8 BLINDNESS IN THE MIDDLE EAST CRESCENT

8.1 Introduction on the MEC Region

This is a very diverse region encompassing countries with U5MR and HDI at the top end of the spectrum such as UAE, Bahrain, Kuwait, where the rates are 20/1000 population, to countries such as Afghanistan, Djibouti, Yemen and Sudan which exhibit very high rates [324, 543] (Table 3-8). The disparity also exists within the same country; in Sudan rates of U5MR in the south (250/ 1000) are more than double that of the rest of the country (109/100) [706]. These disparities are the reflection of two extremes of wealth with oil-producing countries that have enjoyed long period of economical and political stability that have led to rapid improvements in healthcare services and a decline in the prevalence of blindness (Plate 7). Others were doomed by wars and political instability leading to the reverse picture (Plates 8 - 10) with a considerable decline in health services and an associated increase in blindness from infections and malnutrition such as Iraq and Sudan [537, 365, 370]. The healthcare in the latter, until 1969, was the showpiece of Africa [707].

Data on the healthcare is available from Saudi Arabia which has implemented a two-tier health service plan. The first tier is a network of PHC centres and clinics established throughout the country. The number of such facilities, which provide preventive, prenatal, emergency and basic health services, rose from 591 in 1970 to 3,154 in 1992. These are supplemented by a fleet of mobile clinics that routinely visit the more remote villages, dispensing vaccines and performing basic medical services. The infant mortality rate has dropped from 68/1000 in 1980, to less than 30/1000 in 1993. These services are backed by a second tier network of advanced hospitals and specialised treatment centres. The number of hospitals and hospital beds in 1993 had risen from 74 hospitals with 9,039 beds in 1970, having a ratio of one hospital bed per 411 people which was among the lowest in the world, to 274 hospitals and 41,151 beds respectively [417]. This was also reflected in the drop in the U5MR from 185/1000 in 1970, to 28/ 1000 in 2002 [543].

8.2 Prevalence of Blindness in the MEC

There is a scarcity of data on blindness from the majority of countries in this region including some of the wealthy oil-producing countries such as the UAE and Kuwait. Saudi Arabia is one Arab country that witnessed a significant improvement in health facilities and a progressive decline in blindness over the past two decades with ample publications on the epidemiology of blindness and ocular pathology which make it ideal for studying the changes in the pattern of disease in relation to socio-economic factors [334, 336, 337, 417, 543]. In the rest of the Middle Eastern Crescent, reports on blindness are available from Turkey [449] and Iran [450].

The number of blind people in the MEC has been estimated as just over 3 millions [487] and over 22 million people suffering from visual impairment [252, 353]. Figures on the prevalence of blindness in the Arab world vary considerably from as low as 0.2% to as high as 6.4%.

8.3 Causes of Blindness

Cataract, complications of trachoma, corneal opacity, uncorrected refractive error, low vision, glaucoma, childhood blindness and diabetic retinopathy are the major causes of blindness [172, 353, 487.] ARMD is less common, which may be attributed to the shorter lifespan of individuals in the region, the early onset of cataract preventing light related damage to the macula and the protective action of the higher melanin content in the RPE [487]. The lower incidence of ARMD is well recognised in darker races as opposed to light skinned people[478].

8.3.1 Cataract

Cataract remains the primary cause of blindness accounting for 60% of blindness in almost all the countries in the region, with approximately 20 million affected people [171, 253]. The rate of surgery remains low and, in addition, there is also a high rate of surgical complications, both intraoperative and postoperative [334, 487]. Conventional surgical techniques are still used, with less than 20% of procedures using phacoemulsification techniques. This is a reflection of the lack of resources in certain areas, the presence of corneal scars, and advanced mature cataracts. The necessity of adequate rec-

ruitment, training, and transfer of technology and skills to surgeons working in this region cannot be underestimated [487].

8.3.2 Trachoma in the MEC

Wide regional variations in the prevalence and severity of trachoma are present in the region. It is uncommon in Lebanon, Syria, and Jordan but remains highly prevalent in the rural communities of Iraq, Saudi Arabia, UAE, Qatar, and Oman, forming an important cause of blindness and the leading preventable cause of visual disability [84-85, 257, 336-338, 344, 354, 358, 366, 383-384, 397, 423-427, 432-433, 435, 487, 551, 556].

8.3.3 Corneal Scars in the MEC

Corneal scars from trauma, infection, or failed medical intervention contributes to visual disability in the region. The problem is compounded by the lack of availability of eye banks, which are available in only a small number of major centres [487].

8.3.4 Refractive Errors in the MEC

Refractive errors are among the leading causes of visual loss in the MEC. There is a cultural reluctance to wear spectacles, whilst at the same time the use of contact lenses has contributed to an increase in the incidence of infectious keratitis. Refractive surgery has been introduced in some parts of the region; however, the learning curve of ophthalmologists may have contributed to complications such as those associated with flap production in LASIK together with postoperative infectious keratitis [411, 487]. It is also worth noting that the prevalence of bilateral impaired vision due to refractive errors does not appear to be a problem in the younger generation of a well-to-do background as found by Maaita et al [563].

8.3.5 Abuse of Topical Medications in the MEC

The "over the counter" sale of all types of topical medications such as steroids and topical anaesthetic preparations have led to corneal complications[487, 560]. In addition, in many rural areas of the Middle East, homemade

remedies and folk medicine are still produced and available and have contributed to serious ocular surface complications leading to blindness [562, 668].

There is also a common tendency for prolonged use of various topical medications, frequent change of the treating specialists, and a culture of seeking multiple opinions on the same condition within a short space of time. This tends to trigger unavoidable additions and omissions to medication with an end result of prolonged heavy assaults on the integrity of the anterior ocular surface with the cornea being the prime victim and eventually masking the clinical picture of the original pathology [645].

8.3.6 Iatrogenic Blindness in the MEC

The rapid transfer of technology without proper training of ophthalmologists has led to serious iatrogenic blindness in many parts of these countries [411, 487]. Approximately 4% of all blindness in Saudi Arabia was found to be iatrogenic, caused by failed medical or surgical therapy although this may represent the previous status of ophthalmic care in the country [334, 487].

8.3.7 Diabetic Retinopathy in the MEC

Diabetic retinopathy is an important and increasing cause of blindness. The improved socioeconomic conditions in the region, with the increased intake of sugar and carbohydrates, have led to an acute rise in the incidence of diabetes mellitus. For many years, individuals in these countries had limited intake of sugars and carbohydrates, leading to the evolution of a thrifty gene [559, 565-567, 487]. The complications of diabetes, including diabetic retinopathy, have increased dramatically in the past two decades [487]. In Pakistan for e.g 33% of the diabetic population suffers from retinopathy [564].

8.3.8 Glaucoma in the MEC

Glaucoma remains an important cause of blindness in the Eastern Mediterranean countries [487]. Delay in the presentation of patients with ocular hypertension and glaucoma has led to blindness in many countries. In Saudi Arabia, glaucoma was responsible for blindness in 3% of the population above the age of 40 years.

8.3.9 Unilateral Blindness in the MEC

Considering unilateral causes of blindness, trauma remains the most important factor. This is followed by congenital anomalies, unilateral cataract, amblyopia, corneal opacities, and iatrogenic factors [487]. Bilateral blindness from landmine injuries is an additional problem in some of countries in the region in recent years [541].

8.4 Blindness in Saudi Arabia

8.4.1 Causes Of Blindness in Saudi Arabia

The most common causes of blindness include cataract, trachoma, non-trachomatous corneal scars, refractive errors, congenital anomalies, failed medical or surgical treatment, and glaucoma. Other, but less severe and mainly unilateral causes were refractive errors, amblyopia, and trauma. About 7% of all Saudi Arabians, and 42% of those older than 40 years, have a cataract or its sequelae. Over 3.5% of the population have corneal scars, about half of which are caused by trachoma.

Cataract has become the main cause of blindness in Saudi Arabia, which, both in isolation and co-existing with other ocular pathology, was the major cause of both low vision and blindness (58.5% and 81.7%, respectively) [339, 340]. However, achieving 6/12 vision or better post-operatively is hampered by several factors which are: (1) error of refraction in 32%; (2) pre-existing corneal scarring and opacity in 14%; (3) climatic droplet keratopathy in 9%; and (4) presumed visual loss due to glaucoma in 9% of eyes [339]. Climatic keratopathy is an important cause of blindness in Saudi Arabia [341].

Similar trends were reported in Bisha region, Saudi Arabia. The prevalence of blindness was 0.7% and the prevalence of visual impairment (VI/-SVI) was 10.9% in 2882 persons seen. Cataract was the main cause for 52.6% of blindness, and 20.6% of visual impairment. Refractive errors accounted for 67.9% of visual impairment [335, 337].

The prevalence of blindness in the population is 1.5% and 7.8% visually impaired [335, 337].

8.4.2 Trachoma in Saudi Arabia

There has been a dramatic change in the prevalence of trachoma

over the past 40 years. A survey in 1986 [334] reflected this trend and showed a remarkable decrease in the prevalence of active trachoma over the previous decade.

The progress in tackling this problem is fascinating and a good example of a methodical approach to this problem. The first survey on trachoma in 1955-65 in Eastern Province [338] revealed phenomenally high prevalences at 100% in Al Hasa, 98.0% in Qatif Oasis, and 93.0% in Qatif town dwellers. In 1986, a preliminary study in the Eastern Province by the Ministry of Health showed that 3.74% of the population were blind, with 10.1% from trachoma. The same year, the Ministry of Health established a Regional Prevention of Blindness & Ophthalmic Medical Education Committee, Eastern Province with six sub-divisions in Al Hasa, Qatif, Dammam, Al Khobar/Dhahran, Jubail and Hafr Al Batin. The whole health care system was divided into primary, secondary and tertiary levels in 1987 and incorporated primary eye health care. The latter included a Trachoma Centre which commenced in 1987, and was followed a year later by a mass trachoma eradication programme combining increasing public awareness, prevention, and treatment of the bulk of active trachoma in this region, particularly in Al Hasa. This succeeded in reducing the rate of prevalence of active trachoma to 1.5% in Al Hasa. Addressing the problem in other regions followed, with the aim of reducing the incidence of active trachoma below 0.5% within the following five years.

Another study, comparing the size of the problem of trachoma in 1984 and 1994 was reported by Tabbara and al-Omar [336] who found the prevalence of trachoma (active and inactive) had declined from 22.2% in 1984 to 10.7% in 1994, active trachoma from 6.2% to 2.6%, trachomatous conjunctival scarring from 17.4% to 8.1%, and the presence of trichiasis and entropion from 1.5% to 0.2%. The prevalence of trachoma in households was directly related to the presence and appearance rating of children in a household, the household itself, and the presence of flies. An increase in individual risk was found among women who veil and men who use kohl (a black eyeliner preparation derived from antimony sulphide or lead sulphide). Similarly, Al-Faran found that trachoma was not a major ophthalmic problem in the south western part of the country. Only 0.26% of the 7126 persons examined had active trachoma and 0.5% had inactive trachoma. Among 635

subjects with visual impairment, only 6 (0.95%) patients had visual impairment due to trachoma.

8.5 Blindness in Oman

8.5.1 Prevalence of Blindness in Oman

The prevalence of blindness was estimated to be 1.1% in a stratified cluster random sampling procedure examining a total of 11,417 people [343]. The prevalence increased from 0.08% for the 0-14 age group, 0.1% for the 15-39 age group and 2.3% for the 40-59 age group, to 16.8% for the 60 years and over. There was a statistically significant difference between the prevalence in females (1.4%) and males (0.8%). The northern and central regions had a higher prevalence of blindness (1.3% to 3%).

8.5.2 Causes of Blindness in Oman

The major causes of blindness in Oman were unoperated cataract (30.5%), trachomatous corneal opacities (23.7%), and glaucoma (11.5%). This is despite an active healthcare programme. The problem of trachoma remains unaddressed and an important public health problem in several regions of the sultanate.

8.5.3 Trachoma in Oman

According to the WHO [559], the prevalence of trachoma in Oman is low (<1%) and the SAFE programme is well underway. The rate for cataract surgery has shown a marked increase, from 1,500 cases/million/year to 2,222 cases/million/year as a result of several innovative approaches. The prevalence of glaucoma is 10% in the population. Specialised treatment of glaucoma at tertiary level, and glaucoma clinics at some of the regional ophthalmic units, have been established. Refractive errors among school children are around 7% with students of senior classes showing prevalence of over 10% [559].

8.5.4 Diabetic Blindness in Oman

In addition to the above, diabetes, with the associated risk of diabetic blindness, is a cause of growing public health concern in Oman. The National Health Survey conducted in 1999 revealed that the prevalence of diabetes

and impaired fasting glycaemia (IFG) in persons 20 years of age were 11.7% and 6.1% respectively. There has been a considerable improvement in the awareness of diabetes that has resulted in strengthening of health services. A system of registration and reporting of long-term complications was also developed and early detection and management of diabetic retinopathy have been strengthened at the level of regional hospitals [559].

8.6 The Rest of the Arabian Gulf Countries

Recent epidemiological studies are lacking from the rest of the Arabian Gulf region. Qatar is one of the rapidly developing Gulf States. Its life style is rapidly changing from a seminomadic to a more settled urban one, and the under 5-mortality rate in Qatar has come down from 65 to 16/1000 between 1970 and 2002 [543]. A study in 1977 by Hosni [538] showed that the most common causes of SVI/blindness in the under 40 years of age were trachoma, infectious diseases, retinal diseases, trauma and congenital malformations. In the over 40 years age group population, cataract and glaucoma occupy the second and third commonest causes after trachoma. Combating trachoma, early diagnosis of glaucoma, and addressing the practice of unsupervised use of medication were put forward as measures to reduce blindness in the country[538].

8.7 Blindness in Yemen

8.7.1 Eye Morbidity in Yemen

Eye morbidity is marked in Yemen [345, 346, 568, 569, 618] and the general prevalence of the different eye diseases among the population is as high as 15.3%.

8.7.2 Causes of Blindness in Yemen

Cataract, trachoma and onchocerciasis are important causes of blindness in Yemen. The most frequent bilateral pathology was cataract with 40.7% of patients needing some sort of medical or surgical intervention [568].

In addition, Yemen is identified as a trachoma endemic area, which should be targeted by the control programmes. An overall rate of infection of 45.9% was determined. The rate of infection among rural pupils (73.2%) was higher than that among urban ones (23.1%). The prevalence correlated

inversely with age. Risk factors for the infection were rural residence, unplastered walls, mud floors, lack of standpipe water, lack of latrine and the presence of animals within dwellings. Also, the male sex and illiteracy of the parents have been found to be risk factors for infection [569].

In addition, xerophthalmia has been reported as a significant problem among children in Yemen [345] (see section 10.14).

8.7.3 Onchocerciasis in Yemen

Yemen is also the only Middle Eastern country with an endemic onchocerciasis [247, 346]. The geology of north Yemen is a suitable breeding environment for the simulium, with its north-south running mountainous fish bone (rising to more than 2,000 meters), and numerous rivers or "wadis" - valleys. Two types of disease are found; the classical African onchocerciasis with generalised and diffuse dermatitis, and a localised hyper-reactive dermatitis type associated with a collateral lymphatic ganglion. This disease is well known to local populations as "aswad" or “sowda” meaning "black". The two types coexist irrespective of the focus. The generalised type is more predominant. Eye lesions seen in the West African onchocerciasis are not found in sowda cases [346].

Two kinds of microfilariae have been detected in Yemen. One, with numerous dermal microfilariae but without any clinical “sowda”, which corresponds to microfilaria Onchocerca volvulus type, but is different from the forest or savannah strains found in sub-Saharan Africa. The second, with less than 5 microfilaria in their snip-test, and associated with the clinical picture of sowda, do not belong to species volvulus, or to species ochengi. It has been suggested that the clinical picture of “sowda” may be the result of developing onchocerciasis of animal origin which has not yet been identified. The ivermectin which is effective in the African onchocerciasis, is less effecttive in the sowda type, thus the need for emphasis on limiting the transmission of this filariasis.

8.8 Blindness in the Northern Arabian Crescent (Lebanon, Syria and Iraq)

In the northern regions of the Arab world, there is a scarcity of literature on blindness. In Lebanon, a population survey [348] of 10,148 individuals

in 1997 showed that the prevalence of blindness was 0.6% and that of low vision 3.9%. The major causes of blindness were cataract (41.3%) and uncorrected large refractive error (12.6%). The need for educational and screening programmes in combating blindness in Lebanon was put forward by the authors. More recently, the findings from 1,000 patients seen over a period of 26 months at the Caritas Centre, Sidon[347] showed no cases of xerophthalmia due to VAD or of florid trachoma. Diabetic retinopathy was a significant cause of blindness which were complicated in 70% of cases as a result of delayed referral by diabetologists. Patients are only referred when the visual loss becomes evident, when it is often too late to be treated effectively. In addition, the elderly do not consult as frequently as young patients. The concept of mobile eye units was considered to be very important in initiating nationwide mass campaigns for health education, screening and treatment of diseases causing irreversible blindness in addition to recovery of old glasses for the use of poor patients.

8.9 Blindness in Jordan

According to the WHO, blindness remains a public health problem in Jordan and the prevalence of blindness is 0.6% of all population. Cataract is the major cause. It is estimated that there are 64,000 people with low vision due to cataract. More accurate baseline data on the prevalence and causes of blindness and low vision, together with the need for more trained manpower in district hospitals and the provision of necessary equipment for cataract surgery, have been suggested as remedies for the problem [558]. Diabetic retinopathy is also a major cause for concern in Jordan and was found to be the leading cause for severe and moderate bilateral blindness and unilateral blindness according to a hospital-based study [349] on 2732 patients aged 20 years and over in two busy general ophthalmic clinics at two teaching centres in Amman. Glaucoma was the second cause in patients with severe bilateral blindness and cataract was the second cause in cases with moderate bilateral blindness and unilateral blindness. In the latter, trauma scored third.

Trachoma was also seen as a serious problem in Jordan earlier in the century [63] when 95% of the total population were affected. The introduction of trachoma prophylaxis and an improvement in the general living

standards has reduced the incidence markedly eliminating trachoma as a cause of blindness [178].

8.10 Blindness in the Occupied Palestinian Territories of the WB And GS (OPT)

8.10.1 Causes of Blindness in the OPT

Studies in this region have focused on trachoma, and in particular a study of 9054 Palestinians examined from an identified random sample living there in 1984 with particular attention to trachoma [85]. The three principal causes of blindness in order of frequency were cataract, trachoma, and corneal leucoma, which accounted for 66.7% of binocular blindness. The overall incidence of binocular blindness was 1.7% and visual impairment (<6/18) was 6.8%. Trachoma was present in 2568 (28.4%) of the 9054 people examined [85].

In another prospective, randomised population based study of 9058 Palestinian Arabs living in the West Bank and Gaza Strip, and in a prospective study of 1,000 consecutive unselected ophthalmic outpatients at SJOH some four years later, trachoma was found to be widely distributed throughout the two regions [84].

8.10.2 Trachoma Characteristics in the OPT

Trachoma in the OPT is mild, self-limiting, and interspersed with discontinuous pockets of blinding disease. The highest prevalence was found in the Hebron and Jericho districts. Sub-populations at increased relative risk included females, older age groups, rural dwellers, patients with pre-disabling or disabling lesions and patients with moderate to severe active trachoma. An increased recovery of bacteria by culture of the lids and conjunctiva of patients with moderate to severe trachoma was noted. Prevalence of lacrimal disease, dacryocystitis, and acute bacterial ulcer were significantly higher among outpatients with trachoma than among those without trachoma. An increased prevalence of trachoma was found in communities without a continuous year-round supply of running water when compared with communities with the facility [84, 723].

8.11 Blindness in Egypt

The prime causes of blindness in Egypt are corneal opacities followed by cataract, glaucoma and diabetic retinopathy [173]. The bulk of the literature on blindness, however, has focused on trachoma [354- 358, 366].

8.11.1 Epidemiology of Trachoma in Egypt

Trachoma remains hyperendemic in the Nile Delta in the 2000s (Figure 8-1), which is a unique environment for trachoma to flourish [354- 358, 366]. This is despite the improvements in socioeconomic status that took place in the past decade which extended to rural environments, and the fact that there is no problem of water availability in many rural communities. This has been highlighted recently in the Menofiya governorate (2.7 millions), where trachoma was identified as a serious public health problem and a significant contributor to vision loss. Active trachoma was found in 36.5% of children. This is caused by the continued poor hygienic conditions in rural Egypt which have limited the reduction of active trachoma [354].

8.11.2 Prevalence of Trachoma in Egypt

A study in 1984 in 3 rural villages of the Qalyub Governorate showed that trachoma was prevalent and 26% of 777 primary school students were found to have clinically active disease. The overall prevalence of the disease in Qalyub [358] ranged from 16% to 35% and trachoma infection was present in 32% of 312 patients with ocular complaints. The prevalence of infection was higher in younger groups and decreased throughout primary school. Courtright et al [366], in a rural Nile Delta hamlet, found the same predominance of active trachoma among preschool children with over half having moderate to severe disease. Of residents 25 years old, 90% had substantial conjunctival scarring. Severe conjunctival scarring was commoner among women (84%), than men (58%), and three-quarters of older women had trichiasis/entropion compared with 57% of older men. Males and females had equivalent age specific rates of inflammatory disease.

8.11.3 Regional Variations in the Severity of Trachoma in Egypt

In a study by Ezz al Arab et al in the Governorate of Menofiya, intense inflammation (TI) was almost twice as common in rural children compared to urban children. The prevalence of trichiasis (TT) in adults was 6.5%; women had age-adjusted odds of trichiasis of 1.68% compared to men. Trichiasis was also over twice as common in rural parts compared to urban regions. Trichiasis (TT) accounts for blindness in 8% of patients and accounts for 13.2% of visual impairment [354].

Overall, trichiasis surgical coverage was 34.4%, slightly higher among men. The outcome of trichiasis surgery was poor in 44.4% of cases. The high proportion of trichiasis surgery cases with a poor outcome highlighted the need to reassess current surgical practices in Egypt and improve training and monitoring. Blindness was recorded in 13% of the region [355].

Figure 8-1: The Nile Delta

Adopted from Visible Earth, NASA
http://visibleearth.nasa.gov/data/ev161/ev16119_Nile.A2002154.0835.721.1km.jpg

8.11.4 Visual Morbidly of Trachoma in Egypt

Estimates of blindness from trachoma based on various surveys in Egypt indicate that blindness is still a serious public health problem in rural Egypt and is associated with old age [366]. It contributed to 13% of SVI/Blindness in one study [355], and to 17% of residents aged 50 and over in another study [366]. The number of blind persons in Egypt will increase from an estim-

ated 420,000 in 1980 to 868,000 by the year 2020. The current crude blindness rate of 1.8% is expected to increase to 2.3% in the year 2000, and to 3.2% in 2020 [366].

8.11.5 Factors Influencing Trachoma in Egypt

It has also been found that socio-cultural factors, in particular characteristics associated with gender sensitive decision making within households, are likely to be more important considerations in understanding blindness in the Nile Delta rural communities rather than the socioeconomic status. Combating blindness in this region will require gender sensitive efforts aimed at timely and effective utilization of eye care services [355].

In addition, other factors associated with blindness in these rural communities were age, sex, marital status and poor sanitation in the household. Other risk factors described as predicting inflammatory trachoma in children in Egypt were the absence of a latrine in the household, school-age siblings with inflammatory trachoma, and additional same-age siblings (with or without disease) in the household [392].

In the Egyptian setting the presence of pit latrines in all houses, even when full and unscreened, might result in a reduction in trachoma prevalence in this population from the current 49% to 35%. The construction of pit latrines may offer the simplest and most acceptable environmental method for reducing trachoma in this trachoma endemic area [392].

8.11.6 Blind Villagers in Egypt

It is interesting to note that the experience of blindness in rural Egyptian villagers' subjective assessments of their vision differ significantly from ophthalmic measurements of their vision. Individuals with profound visual loss remain independent in their daily activities and continue to contribute to their families' subsistence. They do not perceive themselves to be disabled although they may agree that they have "weak eyesight". It has been thought that stigmatizing attitudes, in that the blind are completely dependent and unable to fulfill their social roles, may encourage these to deny the extent of their visual loss [356].

8.12 Blindness in Sudan

8.12.1 Geographical Characteristics

Sudan is a large country with a population of 37 million in 2000, and has many climate zones. In the northern half the nature is arid with the exception of the valley along the Nile. In the southern half, there are many mountain ranges with fertile climates. To the very south, the nature is fresh and wild [385] (Figure 8-2).

8.12.2 Prevalence of Blindness

The prevalence of blindness in Sudan is around 1.5% (non population based survey). Sudan has a huge cataract backlog (around 300,000). It is one of the countries with endemic trachoma, and pockets of onchocerciasis still remain in some parts of the country. The number of blind in the population is increasing day by day, mainly because of the cataract backlog, and it will double within the next twenty years if no action is taken. Sudan is also one of the countries with relatively few ophthalmologists [365].

Visual morbidity is higher in Southern Sudan, as socioeconomic development in the area has been low, growth slow, and traditional methods of farming, fishing, and pastoralism have remained unchanged. This is compounded by the large-scale presence of blackfly and trachoma. Blindness in this part of Sudan is believed to be very prevalent due to the high prevalence of onchocerciasis and trachoma [370].

Kawuma et al [367], in a study of the prevalence and causes of blindness and ocular morbidity amongst 700 Sudanese refugees in eighteen of Adjumani refugee settlement camps in Uganda in 2000, found that the major causes of blindness are cataract (42%), xerophthalmia (28%), and trachoma (21%). Glaucoma and other non-specified causes were responsible for the remaining blindness (9%). Bilateral blindness existed in 21% of the people, and 11% were unilaterally blind. This is an extremely high prevalence, nearly ten times higher than for Ugandans living in Uganda.

8.12.3 Causes of Blindness

The important causes of blindness in Sudan are cataract, trachoma, onchocerciasis and glaucoma. Gaf, in a seven-week stay in the Sudan in the winter of 1988/89, found that 80% of 990 patients examined (details not avail-

able), were either unilaterally or bilaterally blind [368]. The top 3 causes of blindness in his study were cataract, trachoma, and glaucoma.

8.12.4 Onchocerciasis in Sudan

Onchocerciasis has been reported in Sudan since 1908 and it prevails in three endemic regions known as the southern (south-west), northern and eastern (near the Ethiopian borders) foci [370, 372-374, 376-377, 386]. In these areas there is fast flowing water suitable for S. damnosum S.L, which is the only fly in which the Onchocerca volvulus has been found to breed in Sudan [372].

8.12.5 Onchocerciasis in the Sudanese South Western Focus

The south-western focus is the largest, encompassing the huge area between Bahr El-Arabe and the White Nile, which is the most serious focus with blindness rates equal to, or in excess of, those in the worst affected foci elsewhere in Africa. These are often small villages localised along the rivers flowing north and east from the borders with the CAR and Zaire. In the blinding foci, ocular onchocerciasis was as severe as that found in other African foci [370, 372, 374].

Blindness and nodule rates in excess of 12% and 80% respectively were found in certain villages. Systemically, the infection in this region causes only a mild skin reaction, although microfilarial loads in the skin are high [370]. Of 202 skin biopsies performed on residents of Pongo Nuer, a village in the province of Bahr El Arabe [373], 94% (189) were positive for microfilariae of Onchocerca volvulus[373]. Nodules were most common around the pelvic girdle and rare on the limbs or head. Microfilarial intensities in young adults [376] were generally about 30 mf/mg; but ranged up to 100 mf/mg although in another study [373] it was found to reach up to 1,094 mf/mg of skin. They were highest at the iliac crest and shoulders and increased rapidly in childhood but then appeared to reach a plateau maintained through adult life. Infections were detected in subjects as young as two years old [376].

8.12.6 Onchocerciasis in the Northern And Eastern Foci

The Northern focus is located between the fourth and fifth Nile cataracts. In contrast to the South Western focus, onchocerciasis in this focus is

characterised by the absence of ocular involvement and limited, but severe, skin reactions, low nodule rates (16%) and low microfilarial loads in the skin.

The disease in the Eastern focus is close to the Ethiopian border. It is similar to that in the northern focus, with the exception that most onchocercal skin disease in this area is in the form of severe localised pruritus “sowda” [369], which is similar to the Onchocerciasis in Yemen.

8.12.7 Factors Influencing Pathology in Onchocerciasis

Host response was blamed as a major determinant of disease outcome. Although nodule presence and number is an important parameter to assess the severity of the disease, and is significantly related to skin microfilarial intensity, high skin microfilarial intensities were found in asymptomatic individuals and conversely, lowest intensities were in those with severest maculopapular lesions [373].

8.12.8 Ocular Involvement in Onchocerciasis

Ocular involvement in Sudan was addressed by el Sheikh et al [376] and Mackenzie et al [373] who detected microfilariae in the cornea or anterior chamber of the eyes of one third of those examined in all age groups. Lesions of the posterior segment, including optic neuritis, chorioretinitis, and pigmentary abnormalities, were considered responsible for visual deficits in the population sample [373, 376]. Bird et al [375] has already established that optic nerve disease, alone or in the presence of chorioretinal changes, was responsible for a large proportion of the blindness due to posterior segment lesions in onchocerciasis (87.6% in the series), and that inflammation alone was responsible for fundus lesions in onchocerciasis. It has been found that some pathologic changes in the anterior segment, attributable to microfilariae, were more common in the young than in adults but there was no preponderance of sclerosing keratitis in adults, contrary to expectations in hyperexposed individuals in the Sudan savannah zone [373]. The best correlate of the presence of microfilariae in the eye was the intensity of infection in shoulder skin snips.

Different Onchocerca simulium complexes (different strains of parasite with different pathogenicities transmitted by different vector species) may be

responsible for the different severities of disease found in the 3 main areas of onchocerciasis in North, East and South-West Sudan [374].

8.12.9 Strategies in Tackling Onchocerciasis in Sudan

The localised and focal distribution of the communities seriously blinded by onchocerciasis suggests that the disease should be tackled on a focus basis by treating the entire vector breeding sites with insecticide [374]. It is interesting to note that although serum vitamin A levels were found to be adequate in all groups studied, patients from Southern Sudan with both eye and skin lesions due to onchocerciasis had the lowest mean serum vitamin A levels [377].

8.12.10 Vitamin A Deficiency in Sudan

Vitamin A deficiency has been described in Sudan [380-382]. Its prevalence was found to be 2.9% among 29,615 Sudanese children between 6 and 72 months of age in 5 rural areas of Khartoum and Gezira provinces [381]. Much higher figures were reported in malnourished children aged 4-60 months at 29% (n=213) [380] (Plate 12).

In the first study [381] over 90% had Bitot's spots. More advanced changes were found in the malnourished series [380] with 56% of patients with conjunctival xerosis, 19% with Bitot's spots, 11% with corneal xerosis, 11% with corneal ulceration and 3% with corneal scar. Evidence of night blindness was detected in 4% of all patients. All patients who had signs of xerophthalmia in this series responded to vitamin A therapy (Plate 13).

In Sudan, bivariate associations were found between xerophthalmia and the rural councils where the children lived, household wealth, consumption of vitamin A-containing foods, child's sex, child age and weight-for-height Z- scores. Risk factors of xerophthalmia were; living in remote and arid regions, male gender, age, poverty of the household, and prevalence of diarrhoea. Less xerophthalmia was observed among children who during the 24 hours preceding the survey had consumed dairy products or non-leafy vegetables containing vitamin A [381].

Figure 8-2: Map of Sudan [713]

Adopted from University of Texas Website, Perry-Castañeda Library, Map Collection.
http://www.lib.utexas.edu/maps/africa/sudan_pol00.jpg
(Update 21 December 2003)

The situation of Ethiopians who fled the famine in the mid 1980s in refugee camps in Sudan and Ethiopia showed xerophthalmia in much older children up to the age of 15 years in these two countries. The rates of Bitot's spots were three times greater in those between the ages of 7 and 10 compared with those under 7. Rates of corneal xerosis were similar in camps in both countries [382].

8.12.11 Trachoma in Sudan

Trachoma is an additional cause of ocular morbidity in Sudan and was evaluated in 1975 by Salim and Sheikh who found a morbidity rate of trachoma of 83.2/1000 in the Northern Province [383]. This diminished southwards until it reached 0.94/1000 in the extreme south (Equatorial Province). In endemic areas infection starts very early in the first year of life. There was also a marked difference between the prevalence of trachoma in towns and villages with 71.3% in the age group 1-4 years in villages, and 56.7% in the towns. A relationship was found between the rainfall, the relative humidity, and the incidence of trachoma that was thought to be peculiar to Sudan.

The explanation for the high prevalence of trachoma in northern Sudan was thought to be multi-factorial; related to mechanical trauma caused by frequent sandstorms, irritation of the eyes by dust particles leading to excessive watering and discharge, rubbing with the fingers, the custom of frequent hand-shaking, poor personal hygiene in pre-schoolchildren, associated bacterial conjunctivitis, and the presence of eye-seeking flies (Plates 10 and 11).

Some 20 years later, trachoma was still prevalent in the country among persons of low socio-economic status as delineated by Mahmoud et al [384] who assessed the prevalence of the disease in 616 persons among displaced people from the north, west and south of Sudan who had settled in Angola Village, Omdurman County in 616 persons. Clinical signs of active trachoma were found in 61%. Of 448 children, aged 4 months to 15 years, 12% had mild disease (adults 3%), 15% moderately severe disease (adults 7%), and 47% severe disease (adults 15%). The prevalence of active trachoma among the children in the village was 75% (adults 25%), being higher among those from southern Sudan 86% (adults 38%) than for those from the northern 64% (adults 13%), and western 66% (adults 14%) regions. Antibodies to Chlamydia trachomatis were found in the lacrimal fluid of 67% children, again with regional variations.

8.12.12 Diabetic Blindness in Sudan

It is highly possible that diabetic retinopathy is an important cause of visual morbidity in Sudan considering that diabetes is a growing health problem with major health impact according to the WHO [365]. The estimated prevalence is 3.5% and almost all diabetic patients receive minimal diabetes care.

The poor control is attributed to poor drug compliance, diet and insulin availability, together with the absence of diabetic education and screening programmes.

8.13 Blindness in Tunisia

8.13.1 Prevalence of Blindness in Tunisia

The prevalence of blindness was 1.2% (adjusted prevalence 0.8%), and that for bilateral visual impairment was 3% (adjusted prevalence 2%). In 1993, in a sample of 3,547 people examined, persons over the age of 60 years were over represented. About 80% of blindness was preventable or treatable. Individuals over the age of 60 were eight times more likely to become blind, and 6.7 times more likely to suffer visual impairment than those below the age of 60 [425].

8.13.2 Causes of Blindness in Tunisia

The commonest causes of blindness in Tunisia are cataract, uncorrected aphakia, and corneal blindness. Age-related cataract is the major cause of curable blindness, ranging from 51% [426] to 66% [425]. In the latter, people above the age of 60 years were over represented. The presence of trachoma in these patients makes surgery problematic. Risk factors for cataract existing in the population were diabetes, or abnormal glucose test tolerance, high systemic blood pressure, especially diastolic, low education and non-professional occupation, and family history of cataract. Complicated trachoma was found in 5.1% of cases compared to only 0.6% in controls [426].

Second to cataract came uncorrected aphakia accounting for a significant fraction of the visual deficiencies identified in this survey (6.4% of cases of blindness and 11.8% of cases of bilateral visual impairment). The ratio of cataract surgery was small with only 41% of those individuals with cataract having undergone surgery [425].

Corneal blindness in the rural areas of the southern part of Tunisia, accounted for 25% of the cases of blindness [427].

8.13.3 Trachoma in Tunisia

In respect of trachoma in Tunisia, reports from the mid 1970s and late 1980s indicate that trachoma was a public health problem in some parts

of Tunisia, being endemic in central and southern Tunisia [422-424, 427] and has remained unabated [427]. In study of 2 rural villages in the southern region, it was responsible for visual disability of 3/60 and less in 7-14% of adults. Active trachoma affected most children under the age of two, reached a peak in 2-5 years olds, and then declined to age 15. The lower rate of blindness in one village was attributed to economic development enhancing a decline in active, infectious diseases [423].

The only reports on VAD in Tunisia date back to 1955, suggesting that this is no longer a health problem in the country.

8.14 Blindness In Morocco

8.14.1 Prevalence of Blindness in Morocco

There was a lack of reliable epidemiological data on the prevalence and causes of blindness in Morocco; this hampered the effectiveness of attempts to prevent blindness in this country. In 1992 a nation-wide population-based survey of 8878 persons, from both urban and rural areas, was conducted based on WHO criteria. The crude point prevalence was 0.8% for blindness, 2.3% for bilateral visual impairment, and 2.8% for unilateral poor vision. It was estimated that 195,000 people were blind and 1,300,000 at risk of becoming so; making up a total of nearly 1,500,000 people with serious visual impairment [430].

8.14.2 Causes of Blindness in Morocco

Age-related cataract was the most important cause of blindness in Morocco (45.5%) and bilateral poor vision (43.1%), with an estimated prevalence of 2.1% of cataract-related visual impairment (operable or inoperable). However, the percentage of patients who had undergone cataract surgery in hospitals was very poor at 0.8%. Existing eye services could cover only 25% of the demand for cataract surgery. Uncorrected aphakia was noted as a problem with 40% of aphakic people unable to obtain eye care. Traditional "couching" method was noted in 0.1% of people studied [430].

8.14.3 Trachoma in Morocco

Trachoma was endemic in certain locations such as Errachidia, Ouarzazate [435] and Zagora [436] provinces. A survey on the prevalence and

severity of trachoma was carried out in the latter province [432]. The prevalence of trachoma was estimated at 40.8% and that of active, inflammatory and mixed types was 18%. The prevalence of severe trachoma (with trichiasis/entropion) was 2.2%, and central corneal opacity 3.3%. Corneal blindness affected 1.6% of the series. In children <10 years, the trachomatous intensity indicator (presence of TI) was 12.8%. The worst area affected was the valley of Oued Draa, where all the indicators were consistently higher than elsewhere in the province [432]. It was believed that tackling the problem of trachoma could only be achieved through a continuous mass treatment strategy combined with a sanitary education programme aimed at the development of hygienic conditions, especially among children living in trachomatous communities [435]. Educational campaigns, however, had been started earlier in the same province [434].

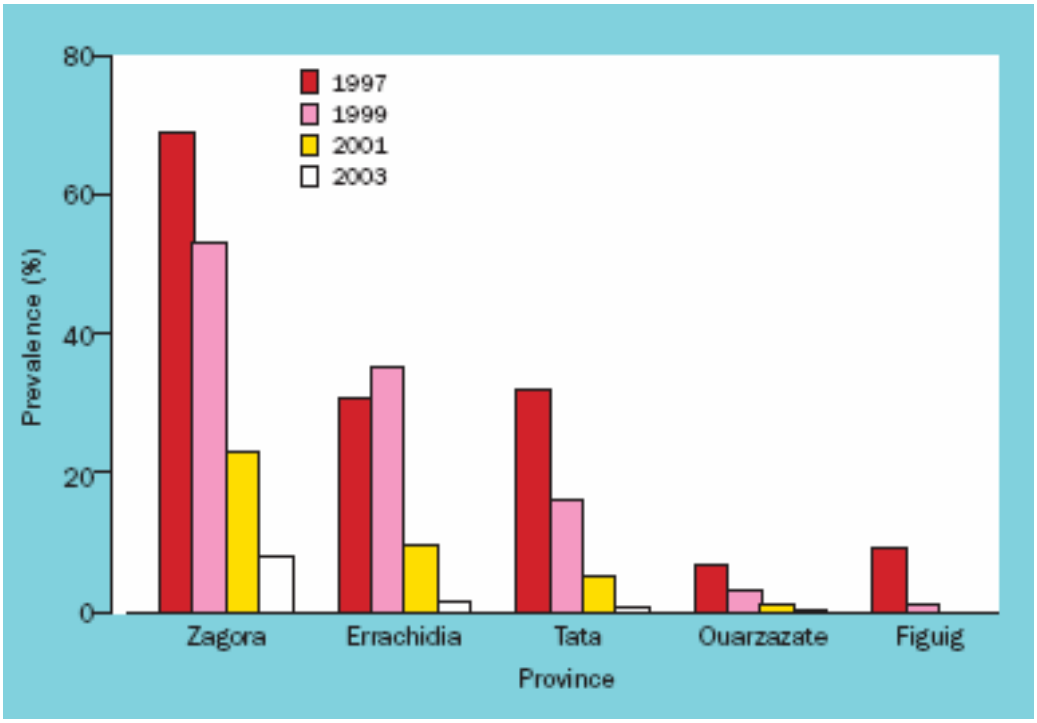

Figure 8-3. Reduction in the prevalence of active disease in Morocco, 1997–2003

Adopted from Mecaskey et al [609] http://infection.thelancet.com

The prevalence of trachoma, however, has diminished by nearly 75% (from 28% to 6.5%) and recent reports by the International Trachoma Initiative, indicates that blinding trachoma will be eliminated from Morocco by 2005

[251,433]. This success is the result of the initiative, founded in 1998 by the Edna McConnell Clark Foundation and Pfizer (see section 11.4.3) in partnership with the country's national programme for the control of blindness which was initiated in 1999. The initiative worked with local teachers, health professionals, and volunteers in five targeted provinces and local health workers have been trained to conduct trichiasis surgery. The initiative currently operates in Ghana, Mali, Tanzania, Sudan, and Vietnam and will be extended to Ethiopia, Nepal, and Niger [433]. The outcome of trichiasis surgery in the endmic areas has been addressed by Negrel et al [436] (Figure 8-3).

8.15 Blindness in Djibouti

In Djibouti, droplet keratopathy [364] appears to be an issue in the causation of blindness. It was found that spontaneous corneal blindness is significant among these people suffering in comparison to controls (12% versus 0.7%). Data on blindness otherwise are not available.

8.16 Blindness in Turkey

8.16.1 Prevalence of Blindness in Turkey

In Turkey [449], a population-based survey of blindness and eye disease was conducted in the two provinces of Diyarbakir and Mardin in southeast Turkey in an attempt to gather information for the planning of a regional prevention of blindness programme. The prevalence of visual impairment was estimated at 1.9% totalling 29,400 +/- 4500 visually impaired persons out of the 1.6 million people in the two provinces.

The prevalence of blindness in 8,571 persons was 0.4%, and an estimated 1.5% had low vision. This is 8 folds higher that the 0.2% prevalence of blindness the European Economic Community (EEC).

8.16.2 Causes of Blindness in Turkey

The main causes of blindness were cataract (50%), corneal opacity (15%), glaucoma (12%), phthisis (6%) and optic atrophy (6%). Cataract and refractive errors contributed to 52% and 26% of the low vision respectively. Acute inflammatory trachoma was prevalent in a number of rural and urban communities, affecting an estimated 25,900 people in the region.

The size of the surgical load for the two provinces was estimated to be in the region of 26,600 cataract operations and 4,400 eyelid surgeries for the cicatricial complications of trachoma. In addition, 28,600 required spectacles to improve their visual acuity to 6/18 or better.

More than half of the current burden of severe visual loss in the two provinces of southeast Turkey is potentially remediable through the provision of cataract surgery and of spectacles to correct aphakia. It was feared that as the age structure of the regional population approaches that of the EEC, a four-fold increase in the burden of blindness might be expected if provisions are not made to develop health services in line with longer survival.

8.17 Blindness in Iran

In Tehran, Iran [450] of 4565 people examined, 0.28% was blind despite correction while 0.39% was blind with presenting uncorrected vision. The prevalence of visual impairment in the corrected and presenting vision was 1.11% and 2.13% respectively. The causes of visual impairment in the corrected eyes were cataract (36.0%), macular degeneration (20.0%), and amblyopia (10.7%). Refractive errors caused 33.6% of visual impairment in uncorrected eyes. The prevalence of visual impairment correlated with advancing age and lower education. The results highlighted the need for prevention programmes, with emphasis on treatment of refractive errors and cataract. Active trachoma is still found in some parts of Iran [556].

8.18 Blindness in Pakistan

In Pakistan, according to a population-based survey conducted by the Ministry of Health of Pakistan and the World Health Organization (WHO) in 1987-1990, a prevalence of blindness of 1.78% was found[547]. The causations of blindness were reported in a prospective study of 100 consecutive blind cases (M:F ratio 1.27:1) at the eye department in Peshawar in 1999, by Wajid and Khan who found that glaucoma, followed by diabetic retinopathy were the commonest conditions. The various conditions rated as follows: glaucoma 40%, diabetic retinopathy 33%, VAD 8%, trauma 7%, retinitis pigmentosa 3%, retinoblastoma and unidentified causes 6%. Irreversible blindness was more common in people above fifty years of age and mostly males were affected [550]. Trachoma was also a major public health problem in the

country as found from data collected from district ophthalmologists of randomly selected districts and tertiary centres. Active trachoma was found to be the most common presentation (2.4%), followed by trichiasis (1.6%). It was felt that "SAFE" (Surgery, Antibiotics, Face washing and Environmental change) strategy needed to be implemented in Pakistan in order to eliminate trachoma as a cause of blindness in the next decade [551].

8.19 Blindness in Afghanistan

8.19.1 Prevalence of Blindness in Afghanistan

There is a lack of epidemiological studies on blindness in Afghanistan. The only available work from this country was carried out by three students during a six-week stay supported by an ophthalmologist at Noor Eye Institute in Kabul. Among 473 patients whose visual acuity was below CF at 3 meters, 40.46% were new patients [593].

8.19.2 Causes of Blindness in Afghanistan

The leading causes of blindness were found to be cataract (31.12%), corneal scarring (19.8%), chorioretinal degenerations (6.79%), glaucoma (6.65%) and aphakia (5.52%). Preventable and treatable conditions formed 40% and 30% of the main causes respectively. The proportion of blindness caused by infection was significant in the 30 years and under age groups. Cataract is a major cause of blindness in the older patients. The delayed presentation of pathologies was noted and was believed to be due to the lack of awareness of the irreversible nature of many diseases, the remoteness of available services to their homes and a lack of knowledge of the existence of the services [593].

Eye disease and blindness are reported to represent important public health problems in the Afghan refugee population in Pakistan with over 2% of the total population, and over 18.3% of the population over 60 years in the study sample, blind. This population, estimated to be about 4 millions, has settled in Pakistan since 1980 and mainly resides in camps in the northern part of the country. The survey included 1156 people and showed that 2.1% of the population was blind and 6.9% were visually impaired according to WHO criteria. The leading causes of blindness included catar (62.5%), uncorrected refractive errors (16.6%), retinal degeneration/dystrophy (12.5%),

glaucoma (4.2%) and microphthalmos (4.2%). The causes of visual loss were uncorrected refractive errors (46.2%), cataract (32.7%) and corneal opacities (4.8%). These conditions were also important causes of unilateral lost vision. Active trachoma was found in 3.7% of all children <10 years of age [515]. The proportion of those who had cataract surgery among the population with cataract is only 13.3%, very similar to figures reported in Saudi Arabia [334].

8.19.3 Mine Blast Injuries

Another concern in Afghanistan is blindness caused by mine blast injuries in non-combatants. These injuries are usually fatal but, in those who survive, bilateral eye injuries are common [544-546]. The frequency of these injuries were found to be high in a study by Muzaffar et al on Afghan non-combatants engaged in mine clearing operations in Afghanistan in the aftermath of the Russo-Afghan war [541]. Obviously the size of the problem is likely to be higher after ongoing war and unrest in many countries in the Eastern Mediterranean Crescent.

8.20 Other Countries in North Africa

Literature on the blindness in Algeria and Libya are lacking. On the latter, there is a brief reference to the presence of trachoma in this country [571].

8.21 Conclusions on World Blindness

The state of blindness worldwide is summed up in Figure 8-4, which demonstrates the number of blind by various causations. The importance of age-related cataract, trachoma and glaucoma as causes of blindness in all countries, with the exception of the EME and PSE, is very clear. On the other hand, the lower prevalence of blindness from ARMD (referred to as 'others') is shown in the first two columns

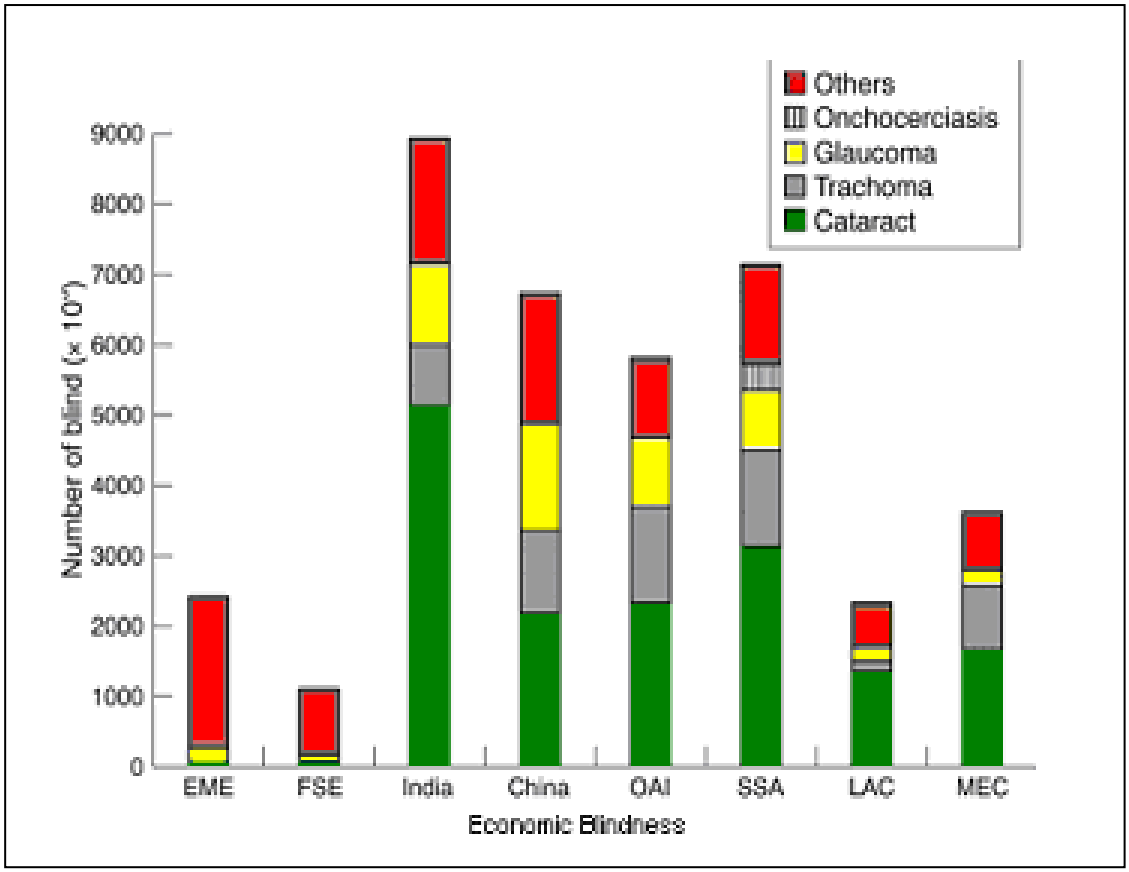

Figure 8-4: Global blindness worldwide by conditions in the World Bank Economical categories.

Adopted from Ho VH, Schwab IR. Social economic development in the prevention of global blindness. *Br J Ophthalmol* 2001; **85**: 653-7 [655].