td>
<td>27.92%</td>
<td>72.08%</td>
<td>67.65%</td>
<td>32.35%</td>
<td>44.06%</td>
<td>1994</td>
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<tr>
<td>Average</td>
<td></td>
<td></td>
<td>323</td>
<td>198</td>
<td>521</td>
<td></td>
<td></td>
<td>142</td>
<td>44.06%</td>
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**Table 1.1 - Leunig & Farmer Eyecare Visits to PNG**

The table presents the available data from the Leunig and Farmer Eyecare visits to PNG.
About 28% of the people examined were expatriate (mission or welfare workers). Often, this was because they were very eager to avail themselves of the opportunity as many were on 4 year terms away from their home country. They were conscious of the need for eye care, whereas for many of the national people it was their first exposure to eye care and they had little comprehension of what could be done to help them.

Over 67% of the glasses prescribed were made in Australia, a high proportion because of the high number of expatriates seen who required more than simple pre-manufactured ‘readymade’ reading glasses. Also the readymade glasses available at that time were of poor quality, only available in one style of plastic frame and only in a limited range of plus power prescriptions.

Of the eye examinations some 44% resulted in a glasses prescription.

The national people still had to develop an understanding of what ‘the eye glass doctor’ could offer them that may be of benefit or value. A few came with acute eye disease or blindness hoping for a miracle cure. Most people generally came because they wanted glasses, although many had little comprehension of what glasses could do to help with vision.

There was also the significant overlay that glasses were seen as part of the ‘big’ man’s accessories, like an umbrella. In the emerging ‘new’ culture, having an umbrella was a status symbol as well as the practical benefit of protection from tropical downpours or occasionally providing ‘mobile’ shade. Eye glasses (the PNG term for spectacles), including sunglasses, became another of these status symbols. Metal frame glasses were of higher status regardless of whether the lenses were appropriate. This had other implications such as difficulty encouraging women to wear glasses even when they needed them as the social implications of a subjugated gender being perceived as trying to portray importance by wearing glasses was unacceptable, especially in the highlands areas. Only in the few urban centres or with well educated nationals (eg. school teachers) would the females readily wear glasses. The male domination in glasses usage particularly in rural areas is supported by the results from the eye nurses (see later analysis...
of the eye nurses data). With time and the slowly improving status of women towards equality with men, this will hopefully change.

National people had all experienced many years of exposure to ‘White skins’ and so being ‘white’ was not considered to present a significant impediment to national people presenting for eye care, although the concept of a doctor for eyes was a new one. Most would never have had an eye examination of any type previously.

Expatriates with years of PNG experience strongly advised that the national people needed to learn to pay for services, as well as goods. The cargo cult mentality, which suggested that goods, including glasses, would be given free (donated), was not something to be encouraged. It was important that from the outset, people were expected to pay for the provision of services, even if only a token amount.

In PNG, although the vast majority live a subsistence lifestyle, they are not poor compared to the people in many African countries. Most have access to small amounts of money either from food they have grown and sold at local markets, or provided by family or relatives who culturally are expected to share their income with their ‘wantoks’ (clan groups are very strong in PNG). The term ‘wantok’ refers to ones relatives, but it applies in a much broader sense than Westerners would expect. It extends to second and third cousins when considered in the home location, and is broadened to include people from the same clan group when in another area or large central town.

A sliding scale of charges, related to ability to pay, was used. Consultation fees ranged from 50 toea (about 50 cents at that time) to 2 Kina (about 2 dollars), and a similar scale for glasses (10 dollars to 40 dollars). The money raised from consultation fees was used to help offset the costs of internal flights, and the glasses money helped cover some of the costs to provide the spectacles.
Whilst this voluntary help and the provision of low cost glasses was often the only eye care many of the areas visited had ever experienced, it could never be more than a bandaid to what was really a much deeper need for local eye care services and a long term solution to the lack of eye care in PNG. A significant and lasting improvement in the visual welfare of the people could only come through training local people to provide basic eye care. Not only would this training provide constant ongoing eye care in many parts of the country simultaneously, it would help enable the few local ophthalmologists to be able to spend a greater proportion of their time on the difficult cases and in cataract surgery rather than having to provide basic eye care as well.

The PNG Health System

The Public Health System in PNG at that time (1993) was provided through 19 Hospitals, 32 Urban Clinics, 238 Health Centres (some as large as hospitals), 457 Health Sub Centres and 2440 Aid Posts. About 40% of the hospitals and health centres are run through church mission organizations. In 1998 there were some 361 doctors, 1767 nurses, 1474 nurse aids, and 2108 aid post orderlies (and 4 ophthalmologists). In 1989 the government spent 7.7% of its total budget on health, which was 2.8% GDP or $US24.64 per capita (Handbook Health Statistics Papua New Guinea, 1989).

There was a growing private health care system in the main centres with about 25% of the national doctors in private practice (where pay and conditions are much better). Alongside the developing and struggling ‘western’ health system was a village based traditional health care system.

Eye Care Providers (before Eye Nurse Training began in 1994)

As previously mentioned, prior to 1994, eye care was primarily provided by a relatively small number ophthalmologists and optometrists.
Some other limited eye care was provided through a range of different organisations.

The Christian Brothers (a Catholic teaching order) in Goroka and Wewak had been providing some basic refraction services for many years. They had also provided some services for hearing impaired people and a school for blind children. In 1991 CBMI had funded the establishment of a low cost optical workshop in Goroka (the Mt Sion Optical Workshop) to assemble basic glasses using imported lenses from India and recycled donated frames from Australia. This optical workshop was located within a school for the blind that the Christian Brothers conducted in Goroka. A couple of the Christian Brothers provided basic refractions themselves, and taught a few local people to undertake simple refractions. These nationals also received some teaching from the CBMI sponsored ophthalmologist in Goroka. They also conducted some school screenings and visited villages around the Goroka area. The national people trained in this way prescribed basic glasses and referred any eye health problems to the ophthalmologist at the hospital.

Based in Wewak, a Catholic health care service known as Callan Services provided visiting vision and hearing screening in the areas surrounding the Catholic Health Services network. The Christian Brothers provided basic refraction and glasses service along with basic hearing services. With the exception of the one national who accompanied the optometrist from Leunig and Farmer Eyecare for some training in 1987 and now works in private practice in Goroka, none of the nationals trained in vision screening have continued to be involved in eye care after leaving the Mt Sion Optical Workshop.

The valuable services provided by Callan Services in Wewak and the Mt Sion Optical Workshop in Goroka were the only functional, non-visiting, eye care being provided outside the government ophthalmologists and the private ophthalmologist and optometrists.
In the early years the St John Blind centre in Port Moresby provided some low cost readymade glasses for national people, based on prescriptions from the hospital ophthalmologist or by trial and error.

**Visiting eye care providers**

Apart from the regular Leunig and Farmer Eyecare visits, there were a number of visits from eye surgery teams. These provided a valuable cataract surgery service to many regional areas. Visits by the government ophthalmologists away from their clinics were sparse due to the overload of work and the lack of funding for travel. The coordination of these visiting surgical teams was not always optimal, causing some doubling up and visits to areas that may not have had the greatest need at that time.

When Dr Nitin Verma became the senior government ophthalmologist in 1994, he was able to improve both the coordination of visiting teams and facilitate a significant increase in the number of regional eye surgery visits by attracting additional non-government funding to support rural visits by the government ophthalmologists.

**Other eye training courses in PNG**

There has been a Diploma and more recently a Masters in Ophthalmology program at the Port Moresby General Hospital training ophthalmologists, resulting in a slow increase in the number of national ophthalmologists over the years. By 2000, there were 8 ophthalmologists including 1 expatriate ophthalmologist supported by CBMI.

Elizabeth Cubis, an Australian optometrist, spent a few years in PNG in the late 1990’s working with Mt Sion Optical Workshop and Callan Services. She was able to improve the organization and service at the Mt Sion Optical Workshop and enhance their training. She also undertook a number of short
one or two week courses training health workers within the Catholic Health Services in basic eye care.

**Leunig and Farmer ‘on the job’ training**

During the Leunig and Farmer Eyecare visits a small amount of training of school teachers in vision screening was undertaken. In addition, a national who had been working with the ophthalmologist and the Mt Sion Optical Workshop in Goroka, accompanied the visiting optometrist during the 1998 trip. This was specifically with a view to training him in refraction and the provision of basic eye care. A number of years later this national eye worker left Mt Sion Optical Workshop and Callan Services, and he is now in private practice (although without any formal qualification) providing a basic refraction and glasses service in Goroka.

**Other known early courses**

A number of other short training courses in eye care had been previously undertaken in PNG. These ranged greatly in style, scope, content and most were of limited effectiveness and often with only a short term effect. This seemed due to the training not always being appropriate to the situation and the needs of PNG. Also, it was too short to ensure competence and confidence in the trainees, and no equipment or follow-up was provided.

**British Optometrists training course**

In October 1992, two British optometrists, Paul Chapman-Hatchett and Karen Wallace, spent three weeks conducting a training project in the Goroka region. They trained 3 local health workers, a Dutch missionary and a Dutch physiotherapist (working with Voluntary Services Overseas) in eyesight testing and glasses provision. Two sets of testing equipment were provided to the
trainees. They reported that six months after the training the trainees were testing one afternoon a week in rural areas, making use of the testing equipment and arranging glasses through Mt Sion Optical Workshop (Chapman-Hatchett & Wallace 1994). A few years later the three national trainees who were no longer actively undertaking eye examinations apart from occasional vision screenings. The concept was good but a longer training program and further follow-up and consideration of ongoing support was needed.

**Trachoma Training**

One of the trainees at the first eye nurse training course conducted in 1994 had previously attended a one week eye care course given by a visiting expatriate ophthalmologist. Whist the course covered some good basic concepts, a large amount of time was spent explaining the classification and treatment for Trachoma. Although the intent was good, the net result was of little specific gain because insufficient and inappropriate training was provided (given the effective absence of trachoma as a significant eye problem in PNG (Parsons & Adams 1987, Parsons 1991). This highlights the need for training to be appropriate to the situation.

**Pacific Islands Council**

Just before the first eye nurse training course was conducted in 1994, a group called the Pacific Islands Council conducted a one week eye care course in Fiji. A number of national PNG workers attended, but there was little if any impact on eye care in PNG. A few of the attendees commented that although they had learnt a little more about eyes it had not changed the way they worked (personal communication). The length of training was too short to teach more than just vision screening.
The author is unaware of any other short eye care training courses conducted in PNG.

Proposals for training in Eye Care - The 1989 proposal

A number of other proposals for training mid level workers were put forward for PNG. Some came from non-government organisations (NGO’s) such as Foresight, CBMI (Christian Blind Mission International), HKI (Helen Keller International) as well as from visiting ophthalmologists, and eye care teams. In 1989, CBMI, Sight Savers (Royal Commonwealth Society for the Blind) and Helen Keller International hosted a workshop from which a proposal for the development of eye care in PNG was produced (Primary eye care proposal 1989).

This proposal planned to improve the eye health education at all levels of the PNG health system so that each higher level of health worker could deal with progressively more complex eye conditions and refer to the next level as appropriate. It talked about the need for a national coordinator for primary eye care, and the need for improved low cost glasses supply. Finally, it proposed the training of ‘Ophthalmic’ Health Extension Officers. Health Extension Officers (HEO) in PNG are national people with some medical training at a level between that of a nurse and a doctor. Often, they also carried the administrative responsibility for a health centre. The concept suggested that selected HEO’s could be trained as second level eye care personal, called Ophthalmic HEO’s. A one year course was suggested. An annual eye care conference for eye care workers was also encouraged. In general terms this was an excellent proposal, framed by national people and supported by others working in eye care in PNG. However, as is often the case in PNG, a good or even great idea is not enough to provide the inertia to bring about action and practical outcomes, and no further progress beyond the proposal was made.
Approaches to training mid level eye care workers in other developing countries

There has been widespread recognition for many years that there is a role for training non ophthalmologists in eye care especially in the rural parts of developing countries.

It is accepted that as well as Ophthalmologists, an effective eye care delivery system needs mid level eye care workers to provide the bulk of the eye care so that the ophthalmologists (who are expensive and time consuming to train and pay) are not spending great amounts of their time dealing with basic eye care but rather put to best use dealing with the more difficult cases and surgery (Johnson & Foster 1990, Thylefors 1990, Thylefors 1990b, Pizzarello 1990, Thylefors 1992, Rao 2000, WHO, IAPB etc..) The IAPB meeting in Sydney in 1992 identified human resource development as the highest priority to develop eye care in countries in the region (Keefe et al. 2002). The Vision 2020 initiative continues to identify mid level eye care workers as a significant need in reducing avoidable blindness (Pizzarello et al 2004).

Targets for these mid level eye workers of 1 per 200,000 by the year 2000, 1 per 100,000 by 2010 and 1 per 50,000 by 2020 have been recommended by the World Health Organisation (WHO 1997)

As early as 1954 Ophthalmic Clinical Officers were trained in Kenya. Medical Assistants in Ophthalmology began training in Malawi in 1969, and this eventually developed into a one year course. Training in community ophthalmology has since been undertaken in many developing countries with different training programs and titles for the different needs and roles these eye workers perform. Ophthalmic Nurses and Ophthalmic Medical Assistants are two of the terms that have been used for mid level eye care personnel. Nepal has a 3 year Ophthalmic Training Program teaching Ophthalmic Assistants the diagnosis and management of common eye conditions. This course is based on 3 month intensive theory followed by 2 and a half years of clinical experience in hospitals and eye camps and a final 3 months of refraction training (Johnson & Foster 1990). The International Agency for the
Prevention of Blindness lists a number of similar courses in Africa, India, Pakistan, Bangladesh and Latin America (IAPB 2004).

In the Pacific region, Ophthalmologist Dr John Szetu, has been training eye nurses initially in the Solomon Islands and more recently in Vanuatu (Szetu 2004).

Such models have developed ‘contextually’ as appropriate responses to the needs and situations that existed at that time and against the background of the eye care delivery models that were current in the developed world.

Ophthalmologists working in these developing countries have logically focused on training ophthalmic nurses similar to those in their country of origin with some extension of their knowledge and skills to assist with dealing with the overwhelming eye care needs and the local situation.

Until the eye nurse training in PNG, optometrists have had very little role in training mid level eye care workers in developing countries. Optometrists were generally perceived by ophthalmologists as being simply spectacle providers. Also, until recently, considerable professional animosity has often existed between Optometry and Ophthalmology. Optometry was not seen as having a contribution to eye care development and training and there was little role for optometrists beyond the provision of spectacles.

Optometry overseas aid programs, in operation for many years, have been confined primarily to visiting teams providing refraction and spectacles in areas of need, with very little if any structured training of local personnel. A notable exception is the work of UK Optometrist, Clare Davies, who went to Cambodia in 1993 to work with Southeast Asia Outreach. She established a new (and the only) Cambodian Optometry course. This excellent work was undertaken with the support of the expatriate ophthalmologists working in Cambodia as well as with the support of the Cambodian Ministry of Health (Davies 1994).
PNG National Health Plan 1991-1995

The Government Health Department saw the need for training eye care workers as part of the implementation of the National Health plan for Ophthalmology.


It recognised the difficulties;

- That eye care is not available to all, but confined to a few urban areas
- Refraction services are scantily provided by the ophthalmologists
- Eye care receives only a minute allocation from the health budget
- There is no proper training of para-medical and primary health care workers in eye screening
- There is no screening for eye disease and blindness in school children
- There is no proper records on eye disease in PNG
- There is not enough trained ophthalmologists

The Ophthalmology section of the Health Plan set as its goal to prevent blindness and provide primary eye care to every citizen of PNG.

Suggested strategies included;

- The design and implementation of a primary eye care program and integration into current primary health care activities
- Make treatment and consultation readily available
- Collaborate with NGO’s who are directly involved
- Provide refraction services in the country and the production of affordable glasses
- Provide school screening
- Train Maternal Child Health Nurses, Teachers and other Health Workers in vision screening
- Establish proper referral system and information system
- Improve data collection and storage
- Establish an eye bank
- Conduct more surveys and research
Together with the various proposals and objectives of the Health Plans, there was no shortage of people and organizations calling for further training of national eye care workers to improve eye care with in PNG.

Although it was part of the National Health Plan to see more people trained in eye care, the PNG Health Department seemed to be more focused on other health issues (of which there were many) and there was never any response beyond verbal agreement that these proposals were a good idea. It would require more than just a good idea to bring about improvement in the visual welfare of the people of PNG.
Chapter 2

A Strategy for Developing Eye Care in PNG

Developing a strategy for eye care in PNG

Through the many years of eye care visits, Leunig and Farmer Eyecare struggled with this problem of the need for local training. It was not a simple issue. An appropriate strategy was needed that would place the trained people in the rural areas, accessible to the local people and with the eye care delivered at an affordable cost, including the provision of low cost glasses, all without adding to the already struggling national health budget. There was also the danger that once trained the new eye care workers would move to the main towns and set up a private practice making a good income but serving only a limited number of people, leaving eye care still beyond the reach of most of the population.

A number of different concepts for training were considered, and discussed widely with people within PNG involved in health care delivery, including Government health officials.

Everyone recognised the need for increasing the number of people trained in eye care. It was not clear, however, exactly who should be trained, for how long and who would employ them after their training. These were not minor issues. Training someone from scratch would take a long time, and most national people with drive and academic ability were already involved in some training or employment. Training existing health workers would help reduce the training time, but why would they give up a secure job? Ongoing employment of the graduated eye care trained people was a major concern. The National and Provincial levels of government were always very short of funds making it very unlikely they would finance secure eye care worker positions, and any strategy needed to see the trained eye care workers involved in rural eye care, not becoming private consultants and moving to the
major towns. It was these issues that needed a solution appropriate to the situation in PNG if a real and lasting impact on eye care was to be realised.

In 1992 the author was discussing these concerns to see national people trained in eye care and the problem of an appropriate strategy with Dr Mark Fitzmaurice, an expatriate mission doctor with many years of experience in PNG health care. He mentioned that nurses often obtained 3 months leave from their position to attend a post graduate course in Midwifery or other nurse specialty. He suggested perhaps we could do the same with eye care. The nurses were already employed in the hospital system throughout all areas of the country. With some training they could, along with their normal duties, provide basic primary eye care and low cost glasses without additional cost to the health system.

This inspiration answered many of the earlier concerns and became the basis for the strategy for training eye nurses. This concept was supported by the senior government ophthalmologist at the time, Dr Bage Yominao.

So, in 1992 a strategy was conceived that seemed to offer the ‘right’ approach within the PNG context of eye care needs, and enable the development of a sustainable, accessible and affordable delivery of eye care throughout the country.

**The Strategy**

The strategy was to conduct a 3 month ‘Eye Nurse’ training course with the idea that the trained, and equipped, ‘Eye Nurses’ would return to their Hospital or Health centre and among their normal nursing duties, provide eye care from that centre to the surrounding region. Alongside this training an ongoing supply of low cost eye glasses (spectacles) would be developed, as well as follow-up and support for the eye nurses. Selected eye nurses would be trained over time, to take over the support and eventually the teaching of the eye nurses. Once implemented this strategy would go a long way towards
developing sustainable, accessible, affordable and appropriate eye care in PNG.

It was suggested to the Hospitals that in return for training their nurse and providing them with a substantial set of eye examination equipment they would allow the eye nurse at least one half a day a week release from their normal duties so that they could provide eye care from the Hospital. This would give the Hospital the opportunity to provide eye care for the first time, as rural eye care in PNG was virtually non-existent. It was hoped that with time, as the Hospitals saw the good work the nurses were doing that they would be released to work in eye care for increasing amounts of time.

**Implementing the strategy - Getting started**

Developing an appropriate strategy was a vital starting point, but many previous proposals had not resulted in any action. The Papua New Guinea Government was keen to see eye care develop but struggled with limited resources and enormous problems in many areas of health delivery. Simply trying to maintain the existing health structure and services was a struggle. Despite numerous proposals to improve eye care the PNG Government was not willing or able to invest financial resources in bringing about any significant improvements.

Implementation of any strategy requires drive and determination from someone to make it happen (Professor Fred Hollows is a good example). The system itself rarely brings about the change required to get these things going.

In late 1993, after waiting 18 months for the Health Department in PNG to act on the strategy it became clear that despite the support of the senior Government Ophthalmologist and the verbal support of the Secretary for Health, further initiatives would be required to help bring about this much
needed training. The 1989 proposal had not been enacted, and it was clear that some active intervention would be required if any training was to occur.

The author contacted Ian Rowse who had organised the Leunig and Farmer Eyecare visits to PNG. Ian was convinced the eye care strategy was appropriate and desperately needed in PNG and he approached the Churches Medical Council seeking their support for a ‘pilot’ eye nurses training course to ‘prove’ the strategy. The Churches Medical Council was the collective body representing all the church health work in PNG, which at that time accounted for about 40% of the country’s health care, and most of the rural health care.

With the endorsement and enthusiastic support of the Churches Medical Council the author began planning for the course, talking with interested parties involved in eye care in PNG and looking for ways to fund the training and equipment. The Asia Pacific Christian Mission (now Pioneers) of which Ian Rowse was director, offered facilities in Tari in the PNG highlands to accommodate the nurses and a classroom for teaching the course, all at a nominal cost. The Churches Medical Council selected the most appropriate hospitals and health centres to be involved and arranged to send 11 trainees from these centres. The author was willing to donate his time to undertake the teaching but there was still a need for a significant amount of money to fund the equipment and food for the trainees. A generous donation from Royce Jackson (Modstyle Pty Ltd, an Australian spectacle frame supplier), donations from others who supported the strategy, and shortly before leaving Australia to begin the course, a significant grant for the equipment from AIDAB (now AusAid the Australian Government Overseas Aid Organization) was received. A total of $43,000 was raised to help cover all the essential costs.

The trainees or their Hospital or Heath centre paid for most of the transport to and from Tari, and most of them contributed towards the food costs. The majority of the money raised went to fund the almost $2,000 of eye examination equipment for each trainee and about $600 for a starting ‘seed’ stock of about 200 pair of glasses for each trainee. The remainder covered
food, accommodation and travel costs as well as teaching materials and associated costs. It was pointless training the nurses if they were not supplied with the equipment they would need to be able to work.

**Ten years of eye care training**

And so began 10 years of developing eye care education in PNG, training eye nurses from all parts of the country, both churches and government hospitals and health centres in the country, improving the supply of low cost glasses, conducting refresher courses and annual conferences, training tutors and teachers, and working with the government ophthalmologists and various NGO’s to see eye care develop in PNG. It has resulted in a substantial and lasting improvement to the provision of eye care throughout PNG and a significant step towards making eye care accessible and affordable to the population of PNG.

**Details of the Eye Nurse Training Course**

**The Certificate in Eye Nursing Course**

The eye nurse training course aimed for graduate trainees with a basic understanding of the eye and eye problems (both refractive and disease), skilled in the diagnosis and prescription of appropriate eye glasses, and in the recognition of eye disease and basic treatment.

The post graduate nursing courses were of 3 months duration. It was an important part of the strategy that the eye nurses course fit in with the existing post basic nursing training system, so 10 weeks was chosen for the course length. A basic curriculum outline was developed for this 10 week time frame with the aim to adequately teach the knowledge and skills required for diagnosing and treating the common eye conditions encountered in PNG as well as allow sufficient practical clinical experience with patients to consolidate
the training so that the trainees would return to their own Hospital or health centre with a level of confidence that would enable them to put their training into practice.

People who had spent many years in PNG reported that often training programs had a high failure rate with the trainees not putting their training into practice through a lack of confidence with what they had been taught, little, or more commonly, no follow-up occurred and rarely were any tools (equipment) provided to enable trainees to use the knowledge and skills they had acquired.

The teaching program used in the eye care training was a mix of lectures and practical sessions with an emphasis on ‘hands-on’ experience, visual models and practical illustrations to enhance the lectures. A number of worksheets and weekly ‘assessments’ were used to monitor the progress of the trainees. These also help to and gauge their understanding of the material and to highlight areas requiring revision. Research of developing country eye care training courses by Helen Keller International confirmed this approach and style, as they had also found this to be the most effective in their experience (Pizzarello 1990).

Theory and clinical practical teaching were complete by the end of week 6, practice patients were seen during week 7 when they were also taught the basics of running an eye clinic and managing records, reports and money, with the final 3 weeks spent in real supervised clinical practice.

The detailed teaching curriculum outline is in appendix A and can be summarised as follows

<table>
<thead>
<tr>
<th>Week 1</th>
<th>How the eye works</th>
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<tbody>
<tr>
<td>Week 2,3a</td>
<td>Examination of the eye</td>
</tr>
<tr>
<td>Week 3b,4,5</td>
<td>Refractive errors, refraction and optical correction</td>
</tr>
<tr>
<td>Week 6</td>
<td>Eye diseases, injury, and aging of the eye</td>
</tr>
<tr>
<td>Week 7</td>
<td>Running an eye clinic, community eye health</td>
</tr>
<tr>
<td>Week 8,9,10</td>
<td>Supervised clinical experience</td>
</tr>
</tbody>
</table>
Generally theory was taught in the morning and then reinforced with practical teaching in the afternoons. Classes were held all day 5 days a week. The teaching was intensive compared to the more casual pace of many other PNG training courses. This was necessary to be able to cover the knowledge and skills required. Although it was intense, the trainees were able to keep up and the curriculum seemed an appropriate balance between covering the required material and allowing sufficient time and revision to consolidate what was taught. When necessary some additional tuition (usually on the weekend) was given to any student struggling with their studies.

Whilst there may have been benefits in a longer training course allowing greater depth and breadth, the 10 weeks was sufficient to be able to train nurses in the knowledge and skills required to manage the common PNG eye conditions and prescribe basic glasses. The experiences in the final few weeks of clinical practice confirmed the basic training had covered the knowledge and skills required to manage the presenting patients. Subsequent follow up visits with the eye nurses 6 months after the training also found very little that the eye nurses felt they had not be taught that they had needed.

The teaching was in English as was the norm in PNG for school and post school courses.

The emphasis in the teaching of basic anatomy and physiology was very much on the applied and practical aspects. It was best to teach the structure and function of the eye and vision in terms of the purpose the anatomical part being taught about had to play in the eye, together with what can go wrong. Detailed teaching of the eye diseases would then make more sense. It was important to ensure that the whole of the eye was not lost in the dissection and discussion of the fine detail. In western culture and teaching we generally study things by breaking them into their individual components. National people think in whole parts, not by breaking things up into little sub parts as we so readily do. Concepts of cross sections are not readily understood. Advice from people with years of teaching experience in PNG suggested that these things were not easy for many
people from developing countries with non-western cultures to comprehend. Continual reference to the overall structure and clear simple illustrations without unnecessary detail helped. Wherever possible physical models of the structures were used and found to be beneficial. Using comparisons with everyday examples and illustrations from the culture greatly aided the trainees grasping of concepts. The focus of the teaching needed to be on what they needed to learn to be able to provide basic eye care in their own country, and teaching extra detail was unnecessary. “The emphasis... must be on the doable not on the esoteric” (Pizzarello 1990). For example, there was little practical benefit in them having more than an overview understanding of eye muscles, eye movements and binocular function as these areas were not significant in the scheme of the visual problems and what was treatable in PNG.

Judy Farmer, the author’s wife was involved in the first 3 month training course. As a non-optometrist, Judy helped by proof reading any teaching notes and handouts to check that simple vocabulary was used and where technical words were needed, that they were explained. It was also of great benefit to have her sit in on all the teaching and practical classes providing nightly feedback on how well the topics of the day had been explained. Another cultural feature in PNG and many Pacific countries is the reluctance of the trainees to ask questions of the teacher. Despite working hard to overcome this, it took some time for them to feel comfortable enough with their teacher (and importantly with the other trainees before whom they did not want to seem too forward or embarrass themselves with their questions). They were more willing, however, to ask Judy a question over morning or afternoon breaks in an informal setting. She was then able to feedback these comments to the author so whatever was found difficult could be re-explained or a different approach taken the next day. In this way it was possible, over the duration of the first course, to refine the teaching to develop a sound and appropriate curriculum that would be delivered in an effective way.

The teaching notes had not been prewritten before the first course, as they would need to be developed as the course progressed based on how the
teaching was being received and how the trainees learned. The planned basic outline proved suitable, and by the end of the first course a good set of teaching and student notes had been developed. These needed very little revision for the subsequent 2 courses, even when the national eye nurses began to take over the teaching (see appendix B – teaching notes and appendix C – student notes).

Perhaps the most surprising area of difficulty with the teaching was with negative numbers. Whilst some of the students could handle the simple maths with negative numbers (needed in refraction and prescriptions), many struggled and some number lines and methods of addition and subtraction using their trial cases lenses numbering had to be used to help them in this area.

It was a live-in course so as well as learning together, time was also spent playing basketball together, going for walks, and eating meals together. Although it was an added strain being responsible for the food supply for all the trainees, as well as being the entertainment and social coordinator, these times proved helpful in building relationships and a sense of working together. Living on site with the trainees helped build trust and it certainly enhanced the learning. The strong feeling of being in the program together was also a factor in why so many of the graduated eye nurses are still providing eye care years after graduating.

At the completion of the course the trainees undertook both a clinical and written examination. All of the trainees reached a satisfactory level of knowledge, understanding and skills to be able to manage the common eye problems and prescribe basic glasses. A ‘Certificate in Eye Nursing’ was presented to each trainee. The Certificate carried the endorsement of the Churches Medical Council and Dr Nitin Verma, the senior government Ophthalmologist at that time (see appendix B). By the third course in 2001 the certificate carried the endorsement of the PNG Department of Health and Vision 2020 Australia.
A letter explaining the new abilities and knowledge of the nurses, as well as how they could provide eye care was sent to each of the Hospital or Health Centre management (see appendix B).

The Role of Eye Nurses

The Eye Nurses are second level eye care workers in the context of eye care personnel where the first level, or ‘primary’ eye care is provided at a very basic screening level by general medical workers and health care providers of all levels, and tertiary level eye care is provided by the ophthalmologists in referral hospitals (Johnson & Foster 1990). The word ‘primary’ has different meanings in different contexts in eye care1.

1 ‘PRIMARY’ Eye Care - Terminology

In the early stages of the training of eye nurses in PNG the strategy was referred to as the ‘Primary Eye Care Program’, and the graduated nurses were called Primary Eye Care Nurses. These words and meanings were already in use in various discussion papers, proposals for training. This was similar to the terminology used in Australia where Optometry is understood as the primary eye care provider. Following the American model and terminology, Australian Optometry has expanded its range of service into full scope ‘primary’ eye care including the prescribing of therapeutics. Primary Eye Care is a term very much in current use by optometrists and the ophthalmic media in western countries when talking about the type of eye care delivered by current Optometrists.

In many models of eye care in developing countries, the word ‘primary’ is used to refer to the very basic vision screening and first contact type eye care that could be provided by anyone involved in health care delivery (Johnson & Foster 1990). Primary eye care in this context is the basic vision screening and care provided by local community health workers and general health nurses. The word primary was not appropriate for the much greater level of training being provided to the eye nurses in PNG. In the global context, the level of training that was being delivered in PNG was that of ‘mid level’ or second level eye care workers (Johnson & Foster 1990). In PNG the terminology was changed to ‘Eye Care Program’ and the graduated students became known as ‘Eye Nurses’. This avoided confusion when talking about the training program with others involved in eye care development and training throughout the world.
The Eye Nurses were trained to treat eye infections and prescribe glasses. Based on experience and the reports and statistics from the eye nurses as outlined in Chapter 4 they were able to independently handle 80% of the eye cases that present to a hospital eye clinic for assistance. They could identify those patients requiring eye surgery. In this way the eye nurses could enable the maximum effectiveness for the few ophthalmologists. They could also encourage the prevention of eye disease and improve community eye health. They had a curative as well as a public health role. By having many eye nurses spread throughout the country, most of the population would have access to affordable eye care, and the visual welfare of the people of Papua New Guinea could be greatly improved.

The Eye Nurses were trained and able to
- Examine patients for the presence of eye disease
- Treat eye disease
- Measure a patients’ refraction and prescribe eye glasses (money generated from the sale of low cost glasses could assist with subsidising eye care patrols to surrounding districts)
- Conduct eye clinics at their hospital
- Conduct eye patrols in the region around their hospital
- Provide training in eye screening (primary eye care) to nurses, Community Health Workers and other health providers in their region.
- Conduct vision screening programs in the region including school screening.
- Maintain records, collect statistics and provide reports on the visual status of the people in their region
- Provide community eye health teaching and advice, encouraging prevention and early treatment of eye conditions
- Assist those with low vision to make the most of the vision they had remaining
- Provide pre and post operative patient care and support to the visiting PNG ophthalmologists and visiting overseas surgical teams.
Eye Nurse Equipment

Each trainee was provided with a set of eye examination equipment. The items were chosen to try and ensure they had the necessary equipment to provide appropriate eye examination and treatment.

Ophthalmoscope and retinoscope diagnostic set
This was a Welch Allyn set with a rechargeable battery handle and a converter so the handle could also be used with C size dry cell batteries. Whilst cheaper sets could have been obtained the quality, robustness, and the ability to have both a rechargeable battery and convert to ordinary batteries, were the main reasons for choosing this set. It has proved durable and has given trouble free performance. The rechargeable batteries need to be replaced after about 3 years.

Trial lens set
A full trial lens set in a strong plastic carry case was obtained from Zabbies in India. These were of excellent value, satisfactory quality and well packaged for easy carrying and transport.

Trial frame
A sturdy Magnon TF 510 model was used and proved to be very suitable

Cross Cyl
An 0.50 cross cyl for astigmatic refractions was provided. The stronger power cross cyl was chosen to make it easier for the national patients to notice the difference between the two views. It also avoided chasing small cylinder prescriptions. Astigmatism is not a common significant refractive issue in PNG (personal experience and the eye nurse data) so the training was directed primarily at spherical refractions. It was important to teach a basic understanding of astigmatic refractions and using a stronger power cross cyl made it easier to not get tangled up with small corrections.
Loupe
A headband +3.00 loupe was chosen for external eye examination. These kept the hands free for evertting lids or removing eyelashes. The Eschenbach loupe had the advantage of allowing the lens to be replaced should it become scratched or broken.

Cilia Forceps
For removal of eyelashes

Fine Forceps (Number 5 or Jewellers forceps)
For removal of foreign bodies

Flourescein strips
For anterior eye examination and staining for corneal damage

Eye Drops
Tropicamide 1% and Amethocaine Hydrochloride 0.5% both in minims were provided because the hospitals and health centres did not always have ready supplies of medications. Sometimes homatropine, zylocaine and lignocaine were available. Antibiotic eye drops and ointment were generally in stock and could be purchased without prescription readily from the chemist in major centres.

Textbooks
These were chosen as for their extensive pictures making things easier to understand and allowing the eye nurses the possibility of finding a picture to match the eye condition of a patient with a difficult diagnosis. Both were also written in relatively straight forward English. The ABC of Eyes was written with the structure of the book set out by symptoms. The Manual for Eye
Examination and Diagnosis had the usual structure of an anatomically based layout.

More recently an excellent PNG eye textbook has been written by Dr Van Lansingh (CBMI Ophthalmologist in Goroka for a number of years)
Eyes (Van C. Lansingh and Gerard Buzolic, Rural eye and Ear Service Papua New Guinea 2000)

Letter charts
A new letter chart for use in PNG was designed by the author based on the LOGMAR principle (see sample in appendix D). The 7 Stycar reversible letters were chosen so the chart could be used with or without a mirror. A 7 letter card was made so the chart could be used by matching the symbols. This overcame any language barrier. PNG has over 860 local Languages and whilst many people speak Pidgin English literacy was about 50% (Johnstone & Mandryk 2001) and much less in the older population. The letter chart and card were screen printed onto a stiff lightweight waterproof board, which proved extremely serviceable. Normal cardboard does not survive the humidity very well, and is not washable or waterproof. The chart was made short enough to fit inside a normal briefcase enabling it to be carried with all the other equipment except the trial lens set (which had its own sturdy case). The letter chart covered 6/30 to 6/3 letter size (6/60 to 6/6 at 3 metres). An illiterate E chart was printed on the reverse side.

Reading Cards
A reading card for PNG was also designed by the author (see sample in appendix E). Two thirds of the card was in English with N8, N10 and N12 print. There was a line of Stycar letters and numbers with each of the English print sizes. This allowed for using the matching card with illiterate patients. When the card was turned upside down the other one third was in Pidgin English (N8 and N12). The N8 acuity was more than enough to accurately measure near refractions, and for general reading requirements. It was decided not to have print smaller than N8 to avoid the patients feeling the need to have to be able to read the smallest print (often N6 or even N4 on
some commercial cards). The wording was chosen to provide patient eye health education.

+/-2.00 Flippers
Flipping frames with a pair of +2.00 and a pair of –2.00 lenses was useful for a retinoscopy working lens, quick retinoscopy approximation for screening and the + 2.00 was useful for vision screening for hyperopes.

Screw Driver sets
A small set of screwdrivers suitable for eye glasses screws was provided to enable adjustment and repair of eye glasses

Screws for repair
A number of replacement screws for repairing eye glasses were also provided

Brief cases
A lockable standard brief case was provided to contain all of the equipment except the trial lens set. There was ample room in the case to also allow for the inclusion of paper, record cards, pens, receipt books etc. This enabled the eye nurses to travel anywhere with two robust cases containing all the equipment they would require.

The total value of the equipment provided to each eye nurse was almost $AUD 2000. Whilst this might be considered expensive, providing this set of good equipment has ensured the eye nurses put into practice what they were taught when they finished the course. Waiting for the hospital or health centre to provide equipment would mean it was unlikely to happen. The eye nurses took personal pride in looking after the equipment. It is now almost 10 years since the first course was conducted and the equipment has proved robust and appropriate, and been well cared for. There has been only two or three replacement items required (for stolen equipment) after 3 courses and 36 trainees.
Hindsight and experience have shown that nothing was lacking that was required and nothing was provided unnecessarily.

Schiotz tonometers were provided to some of the busier eye nurses at the refresher conferences, although as expected they have not found much use. As has been previously mentioned simple glaucoma is rare in PNG (Parsons & Adams 1987, Parsons 1991).

**Mt Sion Optical Workshop - assistance and development**

When conducting the first training course consideration was given to how to supply the eye nurses with replacement glasses as they sold the ‘seed’ stock of eye glasses they were given. The options were to import readymade glasses and supply them from a central store, or assemble them in PNG at a locally staffed and run optical workshop. Such a low cost optical workshop had previously been established in PNG by CBMI, and it was managed by the Christian Brothers in conjunction with the Blind School in Goroka. Whilst it was slightly cheaper to import readymade glasses, supporting the local industry seemed the right approach and time was spent by the author helping to upgrade the workshop. All the spectacle lens edging was initially done by hand, so to help improve productivity a reconditioned automatic edger was provided. The staff were taught to use the edger and a supply of frames and lenses was arranged so that the replacement eye glasses stock for the eye nurses could be manufactured in PNG.

This arrangement was reasonably successful in supplying the glasses to the eye nurses.

**Follow-up of the eye nurses**

Six months after the completion of the course each of the trainees was visited in their own home Hospital or Health Centre to see how they were getting on.
These initial visits were made by the author. After the first course it was particularly important to check if the eye nurses had been taught what they needed to know to be able to handle the common presenting eye problems. Secondly, to see if the equipment was appropriate to their needs and whether it was still working and being looked after. There was also a need to hear from their hospital how they were doing, and to encourage the eye nurses in their work.

These follow up visits were an important part of the ongoing support of the eye nurses. In subsequent years, as well as conducting a visit to the eye nurses six months after they graduated, where possible the nurses from earlier courses were visited every second year by the eye nurse coordinator (see later).

The aim of all these 'supervisory' visits were:

- To encourage and support the eye nurse.
- To try and resolve any problems in knowledge and skills
- To try and resolve any problems with the administration of their clinic
- To check the performance of the eye nurse
- To check their equipment
- To check their eye clinic management and finances
- To check on the room or facilities they were using.
- And to talk with the management and doctors of the hospital or health centre

**Annual conferences**

Every year since the first course in 1994 an Annual eye nurses Refresher Course or conference was held until 2002. The purpose was for the eye nurses to be able to get together again (as most were working on their own remote from other eye nurses) so they could renew friendships, encourage and support one another as they shared stories of problems and successes.
and discussed cases to enhance their learning. Some additional teaching or expansion of their knowledge and skills was also a part of the workshop.

These gatherings were well attended and greatly appreciated. They formed a significant part of the support, encouragement, and ongoing education and development for the eye nurses. They played a major role in helping maintain the eye nurses’ enthusiasm and assisting them to continue with their work in eye care. On some occasions the eye nurses were joined by the ophthalmologists, providing a vital opportunity for enhanced communication and facilitating working together for the improvement of the eye care delivery in PNG.

Subsequent courses

The second Eye Nurses Certificate Training Course 1997

Following the success of the first course, Dr Nitin Verma, who had taken on the role of Senior Government Ophthalmologist just before the first course began, asked on behalf of the PNG Health Department for a second training course to be conducted for nurses from the Government Hospitals. This course was held in 1997 and 14 nurses attended. As part of the aim of developing local eye nurses to eventually take over the training, Rody Ukin, an eye nurse from the first group who had an exceptional record of eye care delivery in his region, was asked to attend the course and act as Tutor, helping with the teaching and training. Initially reserved, Rody grew in confidence and became a mentor to this second group of eye nurses. He capably undertook the 6 month follow-up visits to this group of nurses, eventually taking on the role of eye nurse coordinator.

The selection of trainees for this course was undertaken by a general invitation circulated throughout the hospitals and health centres asking for applications. The invitations also asked for indications of support from the
hospital for their proposed trainee. These applications were then considered and the trainees were chosen based on trying to get a spread in the location of the trainees and well as considering the most promising candidates. There was a minor problem with the tendency of people in hospital management to nominate their ‘wantoks’ without due consideration to whether they would be the most suitable candidate, a common issue in PNG.

The third Eye Nurses Certificate Training Course 2001

Vision 2020 was launched at the IAPB (International Agency for the Prevention of Blindness) meeting in 1999. In 2000, the Fred Hollows Foundation undertook an analysis of the eye care situation in the Pacific region and recommended the ongoing training of eye nurses. Discussions between the various aid agencies and individuals involved in developing eye care in the Pacific resulted in a collective plan for assistance which included further training of more eye nurses as the mid level eye workers in the Pacific region. The development of eye care in PNG had grown from training a few nurses into training many eye nurses, trying to help establish mid level eye care and coordination of this with the whole eye care delivery in PNG. It had become too big for one person and the time was right for the development of eye care to be pursued by organizations with greater resources. The Vision 2020 group provided this together with the all important cooperative approach by a number of aid agencies to improving eye care in the Pacific region. During the training of the first two groups of eye nurses, considerable effort had to be made to keep others with interests in eye care development in PNG informed and working together, so that what was developing with the eye nurses training would dovetail with their work. It was pleasing to see this cooperative approach more formalised under the Vision 2020 banner.

As a part of the Vision 2020 plan for developing eye care in the Pacific a third eye nurses certificate course was conducted in 2001. Two of the trainee nurses came from outside PNG, one from Fiji and one from Tonga. The remaining 8 were from PNG, making a total of 10 trainees. Rody Ukin took on
the role of teacher, with some assistance from Dr Bage Yominao (who had returned to work as an ophthalmologist with the government after a period of leave). The author provided support with advice on equipment requirements and teaching materials as well as attending for two weeks half way through the course to help revise and round out the teaching. Christopher Dean (an optometrist from Leunig and Farmer Eyecare) followed-up for another two weeks to help Rody with teaching refraction, and the author returned for the final 2 weeks to help conclude the teaching and assist with the clinical training that was undertaken at the Hospital eye clinic in Mt Hagen. Dr George Jacob, the ophthalmologist at Mt Hagen, also provided support.

Janet Ropkil and Kulap Ekonia were two of the eye nurses trained at the second course. They were undertaking a formal course in nurse education and attended the last few weeks of this eye nurses course to act as tutors and clinical teachers. This formed part of their nurse education practical requirement and proved very worthwhile in assisting the new eye nurses.

Rody Ukin and the author conducted the written and clinical exams at the end of this course.

By attending for only 4 weeks of the 10 week course the author was able to provide Rody with enough, yet not too much support, leaving him with the main responsibility and the opportunity to grow and develop as the Teacher. It also helped to ensure the quality of the training, and this third group of eye nurses were as well trained as the previous graduates. This was another step in the development of national eye nurses capable of delivering and managing the training of future eye nurses.

**An Eye Nurse Coordinator**

As the number of eye nurses grew with subsequent training courses, there was a need for one of the national eye nurses to take on responsibilities as eye nurse coordinator. As well as continuing to deliver eye care in their own centre, they would be able to encourage, support and coordinate the
development of the eye nurses and eye care in PNG together with the
government ophthalmologists. Beginning in 1999 one year after the follow-up
visits for the second group of eye nurses, Rody Ukin, who had been the tutor
for the second course and undertaken these follow-up visits, took up this
position. In 2000 the funding of this position was undertaken by the Fred
Hollows Foundation as part of the Vision 2020 initiatives to assist with the
development of eye care in the Pacific region. Rody served in this role very
well, his confidence blossomed and he earned the respect of all the eye
nurses. He became accepted as the leader of the eye nurses and represented
them with the PNG Health Department.

The job description for the Eye Nurse Coordinator was:

To coordinate the eye nurses in Papua New Guinea by

- Encouraging and supporting eye nurses
- Regular communication with eye nurses
- Regular support visits to eye nurses
- Compiling statistics from eye nurses eye clinics
- Regular communication and reporting with the Health Department
- Regular communication with the Senior Ophthalmologist PGH
- Conducting Annual eye nurses Conference
- Assisting with Training of eye nurses
- Helping to implement the policy guidelines of the Eye Care Program
- National promotion of Eye Care and Community Eye Health
- Coordinating with Regional Ophthalmologists
- Coordinating with Provincial Health Department
- Coordinating with Church Health Services
- Coordinating with Hospital Management (CEO, DMS, DNS)
- Coordinating with Nurses Association and Nursing Council
- Coordinating with visiting eye surgery teams
- Coordinating with Suppliers of Low Cost Eye Glasses
Running the eye clinics

As well as conducting eye examinations the eye nurses were taught and expected to keep basic records of the patient consultations as well as summaries of the patient types, details of patients needing referral, and records of any glasses sold and money received. A very small mark up on the glasses sales helped fund the purchase of batteries, postage, travel to conferences and outreach trips from their Hospital or health centre to provide eye care. The hospitals and health centres generally had no funds for anything and struggled just to stay afloat. By using the small mark up on the eye glasses the eye nurses were able to continue to provide their service despite the continual funding crisis in the health system. Monthly reports, provided to the senior government ophthalmologist, the eye nurse coordinator and the author, summarised patient eye conditions, numbers and type of patients for referral and eye glasses used. This provided feedback on the eye nurses progress and information on what was happening in eye care at each location. The data collected from these monthly reports is the basis for the analysis on eye conditions in PNG reported later in chapter 4.
Chapter 3

An Analysis of the Eye Nurses Training Course and its outcomes

Analysis of the chosen strategy - Contextualisation

Any approach taken in developing a strategy for training national people in eye care (or any other training or development program) must take account of ‘contextualisation’ rather than a ‘colonial’ approach (Hiebert 1987).

It is not a matter of duplicating our Western models of training, or health care delivery. There are multiple reasons of history including both factors of intent and accident in the context of the historical, social and political structures that have given rise to the eye care delivery system, professions and training that we know in Australia. Not all we do now is based on good reasoning, and with hindsight we might well do it differently. Duplicating the many layers of eye care personnel we have in Australia would be inappropriate and a disservice to eye care in PNG.

The plans for developing eye care in any country should be the best for the ‘context’, the best for the local situation and circumstances (Sommer 1995, Dandona & Dandona 2001).

“The solution for improving eye care delivery for each developing nation must originate from that country itself. … The sophisticated eye care delivery model in the USA has little in common with the contemporary ocular services and blindness prevention strategies in most developing nations. It can be replicated in the developing world only at enormous expense and even then it would impact only on a tiny minority of the developing world’s population.” (Schwab 1994 p153)
“The emphasis in these countries must be on the doable, not on the esoteric. … The maxim ‘simpler is better’ should always be kept in mind.” (Pizzarello 1990 p55)

If a training program was to be effective in providing a lasting improvement in the visual welfare of the people of PNG a number of factors would need to be considered. The overall strategy, the choice of trainees, the approach and method of teaching, the length and scope of the course, and how it would fit within existing health care delivery systems and their bureaucracy, needed to be examined in the light of what was appropriate for PNG (not another developing country such as Africa, nor Australia).

There is often a grave danger of being paternalistic in the eagerness to help. Visiting health workers “often exhibit a lack of cultural sensitivity and presume that the ‘blanket panacea’ they have devised for one application in one region of the developing world, will be just as suitable in another.” (Hughes, cited in Scott-Hoy 2000 p87)

Apart from considering the cultural and social structure differences between PNG and other developing countries, there are even the basic issues like the common significant vision problems in PNG being quite different to much of Africa and Asia (Parsons & Adams 1987, Parsons 1991), where most other training programs for mid level eye care workers have been established. The different disease prevalence and significance in these countries have resulted in quite different training programs and training emphasis to that undertaken in PNG. Likewise, the geography and consequent difficulties with transportation is such a problem in PNG that travelling eye teams, effectively used in India, is inappropriate and not cost effective in PNG.

The opportunity for the author to visit and work in most of the provinces of PNG over a 10 year period before undertaking any training was a major advantage. That background experience and the opportunity to listen and talk at length with experienced missionaries and nationals involved in health care was essential in developing a strategy that was appropriate to the context of
PNG at that time. It was vital that the PNG strategy reflected what was needed for PNG from the ground up, not copied or modified from some other country with different health structures and eye problems.

A Role for Optometry in training mid level eye care workers

Eye care delivery models are not uniform even in the developed world. They are also undergoing considerable change. Optometrists still have a very limited role in eye care in most of Europe, compared with a much greater role in primary eye care in the United Kingdom, Canada and even more so in the USA and Australia, particularly in recent years. Over the past 50 years, (since the Ophthalmic Nursing and Assistant training programs in Africa began) and especially over the past 20 years, the Optometry profession has been expanding its scope of service. With therapeutic registration in USA and Australia, Optometrists now provide ‘full scope eye care’ encompassing eye care for refractive errors and visual problems as well as the diagnosis, treatment and management of eye disease. The modern Optometrist in these countries provides non-surgical refractive and medical ophthalmic eye care. This is a vastly different role to that of Optometry’s early beginnings as an ‘Optician’ just providing spectacles.

Consequently a different model of eye care delivery has now emerged where Optometry is the primary eye care provider and Ophthalmology the specialist surgical eye care provider. Optometry is the mid level eye care provider equivalent, not ophthalmic nurses, and as such Optometry has a great deal to offer in training mid level eye care providers. The Optometry profession is now ideally placed to train mid level eye care workers in developing countries in order to produce ‘contextually appropriate’ national ‘Optometrists’ to work with Ophthalmologists in the delivery of eye care.

PNG needed mid level eye workers as the main eye care providers who would function independently of the ophthalmologists but as part of the eye care team. PNG needed a contextually appropriate equivalent to a therapeutically
endorsed optometrist. Rather than focusing on training ophthalmic nurses or ophthalmic assistants in PNG (as had been the case in most other developing countries such as Africa), the strategy was to train a PNG equivalent of an Optometrist.

**Ophthalmic Nurses**

Within PNG some nurses working with the few ophthalmologists had received limited on the job training as ophthalmic nurses to support the ophthalmologists in their work. They were trained as assistants who had limited ability to function independently of the ophthalmologist and the major hospital eye clinic setting.

Philosophically Optometry and Ophthalmic Nursing have quite different foundations and approaches to their role in eye care. Ophthalmic nursing supports and enhances the effectiveness of the ophthalmologist whilst usually working alongside the ophthalmologist. Ophthalmic nurse training focuses on surgical and pre and post operative nursing care, and there is little training in refraction. The lack of extensive training in refraction is also a major consideration when much of the treatable eye conditions are uncorrected refractive error (38% in the eye nurse PNG data, chapter 4)

Ophthalmic nurses are generally not trained to make a final diagnosis and arrange appropriate treatment for eye disease without ophthalmological approval. Their role has not been to provide eye care independently of the ophthalmologist. By contrast, optometrists are trained to work as independent self-sufficient non-surgical eye care providers referring only the more difficult cases and surgery to the ophthalmologist.

Like ophthalmic nurses, Orthopists (another allied health eye profession in some countries) are a group trained to work as assistants and technicians for ophthalmologists, as well as having a role in vision training and rehabilitation. Similarly to ophthalmic nurses their training is not designed to equip them to work as independent full scope eye care providers.
Whilst the ophthalmic nurses trained in developing countries have been effective in improving the efficiency of ophthalmologists, they appear to be more closely aligned to the western ophthalmic nurse model with a focus on surgical nursing and assisting the Ophthalmologist rather than the modern optometry model focusing on independent non-surgical eye care.

In countries where the training has emphasised a more independent role for the mid level workers, the training would be more closely aligned to aspects of a modern optometry course than the ophthalmic nurse courses.

A ‘contextualised’ optometry style course was considered to be the most appropriate approach in PNG.

**Training ‘PNG Optometrists’ - An Optometry Course?**

Whilst training a PNG ‘optometrist’, any strategy for developing eye care needed to be PNG focused and seen as an integral part of the PNG Health system. It should grow within the health structure, work within the existing health system and extend the present system to improve the accessibility and affordability of eye care.

Whilst it might be considered by some to be desirable to set up a 3 year optometry course it was inappropriate in PNG at that time for a number of reasons.

It would be very expensive in staffing and infrastructure for the course, and these would be ongoing recurrent expenses. The graduates from such a course would be unlikely to be employed in a financially strained government health system and they would very likely end up working in the private sector located in the major centres providing eye care for those with substantial income. Setting up an Optometry course would also imply beginning with trainees who had no previous health care education.

It would be much more efficient to give a one year intensive course to nurses (who have had 2 years of basic health care training) to produce a ‘3 year’ trained eye nurse (‘PNG optometrist’). This approach would also be more
effective in the context of the PNG health system and structure as the trainee nurses were already employed within the PNG Health system.

**Nurses as ideal candidates for eye care training**

There had been considerable discussion in previous proposals (especially the 1989 workshop proposal (Primary eye care proposal 1989) that Health Extension Officers (HEO’s) were the most appropriate candidates to train. Their training was at a level between that of a nurse and a doctor, and in many rural areas they functioned as the doctor. They often were the Health Centre administrators as well. The future of HEO’s was uncertain as their role of pseudo-doctor was slowly being phased out as increasing numbers of doctors were trained. The HEO’s often ‘advanced’ into hospital administration and they seemed to consider themselves above doing the general nursing type health care. They generally did not seem as willing to work as hard as the nurses, and it would have proved difficult to free them from their centre for 3 months training. The hospital or health centre would much prefer to send a nurse for training. In the rural areas where they were located, their role as pseudo doctor/administrator did not sit well with a future role as the eye care provider for a region, they would most likely have stayed with their current duties and allowed the eye care to lapse.

A 3 month post graduate course in eye care fitted with the existing nursing system naturally, whereas it was foreign to the HEO training and development. For these reasons it was not considered appropriate to select HEO’s as the candidates for training. Nurses had a good basic medical training (a 2 year course), were keen to learn new skills, prepared to work hard, and willing to return to their rural centre.

PNG also had a level of health worker called a Community Health Worker (CHW). These people were trained at a lower level than the nurses. Initially some CHW’s were sponsored to complete the eye nurses course. Over time the nurses proved to be a better choice as the CHW’s found the intensive training difficult, as their previous training was not as advanced and thus not
as good a basis for the eye care training. Also the CHW’s were generally employed in more isolated rural and smaller health centres than nurses and their potential impact in eye care was much more limited because of the smaller population they serviced compared with a nurse working from a hospital or large health centre setting.

It was most appropriate in the PNG context to train nurses.

The ‘Eye Nurse’ Title

The graduates from the training program were not called optometrists for a number of reasons. Firstly, the nurses wanted a name that reflected their nursing background, and they would still continue to be nurses for part of their working role. Secondly, using the title Optometrist would introduce confusion with old ideas of optometrists as just spectacle people (especially in countries outside Australia, USA and the UK). Thirdly, and probably most significantly, it was important that this new type of eye care provider needed to develop within the existing PNG Health system, a task that would be much easier as a new type of specialist nurse rather than trying to establish a completely new profession altogether with all the confusion and misunderstanding this foreign concept would carry.

A deliberate choice was also made not to use the terms, Ophthalmic Nurse or Ophthalmic Medical Assistant to avoid any confusion over the role and training emphasis given to the eye nurses.

A future role for Optometry providing training in developing countries.

Optometry is a relative newcomer to the challenge of delivering eye care in developing countries. In the early 1980’s the International Optometric and Optometry League (IOOL, now called the World Council of Optometry) began to promote optometry’s involvement in humanitarian efforts to improve eye care in the Third World Nations (Stefano 2002).
In recent years, with the expanding scope of optometry, and dramatically improved relations between the Optometry and Ophthalmology professions, Optometry is now seen on the world stage as having a significant role to play in training mid level workers. This is especially so in the area of uncorrected refractive error, one of the major causes of vision impairment across the world. Whilst some of the opportunities are focused on specific training in refraction, success of the eye nurse training in PNG has helped to show that optometrists can effectively deliver eye care training across all the areas appropriate to mid level workers. Using a similar model of training eye nurses to the strategy initiated in PNG, the International Centre for Eyecare Education (ICEE), established in 1998, employs Optometrists to undertake a growing amount of eye care training in a number of developing countries. The Fred Hollows Foundation also now employs Optometrists to provide eye nurse training in the Pacific region.

The PNG eye nurse training may be a world first for Optometry?

There seems to be no evidence from a literature search, or through talking with those involved in developing world eye care, of any other significant mid level eye care training courses initiated, designed and conducted by an optometrist and so the PNG eye care training program may be the first time that an optometrist has developed a strategy and trained mid level eye care workers in a developing country.

Outcomes of the eye nurse training

Distribution

The trainee eye nurses came from a variety of locations throughout PNG. A major factor in the selection of potential trainees was the location of their hospital or health centre. This provided a reasonable spread of the eye nurses...
and vastly improved the accessibility of eye care throughout PNG (see figure 3.1 - Eye Nurse location map). The greater concentration in the central highlands matches with the higher population density.

![Figure 3.1 - Eye Nurse location map](image)

- Each red triangle represents the location of the one of the 25 eye nurses trained in the first and second eye care training courses

**Retention**

At the end of 2000 there were 20 active eye nurses from the 25 that had been trained in the first two courses (1994 and 1997) providing accessible and affordable eye care in PNG. This gives a ratio of 1 per 250,000 people (population 5 million), which was a good step towards the WHO target of 1 per 200,000 people by the year 2000 (WHO 1997).
Most of the inactive nurses had moved from their original work place due to family reasons (marriage, divorce, husband transferred) and did not take up eye work in their new location. A couple were never very interested in eye care and did not continue beyond the first year. Some who moved to another hospital continued to provide eye care from their new location.

The 80% retention is a very good result and exceptionally high for PNG and other developing countries. Those who were involved in general nurse training in PNG indicated it was realistic to expect that less than 50% of the trainees would still be involved after one year. In the Philippines, only 60 out of 400 (15%) workers trained in primary eye care remained in service after 5 years (Pizzarello 1990)

At the time of writing (2007), there were estimated to be some 25 active eye nurses in PNG (from the 33 PNG nurses trained over the three courses 1994, 1997, 2001), a 75% retention rate. (One eye nurse has died and another retired after 10 years of providing eye care)
Providing the graduates with appropriate equipment, the follow-up visits to the nurses home, the monthly reports and annual conferences were major factors in the retention of the graduated eye nurses.

Giving the eye nurses enough training and equipment to be able to provide care and really do something to help people when they returned to their Hospital or Health Centre, enabled the eye nurses to receive positive feedback and a sense of satisfaction from the care they delivered. They were able to make a real impact on the visual welfare of their people. This acted as a powerful reinforcement, to encourage and reward them in their eye work, all of which helped them to continue despite the enormity of the tasks and the isolation of often being the only eye care provider for many kilometres.
Developing Teachers

Not only were eye nurses trained and empowered to deliver eye care in PNG the training program also encouraged the development of Rody Ukin initially as a tutor, then as the coordinator, and finally as the major teacher for the last training course in 2001. Another 2 eye nurses were able to undertake the practical component of their nurse educator course during the third training course, producing 2 trained and qualified nurse tutors with skills in eye care training. This provided a valuable resource for future eye nurse training in PNG.

Capable Eye Nurses

The eye nurses were able to manage almost all of the eye problems of the patients presenting to their eye clinics (see eye Nurses data chapter 4). This suggests that the training of eye nurses was successful in producing mid level eye workers capable of delivering substantial eye care to the people of Papua New Guinea.

Comparisons with other eye care training courses in PNG

The Eye Nurse Training Program has been much more successful than previous attempts to train national people in eye care. There are no other mid level eye care workers currently delivering eye care in PNG. Previous training programs have produced eye care workers who were largely conducting vision screening and very few if any have remained active. There are a couple of national people providing a basic refraction service with the Mt Sion Optical centre and Callan Services and one independent refractionist who trained with Mt Sion Optical Centre and accompanied Leunig and Farmer on one of their visits.
The major reasons that other courses seemed to be less effective in producing a significant and lasting impact could have been:

- No equipment was provided to the trainees. This is a major issue as providing training without the equipment makes it almost impossible to put that training into practice.
- The training was of insufficient length to give trainees a good grounding and understanding of eye care. It is hard to remember and harder to use what we don’t understand.
- There was little chance to practice providing eye care enough so that the trainees would return to their centre with some confidence in themselves.

The 3 months of the eye nurses Training Course was intensive training compared to the normal rate of teaching in PNG. Whilst this made it hard work for the trainees it reduced the time they were away from their home place and work position. Current PNG teaching rates would probably take 6 months to cover the same material.

**The course size**

The larger number of trainees in the second group (14) made the teaching and subsequent support (glasses supply and surgery visits) more difficult than with the first group (11).

With the group of 14 trainees, keeping the nurses working together as a single unit was quite difficult. It is a significant advantage in the long term success of the strategy if the trainees develop a strong sense of belonging together. This was found to be possible even when the trainees came from such vastly different backgrounds and people groups. Their sense of belonging helped them continue with their eye work when they encountered difficulties once they returned home to a place where they were quite isolated professionally. Often they were the only eye care provider in their region (or even province). With a strong sense of belonging they were also more likely to keep contact
with one another and they looked forward to the annual conferences of eye nurses to renew their friendships and share their experiences. In this way they provided ongoing support to each other and were far more likely not to give up the eye work.

Larger classes also make it more difficult for all the trainees to be actively involved during the teaching sessions. They were less likely to ask questions in the larger group (it was hard enough to get them to ask questions at all for cultural reasons) and it was more difficult to provide satisfactory supervision and assistance during the practical sessions. Sufficient active teaching during the practical and clinical learning was considered vital in producing eye nurses who could deliver effective eye care after their training. Accommodation during the course and transport to various locations for practical experience was more difficult with the larger group. Ensuring ample opportunity for the nurses to be involved as they consolidated their learning at the end of the course, when either observing at an eye clinic or seeing patients, would be a greater problem if the group had been larger.

Finally, training too many people at once makes follow up more difficult and providing ongoing support keeping up the supply of eye glasses as well as surgery visits becomes a problem and these are significant factors.

**Problems encountered**

Overall the strategy of training eye nurses has proved to be highly effective. However, there were numerous hurdles to overcome and as expected a number of substantial problems were encountered in training the eye nurses and establishing them within the PNG health structure. Acceptance and recognition, problems with the glasses supply, and lack of surgical visits were the main difficulties. Some of these continue to be issues that are still being resolved.
Acceptance and Recognition

It was expected that it would take some time for people to see and appreciate the eye nurses and their work. The PNG Health System knew nothing of mid-level eye workers and there were significant problems with acceptance of the abilities and role of the eye nurses, and appropriate recognition of them. For some years, whilst the eye nurses were returning to their hospital and taking the additional responsibility and workload for eye care delivery (including extra hours and being called out of hours), they were still receiving only basic nursing pay. In some areas they were recognised as competent eye care workers and they were appreciated for their significant contribution to the health and well-being of the people in their region. A number have been promoted to specialist nursing officers and are working full-time in eye care on behalf of their Hospital. In other places the hospital management has been less supportive.

A major part of this issue of acceptance was the bureaucracy of the health system. The eye nurses training program had strong verbal support from the Secretary of Health and the next two senior Health Department officers responsible for eye care, specialist services and primary health, but this did not necessarily translate to support lower within the health system and at the local health officer level. The Secretary for Health circulated a memo to all hospitals encouraging them to support the eye nurses and this helped a little. Support from the top of the health system was strong, but it would take a long time to prove the value of the eye nurses and allay the fears of those within the system who felt threatened because something new was happening.

Another problem was that although the training course had Health Department support it had no ‘official’ recognition within the existing nursing or medical training institutions. This was illustrated when one of the trained eye nurses was almost replaced in her position in the eye clinic of one of the major hospitals by a midwifery nurse, because the midwifery nurse was more qualified! (She had 2 formal nursing certificates although no training in eye care, compared to one ‘official’ nursing certificate for the eye nurse). The
ability, knowledge and skills of the eye nurse did not seem to be a significant factor.

Instances such as this and the move over time for all post basic nursing qualifications to become one year courses, without which the eye nurses could not get salary promotions or recognition within the health bureaucracy, has lead to the development of a one year eye nurse training course (see development of the Bachelor in Clinical Nursing (Eye Care) course below). The continued work of the eye nurses is speaking for itself. Recognition and acceptance of the vital role the eye nurses play in eye care is growing and becoming much less of an issue than it was previously.

**Problems with the supply of eye glasses**

There were times when the supply of glasses from the Mt Sion Optical Workshop was less than satisfactory. The Optical Workshop was staffed and managed by nationals and overseen by the Christian Brothers. Problems with ensuring the workshop had sufficient stocks of frames and lenses, and difficulties with the money management by the national staff (a universal problem in PNG) seemed to be the cause for the eye nurses not having access to a stable, reliable supply of glasses. There were conflicting pressures on the workshop, which was being expected to fund the blind school in the absence of reliable PNG Government funding that was some years behind in being paid. Ongoing advice and encouragement was provided by the author in the hope that the situation would change. Eventually an Australian optometrist, Elizabeth Cubis, through her work with the Catholic mission over a few years in the late 1990’s, began sorting out some basic management issues and the situation improved.

The concept of supporting the locally staffed and run optical workshop is sound but there have been times when in hindsight a central depot supplying imported readymades may have been a better option. This would have ensured more stability in the supply because of the direct control of this by the
Eye Nurse Training Program and also the ability to generate some funds to support an eye nurse coordinator.

Another problem related to the glasses supply was occurring at some of the hospitals which were collecting the money paid for glasses and banking it with the general hospital funds. When the eye nurses went to the hospital finance department for money to buy replacement glasses they discovered that the glasses money had been used as part of the general funds, and they were left empty handed.

Currently the Mt Sion Optical Workshop continues to supply most of the needs of the eye nurses, but a stock of readymades is planned to be established by Vision 2020 to help ensure ongoing supply.

**Lack of surgical visits**

With the eye nurses providing eye care in rural parts of the country they were correctly identifying patients who needed cataract surgery. Disappointment followed for both the eye nurses and the patients when it became difficult to arrange for an Ophthalmologist to visit and help these patients. The Ophthalmologists had problems meeting this need because of lack of funds for them to undertake rural visits and sometimes a lack of consumables. They were also very busy dealing with the workloads at their own eye clinics. With more eye nurses being trained and some now working with the Ophthalmologists in the main centres hopefully the ophthalmologists will be more able to travel. Solving the funding and consumable problems are other issues continuing to require attention.

**A ‘Three legged stool’?**

It is important to remember that the training of mid level eye care workers is a part of the overall eye care and health system.
The eye nurses need to fit into and be supported by the health system which knew nothing about eye nurses before the training courses.

The Ophthalmologists need to be able to cope with the increase in referrals and cataract surgery load, including rural surgical visits.

The supply of low cost glasses needs to be able to keep up with the surge in demand as more eye nurses are trained.

The eye care program in PNG can be thought of as like a stool with three legs; the ophthalmologists, the eye nurses, and the glasses supply. Raising one ‘leg’ without the other will unbalance the delivery of eye care and have adverse effects on the other ‘legs’. The best way to help maintain a balanced development is through continually working on a cooperative approach to eye care development by the various aid agencies as encouraged by the Vision 2020 initiative.

The future of eye nurse training in PNG

Development of the Bachelor in Clinical Nursing (Eye Care) course

With time all recognised post nurse training in PNG has become a one year course with certain ‘core’ subjects set by the Nursing Council. This has implications for eye nurses within the Government hospital system who cannot get pay rises or advancement without a one year post nursing qualification. This lead to the consideration of lengthening the present eye nurse training course to a one year post basic nursing course in eye care. Initially called advanced diplomas when the first drafts for this new course were being created, all the one year post nursing courses have now become Bachelor in Nursing courses as the nurse training was moved into the University of PNG.

From a purely practical perspective the intensive 10 week certificate training course produced eye nurses with appropriate knowledge and skills to deliver the required level of eye care in PNG. As previously discussed in the analysis
of the eye nurse training strategy, a longer course removes the nurse from their position in the hospital and is significantly more expensive to run and for the nurse to undertake especially if it is conducted in Pt Moresby where the University of PNG is based. But it is inevitable that as the eye care program develops factors such as those mentioned above become the driving issues forcing change. On the positive side, a one year eye nurse training course does allow for an expansion of the teaching and greater practical experience and consolidation.

Rody Ukin developed an initial draft curriculum for the one year course with assistance from the author. This was based on discussions with the Nursing Council (who are in support of the Bachelor in Clinical Nursing (Eye Care) being conducted)

The draft has been further developed by Janet Ropkil (one of the eye nurse tutors), with help from the Nursing Council, the University of PNG and the author, and it is hoped the first course will begin at the University of Papua New Guinea in 2008.

**Bachelor in Clinical Nursing (Eye Care) outline**

Core Studies (common to all post graduate nursing degrees)
- Professional Studies and Clinical Leadership
- Sociology and Cultural Concepts in Health Care
- Research in Nursing

Clinical Eye Specialty Courses
- Anatomy, Physiology and Eye Examination
- Eye Pathology (diseases and injuries) and Treatment
- Optics, Refraction and Vision Correction
- Ophthalmic Surgery Management
- Rehabilitation, Eye Health Education and Management of Ophthalmic services
Considerable time will be spent in clinical teaching and practice in the eye clinic throughout the year.

**Vision 2020 PNG**

In May 2002, the Fred Hollows Foundation on behalf of the Vision 2020 group sponsored a workshop that was attended by many of the eye nurses, the Ophthalmologists, Government Health officials, representatives from the Nursing Council, the University of PNG, CBMI, Fred Hollows Foundation, and other individuals with interests in the development of eye care in PNG. After considering the aims of Vision 2020 and discussing situation of eye care in PNG at the time, the group established some drafts goals for eye care development and elected a local Vision 2020 committee to be known as Vision 2020 Eye Care PNG. (Fred Hollows Foundation 2002)

The ongoing development of eye care in PNG is to be coordinated by Vision 2020 Eye Care PNG.
Chapter 4

An Analysis of Eye Conditions in Papua New Guinea

INTRODUCTION

The eye nurses patient data and statistics

The presented statistics are collated from the monthly reports received from the completion of the first training course in December 1994 until December 2000. They provide an analysis of the diagnosis of eye conditions in over 36,000 people who underwent a full eye examination by the eye nurses and they give a valuable insight into the visual status of the people of Papua New Guinea.

This data is particularly relevant in the light of the limited available information on the epidemiology of visual conditions in the country at large. There have only been a small number of previous studies reporting on the eye conditions of Papua New Guinea.

Mann and Loschdorfer reported on a 1955 ophthalmic survey (Mann & Loschdorfer 1955) that was commissioned by the Minister for Territories at a time when PNG was administered by Australia before independence. A large part of the purpose of the report was to survey the prevalence and severity of trachoma, and try to determine if historically, trachoma was spread from PNG to the Australian Aborigines. The report also lists the prevalence of other eye conditions.

Vines, an epidemiologist with the PNG Department of Health, includes a chapter on eye conditions in his 1970 report on a health survey of the country. (Vines 1970)
George Parsons, who was an expatriate Ophthalmologist based in Madang in PNG for many years, authored a number of detailed reports of ophthalmic data in PNG (Parsons 1982, Parsons 1986, Parsons & Adams 1987, Parsons 1991). His report on ‘A Decade of Ophthalmic Statistics’ (Parsons 1991) is particularly illuminating when looking at the eye conditions of the people of Papua New Guinea.

Dr Bage Yominao, a national Ophthalmologist, conducted an eye health survey in the Asaro Valley area of PNG in 1988 (Yominao et al. 1989).

A number of other papers record data on various specific eye conditions (Heath & Heath 1973, Dethlefs 1982a, Dethlefs 1982b, Verma, Verma, Jacob & Demok 1997, Verma, Prashant, Murphy & Kerek 1999, Ree 1980) and some of these provide additional specific comparative figures to the eye nurses’ data reported in this thesis.


The data collected from the eye nurses Eye Clinic Reports was for presenting patients, it was not a population survey. The presented results cover the 6 year period up to December 2000 and so include results from the first two groups of eye nurses only. Some nurses had been very diligent and their results are complete for this period. Others were spasmodic with their monthly reports. Some worked in main centres conducting eye clinics full time, while others worked in a rural setting and managed an eye clinic part time around their normal nursing duties. A few eye nurses did not continue in eye care. As a result the totals of patients to have a full eye examination by an individual eye nurse vary from as little 270 to as many as 5500 people.
The eye nurses from the first group, trained in 1994, were mostly from rural areas and smaller Hospitals or Health Centres, whereas the second group of eye nurses, trained in 1997, were generally from larger urban town centres and main hospitals.
METHODS

The Eye Clinic Report format

The eye nurses sent monthly eye clinic reports summarising their eye care work to the author, the eye nurse coordinator, and the senior government ophthalmologist. These reports provided a breakdown of the eye conditions the eye nurses identified in their presenting patients, totals of those patients requiring specialist ophthalmological attention, and the numbers of patients provided with glasses, classified by power (see figure 4.1 - Monthly Eye Clinic Report).

Full eye examination

The total examination number in the monthly report submitted by the eye nurses (Figure 4.1) gave the total number of patients who underwent a full eye examination. As mentioned, these were presenting patients to the eye clinics.

The eye nurses were taught a full eye examination which involved the following;

- History including, presenting complaint/s, medical history, past ocular history and family medical and ocular history.
- Vision with and without correction
- External eye examination including with a 3x loupe
- Pupil reactions cover test at distance and near, convergence, eye movements, and visual fields by confrontation.
- Internal eye examination by direct ophthalmoscopy
- Refraction, including near add if appropriate.

(see figure 4.2 - Eye Examination sheet (patient record))
### Eye Clinic Report

#### Place

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Power</th>
<th>Used</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Other+</td>
<td>M</td>
</tr>
<tr>
<td>Myopia</td>
<td>+4.00</td>
<td></td>
</tr>
<tr>
<td>Hyperopia</td>
<td>+3.50</td>
<td></td>
</tr>
<tr>
<td>Astigmatism (&gt;1)</td>
<td>+3.00</td>
<td></td>
</tr>
<tr>
<td>Presbyopia</td>
<td>+2.50</td>
<td></td>
</tr>
<tr>
<td>Cataract</td>
<td>+2.00</td>
<td></td>
</tr>
<tr>
<td>Pterygium</td>
<td>+1.50</td>
<td></td>
</tr>
<tr>
<td>Strabismus/Squint</td>
<td>+1.00</td>
<td></td>
</tr>
<tr>
<td>Conjunctivitis</td>
<td>+0.50</td>
<td></td>
</tr>
<tr>
<td>Corneal ulcer</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Injury/Scar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Condition not above</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
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<td></td>
</tr>
</tbody>
</table>

#### Month

<table>
<thead>
<tr>
<th>Power</th>
<th>Used</th>
<th>M</th>
<th>F</th>
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<tr>
<td>-4.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other -</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total Glasses sold this month**

---

**Eye Care Nurse**

**Total Examination this month**

**Review Patients this month**

**Total Screening this month**

**For the Specialist to see:**

<table>
<thead>
<tr>
<th>This month</th>
<th>Total still Waiting</th>
<th>Operated this month</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL number of Cataract</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL number of Pterygium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL number of Others</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Figure 4.1 - Monthly Eye Clinic Report**

These reports were submitted by the eye nurses for data collection.
**Eye Care Program Papua New Guinea**

Examined by

**Name**

**Address**

**Date**

**Sex/Age**

**History**  
PC (D, N, SE, HA):

**MH:**

**POH:**

**FH:**

- V R L
- V with gl R L

**External Eye**

- R
- L

<table>
<thead>
<tr>
<th>Pupils</th>
<th>R</th>
<th>D</th>
<th>C</th>
<th>L</th>
<th>D</th>
<th>C</th>
<th>Movements</th>
<th>“HH”</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT</td>
<td>D</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NPC</td>
<td></td>
</tr>
<tr>
<td>Visual fields</td>
<td>R</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Internal Eye**

- R
- L

**Rx (Dist)**

- R
- L

- V with Rx R L

**PD**

- add

(Reading strength will = Distance Rx plus the Add)

Reading strength R………………… L…………………

**Diagnosis:**

**Action:**

**Figure 4.2 - Eye Examination sheet**  
This format was used as the patient clinic record by the eye nurses.
Review Patients

This field was added to the report in mid 1998 at the request of the eye nurses to record those patients seen for a review examination. Where the eye nurses provided figures in this category they were included in the screening total for statistical purposes.

Vision Screening

The total screening number provides the total number of people given a vision screening by the eye nurses. Most of this vision screening was conducted in schools, but vision screening was also done in teachers colleges, bible colleges, prisons, as well as on visits to rural areas and villages. The monthly report format does not record any results of pass/fail rates from the screenings. Patients who failed a screening were then seen for a full eye examination and their results recorded appropriately.

The screening protocol taught to the eye nurses consisted of:

- measuring vision, each eye separately (less than 6/9 was a fail),
- a cover test,
- and a check of binocular visual acuity with +2.00 (6/12 or better indicating significant hyperopia).

This was considered an appropriate screening protocol for the needs and situation in PNG. More sophisticated screening protocols may have identified binocular vision problems that the eye nurses in PNG would miss, but these BV problems were not considered to be significant in the context of the visual requirements for PNG schooling or work. Also the management of these conditions was beyond the scope of the eye care training given to the eye nurses.
**Glasses (Spectacles)**

Spectacles are called ‘eye glasses’ in PNG and this category gives the total number of glasses prescribed and provided by the eye nurses. The eye nurses were supplied with a ‘seed’ stock of readymade glasses in the range +4.00D to –4.00D (in 0.50D steps). These glasses were in plastic frames in a mens and a ladies style. They would sell these to patients and order replacement stock from the Mt Sion Optical Workshop. They were also able to order a basic mens and ladies metal frame in these powers. Record sheets were provided to the eye nurses to assist them in keeping track of their stock of glasses (see appendix C). Included in the monthly clinic report was a section for the eye nurses to record the usage of the various powers of glasses supplied.

For a number of reasons the glasses supplied was less than the prescribing rate. The eye nurses could arrange to supply bifocal and photochromatic glasses into standard metal or plastic frames through the Mt Sion Optical Workshop. Glasses arranged this way would not be included in these statistics, as the recording system on the monthly eye clinic reports was setup to report on the more common readymade usage.

Where a prescription only was provided for the patient, who wanted to obtain their own glasses at a later time or through another source, this would also not be recorded. Some patients would be in a position to travel to a major centre and have the funds to purchase a frame and lens type of their choice. In some cases glasses would be recommended to a patient but until they paid for the glasses, they were not supplied. In these situations the prescription would not be recorded in the statistics. There is no information available on which to base estimates of how often these situations occurred, so an accurate total prescribing rate cannot be determined. Personal impressions would suggest these situations might account for 10-20% of the prescriptions from the eye nurses, the remaining 80-90% being supplied as glasses by the eye nurses.
Glasses powers

The eye nurses were encouraged to complete the details of the specific power of any glasses they provided. Some monthly reports from the eye nurses only gave the total number of glasses without the power breakdown. As a result the totals of glasses in the glasses breakdown summary (table 4.6) is less than the total of glasses actually prescribed as recorded in the eye condition summary (table 4.1).

Diagnosis of the eye conditions seen in the eye clinic patients.

This part of the monthly report lists the eye conditions of the patients presenting to the eye nurse at their clinic. The eye nurses collated this information from their eye clinic notes. The patient examination template provided for the eye nurses had a space to record the diagnosis for each patient seen (see figure 4.2 Eye Examination sheet).

They were instructed that all the relevant diagnoses should be recorded, which may mean one patient might have more than one diagnosis. For example a patient could be myopic, have cataract reducing their vision, and have a corneal scar on one eye. They may be myopic in one eye and have a corneal scar in the other eye. So the numbers in the report are not numbers of patients or eyes but occurrences of the condition.

Most of the diagnosis categories are self-explanatory.
Diagnosis categories

Myopia and Hyperopia

The eye nurses were taught to ignore refractions less than +/-0.50D. Refractions below this level were considered not to be visually significant in the PNG context.

Astigmatism

The experience of the optometrists from Leunig and Farmer Eyecare over many years, and confirmed during the training courses showed that excellent visual acuity was obtained in the vast majority of cases with spherical refractions. There was generally no astigmatic refraction measurable. It could be argued that this resulted from the patients not being able to understand the cross cylinder technique during an eye examination, however, the experience from the Leunig and Farmer Eyecare visits by optometrists experienced in the PNG context indicated that significant astigmatism is rare.

The eye nurses were trained to do an initial spherical refraction. If vision was less than 6/9 they were encouraged to look for any astigmatism that might be present. This proved necessary in only a small number of cases. From a practical viewpoint prescribing and supplying glasses is greatly simplified if the refraction is spherical, and acuity of 6/9 or better is certainly quite adequate for the visual demands required.

In summary, the astigmatic diagnosis category records astigmatic refractions required to improve vision beyond 6/9. This would generally mean cylinders of greater than 0.75D (greater than or equal to 1.00D).
Presbyopia

Any patients requiring a near addition would be classified as having presbyopia. The eye nurses did not measure amplitude of accommodation on young patients.

Non-Refractive eye conditions

The list of eye conditions to be identified in the eye clinic reports was selected as the expected common eye conditions based on the years of experience of providing eye care in PNG through the Leunig and Farmer Eyecare visits. It was designed to gather data but not be too complex or difficult for the eye nurses to complete. Glaucoma and trachoma were deliberately omitted as these conditions are not significant in PNG, see later discussion (Mann & Loschdorfer 1955, Parsons 1982, Parsons 1991, Dethlefs 1982).

The eye nurses would list in each category, those patients considered subjectively by the eye nurse to have the relevant condition. No specific grading system was used.

Other

The ‘Other’ option provided a space for the eye nurses to note any eye condition not specifically listed. Some nurses may have included some ‘normal’ people in this total, especially for the first group of eye nurses who for the first year (1995) were using report formats without a ‘normal’ category.

Normal

Initially there was no category for recording normal patients (without any eye condition) on the monthly report forms throughout most of 1995. At the
request of some of the eye nurses, a place for them to record normal patients was added to the reporting sheet from late 1995 onwards. Some of the eye nurses preferred not to record any diagnosis when patients were normal, others preferred to use the ‘normal’ category, so this category is not a complete list of the ‘normal’ patients. As such, this category is of little value for analysis. It was used to assist the eye nurses in recording their clinic statistics.

**Specialist**

This part of the report lists the numbers of patients considered by the eye nurse to require referral to an Ophthalmologist. Initially this was just reported as a single figure, without break down into groups. In late 1995, the report format was changed to include the separate referral figures for Cataract, Pterygium, and Other. As a result, the summary report (table 4.1) shows a total of ‘Initial referrals’ for the first group where a break down of the data was not available.

**Limitations**

The statistics were collated from the monthly eye clinic reports provided by the eye nurses. Patients were categorised by the eye nurses based on their training, and their developing understanding and ability in eye care. Any misunderstanding by an individual eye nurse or the eye nurses in general would affect their result and the collective totals.

There was considerable variation in the numbers of patients seen by different eye nurses and in the regularity of the reporting by some eye nurses. Some would inevitably be more diligent than others in recording and reporting on their eye clinic statistics. Some eye nurses worked in very isolated areas, others in a major hospital eye clinic along with an Ophthalmologist. These factors would contribute to the variation in some of the individual eye nurse results.
The differences between the first and second group of eye nurses could reflect possible differences between the generally more rural based centres for the first group and the main hospital and larger centres for the second group. However, given the individual variation, conclusions about ‘rural’ verses ‘town’ differences should be considered as impressions or suggestion of differences rather than proven fact.

The collective analysis over such a large number of patients should help to even out the data, increasing confidence that the figures are a reasonable reflection of the real situation regarding eye conditions in PNG.
RESULTS

The eye nurses Eye Clinic data is presented in Tables 4.1 – 4.7, and in Figure 4.3.

Eye Condition data

Table 4.1 (Eye Nurses Eye Condition Analysis) is a summary of the monthly eye clinic reports received for the period Dec 1994 - Dec 2000. Shown are the results for the eye nurses trained in the first group in 1994 (EN1), who were mostly from the more rural hospitals and health centres, and the second group of eye nurses trained in 1997 (EN2), who were mostly from larger hospitals and health centres with busier clinics, as well as the combined totals. The table lists the numbers of patients seen for each eye condition as well as expressing these figures as a percentage of full eye examinations. The individual eye nurse data in each category follows a normal distribution at the 0.05 level using the Kolmogorov-Smirnov test for normality. The 95% Confidence Intervals (CI) are shown to indicate the spread of the individual eye nurse results.

The results for each individual eye nurse are presented in Table 4.2 – 4.5 (Individual Eye Nurse Data). Included is a comment on the location where each eye nurse worked.

Glasses powers

Details of the glasses powers prescribed and supplied and the male/female ratios are presented in Table 4.6 (Eye Glasses (Spectacles) Powers). These results give an analysis of over 4,000 pairs of glasses and so provide a good
indication of the prescription profile of the presenting patients in PNG. Glasses for presbyopic prescriptions are included in these figures. Initially the report format did not allow for the data to be gender separated, so some 'no gender' results for this initial period show under the first group. Some monthly reports from the eye nurses only gave the total number of glasses without the power breakdown. As a result the totals of glasses in the glasses breakdown summary (Table 4.6 Eye Glasses (Spectacles) Powers) is less than the total of glasses actually prescribed as recorded in the eye condition summary (Table 4.1 Eye Nurses Eye Condition Analysis 1994-2000).

**Comparative data**

A summary with comparative data from PNG and other Pacific Islands is provided in Table 4.7 (Eye Conditions – Comparative table).

A graph illustrating the comparison of the Parson and the Eye Nurses data is shown in Figure 4.3 (Eye Conditions – Parsons and Eye Nurses)
### Table 4.1 - Eye Nurses Eye Condition Analysis 1994-2000
This table shows the data on various eye conditions in PNG from each group of eye nurses, and the combined totals

<table>
<thead>
<tr>
<th></th>
<th>Eye Nurses Group 1</th>
<th>Eye Nurses Group 2</th>
<th>Combined eye nurses</th>
<th>Individual eye nurses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Patients</td>
<td>Patients</td>
<td>Total</td>
<td>Percentage</td>
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<tr>
<td><strong>PATIENTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full Examination</td>
<td>12280</td>
<td>24142</td>
<td>36422</td>
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<tr>
<td>Screenings</td>
<td>8795</td>
<td>18871</td>
<td>27666</td>
<td>43.17%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>21075</td>
<td>43013</td>
<td>64088</td>
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</tr>
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### Table 4.2 - Individual Eye Nurse data

The individual eye nurse eye condition data is presented together with notes of the eye nurses location.
### Table 4.3 - Individual Eye Nurse data

The individual eye nurse eye condition data is presented together with notes of the eye nurses location.

<table>
<thead>
<tr>
<th>Name</th>
<th>Place</th>
<th>Comments</th>
<th>Location</th>
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<td>N.S.T.</td>
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<td>Mid size Hospital</td>
<td>Main town access</td>
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<td>C.K</td>
<td>Oro Bay</td>
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<td>Town Accessible</td>
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<td>Mendi</td>
<td>Mid size Hospital</td>
<td>Main town access</td>
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<td>L.K</td>
<td>Mendi/Moresby</td>
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#### PATIENTS

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#### GLASSES

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<th>Strabismus</th>
<th>Conjunctivitis</th>
<th>Corneal Ulcer</th>
<th>Injury/Scar</th>
<th>Other</th>
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<td>8.43%</td>
<td>12.76%</td>
<td>7.60%</td>
<td>20.51%</td>
<td>6.66%</td>
<td>2.65%</td>
<td>1.59%</td>
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<td>373</td>
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#### DIAGNOSIS

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<th>Pterygium</th>
<th>Strabismus</th>
<th>Conjunctivitis</th>
<th>Corneal Ulcer</th>
<th>Injury/Scar</th>
<th>Other</th>
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<td>0</td>
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<td>108</td>
<td>24.60%</td>
<td>471</td>
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#### SPECIALIST

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## Eye Nurses group 2a

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<th>J.K %</th>
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<td>Wewak</td>
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<th>Conjunctivitis</th>
<th>Corneal Ulcer</th>
<th>Injury/Scar</th>
<th>Other</th>
<th>Normal</th>
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<td>19 1.44%</td>
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<td>80 6.05%</td>
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<td>19 1.44%</td>
<td>19 1.44%</td>
<td>19 1.44%</td>
<td>190 14.36%</td>
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<td>41 3.10%</td>
<td>41 3.10%</td>
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<tr>
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<td>48 3.63%</td>
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<td>217 6.06%</td>
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### Table 4.4 - Individual Eye Nurse data

The individual eye nurse eye condition data is presented together with notes of the eye nurses location.
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<th>J.J. %</th>
<th>J.R. %</th>
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<td>1355</td>
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<td>685 23.68%</td>
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<td>453 15.66%</td>
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<td>125 5.18%</td>
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<td>1214 41.96%</td>
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<td>427 20.21%</td>
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**Table 4.5 - Individual Eye Nurse data**

The individual eye nurse eye condition data is presented together with notes of the eye nurses location.
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<th>Total</th>
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<td>Female</td>
<td>%female</td>
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Table 4.6 - Eye Glasses (Spectacles) Powers

The supplied eye glasses power data is presented for each group of eye nurses and the combined totals.
### Table 4.7 - Eye Conditions - Comparative table

This table provides comparisons of the available eye condition data from the Pacific region with the Eye Nurses data.

<table>
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<th>Data Source</th>
<th>Patients</th>
<th>Glasses %</th>
<th>Myopia</th>
<th>Hyperopia</th>
<th>Astigmatism</th>
<th>Refractive error without presbyopia</th>
<th>Presbyopia</th>
<th>Refractive error with presbyopia</th>
<th>Cataract</th>
<th>Pterygium</th>
<th>Strabismus</th>
<th>Conjunctivitis</th>
<th>Corneal Ulcer</th>
<th>Injury/Scar</th>
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<td>1.44%</td>
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<td>0.96%</td>
<td>10.73%</td>
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<td>1.42%</td>
<td>8.58%</td>
<td>5.03%</td>
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<tr>
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<td>19.80%</td>
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<tr>
<td>Andrist &amp; Yolton - Fiji</td>
<td>880</td>
<td>61.60%</td>
<td></td>
<td>2.00%</td>
<td>35.10%</td>
<td>61.60%</td>
<td>18.50%</td>
<td>16.50%</td>
<td>1.25%</td>
<td></td>
<td></td>
<td></td>
<td>2.48%</td>
<td></td>
</tr>
<tr>
<td>Presenting patients?</td>
<td>Estimates</td>
<td>4.31%</td>
<td>28.79%</td>
<td>&gt;1.00D</td>
<td>26.50%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</table>

Blank spaces indicate no data was available in the reports for these categories.
Figure 4.3 - Eye Conditions - Parsons and Eye Nurses

This show a graphical comparison of the Parsons and Eye Nurses PNG eye condition data.
<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
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<tr>
<td><strong>PATIENTS</strong></td>
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<tr>
<td>Full Examination</td>
<td>36422</td>
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<tr>
<td>Screenings</td>
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<tr>
<td><strong>TOTAL</strong></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>% full exams</td>
</tr>
<tr>
<td><strong>GLASSES</strong></td>
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<td></td>
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<tr>
<td>Eye Glasses</td>
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<td>12.83%</td>
</tr>
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<td></td>
</tr>
<tr>
<td><strong>DIAGNOSIS</strong></td>
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<tr>
<td>Myopia</td>
<td>4988</td>
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<td>Hyperopia</td>
<td>2191</td>
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<tr>
<td>Astigmatism</td>
<td>336</td>
<td>0.92%</td>
</tr>
<tr>
<td>Presbyopia</td>
<td>6428</td>
<td>17.65%</td>
</tr>
<tr>
<td><strong>Refractive errors (inc. Presbyopia)</strong></td>
<td>13943</td>
<td>38.28%</td>
</tr>
<tr>
<td>Cataract</td>
<td>4498</td>
<td>12.35%</td>
</tr>
<tr>
<td>Pterygium</td>
<td>2447</td>
<td>6.72%</td>
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<td>Strabismus</td>
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<tr>
<td>Injury/Scar</td>
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<td>6.10%</td>
</tr>
<tr>
<td>Other</td>
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<td>Normal</td>
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<td>9.10%</td>
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<td><strong>SPECIALIST</strong></td>
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<tr>
<td>Cataract</td>
<td>3287</td>
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<tr>
<td>Pterygium</td>
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<td>4.98%</td>
</tr>
<tr>
<td>other</td>
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<td>4.55%</td>
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<tr>
<td>Initial referral</td>
<td>471</td>
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<tr>
<td><strong>Total Referral</strong></td>
<td>7229</td>
<td>19.85%</td>
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**Table 4.8 Summary of the Eye Nurses Eye Condition Analysis**

This is a summary of the combined eye nurses total PNG eye condition data.
DISCUSSION

Discussion of the eye examination data

Overall good correlation with previous PNG data

Generally, the collective results for the 25 nurses are comparable with other data, especially the only other detailed PNG eye condition analysis (Parsons 1991).

Although the results are not directly comparable, as Parsons listed his patients by one eye condition only whereas the eye nurses included a patient in all the categories which related to any given patients' various eye conditions, the similarity provides some support that the training courses produced eye nurses with an appropriate understanding of the eye conditions found in PNG.

Individual eye nurse variation

There is considerable variation in the rates of various eye conditions provided by the individual eye nurses. There are a number of factors that may have contributed to this variation.

Some were located in very rural areas, and were quite isolated, while others were situated in or near larger towns. Some eye nurses were working in full time eye clinics, others ran a part time eye clinic. Some were very diligent with their bookkeeping and regular with their reporting, others spasmodic.

Those with a very small number of full eye examinations (eg 269, 276, 306) and very few screenings (eg 0, 4) would have less clinical experience. This as well as the small sample size could easily skew these individual eye nurses rates for various eye conditions.
Some eye nurses undertook thousands of full eye examinations (eg. 3538, 3580, 5459) and screenings (eg. 3273, 3757, 6795), making them very experienced eye nurses and their results are more likely to be a better representation of the eye condition rates because of the experience and larger sample size.

Most of the eye nurses worked alone and they were the only eye care provider for a large population and geographical region. Local factors such as the availability of other sources of glasses supply in a main town may influence the profile of presenting patients or the glasses supply rate.

Despite the individual variation the general trends were consistent in the previously reported statistics.

**Vision Screenings**

There is no data available on the pass/fail rate with eye screenings. Personal experience from Leunig and Farmer Eyecare’s earlier visits to PNG and also from the screenings conducted as part of the training course suggest that most, in fact the vast majority, of the children screened in schools have good vision. No specific data was available, however personal experience suggests that on average only one child might fail the vision screening in each class of 30 students (about 3% fail rate), with perhaps one other child showing signs of various other eye conditions (mostly corneal scars or strabismus). Leunig and Farmer Eyecare optometrists also reported some cases of convergence insufficiencies in their school screenings (Leunig and Farmer Eyecare).

Dr George Parsons conducted an ocular survey on 30 community schools (6,153 children) in the Madang Province of PNG (Parsons 1982). His results were not greatly different. Parsons found 1.4% of the children had a significant refractive error (as screened by Sjogren’s Hand Test). On follow up refraction, about half of these (0.7% of those surveyed) needed spectacles (all myopic). There were 1.2% of subjects with various ocular abnormalities most of which
were minor. Trachoma was diagnosed as present in 19.6% but the “intensity of the disease was low and is usually mild and symptomless. With few exceptions, it takes a natural course of healing without stigmata” (Parsons 1982 p153).

By contrast, Chapman-Hatchett and Wallace reported “9% of the local schoolchildren needed spectacles – considerably lower than the 25% of expatriate children” (Chapman-Hatchett & Wallace 1994 p34). It may be that their criteria for prescribing reflected the standards they would apply in UK. Their result suggests a significantly greater number of vision problems than Parsons or the impression from the eye nurse training course, or the earlier Leunig and Farmer Eyecare visits. Despite this they still recognise that by any measure “this high standard of (good) vision within the young Papua New Guinea population is evident in all parts of the country” (Chapman-Hatchett & Wallace 1994 p34).

The Asaro survey found less than 1% of identified disorders were observed in children less than 16 years of age, from a sample size of 1379 children (Yominao et al. 1989).

Vines survey reported visual acuity for 5-9 year olds as less than 6/12 in the better eye in only 0.9% (3 of 319), and 0.3% (1 of 330) in 10-14 year olds. Acuity of less than 6/6 occurred in only 8.4% (27 of 319) and only 3.9% (13 of 330) in these same age groups (Vines 1970).

These results all indicate that young people in PNG have excellent visual acuity. No specific data on children’s vision was available from the eye training program, but the impression from eye examinations and screenings undertaken by the eye nurses reflected that children generally had excellent vision.

Studies of national people in other Pacific Islands produced similar results.
A survey in Bougainville (an island of PNG near the Solomon Islands) and Malaita (an island of the Solomon Islands) reported only 1 child, of 100 children seen under 15, with less than 6/6 vision and that particular child had 6/9 acuity! (Verlee 1968).


Similar results come from the Tokelau Islands (Elliott 1965) and Fiji (Andrist & Yolton 1986) where very few children were reported as having reduced visual acuity.

**Eye Examinations**

The total of 36,422 full eye examinations recorded accounted for nearly 60%, and the 27,666 vision screenings (mostly in schools) about 40% of the people the eye nurses examined. The ratio of vision screenings and full eye examinations was similar for both the first group of eye nurses who trained in late 1994 and second group of eye nurses who trained in 1997.

Not all the eye nurses reported their statistics every month so the true total of eye examinations would be greater than that reported in these figures. The third group of eye nurses graduating in 2001 added further to the delivery of eye care and collectively the active eye nurses are estimated to be conducting approximately 15,000 full eye examinations annually.

**Glasses**

In total, glasses were prescribed and provided to 12.83% of the full eye examination patients. Remember this only reflects the number of standard
readymade glasses supplied and so it will be less than the actual ‘prescribing rate’. No data is available to directly determine the prescribing rate. The refractive error rate, including presbyopia was just over 38%, and this is a probably closer indication of the ‘prescribing rate’.

The data from the Leunig and Farmer Eyecare visits shows a readymade glasses prescribing rate of 32.35%, and an overall glasses prescribing rate of 44.06% (see Table 1.1). Given the nature of these early visits, where the focus was primarily on vision correction, it would be expected that more glasses would be supplied. In contrast, the eye nurses were conducting eye clinics from hospital outpatient settings and they would be expected to see a greater range of general eye problems and not just focus on refractive errors.

The first group of eye nurses supplied glasses to just over 20% of their patients, whereas the second group only supplied about 9% of their patients with glasses. The figures would seem to reflect that for the first group of more rural based eye nurses the patients were reliant on the eye nurses as the only source for glasses, where as in the main hospitals and centres (the mainly urban based second group of eye nurses) the patients could take their prescription even for basic powers and purchase a pair of glasses from another source. A number of the Asian run General Stores irregularly stocked readymade glasses, mostly in plus powers.

Some individual eye nurses supplied almost no glasses, either because they did not record or submit figures on the glasses they supplied, or because they worked in the hospital eye clinic of a large regional town where a number of other glasses supply options existed. Other eye nurses, especially those from remote rural areas where they were the only source of glasses supply have high rates of over 30%.

A survey in Fiji reported that over 61% of native Fijians examined were supplied spectacles or eye glasses (Andrist & Yolton 1986). This is much higher than the eye nurses prescribing rate, or the Leunig and Farmer Eyecare rate.
In part, this may be explained by the large number of low plus lenses that seem to have been supplied in the Fiji study. A report on the effectiveness of optometrist aid in Fiji suggests younger people and particularly those who presented with asthenopic symptoms were quite likely to discontinue use of the eye glasses they were supplied as part of an overseas aid program (Johnson & Yolton 1986). This would be understandable if many of the glasses were only low powers. Secondly it could be that these expatriate aid providers either have a greater focus on the provision of eye glasses, or are more likely to prescribe eye glasses than the trained national eye nurses in PNG. Perhaps the ‘wanting to please’ answers Melanesian people often give expatriate aid providers, as well the desire for a pair of glasses (Johnson & Yolton 1986) may lead to a different impression of the visual needs of a patient for glasses than that obtained by a national eye care provider. If glasses were provided free of charge, this may have artificially increased the numbers of patients with symptoms of asthenopia because they ‘wanted’ glasses. Johnson and Yolton make it clear that improving the effectiveness of the eye care provided “may require changing the mode of spectacle delivery from ‘island-hopping’, in which only a few moments are spent with each patient, to a system in which each patient’s special visual needs are determined and time is devoted to insuring that the lenses being dispensed actually meet these needs” (Johnson & Yolton 1986 p438). This is exactly what training local eye nurses provides.

The prescribed and supplied glasses data results

Overall slightly more glasses were prescribed to men (55.73%) compared with for females (44.27%), but there is a significant difference between the two groups. Note that for the first group of eye nurses (more rural) the ratio is about 2:1 in favour of men, (males 64.4%, female 35.6%) compared to the almost equal ratio with the second group. Most of the communities in PNG are male dominated, more evident in the rural areas, and particularly so in the highlands. Also, in PNG, glasses have an association with status, so even though glasses would significantly improve vision for women they were often
unwilling to wear them for fear of being seen to be trying to raise their status inappropriately. This problem also applied to wearing sunglasses. The results from the ‘rural’ first group of eye nurses seem to reflect this cultural situation.

Dr Bage Yominao (a national Ophthalmologist) in a survey of almost 4,000 people in the Asaro Valley found 1.03% used glasses with 62.5% being male and 37.5% female ‘as expected’ (Yominao et al. 1988). Dr Yominao also suggested males in this area probably had better access to the health care system and to obtaining glasses. This could be because they were more likely to travel out of the valley to towns and health care. The Male/Female results from the ‘rural’ Asaro area are almost identical to those ‘rural’ eye nurses in the first group. The very low rates of glasses usage at 1.03% in the Asaro survey probably reflects the lack of accessible and affordable eye care services in the rural part of PNG at the time of the survey (1988) some 6 years before the first group of eye nurses graduated.

**Glasses powers analysis**

The breakdown of powers was similar for men, women and the no gender group. It was also similar between the first and second groups of eye nurses. As expected the usage was highest in the +1.50, +2.00, in the reading glasses range.

Plus prescriptions (reading glasses and hyperopia) accounted for almost 70% of the glasses prescribed. The eye condition data suggests about 75% of these ‘plus’ glasses were for presbyopia and 25% were for hyperopia.

Myopic prescriptions would have included a small number of cataract patients with myopic shifts, especially at the higher powers.

This detailed breakdown of 4,000 pairs of glasses prescribed provides a useful insight into the refractive error distribution (with presbyopia included) in PNG, remembering that this data is glasses supplied, not the measured
refractions. It indicates the likely demand for the various powers of glasses required in PNG.

There appears to be no other published PNG data on refractive conditions or prescriptions.

**Diagnosis (Eye Conditions)**

**Refractive errors**

The combined rate of refractive errors (excluding presbyopia) was 20.63% of patients (full eye examinations). Including presbyopia, the figure increases to refractive errors being 38.28% of the ocular conditions. Comparative data for PNG is very limited, and only available as a total refractive error figure, not subdivided by type.

This eye nurse data appears to be the only such detailed refractive error data for PNG available.

Parsons (1991), in a comprehensive summary of 10 years of Madang Hospital eye clinic outpatient statistics, reported a refractive error rate of 32.31% (9,834 patients out of 30,286 total patients). Parsons states the vast majority of these were uncomplicated presbyopes. His data reports only on Papua New Guinean patients, expatriate outpatient consultations being specifically excluded from his data as they were primarily for refraction only. Parsons also wanted the data to reflect only the national population eye conditions.

The comparative eye nurse combined refractive error data figure of 38.28% is similar to Parsons data. This supports the hypothesis that the eye nurses have made appropriate diagnosis of the refractive status in the patients they have seen. It also supports the contention that the eye nurses were capable of providing correct advice on vision problems associated with refractive errors.
The Asaro Valley survey (Yominao et al. 1988) found 2.04% (79 of 3,874) of the surveyed population had a refractive error and 1.03% used glasses. Of those who reported themselves as having a vision problem and subsequently underwent an eye examination, 19.51% (79 of 405) were found to have a refractive error. Given that the eye nurse data is based on presenting patients and not a population survey, this later figure is the more appropriate to look at for a comparison. Also, the Asaro survey considered vision of 6/12 or better as “normal”. Only those with vision below 6/18 were examined by the ophthalmologists to determine the cause of the reduced vision. With the eye nurses, less than 6/9 was the standard used for refractive assessment.

The rate of refractive error in the Asaro self reporting group correlates very well with the 20.63% (excluding presbyopes) rate of the eye nurses. No information was provided to know whether the Asaro survey data included presbyopes, but only distance vision was measured in the screening process used, suggesting presbyopia was unlikely to be included in the statistics.

Some data from other Pacific Islands is available. A survey study in the Solomon Islands and patient study in Fiji found a refractive error rate (greater than –0.25D and greater than +0.50D without presbyopia) of 35.15% and 35.10% respectively (Verlee 1968, Andrist & Yolton 1986). These are both considerably higher than the eye nurses or Parsons results for PNG. In contrast, a Western Samoa study of presenting patients found a much lower refractive error rate (including presbyopia) of 18.24% (Egbert 1986). Reasons for these differences are unknown.

### Specific refractive error data.

#### Myopia

Myopia occurred in 13.70% of the full eye examination patients and it accounted for 35.77% of all refractive conditions including presbyopia. The
results for both groups of eye nurses are very similar. There is no known comparative PNG data on Myopia.

Vines quotes a personal communication from Loschdorfer in 1967 who observed that myopia is very rare amongst Melanesians in his Port Moresby ophthalmological practice (Vines 1970).

Similarly reports from other Pacific Islands suggest very low rates of myopia, ranging from 0.79% in a Tokelau Islands survey (Elliott 1965), 0.8% in the Solomon Islands survey (Verlee 1968) and 4.31% in a Fijian patient group (estimated based on the proportion of spectacles intended for distance only) (Andrist & Yolton 1986).

It would be expected that a survey would report a lower rate than that produced by an analysis of presenting patients. However myopia accounts for only a relatively small portion of the refractive errors in all the Pacific Islands studies. They clearly indicate that relative to hyperopia and presbyopia, myopia was quite uncommon, unlike the PNG eye nurse data.

Initial impressions from the early Leunig and Farmer Eyecare visits, was that myopia was relatively uncommon in the national people. Over time, the prevalence of myopia reported seemed to increase in the patients that were being seen, particularly those with greater education and office work compared to the rural village population (Leunig and Farmer Eyecare).

There is no clear explanation as to why the eye nurse data shows myopia rates almost as high as that in ‘western developed’ countries rather than the very low rates reported for other developing countries of the Pacific. ‘Western’ rates for the prevalence of myopia range from 16.4% to 26.6% (The Eye Diseases Prevalence Research Group 2004).

Whilst it is possible to over correct with minus when measuring a refraction which could lead to an increase in the reporting of the rate of myopia, the danger of this was explained to eye nurses and they were taught to check
their refraction by ensuring that the addition of +0.50D blurred the vision. Supervision of the eye nurses during their training did not suggest any tendency to overcorrect myopia. A few of the higher power myopes would be due to myopic shifts associated with developing cataracts, although these numbers are small. The 13.70% rate reported by the eye nurses in PNG seemed to be consistent with the distribution found during the training courses when the eye nurses were being supervised in their eye examinations. The ‘development’ and ‘westernisation’ of PNG, has brought longer years of education, more ‘office’ work and the increased close workload that accompanies these tasks. This may be a factor in the increasing rate of myopia. Increased near work is associated with higher prevalence of myopia, although there is little evidence of direct cause and effect (Grosvenor 2003). A comparison of the rates for both groups of eye nurses shows they are almost identical so there does not appear to be a general ‘city/rural’ factor.

An extensive study of the refractive error rates in Melanesian School children in Vanuatu reported very low rates of myopia (Garner et al 1985, Garner et al 1988). Personal experience would suggest myopia is also uncommon in children in PNG but no specific age based data is available from the eye nurses or the training courses.

**Hyperopia**

The combined eye nurses rate for hyperopia was 6.02% (15.71% of all refractive conditions including presbyopia) for both groups. The first group of eye nurses had a slightly higher rate of 7.88% compared to 5.07% for the second group. Again, there is no known comparative PNG data on Hyperopia.

The Western Samoa study (Egbert 1986) and the Tokelau Islands survey (Elliott 1965) give similar rates of 5.69% and 5.31% respectively.
The Fiji study (Andrist & Yolton 1986) reports an exceptionally high hyperopia rate of around 28.79\%\textsuperscript{2}.
Perhaps this study shows a higher hyperopia rate because these refractions were based on retinoscopy rather than subjective refraction.

\textbf{Astigmatism}

The statistics from the eye nurses confirm the general impression of earlier Leunig and Farmer Eyecare visits, as well as the supervised practical experience during the training courses, that astigmatic corrections are rarely required. The combined eye nurses rate of 0.92\% (2.41\% of all refractive conditions) is quite low. Both groups of eye nurses recorded similar results. There is no known comparative PNG data on astigmatism.

Studies from other Pacific Islands confirm a low rate of astigmatic refractive error. Verlee reported that 5.3\% of his survey population had 0.75D or more of astigmatism, and only 1.1\% having greater than 1.00D of astigmatism (Verlee 1968). Andrist and Yolton found only 2\% of their survey population had astigmatic corrections greater than 1.00D (Andrist & Yolton 1986). Elliot recorded 3.8\% of his study group with some astigmatism (excluding those with pterygium induced astigmatism) (Elliot 1965). Egbert reported a 1\% rate of astigmatism in Western Samoa in his presenting patient data (Egbert 1986).

\textbf{Presbyopia}

As expected this was the largest group with 17.65\% of eye nurses presenting patients being significantly presbyopic. This category accounted for almost half of the refractive errors (46.10\%). The first group of eye nurses had a

\textsuperscript{2} This Fiji hyperopia rate is estimated by subtracting the 2.00\% who were reported to have astigmatism >1.00D, and the 4.31\% with myopia (assuming that of the 61.6\% supplied with glasses, the 7\% who were given glasses for distance alone were myopes) from the 35.10\% refractive error rate without presbyopia.
higher rate of both hyperopes and presbyopes (presbyopia 20.64%) than the second group (presbyopia 16.13%). It may be that in the major towns, where readymade reading glasses can sometimes be purchased in the trade stores, some of these patients had resolved their own reading vision problems. This would have a greater effect in reducing the number of people with reading difficulties presenting to the second group of eye nurses compared to the ‘rural’ first group.

There is no known comparative PNG data on Presbyopia.

The earlier onset of presbyopia in PNG patients in the late thirties or early forties was a common experience with Leunig and Farmer Eyecare visits (Leunig and Farmer Eyecare) and is well recognised by those working in the country (Parsons 1991). PNG nationals “require reading glasses approximately five years earlier than Caucasians on average and need consistently higher reading powers for the same age group” (Chapman-Hatchett and Wallace 1994 p34).

The early onset of presbyopia has been reported in the rural inhabitants of Central and South America (Wharton & Yolton 1986), and in Africa (Hofstetter 1968). It has also been noted in India, the Philippines, Bolivia, and in Somalia (Weale cited in Wharton & Yolton 1986). Diet, exposure to sunlight, geographical latitude, and climatic differences (higher temperatures), have all be suggested as possible factors in advancing presbyopia (Jain, Ram & Gupta and Weale cited in Wharton & Yolton 1986 p428).

It should be noted that an individual persons ‘age’ can be difficult to determine in PNG, and many, especially older national people did not know their specific age. The average life expectancy in PNG is only 50 years (Handbook Health Statistics Papua New Guinea, 1989)

Reported rates of presbyopia in other Pacific Islands vary. The Western Samoa study recorded 10.39% presbyopia in a presenting patient sample (Egbert 1986). The Fiji survey seemed to indicate presbyopia in 26.50% of the
population seen (estimated from the difference between the refractive error rate without presbyopia and the rate of spectacle provision) (Andrist & Yolton 1986).

**Non-Refractive Eye Conditions**

**Cataract**

Cataract was reported in 12.35% of the eye nurses presenting patients. The rate was slightly higher in the second group of eye nurses (13.07% compared to 10.94% for the first group).

Parsons (Parsons 1991) reports a lens pathology rate of 16.81%. This shows a higher rate than the eye nurses have reported. It would probably only include a small number of other lens conditions. Parsons does separate his Madang (town) and Ex-Madang (rural) statistics, and his cataract rate is quite different being 12.94% in the Madang and 24.10% for the Ex-Madang patients. The eye nurse results are lower and reversed with 10.94% for the first (rural) group and 13.08% for the second (town) group.

It might have been expected that the rate would be higher in the ‘rural’ first group, as it was with Parsons data, where access to cataract surgery is much more difficult. Perhaps because it is so difficult to get an eye surgery visit to treat the identified cataracts, the first group may have used a higher threshold before categorising a patient as having cataract. It is interesting that more of the second group of eye nurses were based in the highlands and Vines reports that senile cataracts develop earlier in the highlands than the lowlands (Vines 1970). This may be due to a greater UV exposure at the higher altitude.

The Asaro valley survey (Yominao 1988) reports 189 cases of cataract being 4.88% of the population or 46.67% of those people self reporting poor vision.
It is difficult to make any direct comparisons between this data and the eye nurses data. If the Asaro self reporting group is seen as a 'presenting patient' pool, then these results give a much greater cataract rate than either the eye nurses or Parson's data. Perhaps the isolated rural area contributed to the higher figures.

The other PNG population surveys reported a cataract prevalence of 5.47% (Vines 1970) and 1.58% (Mann & Loschdorfer 1955).

In the Pacific Islands studies, the presenting patient cataract rate for Western Samoa of 17.25% (Egbert 1986) is comparable to the eye nurses and Parsons PNG data. Similarly, the Fiji survey reported finding 18.50% of their patient population with cataract (Andrist & Yolton 1986).

**Pterygium**

Pterygia were a common finding in PNG with the eye nurses reporting 6.72% of their presenting patients suffering from this condition. The two groups were similar with the (rural) first group of eye nurses recording 5.70% and the (town) second group 7.24%.

Parsons (1991) has reported 3.97% of his total outpatients with pterygium as their main eye condition. The Madang (town) figure was 2.79% and the Ex-Madang (rural) figure was 6.18%.

The two rural figures are similar but Parsons town result is much lower. There is no obvious explanation for this reduced rate in the Madang figures. Perhaps Parsons lists a lower number because he only recorded one eye condition per patient in his figures, compared to the eye nurses listing all the appropriate (multiple) eye conditions. However, if this was a factor it should apply to the Ex-Madang figures as well and these were similar to the eye nurse results.

The Asaro survey (Yominao 1989) did not record pterygium as a separate condition. Vines (Vines 1970) recorded a prevalence of 7.32% in his
population survey, with the Highlands and Island regions having a higher prevalence than the Mainland. Mann & Loschdorfer (Mann & Loschdorfer 1955) reported a prevalence of 2.87% in the population surveyed, and listed pterygium as one of the main eye conditions encountered in PNG.

With the exception of the unexplainable extremely low rate of 0.33% in the Solomon Islands (Verlee 1968), all the Pacific Islands studies reported a much higher rate for pterygium that that found in PNG with the rate in Western Samoa 19.80% (Egbert 1986), Tokelau Islands 16.49% (Elliott 1965), and Fiji 16.5% (Andrist & Yolton 1986). There does not appear to be an explanation for these differences although there could be considerable subjective difference in the threshold for listing the condition.

**Strabismus**

Uncommon in PNG, the eye nurses noted only 1.27% of their patients had strabismus. The rate was slightly lower in the first group (0.96%) compared to the second group (1.42%).

Parsons records 1.47% (Madang 1.30%, Ex-Madang 1.80%) in the category of motility disorders (Parsons 1991). This included nystagmus, and convergence insufficiencies making a direct comparison difficult. It would be expected that these later conditions are a small proportion of the recorded motility disorders total and so, although the proportion of this group that were purely strabismus is not specified, the result is reasonably comparable with the rates found by the eye nurses.

Strabismus is not listed in the Asaro (Yominao 1989) or Vines (Vines 1970) survey data.

Mann & Loschdorfer (Mann & Loschdorfer 1955) survey lists 0.16% for the prevalence of divergent and convergent strabismus. This is a population
survey and it would be expected to be less than the presenting patient statistics of the eye nurses.

In Western Samoa, strabismus accounted for 1.57% of the presenting patients (Egbert 1986), similar to the PNG eye nurses results. As expected when compared to a presenting patient population, the Solomon Islands (Verlee 1968) and Tokelau Islands (Elliott 1965) surveys reported a much lower rate for strabismus of 0.32% and 0.16% respectively.

**Conjunctivitis**

Conjunctivitis occurred in a significant proportion of the patients presenting to the eye nurses at 9.31% overall. The rural first group of eye nurses had a slightly higher rate at 10.73%, with the second (town) group recording 8.58%.

Parsons lists 9.58% for superficial infections, a very similar rate to the eye nurses. Interestingly the figures for Madang (13.88%) and Ex-Madang (1.49%) are vastly different (Parsons 1991). Parsons says “the incidence of superficial infections seen Ex-Madang does not reflect a true picture since one would seldom see such acute cases on visits to other centres” (Parsons 1991 p257).

The national people were generally slow in seeking health care for minor problems and this would be especially so in rural areas where attending the hospital outpatient clinic involved considerable travel and expense to get to the nearest town, unless one was fortunate enough to have a problem just when the visiting health service passed through the area. It is likely that Parsons statistics have included mild corneal ulcers in the superficial infection category, as no separate figure for this condition exists in his results. If so, his rate of 13.88% in Madang is comparable to the combined conjunctivitis and corneal ulcer categories of the eye nurses (9.31 + 4.46 = 13.77%).
The Asaro survey (Yominao 1989) did not report on cases of conjunctivitis. Vines (Vines 1970) survey was concentrating on looking for trachoma and so any evidence of follicular changes in the upper and lower eyelids was recorded as conjunctivitis. If the ‘Purulent’ and ‘Other’ conjunctivitis are tallied the prevalence is 4.98% (0.05% if only the ‘Purulent’ cases are counted) The Mann & Loschdorfer (Mann & Loschdorfer 1955) survey was primarily a trachoma survey, however, conjunctivitis other than trachoma was listed separately enabling some relevant prevalence figures to be gathered and a rate of 0.72% was recorded. If follicular responses other than trachoma were included the figure increases to 2.41%, although the eye nurses would not have recorded follicular changes, especially in the absence of conjunctivitis symptoms.

Comparison data for conjunctivitis is complicated by the various definitions used and that often follicular and papillary conjunctivitis would be recorded in the various studies even if the patient was asymptomatic. Many studies were attentive to any signs of trachoma and so were sensitive to these changes. The eye nurses were not encouraged to look for trachoma (see later) or to record these types of changes in the absence of active symptoms.

The Solomon Islands (Verlee 1968) and Fiji (Andrist & Yolton 1986) surveys report low rates for conjunctivitis of 1.50% and 1.25% respectively. Egbert found 12.35% in his Western Samoan patients (Egbert 1986), but this includes “non-specific follicular and papillary conjunctivitis” (Egbert 1986 p170) and so it would be expected to be much higher that the PNG eye nurse findings.

In PNG, conjunctivitis would often be treated by the general nurses who would have ready access to topical ocular antibiotics. Antibiotics eye drops and ointment are also generally readily available over the counter at the chemist in major towns. Unless the conjunctivitis was relatively severe, the patient may not seek treatment especially in rural areas where health care is not easily accessible. This latter issue was one the eye nurses were encouraged to try and address through public health education. The lack of early treatment of
conjunctivitis and corneal ulcers and the subsequent corneal scarring that often results are significant blindness prevention issues in PNG.

**Corneal Ulcer**

This category was intended for any corneal ulcers, regardless of the cause. In a practical sense it would be any symptomatic eye condition involving the cornea (as opposed to asymptomatic corneal 'scars'). The combined results were 4.46% for both eye nurse groups; with the first group have a slightly lower rate of 3.34% and the second group 5.03%.

The categories used in Parsons outpatient statistics (Parsons 1991) do not have an equivalent figure that would enable a comparison to be made, although it is likely that corneal ulcers in his patients were included in the superficial infections category, as mentioned earlier.

The Asaro (Yminao 1989) and Vines (Vines 1970) and Mann & Loschdorfer (Mann & Loschdorfer 1955) surveys have no data on corneal ulcers. The Mann & Loschdorfer data includes corneal ulcers with corneal scars and injuries. Keratitis was listed separately with a very low 0.13% prevalence.

In his Western Samoan patients Egbert gives a corneal infections figure of 2.75% (Egbert 1986) which it is not greatly different to the PNG figures found by the eye nurses.

**Injury/Scar**

Most corneal scars in PNG are the result of injury, and the severity of the scar often relates to the delay in, or lack of, treatment. This was one area where it was hoped the eye nurses would be able to make a positive impact on the visual welfare of the people of PNG. Corneal opacities are responsible for a significant amount of the visual impairment and the majority of the untreatable
blindness in PNG. Trauma (after cataract) rates as the second greatest cause of blindness in PNG (Parsons and Adams 1987).

Lime is used in association with the chewing of betelnut (a local equivalent to smoking), and obviously it causes devastating consequences when it accidentally gets into an eye.

Eye Nurses found that corneal scars and injuries occurred in 6.10% of their patients. The results were almost identical for both groups of eye nurses with figures of 6.08% and 6.11% for each group respectively. It was intended that this category would include corneal injuries rather than all eye injuries such as eye lid trauma. Combining the corneal scars with injuries makes comparison of the eye nurse data with other reported results difficult.

Parsons (1991) lists 2.65% of his patients presenting with corneal degenerations which he clarifies in his text as “corneal scarring” (Madang 1.97%, Ex-Madang 3.94%).

Parsons records Trauma as the prime eye condition in 6.85% of his patients (8.70% Madang, 3.35% Ex-Madang) (Parsons 1991).

Adding these trauma figures to the corneal scar data, Parsons combined Corneal scar/Trauma rate is 9.50% (Madang 10.67%, Ex-Madang 7.29%). These figures are higher than the eye nurses results.

Parsons Trauma results would include traumatic cataract, retinal trauma, and other traumatic eye injuries that would not have been recorded under this category by the eye nurses. Detailed analysis of trauma patients in an earlier paper (Parsons 1986) suggests about 40% of the ocular trauma involves the cornea. Taking 40% of the Parsons 1991 trauma figure and adding it to the corneal scars figure gives a rate of 5.39%, which is similar to the eye nurses result for the injury/scar category.

The Asaro survey (Yominao 1989) reports a 2.7% prevalence of corneal opacities in the self reporting group.
Vines survey reported a prevalence of 4.91% corneal opacities, and he agrees with Mann & Loschdorfer (Mann & Loschdorfer 1955) that most the result “of trauma, or neglected ulceration” (Vines 1970 p441).

Mann & Loschdorfer combines corneal ulcers with corneal scars and injuries to give a prevalence of 2.85% (Mann & Loschdorfer 1955). They comment, “the large number of corneal scars is an indication of the high injury rate” (Mann & Loschdorfer 1955 p45). And later in his report “many of those blind from corneal scars could have been helped had they sought advice early” (Mann & Loschdorfer 1955 p47). This is one of the positive gains to be made by training national people in eye care as 10.4% (Mann & Loschdorfer 1955) of the bilateral blindness and the majority (65%) of the unilateral blindness (Mann & Loschdorfer 1955) was due to corneal scars.

Parsons reported an analysis of the 7% rate of ocular trauma seen in 13,327 outpatients in PNG (Parsons 1986). Verma et al. reported that 7-9% of all eye clinic attendances in PNG were the result of trauma, with a rate of 39.1 eye injuries per 100,000 (Verma et al. 1997)

It will take time for the national people to learn the dangers of sharp objects and that early treatment of eye injuries will significantly reduce the subsequent scaring and vision loss. The eye nurses were encouraged to take every opportunity to educate presenting patients, other health workers and the general population about these issues. With time it is hoped there will be a reduction in the prevalence of significant and blinding corneal scars.

The Solomon Islands survey reported a very low corneal opacity rate of 0.83% (Verlee 1968). There was no injury data listed separately. In Western Samoa the rate of corneal scars was 8.82% and minor injuries was 5.68% (Egbert 1986). Only a few cases of corneal scaring (0.03%) or injury (0.05%) were reported in the Tokelau Islands survey (Elliott 1965). In Fiji, 2.48% were recorded as having a traumatic injury (Andrist & Yolton 1986).
Other

Whilst it may give some indication of the numbers of ‘other’ eye conditions, it is difficult to draw meaningful conclusions from this category. This category was provided to help the eye nurses with the recording of their statistics. Patients could be listed in this category for many reasons including being ‘normal’ as mentioned previously.

Other Eye Conditions

Two other eye conditions not separately listed in the eye nurse data need brief mention because they are significant eye conditions on the world stage.

Glaucoma

It seems from all the reports of those working in PNG that the prevalence of primary glaucoma is extremely low.

Only one case of open angle glaucoma (glaucoma simplex) was reported in the large Mann & Loschdorfer survey (Mann & Loschdorfer 1955). Parsons did not find one single case of open angle glaucoma in his very extensive analysis of over 30,000 patients (Parsons 1991). He has only seen 2 cases of sub acute angle closure glaucoma in 20 years of ophthalmology practice in PNG. Glaucoma secondary to other causes does occur (158 cases in 30441 presenting patients) (Parsons 1991).

In a retrospective study of patients with glaucoma in Port Moresby Hospital in PNG, Dethlefs found no cases of open angle glaucoma (Dethlefs 1982).

These PNG results reflect similar findings in the Pacific Islands (Holmes cited in Dethlefs 1982, Hope-Robertson, and Loschdorfer, and Mann cited in Verlee 1968), In Western Samoa, only one case of open angle glaucoma was seen.
(Egbert 1986). No cases of glaucoma were reported in the Solomon Islands survey (Verlee 1968), the Tokelau Islands survey (Elliott 1965) or in the Fiji survey (Andrist & Yolton 1986).

During the second training course, one suspected case of primary glaucoma was referred for further investigation. Acute glaucoma as a secondary complication of a swollen and advanced cataract is not uncommon. Perhaps there are some genetic reasons why primary or open angle glaucoma is so rare. Perhaps the low average life expectancy is a factor and more cases may be seen as this improves. Further research is needed to help in understanding the low primary glaucoma rate. Personal comments from Dr Jambi Garap, a national Ophthalmologist, suggested that a few cases of primary glaucoma have been identified at the Pt Morseby Hospital eye clinic in PNG in more recent years (Garap 2004).

**Trachoma**

Trachoma, another major problem in global terms, whilst present, is insignificant in PNG from a symptomatic standpoint (Mann & Loschdorfer 1955, Parsons 1982, Parsons 1991). “The intensity of the disease (Trachoma) is low and is usually mild and symptomless. With few exceptions it takes a natural course of healing without any stigmata” (Parsons 1982, p153). Only 18 patients from the 30441 presenting patients seen by Parsons were listed with significant trachoma (Parsons 1991). Dethlefs found “trachoma, although endemic in the area studied, was of mild intensity and rarely caused a visual defect” (Dethlefs 1982 p16). He also felt the prevalence was decreasing over time, probably with improving standards of hygiene.

Heath and Heath found “no impairment of vision and no cicatricial eyelid changes due to trachoma” (Heath & Heath 1973 p124).

Only one case of significant entropion was seen in an elderly man during the three eye nurse Training Courses.
Other Pacific Islands studies also report low rates of trachoma. No cases of trachoma were reported in the Solomon Islands study although some cases were seen in people not included in the study population (Verlee 1968). No active cases of trachoma were identified in Western Samoa, and only 19 elderly patients had entropion from trachoma (Egbert 1986). The Tokelau Islands survey reports the trachoma prevalence is low with 12 cases, only one active in 1829 people (Elliott 1965). In Fiji, only 0.34% of Fijians were seen with trachoma (Andrist & Yolton 1986).

Specialists

This part of the eye nurses report indicates the numbers of patients they have seen that would benefit from an ophthalmological consultation, and where appropriate, surgery.

The Cataract rate of referral was about 9% compared to the 12.35% with cataract in the diagnosis list. The rate of cataract referral was greater in the second (town) group, although this group also reported a higher rate of cataracts. Whilst it might have been expected that the rate and referral for cataract was higher in the rural centres, the threshold for diagnosis and referral may be lower in the town group because of easier access to Ophthalmologists.

The pterygium referral rate was similar for both groups at about 5% (compare with 6.73% in the diagnosis).

In both these cases approximately 75% of patients with cataract or pterygium made the referral list.

The ‘Other’ category, about 5%, was used to include any other reason the eye nurse felt assessment by an Ophthalmologist was appropriate. Interestingly this figure was lower with the first ‘rural’ group, perhaps because
ophthalmological services were harder to access and ophthalmological visits very rare.

The individual eye nurse data for referral of these conditions varies, perhaps a reflection on an individual eye nurses’ level of confidence in diagnosis and eye care delivery. It could also be quite likely that the variation reflects the accessibility of ophthalmological services to which they could reasonably refer or from whom they could expect a visit.

In most of the cases, the patients in the three groups were compiled on a ‘Specialists list’ (see appendix C) awaiting, ‘hopefully’, for an ophthalmological visit, as for most of the patients travel to one of the few eye clinics staffed with an ophthalmologist for consultation was unrealistic.

The total specialist listing rate was about 20%. This indicates that the eye nurses felt they could manage 80% of the eye problems of the presenting patients on their own. If you consider that the majority of those listed for specialist attention were diagnosed with cataract or pterygium, very few patients (less than 6%) were categorised as requiring additional expertise to manage.

The overall specialist rate was slightly higher in second group. This may reflect the easier access that the patients in the town centres might have to Ophthalmologists. In the more isolated areas only those with significant problems would have been listed as these areas might only see one ophthalmologist visit per year (or less).

On an individual basis, those eye nurses with greater confidence and ability would be expected to refer fewer patients.

**Summary of eye condition data**

Comparison of the eye nurses data with other eye condition data is complicated by several factors. Very little data on PNG eye conditions is available, and none is directly comparable. Parsons data represents best
available eye condition information and the only other large scale eye
condition analysis for PNG. However, it is not directly comparable with the eye
nurse data because Parsons recorded his patients into one eye condition
category only even if they had multiple problems, whereas the eye nurses
listed a patient for each significant eye condition they exhibited.

Despite this difference in recording method and some spread in the individual
eye nurse results, in general, the rates for various eye conditions reported by
the eye nurses are reasonably similar to the ‘benchmark’ figures from Parsons
decade of ophthalmic statistics (see figure 4.3).

Statistical comparison of the Parsons and eye nurses data indicates they are
statistically significantly different (chi-squared, p=0.001), although this is
hardly surprising given the very large patient numbers involved. Given all the
variables, at a clinical level the results for the eye nurses are quite similar to
the Parsons data, and provide a good reflection of the eye conditions situation
in PNG (table 4.8).

The broad similarity with the Parsons data provides support for the quality of
the training program in producing competent eye nurses with an appropriate
grasp of the visual and ocular conditions in PNG.
Chapter 5

Conclusion

Developing Eye Care in PNG

Developing Eyecare in Papua New Guinea required a strategy;

i. that was cost neutral to the government

ii. that minimised any option for the trained eye care workers to set up in private practice (as this would almost certainly result in more urban based eye care that is beyond the reach of most of the population in both cost and accessibility)

iii. that made eye care and low cost eye glasses affordable, yet at a self-supporting cost.

iv. that placed the trained eye care workers in rural areas where the people live.

v. that encouraged cooperation and enhanced existing programs and systems in health care.

vi. that provided people trained to a level appropriate to the needs of PNG

vii. that provided people trained to work independently to deliver eye care for most of the common eye conditions in PNG.

The strategy adopted was to conduct a 3 month ‘Eye Nurse’ training course with the idea that the trained, and equipped, ‘Eye Nurses’ would return to their Hospital or Health centre and among their normal nursing duties, provide eye care from that centre to the surrounding region. Alongside this training an ongoing supply of low cost eye glasses (spectacles) would be developed, as well as follow-up and support for the eye nurses. Selected eye nurses would be trained over time, to take over the support and eventually the teaching of the eye nurses.
The strategy described in this thesis addressed the above criteria in the following ways;

i. No additional cost was placed on the government health budget. Funding only needed to be found to cover the costs of conducting the course and providing equipment for the trainees. These funds were raised through various aid organizations and individuals with an interest in improving the visual welfare of the people of PNG.

ii. By training nurses already employed in rural hospitals as part of the Government health system, with paid positions to which they would return, the risk of graduates setting up in private practice was minimised. This was further discouraged by making it clear that the equipment provided to the nurses belonged to the hospital sending the trainee. As was the practice in PNG, these hospitals continued to pay salary to the nurses for the duration of the training course and the equipment was part of the benefit to the hospital for their investment in the eye nurse.

iii. Eye care was provided by the eye nurse through the normal hospital outpatient system, with appropriate affordable costs for the local people. Each graduate was provided with about 200 pair of readymade glasses as a ‘seeding’ stock. The glasses were readymade or low cost glasses supplied for about 7 Kina ($7), with the money collected being used to purchase more glasses for sale, keeping the system self funding.

iv. The graduate eye nurses returned to their rural hospital and so were providing care where it was needed most.

v. Using nurses as the trainees benefited from the advantage of building on their previous training and understanding of basic medical care. They were well aware of how the health system in PNG functioned and were already part of the health care delivery system. They were recognised and registered as health care providers.

vi. With the shortage of doctors in PNG, the nurses are trained to function at a higher level and with greater responsibility than their western counterparts which helped in training the eye nurses. After a 3 month intensive training in eye care they were well placed to deal with the
common eye conditions in PNG. The 3 months was sufficient to ensure they were taught most of what they needed to know (and not things they didn’t need) as well as allowing time for them to practice their new knowledge and skills to gain confidence before return to the relative isolation of their own hospital. It was the duration that was being used at the time for other post graduate nursing certificates, and it was not so long that the nurses lost their position at their hospital (which would have increased the risk they would not return to their rural setting).

vii. The eye nurses were trained to be able to function competently and independently of the few PNG Ophthalmologists. They were also taught when it was appropriate to refer. The training covered the common eye conditions encountered in PNG and how to treat them as well as how to refract and prescribe appropriate glasses. The eye nurse data supports that these eye nurses were able to manage 80% of the presenting patients and identify the eye conditions requiring surgery in a further 14% (cataract and pterygium).

Probable reasons for success

There are a number of reasons why this eye care program has been successful. The strategy proved to be the correct and appropriate approach to developing eye care in the PNG context. Using nurses that were already employed in the health system was a core factor in the success. Providing a full set of appropriate equipment enabled the trainees to be immediately productive. Ongoing follow-up and encouragement initially by the teacher (author), and then by the eye nurse coordinator helped considerably. The annual conferences played a vital role in the support, encouragement, development and team building, and allowed resolution of minor problems as they occurred. Encouraging monthly reports from the eye nurses as a means of monitoring progress as well as collecting data which provided evidence of the significant role the eye nurses were playing in eye care provision. The support and then adoption by the PNG Health Department was vital for eye care program to ‘belong’ to PNG.
The outcome of the training of the Eye Nurses

By the end of 2000, there were 20 eye nurses still active from the 25 that had been trained in the 1994 and 1997 courses (80% retention). Although there are the ongoing problems of funding and staff shortages within the PNG health system, tribal fights, difficulty with travel and communication and the multitude of family and cultural tensions that exist in this very complex country, the eye nurses have been able to maintain delivery of eye care in a sustained way. Collectively, by the end of 2000, the eye nurses had provided eye care to over 64,000 people throughout PNG. The eye nurses were providing eye examinations at a rate of over 10,000 people per year with a further 10,000 people undergoing vision screenings. This significant impact on the eye health and visual welfare of the people of PNG has been accomplished in the face of the substantial difficulties of providing health care in PNG.

It is estimated that by the end of 2004 the 3 groups of eye nurses had provided about 100,000 full eye examinations and 70,000 vision screenings. The eye nurses are continuing to provide 15,000 full eye examinations each year.

The aim of making eye care accessible and affordable to the people of PNG is now a reality in the areas where the eye nurses are located. Once trained the eye nurses were able to provide eye care without adding to the costs of health care delivery.

There had been a very high retention rate of active graduated eye nurses. Eye care was being provided at an appropriate level. The eye nurses were able to capably manage and provide eye glasses or treatment for 80% of the presenting patients.

A few eye nurses had been trained to be able to take on future teaching and tutoring roles to enable further eye nurses to be trained in the future.

Training nurses to become ‘eye nurses’ functioning as basic optometrists is an effective strategy in improving eye care in developing countries. The eye nurses were able to deliver sustainable, accessible, affordable and appropriate eye care, independently treating and managing the most common eye conditions in Papua New Guinea.
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Appendix A

Eye Nurse Training Course

Outline and Teaching Curriculum
CERTIFICATE

of

EYE NURSING

… a 10 week course in EYE NURSING teaching a basic understanding of the eye and eye problems (both refractive and disease), competency in the diagnosis and prescription of appropriate spectacles (with emphasis on low cost readymade spectacles), and in the recognition of eye disease and basic treatment.

A Certificate Course in Eye Nursing developed by John Farmer

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EYE NURSE TRAINING IN PAPUA NEW GUINEA

Course Outline

Aim:
The course aims to graduate trainees with a basic understanding of the eye and eye problems (both refractive and disease), skilled in the diagnosis and prescription of appropriate spectacles (with emphasis on low cost readymade spectacles), and in recognition of eye disease and basic treatment.

Introduction
10 weeks duration to ensure satisfactory learning and development of significant level of competence and confidence in practical skills.
The basic teaching program will be morning lectures and afternoon practical sessions. Some weekly “assessments” will assist in monitoring progress and areas requiring revision.
This is NOT STRICT time tabling. Some areas will need more and some will need less. The theory and clinical methods practical teaching should be complete by the end of week 7 so that the final 3 weeks can be spent in real supervised clinical examination and interactive learning on the job.

Summary
Week 1 How the eye works
Week 2,3a Examination of the eye
Week 3b,4,5 Refractive errors, refraction and optical correction
Week 6 Eye diseases, injury, and aging of the eye
Week 7 Running an eye clinic
Week 8,9,10 Supervised Clinical experience

Week 1 How the eye works
Very basic anatomy and physiology of the eye
Visual optics - a simple overview of how the vision system works

Week 2,3a Examination of the eye
General examination
History taking, signs, symptoms, previous and family history and general health and medications etc.
Recording notes, patient records.
General observation of the patient
Eye examination
- External eye
- Fluorescein staining etc.
- Ophthalmoscopy
- Tonometry

Visual system examination
- Measuring vision, letter charts, pin-hole etc.
- Pupil reactions
- Binocular vision
- Visual fields

A clinical examination routine, clinical judgment and decision making etc.

**Week 3b, 4, 5 Refractive errors, refraction and optical correction**
- Very basic optics
- Short, long-sightedness
- Astigmatism
- Presbyopia
- Strabismus
- Amblyopia
- Nystagmus
- Refraction
- Retinoscopy
- Refraction
- Near additions
- Aphakia and its correction

**Week 6 Eye diseases, trauma, and aging of the eye**
- Conjunctivitis
- Foreign bodies
- Corneal abrasions
- Pterygium and Pinguecular
- Cataract
- Glaucoma and diabetes
- Albinism

**Week 7 Running an eye clinic**
- Referral
- Community eye health
- Vision Screening
- Low vision
- Prevention and community education
- Maintaining equipment and supplies

**Week 8**

**Week 9**
- Supervised Clinical experience

**Week 10**
- 4 days patients, 1 day case histories and revision each week
Aim:
The course aimed to graduate trainees with a basic understanding of the eye and eye problems (both refractive and disease), skilled in the diagnosis and prescription of appropriate spectacles (with emphasis on low cost readymade spectacles), and in recognition of eye disease and basic treatment.

Summary

Week 1 How the eye works
Week 2,3a Examination of the eye
Week 3b,4,5 Refractive errors, refraction and optical correction
Week 6 Eye diseases, injury, and aging of the eye
Week 7 Running an eye clinic, assessment
Week 8,9,10 Supervised Clinical experience

Week 1 How the eye works

Very basic anatomy and physiology of the eye
Visual optics - a simple overview of how the vision system works

Monday
Arrival and settling in.

Tuesday
Welcome
Introductions - Who I am, How I come to be here
Getting to know each other - names, places, about them and their area
Devotions and thanks
Aims of the course - What do they hope to learn? My hopes for them.
Outline of timetable, daily timetable, course outline etc.
Questions .. about anything, the course, eyes etc.
Theory
Basic eye anatomy and physiology as per notes (external eye)

Practical
Looking at each others eyes
Sharing observations
Labeling what we see... external eye, iris colours, pupil sizes, puncta etc.
Everting eye lids
Wednesday

Theory
Basic internal eye anatomy and physiology as per notes...
Colour vision, Day/night vision, pupil reactions DCN.
Go through noted pages of “Manual for eye examination and diagnosis”

Very briefly, Physiological optics;
Colour vision
Night vision and dark adaptation
Contrast and illumination
Depth perception and stereopsis
UV light and sunglasses

Practical
Using the hand slit lamp and their loupes to look at the external eye and the lens, practicing lid eversion and looking with loupes.

Thursday

Theory
chapter 2 in “Eye Care in Developing Nations”
“Eyes Right” pages 1-15
Pupil reactions

Practical
Explaining care and assembly of Ophthalmoscope, recharging battery, what knobs do what, etc.
Testing pupil reactions
Using ophthalmoscope to look at external eye, .. then looking at fundus through one dilated pupil trying to locate the disc.

Friday

Theory
Assessment of anatomy and physiology - worksheet

Practical
Ophthalmoscopy and drawing the disc and blood vessels through the other dilated pupil. Also locating the macula, looking toward the periphery and focusing from cornea to fundus.
Free afternoon as some needed to get to the bank, post office, phone etc.

Week 2 Examination of the eye

General examination
History taking, signs, symptoms, previous and family history and general health and medications etc.
Recording notes, patient records.
General observation of the patient

Eye examination
External eye
Fluorescein staining etc.
Ophthalmoscopy
Visual system examination
  Measuring vision, letter charts, pin-hole etc.
  Pupil reactions
  Binocular vision basics, cover test
  Visual fields

A clinical examination routine, clinical judgment and decision making etc.

Monday
P  Ophthalmoscopy practice - undilated pupils, Disc
   Worked through answers to Assessment of anatomy and physiology - worksheet
TP  Fluorescein staining - Tear film, staining, tear drainage
TP  Oblique illumination view of anterior chamber depth
TP  Examination of the external eye.
TP  How to go about it and what to look for (overview )
TP  Measuring PD distance and near
TP  Eye movements -  (Excursions) eye movements “H”

Tuesday
TP  Eye movements -  (Excursions) eye movements “H”
   Cover test , exo and eso
   Hirshberg test
   Near point of convergence
TP  Visual fields (confrontation)
TP  Introducing Vision measurement, distance and near
   Lettercharts and reading cards
   Practical exercise, worksheet 1p (includes ophthalmoscopy on undilated pupil)
TP  Epilation of eyelashes
Rev  Measuring PD distance and near

Wednesday
Rev  Examination of the external eye,
   How to go about it and what to look for, a routine
   How to record what you see
T   Examination of the internal eye
   How to go about it and what to look for, a routine
   How to record what you see
T   Revision of examination of the eye from “EyeCare in Developing Countries” chapter 3
P   Demonstration eye examination
P   Eye examination routine and recording on each other (Exam)

Thursday
P   Eye examination routine and recording on each other (Exam) cont...
Friday
T Eye examination routine with revision and explanations of tests.
P Eye examination routine and recording on each other (Exam) ...finish

Week 3,4,5  
Refractive errors, refraction and optical correction

Very basic optics
Short, long-sightedness
Astigmatism
Presbyopia
Strabismus
Amblyopia
Nystagmus
Retinoscopy
Refraction
Near additions
Aphakia and its correction

Monday
Assessment of last week (Work 2)
T Revision of examination of the eye from “ABC of Eyes” chapter 1.
T An introduction to History as the vital part of eye examination.
T History (PC,GH,POH,FOH) basic questions (history sheet)
T An introduction to clinical examination thinking and decision making
T Basic optics, Reflection and refraction of light
TP Dioptre as a measure of strength
TP Plus and minus lenses
TP Lens strength additive
T Trial lens sets
TP Introducing trial lens sets, focal length of lenses, practice lenses in the sun.
P Trial lens sets, trial frames adjustment
TP Movement through lenses (neutralisation)

Tuesday
T Revision of Worksheet 2
T Slides “Eye Examination”
T Revision of Optics (optics sheet)
T Optics of the eye and accommodation
T Presbyopia
TP Short and Long sightedness (myopia, hyperopia)
TP Introduction to Retinoscopy
P Simulation of myopia, hyperopia (Trial lenses)
P Retinoscopy over unknown spherical lenses
**Wednesday**

T  Revision of optics and normal eye
T  Revision of myopia, hyperopia, and presbyopia (refractive error drawings)
P  Retinoscopy over unknown spherical lenses
T  Use of Retinoscope for looking at the Media
T  Introduction to astigmatism
T  Aphakia as a refractive error

**Thursday**

T  Revision of normal, myopia, hyperopia, presbyopia (refractive error sheet)
T  Astigmatism
TP  Retinoscopy of astigmatism (cyls) over unknown sph/cyl lenses

**Friday**

P  Measure Vision with +2.50 to -2.50 and 0 to -2.50 cyls @90,180,45 etc.
TP  Introducing Pin hole, and the concept of blur
T  Writing a prescription of glasses  Sph / Cyl * axis
P  Retinoscopy over unknown sph/cyl lenses, continued

**Monday**

R  Revision of prescription and powers
TP  Retinoscopy (best sphere on unknown spheres)
TP  Refraction (best sphere on unknown spheres)

**Tuesday**

TP  Prisms, Demonstration of Prisms, diplopia
T  Strabismus, ...tropias, R, L, Alternating  (Cover Test, measuring Phorias)
T  Amblyopia, suppression
T  Worksheet 3
TP  Retinoscopy and Refraction (best sphere) unknown and no lenses
T  Do eyes wear out, does wearing or not wearing glasses make eyes weaker?

**Wednesday**

R  Worksheet 3 revision
P  Full eye examination including history (spherical lenses)
T  Strabismus revision
T  Strabismus, .. intermittent, hypertropia, causes (muscle/nerve, congenital/acquired, accommodative esotropia, pseudo esotropia).
TP  Retinoscopy and refraction (cyl lenses)

**Thursday**

T  “Manual for Eye Examination and Diagnosis” pages 6 - 12.
T  Revision of optics, retinoscopy, refraction
TP  Retinoscopy and Refraction , astigmatism (with cyl lenses) practice
Friday
T revision of strabismus (Handout)
T revision squint “ABC of Eyes” p 39 - 42
R Muscles and Nerves (handout)
TP Converting glasses neutralisation (powers in each direction) into prescription form (sph/cyl*axis)
TP Retinoscopy and Refraction, difficult cases, high plus/minus.
TP Near Adds - measuring, writing full Rx, working out reading glasses

Monday
R Near Adds - measuring, writing full Rx, working out reading glasses
R Revision of Near adds and Astigmatic ret and refraction (Handout)
P Full eye examination with ret, refraction and near adds

Tuesday
T Worksheet 4
P Full eye examination with ret, refraction and near add (cont.)
T Cross cyl
P Astigmatic ret and refraction (Xcyl)

Wednesday
R Worksheet 4
R Revision of ametropias and symptoms
T Examining children and vision development in children
T Study glasses
R Cross cyl demonstration and revision
P Astigmatic ret and refraction (Xcyl)

Practice eye examinations (practice patients)

Thursday
TP Vision Screenings
R Cross Cyl (handout)
TP Neutralising unknown lenses
T Converting glasses neutralisation (powers in each direction) into prescription form (sph/cyl*axis)
TP Transposing, plus and minus cyl forms, power diagrams
T Bifocals
Practice eye examinations (practice patients)

Friday
R Neutralising unknown lenses, Converting glasses neutralisation (powers in each direction) into prescription form (sph/cyl*axis), Transposing, plus and minus cyl forms, power diagrams
T Aphakia and its correction, Unilateral, Bilateral
T Prescribing guidelines
1/2 week
**Week 6  Eye diseases, trauma, and aging of the eye**

*Conjunctivitis*
*Foreign bodies*
*Corneal abrasions*
*Pterygium and Pinguecular*
*Cataract*
*Glaucoma and diabetes*
*Albinism*

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**Monday**
T  Worksheet 5
T  Examination and Language difficulties
T  Children, Low vision, Difficult patients
T  Common Anterior eye disorders - Conj. and Cornea
  Pterygium, Pinguecular, Conjunctivitis, red eyes, dryness allergies etc
  “ABC of Eyes” p6-10
  “Manual of Eye Examination & Diagnosis” p40-60 (photos mainly)
P  More practice Retinoscopy and Refractions astigmatic (cross cyl)

**Tuesday**
R  Worksheet 5
T  Ocular trauma
P  Demonstration patient - Trauma
T  Anterior Uveitis, Iritis, etc.
T  Eyelid conditions
T  Common Posterior eye disorders, Lens and Vitreous
  Cataract, floaters, flashing lights, “ABC of Eyes” p9-20
  “Manual of Eye Examination & Diagnosis” (photos mainly) p40-60,66-71
P  More practice Retinoscopy and Refractions astigmatic (cross cyl)

**Wednesday**
R  Special conditions handout
TR  Worksheet 5a
R  revision of Eyelids, Conjunctiva, Cornea, Cataract, Vitreous ..... eye conditions
T  Glaucoma
  “ABC of Eyes” p 26-29,34-38
  “Manual of Eye Examination & Diagnosis” (photos mainly) p60-65,72-75
  **Practice eye examinations**  (practice patients)

**Thursday**
T  Retinal disorders - Heamorrhages and Exudates; Diabetes, Hypertension
T  Retinal detachment
T  Aging of the eye, maculopathy
T  Other Diseases ( Albinism )
  “Manual of Eye Examination & Diagnosis” (photos mainly) p80-98
T  Headaches and migraine
T  Video “Cataract”
  **Practice eye examinations**  (practice patients)
Friday
P Screening at the local community school, Children and teachers

Week 7 Running an Eye Clinic

Monday
Worksheet R (1-5), Cataract handout
Slides No.2
Practice Refractions, Astigmatic ret and refraction sample lenses

Tuesday
Worksheet R (1-5) revision/answers, Worksheet 5b
Slides No.3
Sigma photo book
“ABC of Eyes” p 21-25,39-41,51-54
AOA Pamphlets
Video, short look at corneal graft and glaucoma surgery

Wednesday
Practice Spherical Refraction
An example of how to run and eye clinic - Rody
Discussed some issues and questions that arose
Explained Day sheet, Specialist Sheet, Stock sheet, Monthly report
Ordering, balancing money, cheque accounts, receipts etc.
Revision of History, eye medications
Tonometry, Schiotz and Perkins demonstration measuring

Thursday
Running and eye clinic: Adjusting repairing glasses, plastic, metal, sunglasses
Glasses supply, ordering readymades, custom made prices, stock control
Book keeping, day sheets, specialist sheets/referrals, A room to work in,
Money and balancing books, Vision Screening, maintaining equipment,
replacement parts,
Community Health, Low vision, magnifiers, Bifocals, multifocals, PGX etc.
R Eye conditions handout
T Other Diseases (Tropical diseases TB, Leprosy)
Practice Refractions, Sphere and Astigmatic ret and refraction sample lenses
T Worksheet 6
T “Manual of Eye Examination & Diagnosis” p1,2 Presenting symptoms
T Clinical decision making some examples

Friday
R Worksheet 6
T Report masters handouts
**Week 8  Supervised Clinical Experience**
This week will be spent running an eye clinic at a variety of locations to provide as much practical experience as possible and also to provide example of various conditions and case examples for further teaching.

**Monday**
Eye examinations and screening .... clinical experience

**Tuesday**
Eye examinations and screening .... clinical experience

**Wednesday**
Eye examinations and screening .... clinical experience

**Thursday**
Eye examinations and screening .... clinical experience

**Friday**
Eye examinations and screening .... clinical experience

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**Week 9,10  Supervised Clinical Experience** These weeks will be spent in Clinical practice at the Hospital eye clinic and other locations to provide as much practical experience as possible and also to provide example of various conditions and case examples for further teaching, including Surgery observation.

**Monday**
Clinical Practice

**Tuesday**
Clinical Practice

**Wednesday**
Clinical Practice

**Thursday**
Clinical Practice

**Friday**
Clinical Practice

**Saturday**
Morning at the Optical Workshop

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**Monday**
Clinical Practice

**Tuesday**
Clinical Practice

**Wednesday**
Clinical exams, Assessment & Evaluation

**Thursday**
Graduation

**Friday**
Return home for nurses
Appendix B

Teaching Notes
How the Eye is made and how the Eye works
Anatomy and Physiology

External Eye

Eyelids

Lids
Skin
Muscle
Orbicularis muscle - closes the eye
Levator muscle - lifts the top lid
Tarsal plate
Meibomian gland - oily part of the tears
Conjunctiva - mucus part of the tears

Lashes
Evertting Lids
Ectropian - lower eye lid turned outwards = watery eye
Entropian - lower eye lid turned inwards = lashes scratch eye (remove)

Lacrimal System

Lacrimal gland - produces 90% of tears (aqueous)
Puncta, upper and lower (superior and inferior)
Canaliculis, superior and inferior
Lacrimal Sac
Nasolacrimal Duct - into the nose

Tear composition
Mucus - “wetting”
Aqueous
Oil - “smooth and reduces evaporation”

Blockage = watery eye

Conjunctiva

Normally clear
Blood vessels (often not much blood)
Pigmentation
Joins cornea at the Limbus
Upper and lower Fornix

swelling - allergy?
blood - subconjunctival haemorrhage (clears in 10 days)
infection - conjunctivitis, bacterial, viral, allergic.

pinguecula - lump on the conjunctiva next to the limbus
pterygium - growth over the conjunctiva onto the cornea

Sclera

White outer layer of the eye
Strong
How the Eye is made and how the Eye works (continued)

**Cornea**

Epithelium - 5 cells thick, easily damaged (feels like something in the eye or gritty or burning), repairs quickly
Bowman’s membrane - strong, if damaged then scars
Stroma
Descemet’s membrane
Endothelium - 1 cell layer, no growth, acts as pump

**Internal Eye**

**Iris**

Sphincter - constricts the pupil
Dilator - dilates the pupil
Pigment

**Lens**

Layered - new cells push the older cell toward the centre
Changes with age (harden with age, little shape change)
Capsule (bag)

**Ciliary Body**

Muscle
Zonules
Aqueous production

**Anterior angle**

Aqueous flow - flows from the ciliary body, between the lens and the iris, then through the pupil into the anterior chamber (provides nutrients for the cornea), then into the angle through the Trabecular meshwork into Schlemm's canal.
Trabecular meshwork
Canal of Schlemm

**Vitreous Body**

Clear “jelly” like substance
How the Eye is made and how the Eye works (continued)

Retina

Nerves
Rods       night
Cones day, colour (3 types)
Macula      centre, best vision
Blind spot  optic disc

Blood supply through central vessels which come into the eye through the optic disc. Macula needs blood supply from “net” of vessels in the choroid.

Choroid

Uvea (Choroid, Ciliary Body and Iris )

Sclera

Optic nerve

surrounded by CSF (brain) fluid

Optic nerve

Optic chiasm
Optic tract
Optic radiations
Occipital cortex
Left field to right cortex

Visual Pathway

References:
Page numbers are listed from “Manual for Eye Examination and Diagnosis” Leitman
see also chapter 2 in “Eye Care in Developing Nations” Schwab
and pages 6-14 from “Eyes Right” AOA booklet
## Eye Muscles and Nerve Supply

<table>
<thead>
<tr>
<th>MUSCLE</th>
<th>ACTION</th>
<th>NERVE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Eyelid</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Orbicularis Oculi</em></td>
<td>Closes the eye</td>
<td>Facial (7)</td>
</tr>
<tr>
<td><em>Levator Palpebrae Superioris</em></td>
<td>Opens the eye</td>
<td>Oculomotor (3)</td>
</tr>
<tr>
<td><strong>Iris</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Sphincter</em></td>
<td>Constricts Pupil</td>
<td>Oculomotor (3)</td>
</tr>
<tr>
<td><em>Dilator</em></td>
<td>Dilates Pupil</td>
<td>Sympathetic</td>
</tr>
<tr>
<td><strong>Ciliary Body</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Ciliary Muscle</em></td>
<td>Accommodation</td>
<td>Oculomotor (3)</td>
</tr>
<tr>
<td><strong>External Eye</strong></td>
<td>6 muscles move each eye</td>
<td></td>
</tr>
<tr>
<td><em>Superior Rectus</em></td>
<td>Looks up</td>
<td>Oculomotor (3)</td>
</tr>
<tr>
<td><em>Inferior Rectus</em></td>
<td>Looks down</td>
<td>Oculomotor (3)</td>
</tr>
<tr>
<td><em>Lateral Rectus</em></td>
<td>Looks out</td>
<td>Abducens (6)</td>
</tr>
<tr>
<td><em>Medial Rectus</em></td>
<td>Looks in</td>
<td>Oculomotor (3)</td>
</tr>
<tr>
<td><em>Inferior Oblique</em></td>
<td>Looks up and in</td>
<td>Oculomotor (3)</td>
</tr>
<tr>
<td><em>Superior Oblique</em></td>
<td>Looks down and in</td>
<td>Trochlear (4)</td>
</tr>
</tbody>
</table>

The muscles of both eyes (12 muscles in total) move together as a **team** to allow us to see “one” picture.
Examination of the Eyes - an example

**History** - see later

**External eye**
- A general look at the face and eyes noting any abnormalities
- A close look at the Right eye; (using loupe and ophthalmoscope as needed)
  - Lids,
  - Lashes,
  - Lower fornix,
  - Evertine the upper lid,
  - Bulbar conjunctiva (patient looking up, down, left, right),
  - Cornea,
  - Iris,
  - Pupil (size and shape)
- Repeat for Left eye; (using loupe and ophthalmoscope as needed)
  - Lids,
  - Lashes,
  - Lower fornix,
  - Evertine the upper lid,
  - Bulbar conjunctiva (patient looking up, down, left, right),
  - Cornea,
  - Iris,
  - Pupil (size and shape)

Flourescein staining if needed for looking at cornea, tears or drainage

Pupil reactions; Right direct, consensual (and near)
  - Left direct, consensual (and near)

Eye movements “H”

Cover Test Distance (right and left)
  - Near (right and left)

Fixation (straight and steady)

Corneal reflections for straight eyes if unsure

NPC (near point of convergence) good or poor

PD Dist/Near

Vision Distance - with glasses (aided) and without glasses (unaided) Near ?

Visual fields - confrontation, left/right field comparison

**Internal eye** - ophthalmoscopy (media and fundus - disc, macula, vessels etc)
History

Taking a good History is perhaps the most important part of any eye examination. It is important to remember:
1 that the History never ends (you may need to ask more questions as the examination proceeds) and
2 that you must listen carefully to what the patient says.

The 4 important parts of an Eye Examination History with the 10 questions you should ask are:

<table>
<thead>
<tr>
<th>PC</th>
<th>Presenting Complaint</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>Distance vision?</td>
</tr>
<tr>
<td>N</td>
<td>Near vision?</td>
</tr>
<tr>
<td>SE</td>
<td>Sore eyes? (aching, painful etc)</td>
</tr>
<tr>
<td>HA</td>
<td>Headaches?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MH</th>
<th>Medical History (general health)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Medical conditions?</td>
</tr>
<tr>
<td></td>
<td>Medical treatment?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>POH</th>
<th>Past Ocular History</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trauma? or injuries?</td>
</tr>
<tr>
<td></td>
<td>Eye Operations?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FH</th>
<th>Family History</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Family eye problems?</td>
</tr>
<tr>
<td></td>
<td>Family health problems?</td>
</tr>
</tbody>
</table>

From the patient history you should try to work out what the most likely problem (or problems) are and keep these in mind as you go through the examination. The results you get will help you to decide what is the most likely diagnosis.

By taking account of the patients’ SYMPTOMS (what they say) and noting the SIGNS (what you see and measure) you will be able to decide the DIAGNOSIS and then determine the TREATMENT.

Remember the aim of your eye examination is:
1 to fix the patients problem (PC) and
2 to discover any other eye or medical (health) problems
Optics

Light travels (goes) in straight lines

Reflection of light
Light bounces (reflects) off a surface
Angle out = angle in

Refraction of light
Light changing direction as it passes into a new material
Angle out is less than Angle in when going from air into glass

Lens power is measured in DIOPTRES (D)

Plus lenses
A 1 dioptre lens focuses light at 1 metre
A 2 D lens focuses at 1/2 metres (50 cm)
A 3 D lens focuses at 1/3 m (33.3 cm)

Minus lenses
A -1 D lens focuses light at -1 metres (as if the light was coming from 1 metre before the lens)
A -2 D lens focuses at -1/2 m (-50cm)

Lens strength can be added.
For example:
A +2 lens and a +3 lens = a +5 lens
A +6 lens and a -2 lens = a +4 lens
A +2 lens and a +1 lens and a +3 lens = a +6 lens

Prisms are lenses that change the direction of light but don’t focus the light.
A prism will move the “image” in the direction of the point (Apex)
Refractive Errors

<table>
<thead>
<tr>
<th>Normal</th>
<th>Distance</th>
<th>Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myopia</td>
<td><img src="image1" alt="Myopia Distance" /></td>
<td><img src="image2" alt="Myopia Reading" /></td>
</tr>
<tr>
<td>Hyperopia</td>
<td><img src="image3" alt="Hyperopia Distance" /></td>
<td><img src="image4" alt="Hyperopia Reading" /></td>
</tr>
</tbody>
</table>

Presbyopia - means the eye cannot accommodate (focus) the normal amount.
Refractive Errors (Ametropia)

**Myopia** (Short-sighted) - Distance light focused in front of retina

*Symptoms*  
Blurred distance vision  
Sometimes “screwing” up the eyes

Correct with Minus lenses

**Hyperopia** (Long-sightedness) - Distance light focused behind the retina

*Symptoms*  
Difficulty with reading and close work  
Blurred reading (near) vision  
Tired or aching eyes  
Headaches (usually frontal, task related and mild - moderate)

Correct with plus lenses

**Astigmatism** - Distance light focus at 2 different points

*Symptoms*  
Blurred vision at both distance and near (usually worse at near)  
Difficulty with reading and close work  
Blurred reading (near) vision  
Tired or aching eyes  
Headaches (usually frontal, task related and mild - moderate)

Correct with cylinder lenses

**Presbyopia** - Loss of accommodation (focusing) for near due to age

*Symptoms*  
Holding reading further away  
Difficulty with reading and close work  
Blurred reading (near) vision  
Tired or aching eyes  
Headaches (usually frontal, task related and mild - moderate)

Correct with reading glasses (near add)

**Aphakia** - A large amount of hyperopia that follows removal of the lens from the eye (cataract operation).

*Symptoms*  
Very blurred vision distance and near

Correct with strong plus lenses (both eyes)
Retinoscopy
( use of a special light and the reflection from the retina to measure a person’s refractive error)

A +2.00 lens is used as a “working lens” to allow for the arm length distance that you use for retinoscopy.

If the reflex moves in the same direction as the light it is a “WITH” movement
“WITH” movement = add more plus (+) or less minus (-)

If the reflex moves in the opposite direction to the light it is “AGAINST”
“AGAINST” movement = add more minus (-) or less plus (+)

The direction of movement reverses at the point of “neutralisation”. The closer you get to neutralisation the brighter and faster the movement.

*If the patient has Astigmatism there will be two axis to neutralise. These will be at right-angles. Neutralise all the “with” movement first. This will leave and “against” movement (minus cyl) lens to neutralise the other direction.

The patient’s refraction is recorded as:

\[
\begin{array}{c}
\text{SPH} \\
\text{CYL} \\
\text{AXIS}
\end{array}
\]

The axis is the direction you neutralise first and is the gold line on the cyl lenses.

Refraction spherical (measuring the patient’s refractive error)

1. With the +2.00 working distance lenses in place measure the Retinoscopy for the Right then the Left eye.
2. Take out the retinoscopy (+2.00) lenses
3. Block the left eye with the “B” lens
4. Try +0.50 lens. If the vision is better or the same add +0.50 to the lens and try +0.50 again. If the vision is worse then try a -0.50 lens. If this -0.50 lens improves the vision then change the lens power by -0.50 and try the -0.50 lens again. If the vision is the same or worse with the -0.50 lens then stop. To check that you have the correct answer try +0.50 again. This should blur the vision. If it doesn’t then continue as above.
5. Now block the right eye and try +0.50 and -0.50 lenses in the left eye........
Strabismus or Squint or Turned eyes

Strabismus or Squint are the words used to describe the eyes when they are not straight. One eye will be turned in, called an Esotropia or one eye will be turned out, called an Exotropia.

The term Tropia, means turned eye all the time. We use the term Phoria when the eyes tend or “like” to turn but in a phoria they only turn if one eye is covered.

When one eye is turned in or out all the time the brain Suppresses the image in the central part of that eye to prevent the brain seeing double (2 of everything). This suppression is like a switch that the brain can turn on again as soon as the “good” eye is covered.

If the brain suppresses one eye long enough the eye will not develop and will have poor vision. We call this Amblyopia or “lazy eye”.

Before the patient is 8 years of age it may be possible to improve the vision in an amblyopic eye by covering (patching) the “good” eye and making the “bad” eye exercise or work.

Sometimes a person with turned eyes will Alternate (change) from using one eye to look (fixate) with sometimes and the other eye to fixate with at other times. In these patients the vision in both eyes is usually good and the brain switches the suppression from one eye to the other (suppress the turned eye).

Sometimes a person will only have turned eyes for some of the time, often when they are tired. This is called an Intermittent tropia.

On rare occasions one eye can be turned up, called a Hypertropia.

Most cases of exotropia are caused by the eye muscles being out of position (alignment) making it too hard for the eye muscles to keep the eyes straight. Mostly people are born with their eyes turned (congenital). Sometimes it is caused by injury or disease affecting the muscles or nerves.

Some cases of esotropia are caused by the eye muscles being out of position, but often the eyes are Hypermetropic (longsighted). In these people the eyes try hard to focus to clear the image and the focus so hard that the eyes turn in as well (because the messages from the brain causing the eyes to focus (accommodate) are joined with the messages causing the eyes to converge). In these patients we call the turn an Accommodative Esotropia, and if we stop the eye focusing by give the person glasses to fix their hyperopia we can also fix the turned eyes.

Because some babies have wide epicanthial folds (wide nose) it can look like the eyes are turned in even though they are straight. This is called a Pseudo-esotropia. No treatment is needed and as the baby grows and the nose gets “thinner” the eyes will appear to straighten by themselves.
Near additions (reading glasses)

The Near Add needs to be measured for all patients with near difficulty when the distance Rx alone is not enough to make things clear and/or comfortable.

1 Distance Rx Right then Left
2 Near Rx BOTH eyes together (leave distance Rx in trial frame)
   Start with +1.00
   add +0.50 R & L if better, increase add to +1.50
   continue until no improvement
   Try -0.50. This should blur the print. If not reduce the add and repeat

Remember to test both eyes together
Try to get add so that +0.50 and -0.50 make things worse
Certainly the -0.50 R&L should make things worse.

Record as R Sphere Cyl * axis L Sphere Cyl * axis

Note: Reading glass lenses will be the distance Rx plus the add

Astigmatic Refraction (cyl refraction)

Do a spherical ret and refraction first. An astigmatic refraction only needs to be performed if the vision with a spherical refraction is less than 6/12 and the vision can be improved with pin-hole.

1 Ret using +2.00 working lenses and determine the direction of the axis
2 Ret all “with movement” using sphere lenses (leaves “against” or minus cyl)
3 Record sphere above a line and write the axis (direction neutralised) below
4 Neutralise the remaining “against movement” using minus cyl lenses with the axis (gold line) along the direction already neutralised
5 Repeat for the left eye
6 Remove the ret lenses
7 Block the left eye
8 Refract the right eye
9 Check the sphere with +0.50 and -0.50 sphere as for spherical refraction
10 Check the cyl lens with +0.50 and -0.50 cyl lenses
11 If you have changed the cyl, then you must recheck the sphere
12 If you change the sphere, recheck the cyl
13 Repeat until both the Sphere and Cyl remain unchanged.
14 Block the right eye and repeat for the left eye

Record as R Sphere Cyl * axis L Sphere Cyl * Axis

(Initially prescribe the spherical refraction until cyl refractions become available)
**Refraction**

Perform Spherical refraction first
If the vision with this refraction is not **better** than 6/12,
Try pin hole
If the vision can be improved,
Try astigmatic refraction using the cross cyl method (as below)

**Astigmatic Refraction** (Cyl refractions) - The Cross Cyl Method

1. Spherical retinoscopy and spherical refraction
2. Try the cross cyl -0.50 at axis 180, then 90, then 45, then 135.
3. If it is worse in all directions there is no significant cyl.
4. If better then add -0.50 minus cyl in the “better” direction.
5. Continue to check the power (strength) of the cyl using the -0.50 and +0.50
6. Check the axis by placing the cross cyl obliquely (handle along the axis) and
   move the cyl lens axis toward the -0.50 (red) in the better direction.
7. Once the correct power and axis are determined you need to recheck the
   sphere. If you need to adjust the sphere the recheck the cyl (power only) ..... 

**Neutralising Glasses**

1. Find the amount of sphere lens strength to neutralise in one direction
2. Repeat in opposite direction if cyl lens
3. Record on a cross diagram
4. Convert to prescription form by :
   writing the most plus (or “least minus”) strength as the sphere,
   write the direction of this as the axis,
   write the difference in strength between the 2 directions as the cyl (minus)

**Writing a prescription**

\[
\begin{array}{cccc}
R & \text{Sphere} & \text{Cyl} & \text{axis} \\
L & \text{Sphere} & \text{Cyl} & \text{axis} \\
\end{array}
\]

Sphere  Add

Note: Reading glass lenses will be the distance Rx **plus** the add
Special Cases

Children
Be gentle and encouraging
If having difficulty with a test - leave it and come back to it later
Don’t point out their mistakes

Low vision
Work in big steps
Move the chart closer

Difficult cases
Work in big steps
Use your Retinoscope finding
Use the History and common sense
Repeat test another day

Prescribing guidelines - *Eye Glasses make vision clearer and more comfortable, they also improve people’s quality of life.*

- Always have a good reason for recommending glasses
- Use Spheres
- Generally use the lowest strength needed
- Concentrate on the refraction of the *best* eye when one has better vision
- Differences of 3 D or more in Right and Left refraction cannot be worn
- Generally both lenses can be the same (use the lower strength)
- In Amblyopia it may be appropriate to order different strength lenses
- When the power is more than + or - 4.00D be aware of the PD
- Remember you can’t solve every problem

Bifocals - Distance and reading glasses together in one glass
- Try to keep both eyes the same strength
- Measure the Seg Height (Distance from the edge of the bottom eyelid to the inside edge of the bottom of the frame)
- Use the same Seg height for each eye (if not equal take the average)

Screening
The aim is to use the minimum number of tests to find the most number of problems
- Measure Vision - right and left eye separately  Less than 6/9 fail
- Cover test - distance and near
- Check vision with +2.00 R&L  6/12 or better indicates Hyperopia

Transposing - from plus to minus, or minus to plus cyl form of prescription

Combine the sphere and cyl power to give the new sphere power
Change the sign of the cyl, but leave power of cyl unchanged
Change the axis by 90 deg. (to opposite direction)

<table>
<thead>
<tr>
<th>e.g.</th>
<th>+2.00</th>
<th>+1.00</th>
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</tr>
</thead>
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<tr>
<td>-1.00*90</td>
<td>+1.00*180</td>
<td>+2.00</td>
<td></td>
</tr>
<tr>
<td>+1.00</td>
<td>+1.00</td>
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</tbody>
</table>
Prescribing guidelines for astigmatism glasses

Any pair of eye glasses can take some days for the patient to feel comfortable wearing them. Eye glasses to correct astigmatism are often more difficult for a patient to wear comfortably. When first worn they may cause floors and tables to slope, or cause the patient to feel a little nausea. Both of these symptoms should get less and eventually stop over a few weeks of wearing the glasses. There are some patients who never adjust to astigmatic corrections in their eye glasses.

These guidelines will help to reduce the problems.

Prescribe no more than 1 Dioptre of cyl with the first astigmatic pair of glasses for a patient. (put 1 cyl in trial frame and work out best sphere)

Increase by no more than 1 Dioptre of cyl with each new pair of glasses.

Remember “Oblique” axis (45, 135)cylinders usually cause more problems.

Also older patients will usually have more trouble adjusting to these glasses.

If the patient cannot adjust, check the refraction and try reducing the cylinder power to half the strength.

Remember astigmatic eye glasses are expensive and “individual” and cannot easily be used by someone else. If the patient cannot adjust to the new glasses they will not (and should not) pay for the lenses, you will have to pay for them. You should not prescribe them unless you are very confident of you refraction and prepared to cover the cost of the glasses if the patient cannot adjust to them.
Cataract

Once you have identified patients requiring cataract surgery you will need to prepare them for possible surgery by clearly explaining what is involved. These patients need motivation and you will need to clear up any myths or poor understanding they may have regarding cataract surgery. Tell them it is a simple operation, mostly using local anaesthetic, that will remove the “smoke”, and provided that there is no problems with the retina behind the cataract, the patient should regain good vision. Depending on how the operation proceeds they may have an implanted plastic lens (an IOL - intra ocular lens) to replace the smoky one, or they may have thick glasses. Whatever the outcome they will still need glasses for distance or reading or both. Don’t forget that young people who develop cataract might be diabetic.

Following cataract surgery you will need to examine the patient’s eye carefully:
  Look at the cornea to see that it is clear.
  Check to see if the pupil is round and clear.
  Check to see if the vision is reasonable (an implant will give better vision)
  Check to feel if the eye pressure is normal.
  Look at the retina to see if it looks normal.

Following cataract surgery you will need to ensure the patient is clear what they need to do.
They will normally have an antibiotic drops (or ointment) and steroid drops. These should both be used 4 times each day for 2 weeks, then just the antibiotic for another 2 weeks 4 times a day. (This will need to be altered if things do not proceed normally). Review the patient on day one then normally at 2 weeks.

Tell the patient:
  Patch the eye at night (optional during the day)
  To wash their face each day
  To keep using other medications they may be taking
  Not to bend down below waist height for 2 weeks, squat down instead
  Not to carry heavy loads or children or animals for 2 weeks
  Use sunglasses to help protect them from the sun.
  To come and see you if they develop eye pain

Remember the eye is usually red for 7 - 10 days and the slight drop in the eyelid usually lasts 3 days. Some floaters may occur.
For patients who have not had an implant they will need to use the steroid 6 times a day. These patients also benefit from using oral Prednisolone for 5 days and Intramethasone if available. You should be especially on the look out for retinal detachment , or macular edema in these cases.

You could give glasses straight after the operation but the refraction will not be settled down to a stable result until 8 weeks after and this would be the best time to give glasses. If no implant then you will need about + 10.00 glasses.
Some Complications after Cataract Surgery

Infection of the eye
Increasing pain and redness may indicate an infection (or it could be increased pressure in the eye). If the eye becomes infected after surgery you will need to increase the dosage of antibacterial drops to try and control the infection.

Hyphema (blood in the anterior chamber)
These patients need to be told to sleep sitting up. You need to keep a check on the pressure as the blood might block the angle and cause glaucoma. Watch these patients carefully to see if the amount of blood is increasing. If it is then a second operation is needed. If the amount of blood is not increasing then just monitor the eye pressure.

Glaucoma (increased pressure in the eye)
The inflammation caused by the surgery (an eye injury) can sometimes cause an increase in the eye pressure. This will be a cause of persistent or increased pain and redness after surgery. This can be treated by Pilocarpine drops and or Timolol drops. These drops will need to be used for some time until the eye pressure returns to normal and stays normal after the drops are stopped.

Macular Edema (swelling or a blister under the macular)
This may be why the vision does not improve as much as expected. It is very difficult to see the swelling with an ophthalmoscope. The macular may look normal. The swelling may improve with time but not always. Treatment with steroids may sometimes help.

Haze of the posterior capsule
This can develop at any time after surgery, even some months later, causing poor vision. If it causes enough decrease of the vision then another operation to clear the haze may be necessary.

Some words that are used with cataract surgery:

IOL - Intra Ocular Lens.

ECCE - Extra Capsular Cataract Extraction .....removal of the lens leaving the lens capsule in the eye. These patients usually have a Posterior (behind the Iris) IOL. This is usually the best option if possible.

ICCE - Intra Capsular Cataract Extraction .....Removal of the lens and the lens capsule form the eye. These patients may have an Anterior (in front of the Iris) IOL. This may happen with very dense (old) cataracts because the capsule is weak.
Some Eye Conditions

**Eyelid Conditions**

**Ectropion**

The eyelid is turned outward, causing watery eye and possible redness due to poor lid function. Sunglasses by improve comfort. Surgery is the only treatment.

**Entropion**

The eyelid is turned inward, causing eyelashes to rub on the cornea. This will cause a red scratchy eye and may result in corneal scaring (e.g. Trachoma). Regular removal of the lashes will help. Surgery is the only treatment.

**Blepharitis**

This is an inflammation of the eyelid margins due to bacteria. It can cause redness and possible swelling of the eyelids, itching, and some crustiness of the lashes. There may be an associated kerato-conjunctivitis. Treatment initially by keeping the eyelids clean (washing twice a day). If necessary use antibiotics. Blepharitis is often chronic and may recur following treatment.

**Internal Hordeolum (Chalazion)**

This is an inflammation of the Meibomian gland. The eyelid is swollen and red when inflamed. Treat with warm compresses and antibiotics. A hard lump (chalazion) may stay after the inflammation settles. This can be surgically removed.

**Stye (external Hordeolum)**

This is an inflammation of the eyelash follicles and causes a tender red lump. Treatment is with warm compresses and antibiotics.

**Ptosis**

This is when the eyelid droops and may be congenital, traumatic, due to a nerve/muscle palsy, or the result of aging. Surgery is only needed on severe cases.

**“Red Eyes” (Conjunctiva and Cornea)**

There are many, many causes for “red eyes”, including smoke and dust. It is not always possible to find the cause. Vision should be normal in conjunctivitis, but may be affected if the cornea is involved. Photophobia and greater pain indicate possible corneal problems.

**Bacterial**

Bacterial infections are best identified by the pus and excessive mucous discharge. The eye is quite red and sore and the eyelids often stick together. Wash the eyes. Antibiotics should clear the infection in a few days (Chloramphenicol is best). If not check for other causes, perhaps try another antibiotic and beware of the possibility of allergic reaction to the antibiotic. If the cornea is infected systemic and sub-conjunctival antibiotics are needed. **Ophthalmia Neonatorum** (Gonococcal infection) needs “strong” treatment (Tetracycline 1% and IV penicillin).
Viral
Viral infections cause the eye to be a little red, sore and watery. The patient may have a cold or cough. The eye will usually recover itself in about 2 weeks but antibiotics should be used to prevent a secondary bacterial infection. Herpes simplex and herpes zoster virus can cause corneal infections.

Allergies
The eye is usually swollen and itchy with allergic reactions. It may be watery as well. Once the cause is removed the eye will slowly recover. Antihistamine, vasoconstrictor eye drops may help. Sometimes steroids can be used (careful).

Chlamydial
This causes a chronic red sore eye with a mucous and pus discharge. There is often associated venereal disease. Treat the general health as well as using antibiotic in the eye (Tetracycline). In new born babies treatment must be “strong”.

Dry eyes
A chronic, red, watery, scratchy eye may be due to dryness as a result of poor tears (e.g. Arthritis) or lid function (e.g. leprosy). Artificial tears can help the eye feel better, encouraging the patient to blink (fully) more often and sunglasses may reduce the symptoms.

Fungal
Fungal infections are difficult to diagnose and treat. They should be considered in any severe red eye not responding to treatment.

Episcleritis and Scleritis
These inflammations are often associated with TB or Arthritis. The eye is red and sore. The redness is usually limited to part of the eye. It usually resolves by itself over time. Antibiotics will prevent a secondary bacterial infection.

Subconjunctival Haemorrhage
The eye looks “painted red” due to a broken blood vessel in the conjunctiva. It takes about 10 days to resolve. Recurrent bleeds suggest a vascular problem.

Pterygium
This is a very common growth of conjunctival tissue onto the cornea. It usually grows very slowly. It can cause irritation if lumpy and it may affect the vision if it grows too far. Treatment is by surgical removal. This is best done before the pterygium reaches half way to the pupil margin. The pterygium may regrow.

Pinguecula
This is a common lump of tissue on the conjunctiva next to the limbus. If it is very raised and causing a lot of irritation it can be removed.

Endophthalmitis
The whole eye is inflamed (e.g. post operatively), with pus in the anterior chamber. “Strong” systemic, sub-conjunctival and topical antibiotics are required.
**Trauma**

Any “foreign body” should be removed (unless it penetrates the eye). Antibiotics should be used to prevent infection until the corneal epithelium heals. Any “scratchy”, sore eye should be stained with fluorescein to check for injuries and foreign bodies. Don’t forget to check under the eyelids.

**Chemicals** should be washed from the eye with lots of saline (or water if no saline is available). Lime is very bad in the eye. Again antibiotics should be used to prevent infection until the corneal epithelium heals.

“Welding flash” causes blistering of the corneal epithelium and pain. The epithelium should heal in a day.

**Blunt injuries** can cause bleeding inside the eye which may cause increased eye pressure and glaucoma. Rest and careful observation are best until the blood is absorbed.

**Iritis (Anterior Uveitis)**

Inflammations of the Iris and ciliary body (anterior uveitis) usually cause redness of the eye especially around the limbus. The iris may be hazy due to inflammatory matter in the anterior chamber. Photophobia and pain may be present. Dilating the pupil with drops will improve comfort, as well as prevent the iris sticking to the lens and also improve aqueous drainage. The condition is usually self limiting. Watch for increased eye pressure as a complication.

**Acute Angle Closure Glaucoma**

This may look very similar to iritis, except there is more pain (often vomiting) and redness, the pupil is usually a little dilated and responds poorly to light, the cornea is hazy, vision reduced, and the eye pressure is high (feel the eye). Immediate treatment is with Acetazolamide (Daimox) 500mg and Pilocarpine 2% drops until the pressure drops. In PNG most glaucoma is secondary to another cause, e.g. post operatively after cataract surgery. If this condition is not treated quickly permanent vision damage will occur.

**Vitreous**

As the vitreous changes with age it may pull on the retina causing flashing lights (one eye only) and rarely it may cause a retinal detachment. Sometimes parts of the vitreous form shadows on the retina causing “spots or floaters” in the vision.

**Cataract**

A Cataract is when the lens in the eye is not completely clear. It can congenital, caused by trauma, due to disease (e.g. diabetes), or develop as we age. The refraction may become more minus (less plus) as a cataract develops. Treatment is by surgery usually with an implant to replace the lens that has been removed. Vision will be much better after surgery provided there are no retinal problems (e.g. macula degeneration). If the patient has one good eye it is often better to wait until the good eye has a cataract before surgery (unless an implant will be used, as a unilateral aphake cannot have both eyes corrected with eye glasses). Also a person with only one eye should wait longer before surgery (in case the surgery is unsuccessful).
Retina

**Age Related Macular Degeneration** is a gradual loss of central vision in the eye due to narrowing of the blood vessels that supply the macular. The macular may have pigment or pale spots of damaged retina. There is no treatment. It does not affect the side vision. Brighter light and stronger eye glasses (higher additions) will help these people read a little better.

**Retinal haemorrhages** (spots or flame shaped) and **exudates** (yellow whitish spots) can occur due to Diabetes, High blood pressure, blocked artery or vein, or due to trauma. Larger bleeding may occur into the vitreous looking darker in colour. Treat any general health condition.

**Retinoblastoma** is a retinal tumor that occurs in young children. It can make the pupil look “white”. It needs removal by surgery.

**Retinal Detachment** can occur in high myopia, trauma, or due to vitreous pulling on the retina. Sometimes the retina can be surgically repaired.

**Retinitis Pigmentosa** is a progressive genetic disorder causing pigment changes in the “side” retina, and poor night vision and side (peripherial) vision.

Optic Nerve

Swelling of the optic nerve can occur due to increased pressure in the brain from a haemorrhage or tumor, high blood pressure, a blocked artery or vein, or an inflammation of the optic nerve.

Headaches

Eye related headaches are generally frontal, mild, get worse as the day progresses and especially with reading or close vision tasks. Usually correcting any refractive error with eye glasses will fix the headaches. Sometimes more light for reading is needed.

Migraines are a special type of headache with vision changes. In migraine the patients sees spots, flashing zig zag lights or moving coloured lights that block the vision. These vision changes last from a few minutes to about an hour or two. They are always bilateral, and should not be confused with flashes from vitreous pulling (unilateral and short flashes, not moving ) or intermittent blockages of the retinal blood supply (short times, seconds or minutes, of unilateral vision loss).

Albinism

This is a genetic disorder of reduced pigment. It can cause nystagmus (flicking or wobbling of the eyes), photophobia (sensitivity to light), and poor vision (they may have no working cones and be unable to see in daylight). A cap (hat with a front shade) and dark sunglasses will help.
Running an Eye Clinic

Suggestions
1 Day or 2 days or afternoons each week.
Occasional visits to surrounding centres.
Vision Screening in the local schools.

Reports

Daily
Each clinic day complete “Day Sheet” with details for all patients seen.
Record total number of full eye examinations (not including glasses
collection only) and also record the total money received.
Add entries to the “Eye Specialists report”.
Balance the money collected.
\[\text{Cash} = \text{Receipt book total} = \text{Day Sheet total}\]
Order any glasses required (weekly).

Monthly
Complete monthly “Eye Clinic Report” (totals and diagnosis summary), Post.
Complete monthly “glasses” summary.
Order any stock required.

Send copies of the monthly “Eye Clinic Report” to
John Farmer, PO Box 122 Warragul, Australia 3820
Dr Verma, SMO, Ophthalmology, Pt Moresby Hospital
CEO and, or Director of Nursing at your Hospital
and remember to keep a copy for yourself.

Keeping good records and statistics is important.
It is also important to look after and maintain your equipment.

Community Eye Health

You have an very important part to play in improving the eye health in your
community. This can be done by educating those around you about eyes, eye
treatment, eye safety and eye hygiene. Preventing eye problems is better than
having to treat them.
Encourage people to take care of their eyes by:
- Keeping dirt out of the eyes (keeping hands clean)
- Keeping away from sharp objects (bushes, sticks etc)
- Eating a health diet of good food
- Seeking proper and prompt treatment for any sore or injured eyes
- Encouraging people to seek eye care for any eye problems
- Not looking directly at the sun
- Not throwing dirt or stones (or anything) at other people
- Teaching CHW’s and NO’s about eyes and eye health

You can also teach others to perform basic vision screenings to help in
identifying those people with problems.
## Eye Care Nursing Training Program
### Papua New Guinea
#### Equipment list

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Equipment</th>
<th>Cost $Aus</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>British Optical Pty Ltd</strong></td>
<td>Ophthalmoscope/Retinoscope</td>
<td>$850</td>
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<tr>
<td>PO Box 265, Marrickville, NSW, 2204</td>
<td>Trial Frame</td>
<td>$190</td>
</tr>
<tr>
<td>Ph 0561295572666, Fax 0561295505201</td>
<td>Cross Cyl.</td>
<td>$ 20</td>
</tr>
<tr>
<td><strong>European Eyewear P/L</strong></td>
<td><strong>Trial Lens set</strong></td>
<td>$335</td>
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<tr>
<td>8A Woods St, Nunawading, Vic, 3131</td>
<td><strong>Loupe</strong></td>
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<td>Ph 0561398777956, Fax 0561398777905</td>
<td><strong>Cilia Forceps</strong></td>
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<td><strong>Designs for Vision P/L</strong></td>
<td><strong>Jewellers Forceps</strong></td>
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<td>PO Box 77, Camperdown, NSW, 2050</td>
<td><strong>Fluorescein strips (box)</strong></td>
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<tr>
<td>Ph 056125506966, Fax 056125503853</td>
<td><strong>Drops; Tropicamide 1%</strong></td>
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<tr>
<td><strong>OPSM Instruments P/L</strong></td>
<td><strong>ABC of Eyes</strong></td>
<td>$ 34</td>
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<tr>
<td>PO Box 150, Clayton, Vic 3168</td>
<td><strong>Manual Eye Exam. and Diagnosis</strong></td>
<td>$</td>
</tr>
<tr>
<td>99 Hilliers Rd Auburn NSW 2144</td>
<td></td>
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<tr>
<td>Ph 0561293342415, Fax 0561293342311</td>
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<tr>
<td><strong>Smith &amp; Nephew P/L</strong></td>
<td><strong>Letter Charts , reading cards(2)</strong></td>
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<tr>
<td>PO Box 185, Carlton 3053 Vic.</td>
<td></td>
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<tr>
<td>Ph 05613966363833, Fax 0561396637478</td>
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<tr>
<td><strong>AOA Bookshop</strong></td>
<td></td>
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<tr>
<td>PO Box 122, Warragul Vic 3820</td>
<td></td>
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</tr>
<tr>
<td>Ph 0561356231787, Fax 0561356235677</td>
<td></td>
<td></td>
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<tr>
<td><strong>John Farmer</strong></td>
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<td><strong>TOTAL</strong></td>
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</table>

*Note: Many of the above prices were special prices for the course and were in some cases subsidised by the suppliers. Replacement of a full set of equipment would exceed $2000.00 Aus*  
*June 1997*
CERTIFICATE
of
EYE NURSING

This is to certify that

Eye Nurse

has satisfactorily completed a 10 week course in EYE CARE NURSING showing a basic understanding of the eye and eye problems (both refractive and disease), competency in the diagnosis and prescription of appropriate spectacles (with emphasis on low cost readymade spectacles), and in recognition of eye disease and basic treatment.

Papua New Guinea 19 June 1997

Mr John Farmer BScOptom
Course Lecturer, Coordinator

Dr Nitin Verma
SMO Ophthalmology
Pt Moresby General Hospital

Dr Mark Fitzmaurice
Churches Medical Council
Papua New Guinea

This course was endorsed and supported by the PNG Health Department, Churches Medical Council, Lions International, CBMI, Evangelical Church of Papua New Guinea, and numerous mission groups, individuals.
Eye Nurse Training Program Papua New Guinea

Hospital

Dear CEO,DMS,DNS,

Thank you for your support of the eye nurse Training Program. I believe you will be very pleased with your eye nurse. They will be a significant asset to you in providing health care to the people in your area.

As a graduate eye nurse (EN), your eye nurse now has a basic understanding of the eye and eye problems (both refractive and disease), skill in the diagnosis and prescription of appropriate spectacles (with emphasis on low cost readymade spectacles), and in recognition of eye disease and basic treatment.

I would ask you to encourage your eye nurse to use those skills and the knowledge they have gained to the best advantage in helping the people of your area. I suggest your eye nurse be allocated a room and time to run an Eye Clinic for at least 1 day (or afternoon or perhaps 2 afternoons) depending on demand each week.

As well as the eye examination equipment a large number of glasses has been supplied as a starting stock from which to sell to those who need them. The money received from the sale of these eye glasses will be needed to fund the purchase of replacement stock. I have taught the your eye nurse how to keep good records and balance the money they receive. Please keep the eyecare money separate in your accounting system. If necessary open an eye care account. It must be available to purchase replacement stock when needed. It is expected the stock should be increased over time, funded by charging a few Kina more than the cost of the glasses.

The equipment and glasses have been donated to your hospital/health centre. They should be looked after carefully (value over 3000 Kina). Whilst the equipment has been donated to your centre, it would be a great waste if it remains at your centre in the unlikely event your eye nurse transfers to another hospital/health centre. A worker without his tools cannot work and the time, effort and money expended in the training program should be seen as an investment in the welfare of all the people of PNG. Could I suggest that if your eye nurse leaves your hospital/health centre that you consider transferring the equipment and glasses with him to enable ongoing eye care to be provided.

It is planned that our Rody Ukin, the tutor at the eye care course, will come and visit to your eye nurse at your hospital/health centre later in this year to provide encouragement and help sort out any problems your eye nurse may be having. We expect to hold a 1 week refresher course next year, probably in Mt Hagen. Both of these occasions will be a valuable part of follow-up and support and encouragement for the eye nurses.

The Eye Nurse Training Program has been made possible by the grace of God and the support and encouragement of many people (especially Lions International and CBMI). I am thankful to God for the opportunity to have met, shared with, taught and become friends with a wonderful group of trainees. May God be given the glory for the success of the program.

John Farmer B.Sc. Optom, Course Coordinator and Lecturer
Supervisory Visits
A visit should be made to each trainee, in their home hospital, about 6 months after completing the training to follow-up and encourage and support the eye nurse in their work. This visit would normally be undertaken by the Eye Nurse Coordinator.

Aim
To encourage and support the eye nurse
Try to resolve any problems
   in Knowledge and skills
   with Administration of their eye clinic
Check performance of eye nurse
   Clinical skills
   Astigmatism training - refresh this area
Check Equipment
Check Glasses stock
Check Finances and money management
Check room/facilities used for the eye clinic
Talk with CEO, DNS, DMS or other hospital manager.
Name Date
Address Sex/Age

History PC (D, N, SE, HA):

MH:
POH:
FH:

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External Eye R L

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Pupils & R & D \\
CT & D & N \\
\text{Movements} & "HH" \\
NPC & Visual fields & R & L \\
\end{array}
\]

Internal Eye R L

\[
\begin{array}{ll}
Rx(\text{Dist}) & R \\
\end{array}
\]

V with Rx R L

PD add

(Reading strength will = Distance Rx plus the Add)

Reading strength R L

Diagnosis:

Action:
## Eye Clinic Report

### Place

### Diagnosis

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<td>Myopia</td>
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<tr>
<td>Presbyopia</td>
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<tr>
<td>Cataract</td>
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<tr>
<td>Pterygium</td>
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### Month

#### Glasses

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<tr>
<td>-1.50</td>
<td></td>
<td></td>
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<tr>
<td>-2.00</td>
<td></td>
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<tr>
<td>-2.50</td>
<td></td>
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<tr>
<td>-3.00</td>
<td></td>
<td></td>
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<tr>
<td>-3.50</td>
<td></td>
<td></td>
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<tr>
<td>-4.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other -</td>
<td></td>
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</tr>
</tbody>
</table>

### Total Glasses sold this month

---

**Eye Nurse**

**Review Patients this month**

**Total Screening this month**

**Total Examination this month**

---

**For the Specialist to see:**

<table>
<thead>
<tr>
<th></th>
<th>This month</th>
<th>Total still Waiting</th>
<th>Operated this month</th>
</tr>
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<tbody>
<tr>
<td>TOTAL number of <strong>Cataract</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL number of <strong>Pterygium</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL number of <strong>Others</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL**

Copy for Rody Ukin, ECN Coordinator, PO Box 41 Kiunga, WP
Copy for the SSMO Ophthalmology, Port Moresby
Copy for John Farmer, PO Box 122 Warragul Vic. 3820 Australia
Appendix C

Student Notes
Developing Eye Care in Papua New Guinea

Student Worksheets

John Farmer
How the Eye is made and how the Eye works
Anatomy and Physiology
Worksheet

NAME :

1. On the diagram provided try to write the names of the parts of the eye as pointed to by the straight lines.

2. As well as “aqueous” tears from the Lacrimal gland there are 2 other parts that make up the tears. They are .................................... and ....................................

3. Can you also write what job each of these three parts do in helping the tears to work well?
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

4. Draw a diagram below of the front view of the eye showing the where the tears flow, and if you can, write the name of the various parts.
5. The first layer of the cornea is called the Epithelium. Tell me anything you can remember about it.

6. What is the main job of the inside layer of the cornea, the Endothelium?

7. The lens in the eye is made up of many layers and is surrounded by a bag called the ...............................................................

8. The ciliary body has 2 main functions. Can you write them down?

9. Draw a cross section (side view) of the eye in the space below and show where the aqueous fluid flows from and where it goes to.

10. The light sensitive part of the eye at the back (the part the responds to light) is called the ............................................... There are 2 different types or kinds of cells in this layer. They are ............................................ and .........................................

11. Which one of these works well in low light (at night) .........................

12. Which one of these works well in bright light (daylight) .........................
13 Can you write down why we can see colour.

........................................................................................................................................

........................................................................................................................................

........................................................................................................................................

14 The blood supply for the retina comes into the eye through the ......................

15 The centre part of the retina that is the most sensitive is called ......................

16 When you look into the eye with an Ophthalmoscope you can see the end of the optic nerve. This is called ..............................................................

17 The part where the optic nerve from the left eye and the right eye meet is called ..............................................................

18 The nerve fibers that carry information from the left field (or left side) of our vision end up in the occipital cortex at the back of the brain on the ............... side of the head.

19 The extra ocular muscles move the eye around. How many muscles are there on each eye ..............................................................

20 Write down the 3 different ways the pupil can be made smaller.

........................................................................................................................................

........................................................................................................................................

........................................................................................................................................
NAME: Practical Worksheet

To be done with another person

1. Look at both external eyes noting any things you can find such as pigment on the conjunctiva, etc. Draw a front view of the eyes below showing these things.

   R       L

2. Place a tick next to each of these things as you see or do them. Use your loupe to get a good magnified view.
   - Puncta: R       L
   - The base of the lashes: R       L
   - Any other things you noted above: R       L

3. Evert the top lid of both eyes looking first without and then with the loupe. Note down anything you see and tick when you have finished.

   R       L

4. Using your ophthalmoscope light to check the pupil reactions and record your results below. Also try to check for the near response and record whether you have been able to see it or not.

   R       L

5. Use your ophthalmoscope to look at the front of the eye. Look at the things you noted in 1 and 2 above. Also look at the iris and see if you can see where the two muscles join about halfway out. Also note any extra pigment spots on the iris.

6. Use your ophthalmoscope to look at the optic disc and draw the blood vessels at the disc (arteries in pencil and veins in pen) showing where they branch. Look at the macula and write down if there was a reflection from the fovea or not. Also write down if the artery was pulsing or not.

   R       L
EXAMINATION OF THE EYES

Name
Address

Examined by

Date
Age

History -
Vision R L (without glasses)
R L with glasses

External eye
A general look at the face and eyes noting any abnormalities (injuries, scars, asymmetry).

A close look at the Right then Left eye (using loupe and ophthalmoscope as needed)
Eyelids (ptosis, margins, puncta)
Lashes
Inside lower lids (fornix)
Conjunctiva (up, down, left, right)
Evert the upper lids
Cornea
Iris and Pupils (size and shape)

(Flourescein staining if needed for looking at cornea, tears or drainage)

Pupil reactions R D C L D C

Eye movements “H” R L

NPC (near point of convergence)

Cover Test D check right and left
N check right and left

Fixation (straight and steady ?)
If unsure if eyes are straight check Corneal reflections

PD (pupil distance) Dist/Near (3)

Visual fields R L (confrontation)

Internal eye - ophthalmoscopy (media and fundus - disc, macula, vessels etc)

R L

NAME: Worksheet 2
1. A person can read all the letters on the 6/6 line and 3 letters on the 6/4.8 line. Write down what the vision would be ..........................................
2. Is 6/6 - the same as 6/7.5 +++ ? ......................................( Y/N )
Which is the better way to record (write down) the vision ? ..........................................
3. You notice that the right lower eyelid is turned outwards. What trouble would this be likely to cause ? ........................................................................
What name do we call it when the lower lids turn out like this? ..........................................
4. You notice that the left lower eyelid is turned inwards. What trouble would this be likely to cause ? .................................................................
What name do we call it when the lower lids turn in like this? ..........................................
5. The top eyelids on both eyes are sagging down. What name would we call this condition ? ........................................................................
6. The right pupil on a patient does not react to direct light, however the consensual pupil reaction is normal. Where do you think the problem is from ? The right eye, the left eye or the head ? ..................................................
7. The patients’ NPC (near point of convergence) is poor (20cm). Is this a problem with the right eye, the left eye or both eyes ? ..................................................
What trouble might this cause? ........................................................................
8. There is a problem with the left side of the visual field in the right eye. The visual field of the left eye is normal. Is this a problem with the right eye, the left eye or the head? ..................................................
9. If the eyes tend (like) to turn outward when one eye is covered (in when cover removed ), what name do we call it? ..................................................
10. If the eyes tend (like) to turn inward when one eye is covered (out when cover is removed ), what name do we call it? ..................................................
1) What 4 questions should be covered as part of a patient’s presenting complaint? ................................... ................................
   ...........................................................
2) What 3 other questions might you ask as part of the patient’s History?
   ....................................................................... ........................................................................
3) We measure the power of lenses in ...................................................
4) A +2.00 D lens will focus light from a distance at what length?
   ........................................................................
5) Draw in the light rays for the eye below:

<table>
<thead>
<tr>
<th>Distance</th>
<th>Reading (without focusing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td></td>
</tr>
<tr>
<td>Myopia</td>
<td></td>
</tr>
<tr>
<td>Hyperopia</td>
<td></td>
</tr>
</tbody>
</table>

6) **Presbyopia** means the eye cannot .................................. the normal amount.
7) An **Aphakic** eye is an eye without a ..............................
8) The symptoms of Myopia are .........................................................
   Hyperopia? ........................................................................
   Astigmatism? ........................................................................
   Presbyopia? ........................................................................
9) If distance vision was blurry in a healthy eye would you expect a “Pin-Hole” to make things better or worse? ...........................................................
Eye Nurse Training PNG

Examined by

<table>
<thead>
<tr>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address</td>
<td>Age/Sex</td>
</tr>
</tbody>
</table>

**History**

PC (D, N, SE, HA):

MH:
POH:
FH:

<table>
<thead>
<tr>
<th>V</th>
<th>R</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>V with gl</td>
<td>R</td>
<td>L</td>
</tr>
</tbody>
</table>

**External Eye**

| R | L |

<table>
<thead>
<tr>
<th>Pupils</th>
<th>R</th>
<th>D</th>
<th>C</th>
<th>L</th>
<th>D</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT</td>
<td>D</td>
<td></td>
<td></td>
<td>NPC</td>
<td></td>
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</tr>
<tr>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td>Visual fields</td>
<td>R</td>
<td>L</td>
</tr>
</tbody>
</table>

**Internal Eye**

| R | L |

**Retinoscopy**

<table>
<thead>
<tr>
<th>Rx (Sph)</th>
<th>R</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>V with Rx</td>
<td>R</td>
<td>L</td>
</tr>
</tbody>
</table>

| PD | add |

**Diagnosis:**

**Action:**
Eye Nurse Papua New Guinea

Examined by

Name
Address

Date
Sex/Age

History PC (D, N, SE, HA):

MH:
POH:
FH:

V
R
L

V with gl
R
L

External Eye
R
L

V with Rx
R
L

Internal Eye
R
L

Rx (Sph)
R
L

PD
add

Diagnosis:

Action:
1) Explain what we mean by an **exophoria**? .................................................................

2) Explain what we mean by an **esotropia**? .................................................................

3) What would you expect the vision to be like in a patient with **Amblyopia**?

4) How would you treat a patient who has an **accommodative esotropia**?

5) What causes a **pseudotropia**? ................................................................................

6) How would you treat a patient with **pseudotropia**? ..............................................

For patients with the following prescription what would you write as diagnosis and action (include the actual strength of any reading glasses needed) and what symptoms would you expect the patient to have complained of?

7) Rx  
   R plano  
   L plano  
   +2.00 add

Diagnosis: .........................................................................................................................

Action: ...............................................................................................................................

Symptoms: ........................................................................................................................

8) Rx  
   R +1.00  
   L + 1.50 +1.50 add

Diagnosis: .........................................................................................................................

Action: ...............................................................................................................................

Symptoms: ........................................................................................................................

9) Rx  
   R -2.00  
   L -2.50  
   +1.00 add

Diagnosis: .........................................................................................................................

Action: ...............................................................................................................................

Symptoms: ........................................................................................................................
1) A patient has brought in their old glasses. You are neutralising them to work out the prescription. On the diagram below write the powers of the old glasses (you needed a -2.00 lens to neutralise the vertical and a +0.50 lens to neutralise the horizontal. be careful here!)

2) Now write out the prescription in minus cyl form

Rx ___________

3) Convert the prescription to the plus cyl form if you can

Rx ___________

4) Write the prescription (in minus cyl form) for the following lenses

\[
\begin{align*}
+1.50 & \quad -1.00 & \quad \text{Rx} & \quad \_\_\_\_\_\_\\
+3.00 & \quad -0.50 & \quad \text{Rx} & \quad \_\_\_\_\_\_
\end{align*}
\]
1) A patient has brought in their old glasses. You are neutralising them to work out the prescription. On the diagram below write the **powers** of the old glasses (you needed a +1.50 lens to neutralise the vertical and a -2.50 lens to neutralise the horizontal.. **be careful here**!)

2) Now write out the prescription in **minus cyl form**, 

\[ \text{Rx} \quad \underline{\phantom{0000}} \quad \underline{\phantom{0000}} \]

3) Convert the prescription to the plus cyl form if you can

\[ \text{Rx} \quad \underline{\phantom{0000}} \]

4) Write the prescription (in minus cyl form) for the following lenses

\[ \underline{+0.50} \quad \underline{-0.50} \quad \text{Rx} \quad \underline{\phantom{0000}} \]

\[ \underline{-3.00} \quad \underline{+0.50} \quad \text{Rx} \quad \underline{\phantom{0000}} \]
1) A patient has brought in their old glasses. You are neutralising them to work out the prescription. On the diagram below write the **powers** of the old glasses (you needed a -1.50 lens to neutralise the vertical and a +1.00 lens to neutralise the horizontal .. **be careful here!**) 

2) Now write out the prescription in **minus** cyl form,

\[ \text{Rx } \]

\[ \text{ } \]

3) Convert the prescription to the plus cyl form if you can

\[ \text{Rx } \]

4) Write the prescription (in minus cyl form) for the following lenses

\[ \begin{array}{c}
-0.50 \\
-2.50 \text{Rx } \\
+1.00 \\
-2.00 \text{Rx } \\
\end{array} \]
1) Draw a front view of the eye and label as many structures as you can.

2) Draw a cross-section (side view) of the eye and label as many structures as you can.

2) There are 3 parts that make up the tears. They are ........................................ and ........................................ and ........................................

3) Can you also write what job each of these three parts do in helping the tears to work well?

........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
4) Draw a diagram below of the front view of the eye showing where the tears flow, and write as many names of the various parts as you can.

5) The first layer of the cornea is called the Epithelium. Describe anything you would know and remember about the epithelium.

6) What is the main job of the Endothelium, the inside layer of the cornea?

7) The lens in the eye is made up of many layers and is surrounded by a bag called the ..................................... ..................................

8) Can you write the 2 main functions of the ciliary body?
   1........................................................................................................................................
   2........................................................................................................................................

9) A patient reads the 12 letter size line with the chart at 3 meters. What would you record the vision as? .................................................................

10) Draw a cross section (side view) of the eye in the space below and show by arrows, where the aqueous fluid flows from and where it goes to.
11) The light sensitive layer or part of the eye at the back (the part the responds to light) is called the ...................................................... What are the 2 different types of cells in this layer? They are ......................................... and .........................................

12) Which one of these works well in low light (at night) ......................................................

13) Which one of these works well in bright light (daylight) ......................................................

14) Can you write down why we can see colour ................................................................. ........................................................................................................................................

15) The blood supply for the retina (which you can see with your ophthalmoscope) comes into the eye through the ..............................................................

16) The centre part of the retina that is the most sensitive is called the ..............................................................

17) When you look into the eye with an Ophthalmoscope you can see the end of the optic nerve. This is called ..............................................................

18) The part where the optic nerve from the left eye and the right eye meet is called ..............................................................

19) The nerve fibers that carry information from the left field (or left side) of our vision end up in the occipital cortex at the back of the brain on the ................................ side of the head.

20) The extra ocular muscles move the eye around. How many muscles are there to move each eye ..............................................................

21) Write down the 3 different ways the pupil can be made smaller.
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

22) You notice that the right lower eyelid is turned outwards. What is it called and what symptoms would this be likely to cause? ..............................................................
........................................................................................................................................

23) You notice that the left lower eyelid is turned inwards. What is it called and what symptoms would this be likely to cause? ..............................................................
........................................................................................................................................

24) What name would we call the condition where the top eyelids on both eyes are sagging down? ..............................................................
25) The right pupil on a patient does not react to direct light, however the right consensual pupil reaction is normal. Where do you think the problem is from? The right eye, the left eye or the head? .......................................................... 
26) The patients' NPC (near point of convergence) is poor (20cm). Is this a problem with the right eye, the left eye or both eyes? .......................................................... What trouble might this cause? ............................................................................. 
27) There is a problem with the left side of the visual field in the right eye. The visual field of the left eye is normal. Is this a problem with the right eye, the left eye or the head? .......................................................... 
28) If the eyes tend (like) to turn outward when one eye is covered (in when the cover is removed), what name do we call it? .......................................................... 
29) If the eyes tend (like) to turn inward when one eye is covered (out when the cover is removed), what name do we call it? .......................................................... 
30) What 4 specific questions should be covered as part of a patient's presenting complaint? .......................................................... .......................................................... .......................................................... 
31) What other 3 questions might you ask as part of the patient's History? ......................................................................................... ......................................................................................... 
32) What is the name we use for the measurement of the power of lenses (D) ......................................................................................... 
33) What length will a +2.00 D lens focus distant light? ............................................. 
34) Draw in the light rays for the eye below:

<table>
<thead>
<tr>
<th>Distance</th>
<th>Reading (without focusing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td><img src="image" alt="Normal" /></td>
</tr>
<tr>
<td>Myopia</td>
<td><img src="image" alt="Myopia" /></td>
</tr>
<tr>
<td>Hyperopia</td>
<td><img src="image" alt="Hyperopia" /></td>
</tr>
</tbody>
</table>
35) **Presbyopia** means the eye cannot ................. the normal amount.

36) An **Aphakic** eye is an eye without a .........................

37) The symptoms of Myopia are .................................................................
.................................................................................................................................
.................................................................................................................................
.................................................................................................................................
.................................................................................................................................
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Hyperopia? ........................................................................................................
.................................................................................................................................
.................................................................................................................................
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.................................................................................................................................
.................................................................................................................................

Asthigmatism? ...................................................................................................
.................................................................................................................................
.................................................................................................................................
.................................................................................................................................
.................................................................................................................................
.................................................................................................................................

38) If distance vision was blurry in a healthy eye would you expect a “Pin-Hole” to make things better or worse? .........................................................

39) Explain what we mean by an **exophoria**? .....................................................
.................................................................................................................................
.................................................................................................................................
.................................................................................................................................
.................................................................................................................................

40) Explain what we mean by an **esotropia**? .........................................................
.................................................................................................................................
.................................................................................................................................
.................................................................................................................................
.................................................................................................................................

41) What would you expect the vision to be like in a patient with **Amblyopia**? .................................................................................................................................

42) How would you treat a patient who has an **accommodative esotropia**?
.................................................................................................................................
.................................................................................................................................

43) What causes a **pseudo esotropia**? .................................................................
.................................................................................................................................
.................................................................................................................................
.................................................................................................................................

44) How would you treat a patient with **pseudo esotropia**? ..........................
.................................................................................................................................
For patients with the following prescription what would you write as **diagnosis** and **action** (include the actual strength of any reading glasses needed) and what **symptoms** would you expect the patient to have complained of?

45) Rx  R plano  L plano  +2.00 add  
Diagnosis: .................................................................................................................................
Action: ....................................................................................................................................
Symptoms: ................................................................................................................................

46) Rx  R +1.00  L +1.50  +1.50 add  
Diagnosis: ................................................................................................................................
Action: ....................................................................................................................................
Symptoms: ................................................................................................................................

47) Rx  R -2.00  L -2.50  +1.00 add  
Diagnosis: ................................................................................................................................
Action: ....................................................................................................................................
Symptoms: ................................................................................................................................

48) Please tell me any areas or things you would like us to revise again  
................................................................................................................................................
................................................................................................................................................
................................................................................................................................................
................................................................................................................................................
................................................................................................................................................
................................................................................................................................................
1) Describe the signs of a **Bacterial** conjunctivitis .................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

2) Describe the signs of a **Viral** conjunctivitis ...........................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

3) Describe the signs of an **Allergic** conjunctivitis .................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

4) A patient with photophobia and a painful eye is more likely to have **Conjunctivitis** or **Keratitis**? ........................................................................................................................................

5) A patient presents with an **entropian**. There is some conjunctival redness and the eye is sore. What action would you take? ........................................................................................................................................

6) A patient has a piece of metal on the cornea. What action would you take? 
........................................................................................................................................
........................................................................................................................................

7) A patient has a red eye. The redness is greater around the limbus area. The cornea does not stain with fluorescein. The iris is a little hazy. The eye is painful, photophobic and a little tender. What is your diagnosis and what action would you take?
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

8) A patient has difficulty reading and seeing the letter chart. External eye examination is normal. You find it difficult to see the retina clearly (it looks hazy). What is the most likely cause for the reduced vision? ........................................................................................................................................
9) You look into a patient’s eye with your Ophthalmoscope and you see some hemorrhages and some yellowish spots on the retina around the macula area and the disc (together this area is sometimes called the posterior pole). Can you think of any possible causes for these abnormal changes?

........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

10) A 60yr old patient comes to see you. They have difficulty seeing at distance and especially reading. Even with glasses the best vision they get is only 6/30. Their macula area looks a bit different to usual, with some pale spots and some pigment. What do you think is the most likely cause of this patients problems, and what can you do to help?

........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

11) Can you remember any vision type problems that an Albino patient may have?

........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

12) A patient is experiencing some visual disturbances that last about 1 hr. The vision seems to go blurry in both eyes. What do you think is the most likely cause of this patients problems?

........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

13) A patient has a red, and very painful Left eye. The cornea looks a little cloudy and the patient says they cannot see well with their left eye. Yesterday this eye was normal. What do you think is the most likely cause of this patients problems?, and what can you do to help?

........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
1) Draw a front view of the eye and label as many structures as you can.

2) Draw a cross-section (side view) of the eye and label as many structures as you can.

3) If the letter chart is at 3 meters and a patient can read the number 6 size letters, write down what the vision would be: ........ / ........

4) 2 / 12 (12 size letter at 2 meters) is equal to vision of 6 / ........
5) Why would you use flourescein when looking at an eye?
........................................................................................................................................
........................................................................................................................................

6) What does a **Direct** pupil response mean? .................................................................
........................................................................................................................................
........................................................................................................................................

7) What does a **Consensual** pupil response mean? ..........................................................
........................................................................................................................................
........................................................................................................................................

8) When you cover the right eye, the right eye turns out and the left eye turns in.
When you remove the cover the right eye straightens and the left eye turns out.
When you cover the left eye, both eyes stay as they are. What type of eye turn would
you call this? ....................................................................................................................
........................................................................................................................................

9) Describe the differences between a **bacterial** and a **viral** conjunctivitis.
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

10) A patient presents with a sore, irritable R eye. You observe a small foreign
body on the cornea. What action would you take? .........................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

11) Describe the symptoms (or the presenting complaints) of a patient with
**Myopia** .........................................................................................................................
........................................................................................................................................
........................................................................................................................................
What is the common name for Myopia?
........................................................................................................................................

12) Describe the symptoms (or the presenting complaints) of a patient with
**Hyperopia** .....................................................................................................................
........................................................................................................................................
........................................................................................................................................
What is the common name for Hyperopia?
........................................................................................................................................
13) Describe the symptoms (or the presenting complaints) of a patient with **Presbyopia**

14) You are doing a refraction. You have a -1.00 lens (black) in the trial frame. When you try a -0.50 (black) lens on top of this the patient says it looks the same. When you try a +0.50 (red) lens the patient says it looks the same. Would you change the -1.00 lens. (Yes or No) 

If you would, what would you change the lens strength to? 

15) You get the best spherical refraction you can and the vision is 6 / 15. Write down any reasons you can think of that might account for the vision being not so good? 

Can you think of anything you could do to help decide which is the most likely reason? 

16) For the following cases fill in the **Diagnosis** and **Action**

**PC** Distance blur, Near good, no other problems **Age** 20 years

**Vision**
- R 6 / 30
- L 6 / 15

**Rx**
- R -2.00
- L -1.50

**V with Rx**
- R 6 / 6
- L 6 / 6

**Diagnosis**

**Action**

**PC** Distance good, Near blur, no other problems **Age** 45 years

**Vision**
- R 6 / 6
- L 6 / 6

**Rx**
- R plano
- L +0.50 +1.50 add

**V with Rx**
- R 6 / 6
- L 6 / 6

**Diagnosis**

**Action**
17) A patient presents with an episode of sudden loss of part of their vision lasting for 10 to 30 minutes. Both eyes are affected on the right side of the vision. Where is the problem likely to be? .................................................................
Can you think of a possible cause? ........................................................................

18) A patient presents with sudden complete loss of vision in the right eye only.
Where is the problem likely to be? ........................................................................
Can you think of a possible cause? ........................................................................

19) A patient presents with a scratched cornea and a red eye. What treatment would you recommend? ........................................................................................................
..............................................................................................................................

20) A patient presents with watery eyes that are slightly sore. They say this happens on and off, from time to time (not all the time). Can you think of any possible causes? .................................................................
..............................................................................................................................
What advice would you give? ......................................................................................
21) You have completed an astigmatic refraction and the patient has good vision with a -1.00 spherical lens, a -2.00 cylinder lens and the gold line on the cylinder lens points at 180 direction. Write down the patient’s prescription for this eye.

22) What are some possible complications of cataract surgery?

23) You look into a patient’s eye with your Ophthalmoscope and you see some haemorrhages and some yellowish spots on the retina around the macula area and the disc (together this area is sometimes called the posterior pole). Can you think of any possible causes for these abnormal changes?

24) A 60yr old patient comes to see you. They have difficulty seeing at distance and especially reading. Even with glasses the best vision they get is only 6/30. They do not seem to have a cataract. Their macula area looks a bit different to usual, with some pale spots and some pigment. What do you think is the most likely cause of this patients problems, and what can you do to help?

26) A patient has a red, and very painful Left eye. The cornea looks a little cloudy and the patient says they cannot see well with their left eye. Yesterday this eye was normal. What do you think is the most likely cause of this patients problems, and what can you do to help?
COURSE EVALUATION

Please give honest (true) answers to these questions. This will help to improve the course next time.

1. Was the course what you expected? Please explain.

2. Did you learn enough?  - Was there too much to learn?
   - Should more have been taught?

3. Was the teaching clear?
   Was there enough practical training?
   Was there enough teaching from the front?

4. Was Tari a suitable place for the course? Please explain.
   Do you have any suggestions for a place for the next course?
5. What was the accommodation and the food like?

6. Was the cost of the course reasonable? Please explain.

7. What do you think about the length of the course? Should it be 10 weeks next time?

8. Was there enough for you to do on weekends and in your free time? Should more have been organized or not?

9. Do you have any other comments or suggestions about the course or anything else?
<table>
<thead>
<tr>
<th>Name</th>
<th>Sex/Age</th>
<th>Address</th>
<th>Diagnosis</th>
<th>Date</th>
<th>Action</th>
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<th>Total number of EXAMINATIONS:</th>
<th>Total Money:</th>
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**Eye Clinic Report - Glasses Summary**

Stock start + Stock in = Total Stock

less TOTAL USED = Stock left

**Month**

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**Eye Nurse:**

Total stock returned (uncollected) Mens: Ladies:
## Eye Clinic Report

### Place

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<thead>
<tr>
<th>Diagnosis</th>
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<tbody>
<tr>
<td>Myopia</td>
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<tr>
<td>Hyperopia</td>
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<tr>
<td>Astigmatism (&gt;1)</td>
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<tr>
<td>Presbyopia</td>
</tr>
<tr>
<td>Cataract</td>
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<tr>
<td>Pterygium</td>
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<tr>
<td>Strabismus/Squint</td>
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<tr>
<td>Conjunctivitis</td>
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<tr>
<td>Corneal ulcer</td>
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<tr>
<td>Injury/Scar</td>
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<tr>
<td>Other Condition not above</td>
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<td>Normal</td>
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### Month

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<th>Other+</th>
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<td>Other -</td>
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#### Total Glasses sold this month

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<tr>
<th>Total Examination this month</th>
<th>Total Review Patients this month</th>
<th>Total Screening this month</th>
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### For the Specialist to see:

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<tr>
<th>This month</th>
<th>Total still Waiting</th>
<th>Operated this month</th>
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<tbody>
<tr>
<td>TOTAL number of Cataract</td>
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<tr>
<td>TOTAL number of Pterygium</td>
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<tr>
<td>TOTAL number of Others</td>
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## TOTAL

Copy for Rody Ukin, ECN Coordinator, PO Box 41 Kiunga, WP
Copy for the SSMO Ophthalmology, Port Moresby
Copy for John Farmer, PO Box 122 Warragul Vic. 3820 Australia
Eye Care Program

Money Balance sheet - Monthly

Eye Care Account

Balance from last month K (a)

Plus receipts this month K (b)

add (a+b) to give Total Receipts K (c)

Less Expenses

1st order
2nd order
3rd order
etc.

less Total expenses K (d)

(c-d) equals Balance this month K

Eye Nurse:
To Mt Sion Optical Workshop
PO Box 1068
Goroka, EHP
Ph 732 Fax 732

Please supply the following glasses with clear lenses as soon as possible:

<table>
<thead>
<tr>
<th></th>
<th>Plastic Frame</th>
<th>Metal Frame</th>
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</thead>
<tbody>
<tr>
<td>Power</td>
<td>Mens</td>
<td>Ladies</td>
</tr>
<tr>
<td>Totals</td>
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</table>

Total Plastic Cost @ K8  Total Metal Cost @ K50

Total cost for this order  K

Eye Nurse:
Papua New Guinea Eye Care Program
Eye Glasses Prescription Order

Date ..........................

To From

Patient Name .................................................................. Male / Female ..............
Address ........................................................................... Age .........................
......................................................................................

\[
\begin{array}{ccc}
\text{Rx} & \text{Right Eye} & \text{Left Eye} \\
\text{Distance} & & \\
\text{PD} & \text{Add} & \text{Bifocal Height} \\
\text{(Reading strength will = Distance Rx} & \text{plus the Add}) \\
\text{Reading strength} & \text{R.} & \text{L.} \\
\end{array}
\]

Frame Plastic / Metal ........................................
Lenses Clear / Photochromatic ............................
Type of Glasses Distance / Reading / Bifocals .......... (seg Height?)
Please Make up these Glasses. Money enclosed .................
Special Instructions :
Eye Nurse .....................................................................
Eye Care Program Papua New Guinea

Examined by

Name
Address

Date
Sex/Age

History PC (D, N, SE, HA):

MH :
POH :
FH :

V R L

V with gl R L

External Eye R L

Pupils R D C L D C Movements “HH”
CT D NPC
N Visual fields R L

Internal Eye R L

Rx (Dist) R L

V with Rx R L

PD add

(Reading strength will = Distance Rx plus the Add)

Reading strength R ...........................................
L ........................................

Diagnosis:

Action:
EYE CARE PROGRAM
Appendix D

Letterchart

with letter matching card
Reading Card

English

N8
It is normal to find reading becoming blurry as we grow older. Reading glasses will make print easier to see. We also need a good light if we want to read at night. Some people get headaches or sore eyes when they read. Eye Glasses can prevent this and make reading much more comfortable.

H X V O 3 0 1 4

N10
Our eye sight is a wonderful gift from God. We should take good care of our eyes by avoiding sharp sticks and seeking treatment whenever our eyes become sore and red. Sometimes Eye Glasses may be needed to help us to see clearly.

T U H O 8 2 7 6

N12
As we grow older our eyes may become cloudy inside making everything look smoky. This smoky vision is caused by cataracts. A simple operation to remove the cloudiness can usually make things clear again.

V T X A 7 3 5 2

N7

Our eye sight is a wonderful gift from God. We should take good care of our eyes by avoiding sharp sticks and seeking treatment whenever our eyes become sore and red. Sometimes Eye Glasses may be needed to help us to see clearly.

T U H O 8 2 7 6

N9

As we grow older our eyes may become cloudy inside making everything look smoky. This smoky vision is caused by cataracts. A simple operation to remove the cloudiness can usually make things clear again.

V T X A 7 3 5 2