THE ROLE OF OPTOMETRY IN THE DELIVERY OF EYE HEALTH CARE IN THE EUROPEAN UNION

Rishi Kumar Agarwal

A Thesis
submitted for the degree of

Doctor of Philosophy

City University

Department of Optometry and Visual Science

September 2003

Contents

Chapter 3

Economics of eye healthcare delivery

Chapter 4

Pattern of Eye healthcare delivery in the European Union

Chapter 5

Optometry and Eye Healthcare in the EU: a British Perspective, a perspective for the future and Conclusions

Tables

Acknowledgements

I am thankful to Professor E.G. Woodward, Emeritus Professor and formerly Head of the Department of Optometry and Visual Science at the City University. London, for supervising my work, for his guidance and numerous helpful suggestions.

I am thankful to Mrs J. Dian Taylor, Deputy Registrar/Director of Education, General Optical Council for providing invaluable material concerning European Union Directives and related material.

I also acknowledge with thanks the material provided by Maureen Hunter, Editor of Optometry Today and Richard Carswell of ECOO (European Council of Optometry and Optics.

I also acknowledge with thanks the material provided by Mrs Dorothy Leason, then Secretary of the International Optometric and Optical league, renamed World Council of Optometry, which was based in London, England and now based in Philadelphia, USA.

I thank Ian Hunter, OBE, Chief Executive of the Association of Optometrists and Peter Leigh, formerly Secretary of the College of Optometrists for their comments.

Finally, I thank all those people from all over Europe from various medical, ophthalmological and optometric institutions and societies; government departments and ministries, blind associations and agencies for acknowledging my letters and sometimes providing me with useful information. Many of my letters were not acknowledged but I do appreciate the difficulties especially when requested information is either not available or does not exist.

Abstract

The role of optometry in the delivery of eye healthcare in the UK is well recognised by the state and the British people. Optometry in Britain works very closely with medicine and is steadily moving forward as a profession complimentary to ophthalmology. However, with the exception of Ireland, the role of optometry in the rest of the European Union is restricted by national laws, decrees or acts like Actus Medicus to those professional activities which are normally carried out by dispensing opticians in the UK.

From a British perspective there are no equivalent working optometrists in the EU except in Ireland. British optometrists provide an increasing amount of primary eye healthcare working closely with hospital based ophthalmologists who provide secondary care. In the rest of the European Union primary eye care is generally provided by practising ophthalmologists who refer patients to hospitals or university clinics for secondary care.

With the growing elderly population and changing demography, the UK will remain short of human resources for the management of sight threatening conditions. It is not realistic to expect 750 British ophthalmologists to be responsible for secondary eye care for the entire population of the UK

British standards in eye healthcare must be maintained and optometry in the EU must be reformed effectively and improve to British standards before freedom of movement is implemented under any EU legislation especially under the new directive which would allow healthcare professionals to work in the EU for 16 weeks without registration from the year 2005.

British optometrists with appropriate additional training could be given the responsibility for the specific task of ophthalmic intervention to avoid blindness and visual impairment and this would provide a pragmatic solution to a human resources problem in the eye care field in the UK. Hopefully, such a model would then be adopted by the future optometrists trained throughout the European Union.

Key to Abbreviations

AESOP	Anonymous Enquiry of the Scope for Optometrist Prescribing
AEUSCO	Association of European Universities, Schools and Colleges of Optometry
ABDO	Association of British Dispensing Opticians
AMD	Age-related Macular Degeneration
AURE	Alliance of UK Health Regulators on Europe
BMA	British Medical Association
CBA	Cost Benefit Analysis
CEA	Cost Effectiveness Analysis
CET	Continuing Education and Training
CHC	Community Health Council
CMA	Cost Minimisation Analysis
CNV	Choroidal Neo-Vascularisation
CPD	Continuing Professional Development
CSR	Cataract Surgery Rate
CUA	Cost Utility Analysis
CVM	Contingent Valuation Method
DALY	Disability Adjusted Life tears
DCCT	Diabetes Control and Complications Trial
DECODE	Diabetes Epidemiology Collaborative Analysis of Diagnostic Criteria in Europe
DFI	Diabetes Federation of Ireland
DPV	Diabetessoftware fur Prospektive Verlaufsdokumentation
DRS	Diabetic Retinopathy Study
EASD	European Association for the Study of Diabetes
EBO	European Board of Ophthalmology
ECJ	European Court of Justice
ECOO	European Council of Optometry and Optics
ECSC	European Coal and Steel Community
EEC	European Economic Community
ETDRS	Early Treatment Diabetic Retinopathy Study
EME	Established Market Economies
EU	European Union
FAHV	Federation des Aveugles st Handicapes de France
FSE	Former Socialist Economies
GDC	General Dental Council
GDM	Gestational Diabetes Mellitus
GDP	Gross Domestic Product
GIES	Glasgow Integrated Eye Service
GMC	General Medical Council
GNP	Gross National Product
GOC	General Optical Council
GOS	General Ophthalmic Services

HALY	Handicap Adjusted Life years
HMO	Health Maintenance Organisation
HPC	Health Professions Council
HRQL	Health Related Quality of Life
HYE	Healthy Years Equivalent
IAPB	International Agency for the Prevention of Blindness
IDF	International Diabetes Federation
IDDM	Insulin Dependent Diabetes Mellitus
IEF	International Eye Foundation
IGR	Impaired Glucose Regulation
IGT	Impaired Glucose Tolerance
IHF	International Hospital Federation
LAST	Lutein Antioxidant Supplementary Trial
LSA	Licentiate of Society of Apothecaries
LMSSA	Licentiate in Medicine and Surgery of Society of Apothecaries
MCO	Managed Care Organisation
MCPT	Macular Computerised Psychophysical Test
MEP	Member of European Parliament
MIDD	Maternally Inherited Diabetes and Deafness
MPD	Macular Pattern Dystrophy
MRCGP	Member of the Royal College of General Practitioners
MD	Doctor of Medicine
MS	Manuscript
NCBI	National Council for the Blind of Ireland
NGO	Non Governmental Organisation
NHS	National Health Service
NICE	National Institute of Clinical Excellence
NIDDM	Non Insulin Dependent Diabetes Mellitus
NOTB	National Ophthalmic Treatment Board
OECD	Organisation for Economic Co-operation and Development
ONCE	Organizacion Nacional de Ciegos
PBL	Prevention of Blindness
PDR	Proliferative Diabetic Retinopathy
POAG	Primary Open Angle Glaucoma
QALY	Quality Adjusted Life Years
RCP	Royal College of Physicians
RCS	Royal College of Surgeons
RCGP	Royal College of General Practitioners
RCO	Royal College of Ophthalmologists
RCPCH	Royal College of Paediatrics and Child Health
RNIB	Royal National Institute for the Blind
RPE	Retinal Pigment Epithelium
UKPDS	United Kingdom Prospective Diabetic Retinopathy Study
UN	United Nations
UNICEF	United Nations International Children's Emergency Fund
WCO	World Council of Optometry

WHA	World Health Assembly
WHO	World Health Organisation
WTA	Willingness to Accept
WTP	Willingness to Pay
ZVA	Zentralverband der Augenoptiker

He that is stricken blind cannot forget
The precious treasure of eyesight lost.

Romeo and Juliet
Act 1 - Scene 1 (Stanza 227)
by
William Shakespeare (1564-1616)

THE ROLE OF OPTOMETRY IN THE DELIVERY OF EYE HEALTHCARE IN THE EUROPEAN UNION

Chapter 1

Introduction, an Overview of Health Care and Historical Survey of Eye Care Professions

1.1 Introduction

The World Health Organisation has estimated that about 80% of global blindness is avoidable. It results from those conditions that could have been prevented or controlled if the available knowledge and timely interventions had been applied, (WHO, Fact Sheet 213, 2000). The WHO states that `given the scope of the problem, the time has come for a major focused and concerted international effort to combat avoidable blindness'. The key elements in the prevention, treatment and rehabilitation of avoidable blindness are the availability of appropriately trained human resources, suitable technology and full support of the state. However, the decision concerning the level of training and skills required for different professionals remains a matter for the state and relevant professional organisations.

The role of optometry in the delivery of eye health care in the United Kingdom is well recognised by the state and the people. Optometry in the UK works very closely with medicine and is steadily moving forward as a profession

complimentary to ophthalmology. The role of optometry in the rest of the European Union, with the exception of Ireland, is restricted by national laws, decrees and acts like Actus Medicus to those professional activities which are normally carried out by dispensing opticians in the UK. British optometrists provide an increasing amount of eye healthcare working closely with hospital based ophthalmologists who provide secondary eye care.

With the growing elderly population and changing demography, the UK will remain short of human resources for the management of sight threatening conditions. British optometrists with appropriate additional training could be given the responsibility for the specific task of ophthalmic intervention to avoid blindness and visual impairment.

Before freedom of movement of optometrists within the EU is implemented under any EU legislation, especially under the new European Commission directive which would allow healthcare professionals to work in the EU for 16 weeks without any registration from 2005, optometry in the EU must be reformed effectively and improve to British standards.

The purpose of this work is to evaluate the present role of optometry in the delivery of eye health care in the United Kingdom and the rest of the European Union and recommend a pragmatic solution.

1.1(a) An Overview of Health Care

The provision of preventive and curative health care for the

population within any administrative boundary or border can be defined as an organised social system in which the state undertakes responsibility for the well being and welfare of all the inhabitants by providing access to appropriate health care as and when necessary and ensuring that adequate resources are allocated for this purpose.

It is also expected that the state assumes responsibility for overseeing the provision of suitable professional education and training in skills relevant to healthcare, enacts statutory rules and regulations to safeguard professional standards for the protection of people and various healthcare providers, plans adequate healthcare for all citizens and whenever necessary commissions and authorises relevant research and related studies to ensure continuation of the delivery of quality healthcare.

Public confidence in the healthcare professions in general depends upon accessibility of affordable healthcare without delay, high standard of delivery of healthcare and the level of quality of service provided. Public trust in the optometric profession depends upon the quality of eye healthcare services, the standard of delivery of eye healthcare and prevention of visual impairment. However, the bureaucratic systems and their procedures, which serve the state, allocate resources and implement healthcare policies, can also affect the delivery of eye healthcare.

In the UK the 1983 Griffith Report delegated the Board of the NHS with the following task: 'to ascertain how well the service is being delivered at local

level by obtaining the experience and perceptions of patients and the community: these can be derived from CHCs (Community Health Councils) and by other methods, including market research and from the experience of general practice and the community health service' (St Leger et al., 1992). There are two important elements in the evaluation of healthcare, standard of professional service and objectivity. Assessment of standard of service is considered complete if evaluation is carried out against the stated aims. It is comparative when professional services are proposed as an improvement on the existing services and assessed accordingly. Within the framework of objectivity are those evaluations which are independent of the judgment, errors and prejudices of evaluators and those who commissioned them. However, it is recognised that objectivity is a relative term and occasionally an absolute objectivity may not be possible in some evaluations. Absolute objectivity, nevertheless, remains an idealistic goal in healthcare. It can be stated that total objectivity is dependent upon consensus decision making in any evaluation and it is the collective responsibility of all concerned. Consensus decision making refers to agreement of all those involved and implies impartiality, a constituent element of objectivity. However, in the context of evaluation of health impact assessment, it is stated by Milner et al (2003) that `it is important to guard against unrealistic expectations and illusions of total objectivity and precision in the health impact assessment process'.

Considering that there is no single blueprint that will be appropriate for all circumstances, total objectivity remains an idealistic goal for health policy decision makers, howsoever unrealistic it may appear to those who may regard such concepts as illusory. For the provision of effective healthcare, several factors need to be assessed objectively. These include an efficient and effective allocation and use of resources for the benefit of all citizens especially those who are disadvantaged and therefore socially vulnerable. It is necessary that local needs are always taken into account in healthcare policy decisions.

For an efficient and effective assessment of healthcare services it is sometimes necessary to obtain the expertise of individuals from different disciplines which may include medical, allied healthcare and complimentary professions, scientists, epidemiologists, physiologists, biologists, statisticians, healthcare economists, sociologists, jurists, legal advisers, information technologists and managers in healthcare work. It is also necessary to seek and take into account the views and comments of the recipients of healthcare services. In the context of specific healthcare, evaluation can be defined as critical and objective assessment of the entire professional services within the stated, projected and expected goals. Critical assessment includes objectivity in healthcare priorities that are defined by health-related evaluations. The concept that a disease may lead to disability is an important element of critical analysis in healthcare. It can be argued

that healthcare expenditure is in fact healthcare investment. A system that defines healthcare priorities has to include evaluation of specific services e.g., availability of screening for ocular diseases like diabetic retinopathy and glaucoma to prevent visual impairment and ensure effective interventions. For an assessment of healthcare effectiveness it would be necessary to examine the structure, pattern, procedures and outcome of specific professional services.

The structure covers academic and professional training and appropriate qualifications, geographical distribution of qualified professionals and the number of establishments providing specific professional services and the facilities and type of services provided. A quality control system, economics of training and the actual provision of specific healthcare are also essential parts of the structure.

An assessment of the above mentioned structure would cover organisation of the professional services and, under the heading outcome, an evaluation of the results of such services. Accreditation is a formalised procedure designed for recognised disciplines and professions, individual professionals, professional bodies and organisations by which an agreed protocol and standard is deemed to have been met. Accreditation is a well recognised and established social phenomena. For example, the right of doctors, dentists and optometrists to practise in the United Kingdom has been based upon registration with the General Medical Council, General

Dental Council and General Optical Council respectively. This signifies an individual's ability to pass specific examinations at an agreed standard before registration and practise is allowed.

Similarly, for example, medical schools following inspection of hospitals have to decide which should be accredited for pre-registration training and experience for medical graduates. Royal colleges provide their own accreditation standard for post-graduate training. Quality assurance under an agreed framework commits clinical and management staff to produce a systematic and ongoing process of evaluating the standard of care and service.

Health related issues in all the regions of the world are periodically reviewed by the World Health Organisation (WHO), supported by epidemiological studies and followed by appropriate recommendations. In 1978 worldwide primary healthcare for all was recommended at the joint WHO/UNICEF conference held at Alma Ata, following the adoption of a resolution by the World Health Assembly in 1977: 'Health for all by the year 2000' (Thylefors, 1998).

This ambitious resolution was adopted with the expectation that by the year 2000 all citizens should attain a level of health which would allow them to lead a socially and economically productive life. The conference considered that accessible healthcare was necessary in all the regions of the world. According to a WHO working group quality assurance has four specific components, quality professional performance, patient satisfaction with professional

services, efficient use of resources and risk management. The WHO European targets for 'Health for All' (Target 31) have already stated that `by 1990 all member states should have built effective mechanisms for ensuring the quality of patient care within their health care system'. The UK Government readily accepted the principle of 'Health for All' (St Leger et al, 1992).

The WHO programmes for the prevention of blindness (PBL) and primary healthcare started in 1978. It was in 1980 the WHO-PBL programme started working on primary eye care as part of primary healthcare (Thylefors, 1998).

1.2 The historical, social and professional background of the Providers of Eye Health Care in Europe

Although currently in most countries of the European Union both primary and secondary eye care is provided by ophthalmologists, in two member states, namely the United Kingdom and the Republic of Ireland, both primary and diagnostic eye care is shared between family physicians, optometrists and ophthalmologists.

Family physicians in some EU countries provide a mixture of basic eye care, screening for various eye diseases and referral for ophthalmological services. However, in the UK and Ireland general medical practitioners very often seek optometric clinical opinion prior to an ophthalmological referral.

Before the development of ophthalmology and optometry, health care provided by physicians, apothecaries and the clergy would have included some form of eye care based upon the available clinical information and knowledge of the period.

1.2 (a) The Medical Profession in Medieval and 19th century continental Europe

During the 12th century the clergy were prohibited by the Church from practising both medicine and surgery. In 1139 at the Ecumenical Council meeting of Lateran held in Lateran Palace in Rome, the council prohibited monks from acting as physicians. In 1163 the Council of Tours condemned the teaching and practising of medicine by the monks (Millerson, 1964). In 1215, an ordinance from Pope Innocent the III (Papacy 1198-1216; died in 1216 because of malaria) forbade any surgical operation. Pope John XXI (elected in 1276) was an ophthalmologist before becoming Pope and also personal physician to Pope Gregory X in 1272. One of his important works was Liber di Oculo (Concerning the Eye). His textbook was in two parts, an introduction to the eye followed by descriptions of eye diseases and their medical treatment. The work survived and a copy was found amongst Michelangelo's papers. The book was a plagiarism of two earlier textbooks (Blanchard, 1995). Supposedly, Pope John XXI discovered that Glaucoma was a disease with a hard eye. In fact he was only referring to a suppurative external disease with indurated lids called sclerophthalmia (Blanchard, 1995).

Pope Boniface the VIII (Papacy 1294-1303; died in 1303) absolutely forbade the practice of surgery. However, during the 13th century the Cathedral of Notre Dam in Paris gained recognition as an independent Universitas teaching medicine. Interestingly, physician and surgeon Guy

de Chauliac (1300-1368), the author of Chirurgia Magna, acted as physician to Pope Clement the VI (Papacy 1342-1352; died in 1352). In the 12th and 13th centuries, Salerno, Pavia and Bologna were the earliest universities in Europe to provide formal instructions in medicine. Apprenticeship was required for licensing to practise medicine at Salerno and Montpellier in the 13th century. At Padua a similar system was adopted during the 16th century. In the following century the apprenticeship system was also adopted at Leiden, followed by Austria and England (Gottschalk et al, 1969). In 1503, Giovanni de Vigo (1450-1525) became personal surgeon to Pope Julius II (Papacy 1503-13). De Vigo wrote a surgical textbook in Latin 'Practica Copiosa in Arte Chirurgia' which was completed in 1514. It was translated into English by Richard Traheron and printed by Edward Whytechurch in 1543 (Gurunluoglu et al, 2003).

In Paris an Academie Royale De Chirurgie was established in 1731 on the initiative of Georges Mareschal, surgeon to Louis XV (Gottschalk et al, 1969). The academy was dissolved in 1793 as a result of the French revolution. In 1843 the academy was revived by Auguste Berard as Societe Nationale de Chirurgie. In 1935 it became Academie Nationale de Chirugie.

1.2 (b) The Medical Profession in Medieval and 19th century England

The traders of foreign spices, pepperers and canvas dealers formed

the grocer's company of London in 1345. Another group of traders, the apothecaries, amalgamated with the grocers while retaining their title.

In 1447 Henry the VI (1421-1471) granted the company exclusive rights to inspect all spices and drugs sold in England.

In 1606 the grocers obtained a Royal Charter. The apothecaries decided to form their own society and in 1617 succeeded in obtaining a separate charter.

An act of 1511 stated that all physicians, with the exception of those holding degrees from Oxford and Cambridge, had to be licensed by the Church.

However in 1518, Thomas Linacre who was a personal physician to King Henry the VIII and also to Cardinal Wolsey (chief adviser to Henry the VIII) obtained permission from the King to form an elite group of physicians.

The body was named the 'Royal College of Physicians'. Linacre himself was holder of an MD from the University of Padua. Membership was open to Oxford and Cambridge medical graduates and also foreign medical degree holders (Millerson, 1964).

The King's fear of the plague epidemic may have been a deciding factor in his patronage of a well controlled group of physicians - the Royal College of Physicians (Berlant, 1975; Carr-Saunders and Wilson, 1964).

By 1522, four years after the formation of the Royal College of Physicians, university degrees were formally required as a necessary qualification for licensing by the church for practising as a physician (Elliott, 1972).

The apothecaries after obtaining their own Charter in 1617, fought a series of

legal battles with the physicians over their rights to provide medical advice and prescribe drugs. The plague epidemic of 1665 in London provided the apothecaries with an opportunity to practice almost unopposed because most physicians had left London for the countryside to escape from the great plague.

The Royal College of Physicians had the right to search the premises of apothecaries in London for bad drugs and this right had been strengthened in 1723. Early in the 18th century, a decision by the House of Lords allowed apothecaries to charge for the drugs but not for the advice. However, after the passing of Apothecaries Act of 1815 and following another court case, the apothecaries were also allowed to charge for advice (Elliott, 1972). Although the surgeons in England had already formed a group in 1435, the Barber's company (established in 1308) also received a Royal charter in 1462. In 1421 an attempt on the part of the surgeons to unite with the physicians had not been successful. In 1540, the surgeons reached an agreement with the barbers to form a united company of barber-surgeons. The social status of barbers was that of a craft guild. The membership of the guild of barber-surgeons was not always exclusive and sometimes in different areas members from the guild of apothecaries and even those from non-medical and non-surgical occupations were accepted (Millerson, 1964). By the 18th century, there were almost twenty times more barbers than surgeons in the company, although most of the income for the company was

provided by the surgeons (Millerson, 1964). The alliance of the barbers and the surgeons as a united company of barber-surgeons lasted for almost two centuries and in 1745, after several unsuccessful attempts, a separate company of surgeons was incorporated.

In 1796, because of a violation of the rules the company of surgeons lost it's corporate status and a bill to re-incorporate the company was not successful. In 1800, a royal charter of incorporation was granted establishing a Royal College of Surgeons of London. In 1843 the college was renamed as the Royal College of Surgeons of England. During the 18th century several voluntary hospitals were formed in London: Westminster (1719), Guys (1721), St. George's (1733), London (1740) and Middlesex (1749). Medical Schools developed around these hospitals (Cameron, 1954). However, St. Bartholomew's and St. Thomas's hospitals trace their origins from the medieval times.

During the 17th and 19th centuries only the physicians were regarded as members of a learned profession. The surgeons were considered craftsmen and the apothecaries mere tradesmen (Wilcock, 1830, quoted by Brotherston, 1971). The demarcation between the three was very rigid. In the 18th century an apothecary could not secure the licence of the surgeon's company unless membership from the society of apothecaries was first withdrawn. Similarly, the members of the College of Surgeons and licentiates of the society of apothecaries had to withdraw their membership

from their respective college and society before they were allowed to qualify as licentiates of the College of Physicians. It was socially acceptable that the physicians, surgeons and apothecaries should have different social rank and status (Brotherston, 1971).

Joseph Butler (1692-1752), who was a Bishop of the Church of England, held rigid views on self interest, conscience and class. He held the view that the architect of the universe had distributed men into different ranks and at the same time united them into society. This rigid and influential view was equally applicable to the medical profession and society in general. Interestingly, in ancient Greece, the philosopher Aristotle (384-322 BC) had already assigned a strictly subordinate place for artisans in his polis (Black, 1984). During the first half of the 19th century, debates for the unification of apothecaries, surgeons and physicians met with resistance because of the view that the practitioners of inferior order and rank were necessary for the needs of the socially inferior classes (Brotherston, 1971).

In 1824 an outspoken journal of medical knowledge and opinion named The Lancet was launched primarily to seek reform and to establish and promote communication for a disunited medical profession in England.

In 1832 a Provincial Medical and Surgical Association was formed in the historic city of Worcester by a group of provincial medical practitioners (Elliott, 1972). The association moved to London in 1856 and was renamed the British Medical Association.

Quackery was widespread during this period with unqualified practitioners in evidence throughout England. The Carmichael essays have reported that in 1839 an apothecary falsely advertised himself as a surgeon. The following was copied from a placard suspended in the window of an apothecary shop in Manchester 'Surgeon and Apothecary'.

'Prescriptions and family medicines accurately compounded. Teeth extracted at one shilling each. Women attended in labour at two shillings and six pence each. Patent medicines and perfumery. Best London pickles, Fish sauces, Bear's grease, Soda Water, Ginger Beer, Lemonade, Congreave matches and Warren's blackening'.

The apothecary in question acknowledged that he had no right to describe himself as a surgeon (McLachlan and McKeown, 1971). The Medical Act of 1858 provided the three licensing bodies with recognition under the framework of the newly created General Medical Council. The membership of the General Medical Council included nominees from the Crown, the representatives from the three licensing bodies namely the Royal College of Physicians, the Royal College of Surgeons and the Society of Apothecaries, the representatives from the universities and later representatives from the profession itself. With regard to medical education the General Medical Council had limited powers. The act of 1858 had not abolished the apprenticeship system which was regarded by some as a waste of time in the 'drudgery of the apothecary's shop' (Cameron, 1954).

The act of 1858 had intended to limit the right to practice in the subject of qualification only i.e. medicine and surgery. However, anybody holding a qualification either as a licentiate physician or a qualification of the society of apothecaries or the college of surgeons was free to practice either medicine or surgery with a single qualification. In 1859 a licentiate of the Society of Apothecaries was fined twenty shillings for describing himself both a physician and surgeon. Later, enforcement of this rule was not considered practical and the rule was not pursued (Cameron, 1954). Following the act of 1858, Oxford, Cambridge and Durham universities, the Royal College of Physicians, the Society of Apothecaries and the Royal College of Surgeons unsuccessfully attempted to establish a single unifying examination. In 1878 this plan was abandoned. Later, under the act of 1886, dual qualification in medicine and surgery became necessary for registration with the General Medical Council.

1.2 (c) Quackery in Health Care

The poor, destitute, desperate, socially deprived and ill-informed have in all ages and all societies fallen victims to quackery. Prior to any enforcement of state rules governing the practice of medicine and other health care professions, quacks and charlatans would have flourished in all civilisations. For example the law books of Yajnavalkaya from India (around 1000 BC) stated that a qualified and competent doctor incurs no

guilt if his patient dies, but a quack in such cases should be punished (Basham, 1976). A medical manuscript of Susruta also from ancient India stated that a physician should be sanctioned by the King; a quack doctor kills people out of greed, because of the fault of the King, meaning that the state had been negligent in enforcing proper rules (Basham, 1976).

In Rome under Felix Cornelius (79-82 BC) an unqualified physician was liable to be arrested if, because of his fault, a patient died (Jakobovits, 1959). According to Millerson (1964) by the end of the 15th century, the medical profession in Europe was 'in a deplorable state due to the large numbers of untrained, unskilled practitioners and quacks'. An 18th century poster in London proclaimed:

'Dr Frederich undertakes to cure the Gout and Rheumatism, without any return Likewise, cures the Yellow Jaundice, Stiching in the side.

He likewise cures anybody who is bit by a Mad Dog No cure No pay

(Gottschalk et al, 1969).

During the early 18th century, doctors and lawyers were portrayed in the literature as pettifoggers and quacks taking advantage of the population's misery and misfortune. In England the Society of Apothecaries made efforts to prohibit quacks from practising medicine, to raise the educational standards and enhance the social and professional status of apothecaries. Because of opposition from the physicians and surgeons and also chemists and druggists, the Society's desire to seek the prohibition of medical practice by the untrained was not

successful. The apothecaries act of 1815 simply gave the Society powers to organise and supervise apprenticeships, examinations and licensing, but did not prohibit medical practice by the unqualified (Elliott, 1972). The society obtained jurisdiction over England and Wales and worked out a system of examination and awarded LSA, now LMSSA.

At a time when quackery was widespread and there was disorder in the provision of medical service, the act of 1815 was the beginning of the organisation of medical profession, properly manifesting itself in the subsequent act of 1858. Throughout the middle ages and until the middle of the 19th century when the General Medical Council was formed under the Medical Act of 1858, quacks and charlatans had flourished. In 1858 the physicians, surgeons and apothecaries were all combined to form a unified medical profession. One of the aims of the the act was to enable the recipients of medical services to distinguish the qualified medical practitioners from the unqualified.

The Provincial Medical and Surgical Association formed in 1832 appointed a committee on medical ethics in 1849 and two years later, following a report by its committee on quackery, another committee was appointed to form a code of ethical laws (The British Medical Association Handbook of Medical Ethics, 1980).

1.2 (d) Quackery in Eye Health Care

In the field of ophthalmology, there were no restrictions to prohibit

quacks from setting up as oculists. For example William Read (died 1715) started his career as a tailor and subsequently became a successful quack oculist. William Read had an opportunity to treat Queen Anne for which he was knighted in 1705 (Porter, 1989).

During this period, under royal patronage, a quack named Joshua Ward (1685-1761), describing himself as a physician, even managed to obtain a personal exemption from being searched for medicines by the officials of the Royal College of Physicians (Porter, 1989). An itinerant oculist named John Taylor (1703-72), son of an apothecary from Norwich with regular surgical education and MDs from Basle, Liege and Cologne was describing himself as 'Ophthalmiator Pontifical Imperial and Royal' and claiming that he had treated several members of the continental royal families (Porter, 1989). Taylor regarded ophthalmology as 'distinct and independent of every other branch of physic', meaning the art of healing After moving into a new town, Taylor's advertisements and handbills usually extended an invitation for a public show of his ophthalmic expertise (Porter, 1989). In 1747 in Northampton Taylor described himself as Oculist to the King of Great Britain and invited local gentry to witness his method of restoring sight, to hear his lecture on the 'alterations of the eye' and to watch a dissection of the eye and an exhibition of 'all its various beauties displayed' (Porter, 1989).

1.3 Historical and Social background of Optometry

1.3 (a) Development of optics and topics related to Optometry and Ophthalmology

Philosophers and scientists in different civilisations and cultures had shown keen interest in optics and vision which is evident from optical theories and speculations. During the 6th century BC the Buddhist texts had dealt with optical theories (Malik, 1921). Prior to Euclid (300 BC), Pliny (23-79 AD), Ptolemy (150 AD) and Galen (131-210 AD); Empedocles (d. 430 BC), Plato (428-347 BC) and Aristotle (384-322 BC) had already speculated about light and optics. Much later, Al-Hindi or Al-Kindi (800-873) and Alhazen (965-1040 AD) made contributions in optics. Abelard (1079-1142) from Bath supported Plato's works. A Franciscan monk, philosopher, scientist and Oxford scholar Roger Bacon (1214-92) studied the works of Alhazen and others with his teacher Robert Grosseteste (1175-1253) and made further contributions in the field of optics. Bacon was also a recipient of a Doctor of Theology degree from Paris. In his Opus Majus, Bacon recommended the use of a lens for old people with poor or weak eyesight (Bridges, 1897-1900; Burke, 1929).
The Polish scientist Witelo (born 1230) experimentally determined the value for the angle of refraction (Wiet et al, 1975). Leonardo da Vinci (1452-1519) made further contributions in the field of refraction by attempting to identify the lens and the cornea as the refracting components of the human eye. Plater (born 1536) contributed in the field of ocular anatomy, followed by Scheiner in 1619. During the 17th and 19th centuries notable

contributions were made in ocular anatomy and physiology :- Mariotte (1620-1684), the blind spot of Mariotte; Meibom (1638-1700), Meibomian glands in the lid; Zinn (1727-1759), suspensory ligament of the crystalline lens; Descemet (1732-1810), Descemet's membrane of the cornea; Fontana (1720-1805), spaces in the iris; Tenon (1724-1816), Tenon's capsule surrounding the eye; Horner (1793-1853), Horner's muscle in the lid; Cloquet (1790-1882), Cloquet's canal in the vitreous; Schlemm (1795-1858), Schlemm's canal in the sclera; Henle (1809- 1885), Henle's layer in the retina; Bruch (1819-1884), Bruch's membrane in the choroid; Brucke (1819-1892), Brucke's fibres in the ciliary muscle; Bowman (1816-1892), Bowman's membrane in the cornea and Muller, (1820-1864) Muller's fibres in the ciliary muscle.

Maurolyco (1495-1575) explained myopia and presbyopia and his work in physiological optics was later incorporated by Johannes Kepler (1571-1630). Kepler (1604) attempted to formulate general laws of refraction, improving on Alhazen. Snell (1591-1626) worked on the laws of refraction and photometry. In 1673, Descartes restated Snell's laws. Grimaldi (1618-63) and Hook (1665) worked on the theories of diffraction. In 1675, Roemer suggested that light had finite velocity. In 1672, Isaac Newton published his first paper, reporting his experiments with prisms, in the Philosophical Transactions of the Royal Society, speculating on the arrangement of the spectrum.

In 1678, Huygens, differing with Newton, announced his theory at the Academie des Sciences, publishing it in 1690 in Traite de la Lumiere.

Euler's work was published in 'Lettres a une princesse d'Allemagne' (1760-62) supporting the wave theory of light. Boscovich (1711-87) proposed his own light theory. Joseph Priestley (1733-1804) published 'History and Present state of discoveries relating to Vision, Light and Colours' in 1772; an 18th century update.

Comte de Buffon (1707-88) experimented with sunrays. Pierre Bougner (1698-1758) constructed a photometer and was able to show that light intensity was inversely proportional to the square of the distance from its source. Snell (1591-1626) had already implied this earlier. Lambert (1728-77) summarised the works on photometry in 1760.

Scheiner's work in 1619 formed the basis of the construction of an optometer, although da Vinci's simple concept antedates Scheiner. Despite the fact that de La Hire (1640-1718) had constructed a simple optometer by 1696, Porterfield (1696-1771) was first to use the term optometer. Thomas Young (1773-1829) later developed the instrument. In 1737 Porterfield published his works on physiological optics (Levene,1977).

Maurolyco (1495-1575) had already discussed myopia and presbyopia and in 1696 Hamberger explained the optics of hypermetropia. Janin (1731-99), a French ophthalmologist had described three types of vision, myopia, presbyopia and perfect vision. Hypermetropia was further explained by Wells(1757-1817) and Ware (1756-1815). In 1623, Benito Daca de Valdes published his book on the remedial use of spectacles. The three sections of his work covered the 'nature

and properties of eyes', 'remedies for the sight by means of glasses' and 'dialogue between various persons and a master maker of spectacles'. In 1692, William Molyneux had recognised that spectacles were 'for the help of the defective eye; whether they be those of old men or those of pur-blind'. The term pur-blind to describe myopia was also used in 1656 when Beal, in a letter, noted that his brother Captain Richard Beal had observed that King Adolphus was short-sighted, almost pur-blind (Levene,1977). Barrow (1630~77), Newton (1642-1727), Smith (1689-1768), Bouguer (1698-1758) and L'Hopital (1661-1704) had made contributions towards understanding astigmatism, prior to Thomas Young's discovery and measurement of astigmatism described in his paper in 1800 on the 'Mechanism of the Eye'. In 1825, Airy also announced his independent discovery and correction of astigmatism.

Von Helmholtz (1821-94) contributed in the field of physiological optics and is usually credited with the invention of the ophthalmometer and the ophthalmoscope. However, the Cambridge mathematician Babbage (1792-1871), the founder of the British Association for the Advancement of Science in 1831, had already constructed an ophthalmoscope four years earlier. The ophthalmometer had already been described earlier by Ramsden (1735- 1800). Leeuwenhoek (1632-1723), Jurin (1684-1750), Albinus (1697-1770), Young (1773-1829), Home (1756-1832), Bowman (1816-92) contributed towards understanding the mechanism of accommodation. Hooke's (1679) method of testing visual acuity involved measuring the minimum separable at a specified distance. The

first attempt to achieve uniformity in the determination of visual acuity was published by Kuchler in 1843.

Around the same time as Kuchler (1811-73), Fronmuller (1809-89) published his version of a trial set. In 1838, Cox had made his own trial set. However, both Ramsden (1735-1800) and Cary (1759-1825) had already designed their own trial sets earlier.

In 1872, Monoyer (1836-1912) had suggested the use of the term Dioptre and in 1875, the ophthalmological congress at Heidelberg approved the term, largely due to the efforts of Donders (1818-1879), Nagel (1833-95), Javal (1839-1907) and Wells (1824-79) (Levene,1977).

The early concepts of corneal neutralisation of Leonardo Da Vinci (1452-1519), Descartes (1596-1650), Thomas Young, (1773-1829) and De La Hire (1640-1718) contributed towards the later development of contact lenses. During the 19th century, approximately sixty years after the appearance of the writings of Sir John Hirschel (1829), the first contact lenses were made during 1887-89 by F.E.Muller, an artificial eye maker and recipient of an honorary degree of Doctor of Medicine. Other contributions in the contact lens field were made by Fick (1887), August Muller (1889), Kalt (1888- presented by Panas before the Paris Academy of Medicine) and Sulzer (1892).

An important development during the late 18th century was the invention of bifocals, generally attributed to Benjamin Franklin (1784); other noteworthy contributors from the same period were Sir Joshua Reynolds, Benjamin West,

Samuel Pierce and Peter Dollond.

References for all the above medieval scientists are from:- Bernal, (1969); Gottschalk et al, (1969); Hirsch and Wick, (1968); Levene, (1977); Pareti, (1965) and Wiet et al, (1975).

1.3 (b) Mention of Spectacles in European Literature, Paintings and other Historical Evidence

Mention of spectacles in literature and depiction in paintings suggests a rudimentary phase of optics in that period. In a Florentine manuscript (MS) from 1299 'Trettato del Governo da Sandra di Pipozzo di Sandro Fiorentino' spectacles (occhiali) were mentioned. Another MS from 1322 mentioned spectacles (occlialium) in an inventory of personal items of the Bishop of Florence. In another MS dated 1329 from Tuscany, a merchant complains of stolen goods which included spectacles (ochialium). Spectacles were also mentioned by the Italian poet Petrarch (1304-1374).

In a sermon dated 23 February 1305, Giordano da Rivalto stated that 'it was not yet twenty years' since the art of 'occhiali' making was discovered i.e. spectacles first appeared in Italy around 1286. Rosen (1953,1956) believed that spectacles were invented in Italy by an unknown layman of Pisa during the 13th century. However, spectacles are depicted in an Italian fresco dated 1352 by Tomasso da Modena showing Cardinal Ugo di Provenza in the Sala del Capitolo at the Seminary of San Nicolo in Treviso; believed to be the

earliest painting depicting a pair of spectacles. Numerous subsequent European paintings depict spectacles; France-1380, Germany-1404, Prague~1471, Spain-1441 etc. In Germany in the songs of the Minnesingers from 1260-1280 'Die Brillen' were mentioned (Von Rohr,1923). A portrait of Thomas More, Lord Chancellor during the reign of Henry the Vlll and beheaded for treason in 1535, also depicts a pair of spectacles.

During the 14th century spectacles were depicted in paper watermarks and in the 15th century spectacles appeared as part of emblems. Also during the 15th century, spectacles were depicted in a sculpture from Dijon (France) and Salisbury (England). Spectacles formed a part of the 16th century heraldic coats of arms of Jacques Gallouchau, Canon of the Cathedral Church of St. Martin in Tours (France) and also the coats of arms of a convent in south France from the same period.

Spectacles were mentioned by Chaucer (1340-1400) in the 'Tale of Wyfe of Bath' from the Canterbury Tales and by Lydgate (1370-1451) in his poem Lykpenye. The English writers Hoccleve in 1414 and Thomas Newberry in 1563 mentioned spectacles in their works. Spectacles were also mentioned in the works of William Shakespeare (1564-1616). The diary of Pepys (1633-1703) contains his personal notes from January 1600 until May 1679 and mentions spectacles.

An anthology by Flick (1951) covers many references to spectacles in Europe between the 14th and the 20th centuries. However, the earliest printed

illustration of spectacles appeared in the Nuremberg Chronicle from 1494.

1.3 (c) The Guilds of Spectacle Makers in Europe

It could be argued that in Europe the rudimentary phase of professionalisation in optometry began with the formation of spectacle makers guilds during the medieval period. Consistent with then prevailing social attitudes the spectacle makers (predecessors of the present day optometrists) were regarded as non-professional artisans.

Although early social guilds could be described as forerunners of the later craft guilds, the rationalised appearance of such guilds incorporating several features of the earlier collegia and confraternities emerged in Europe around 1100 AD. The craft guilds even described themselves as fraternities (Black, 1984). The medieval craft guilds differed considerably in size, wealth and social status and sometimes the authorities in towns and cities determined the permitted number (Black, 1984). It is noteworthy that Aristotle (384-322 BC) in Greece had assigned a strictly subordinate place for artisans in his polis and an almost similar social attitude had prevailed in medieval and later Europe. An important reason for the development of craft guilds would have been a desire to create an autonomous corporation on the part of some members of the community of artisans. Economic motives had probably established priority over other considerations, and by the end of the 13th century self regulating measures taken by the corporations towards monopoly appeared as the promotion of

collective self interest for the guild members. The earliest spectacle makers guild in Europe was formed in Venice in 1320 and by the mid 14th century another one was formed in Antwerp in Belgium, followed by two others during the later half of the 15th century, one in Nurnberg and the other in Regensberg (Dreyfus, 1988). In 1465 under King Louis the XI the spectacle makers were attached to the guild of haberdashers and upholsterers. Spectacle makers in France were not even considered worthy of an independent guild (Champness, 1952).
This trend continued in France since in 1581 under King Henry the III the patent of membership was granted to the combined crafts of mirror makers, toy makers and spectacle makers.
In England, for spectacle makers the most important event was the granting of a royal charter of incorporation on 16 May 1629 by King Charles I and the formation of the Worshipful Company of Spectacle Makers. Royal patronage for spectacle makers was evident in the early 18th century; the name of Edward Scarlett (1677-1743) is recorded as spectacle maker to King George II (Champness, 1952).

1.3 (d) The abolition of guilds

The medieval jurists and the church regarded the guilds as voluntary craft colleges, ignoring the mutual aid aspect. Because of economic and political reasons the state and church were in agreement in not promoting the guild concept. The rulers feared that the spreading of guild socialism and the

overall loyalty to the guilds may outweigh loyalty to the state. During the 13th century, Pope Innocent the IV (d. 1254) had defined the craft colleges as voluntary and not obligatory, also declaring that the craftsmen were not under any compulsion to join or enter guilds and were completely free to leave at will.

During 1276 AD the artisans and craftsmen were generally considered serfs and in order to seek dignity in society and raise their standing and morale they often used examples of skills mentioned in Christianity. Interestingly, in ancient Rome under Diocletian (284-305 AD) even medical skills were considered inferior and mainly practised by former slaves of Greek origin. Craftsmen believed that their entitlement to form guilds was in pursuit of social justice. The Pope had accepted that with a minimum of three members automatic recognition of a guild should follow, provided such a formation was for a just cause which included defending justice and preventing fraud. Whereas within the guild community their own rules created a sense of economic security and social justice, the policies pursued by merchant capitalists often created economic imbalance and led to dissatisfaction within the brotherhood of the guild community.

The city authorities often revised the guild rules and even dissolved a guild altogether for the protection of consumers, although in reality it was for economic and political reasons. For comparison, in our times the political and media obsession that professional autonomy, usually described as a

monopoly, is not in the best interest of the consumer appears fairly similar to the medieval political philosophy and social propaganda. The fact that professional autonomy is based upon lengthy specialised training and skills is often conveniently overlooked by the popular media in our times.

Medieval guilds in Europe were subjected to a mixture of Roman and Germanic legal and state traditions. The city authorities used either tradition whenever it suited them. There was, however, a traditional difference in Roman and Germanic attitude towards guilds. Whereas the Roman tradition asserted the authority of the state, the Germanic tradition mostly upheld the self-governing rules of the guilds.

The Roman laws and traditions severely restricted the rights of people to form Collegia which had to be approved by the state. By comparison, the Germanic tradition accepted the formation of guilds as a matter of collective right of the people and guild elections were simply ratified by the civic authorities.

Traditionally, anyone with a trade complaint went to the guild court but the jurists gave the plaintiff a choice between the guild and city courts. This option undermined the authority of the guild court within the guild community and society at large.

Guilds did not feature in the medieval political system of many European states. For example, the Italian writer Gianotti did not consider that craft guilds should be allowed political citizenship. When Marsiglio (1275-1342) proposed better participation of the guilds in civil life, his writings were declared heretical and he

was ex-communicated. The concept of co-sovereignty of the guilds with the state threatened the paramountcy of the state and was an important factor in the abolition of guilds. In England the guilds had been in decline since before 1750 and were legally abolished in 1835. However in 1832, shortly before the abolition of guilds, a provincial medical and surgical association was formed which became the British Medical Association in 1856.

Many of the guild ideals have survived in the form of trade unions, co-operative movements and professional associations. In France the craft guilds were abolished in 1791 as part of the revolutionary measure by the republicans, although some less visible compagnonnages survived until the 19th century. In the 18th century Germany various means were used to weaken the guild system. In 1848 the German guilds attempted to create a national organisation. However, by 1869 the guilds were abolished in Germany. The guilds in Belgium and the Netherlands were abolished when these were under French administration. In Spain and Portugal the privileged associations of craftsmen were abolished during the revolutionary period of 1833-1840.

In Italy the guilds were abolished in 1864.

Some parts of Switzerland still have old guilds known as Zunfte or Gilds without any special privileges. However, in Austria and Germany attempts have been made to replace Zunfte with Innungen i.e. associations.

1.4 Development of optometric profession in Europe

1.4 (a) Optometry in Continental Europe in the late 19th and early 20th century

An optical school was established In Vienna in 1898 and in 1909 a school of optics (Fachschule fur Optiker) was established in Mainz. By 1917 Jena school of optics was established although short courses were provided in 1913 by Zeiss (Hofstetter, 1948). In 1924 under the medical laws of France a Paris optician named Odin was accused of using a medical instrument because he had used a retinoscope for the purposes of refractive assessment objectively. Odin lost the case. In 1930, a Dutch optician named Paul Bas from Amsterdam was arrested for practising refraction. Subsequently judgement was given in his favour (Hofstetter, 1948). Optical or optometric training of varying standards developed in continental Europe. In our times some progress has been made for the provision of recognised education in optometry in several countries of Europe. However, despite geographical proximity, optometry in continental Europe in the early 20th century did not develop on the lines of the United Kingdom.

1.4(b) Optometry in the United Kingdom until the late 19th century

'A blessing to the aged' was the motto on the coat of arms of the Worshipful Company of Spectacle Makers. However, the formation of craft or spectacle maker's guilds did not imply or signify any professional status for the artisan members. The period around the emergence of the Spectacle

maker's guilds in England and the rest of Europe and prior to the formation of the British Optical Association in 1895, laid the foundation for the future development in the field of optometric profession. In England between the 17th and 19th centuries spectacles were supplied to the public either from a spectacle maker's shop or by a peddler or as part of merchandise in a shop selling a variety of goods.

Self selection of spectacles combined with some form of suitability test would have been carried out by the purchaser and in some cases with the help of the seller. The spectacle maker eventually evolved into spectacle fitter and supplier.

In 1756, at a court meeting of the Worshipful Company of Spectacle makers held on 26 December, it was agreed that an applicant named John Berge be apprenticed and bound to Peter Dollond (1730-1820) who was described as an optician. This was the first use of the term optician in the company's records (Champness, 1952; Barty-King,1986). After completing his apprenticeship, John Berge stayed with Peter Dollond until 1791.

During the 18^{th} and 19^{th} centuries an attempt was made to determine refractive errors on an individual basis due to the pioneering works of William Porterfield (1696-1771), Ware (1756-1815), Thomas Young (1773-1829) and Wells (1824-79), all of whom were physicians (Levene, 1977: Hirsch and Wick, 1968).

The construction of a simple optometer was carried out by De la Hire (1640-1748), a mathematician.

Later, Thomas Young experimented with his optometer testing many people

including his instrument maker William Wollaston (1766-1829) who was also a physician. However, the demand for spectacles was probably age related. During the early 19th century a physiologist named Purkyne mentioned an acuity apparatus which was made by an optician named Tauber.

Numerous developments took place between the 17th and 19th centuries in the field of physiological optics and optometric instrumentation, although experiments were mostly part of a philosophical or scientific pursuit undertaken by aristocrats, physicians, physicists, mathematicians, astronomers, theologians etc. Around 1780, the newspaper advertisement of Gustavus Katterfelto claimed expertise in various therapies including philosophical, mathematical and optical. In his advertisements Ketterfelto stressed aristocratic connections mentioning a duke, several lords, ladies and gentlemen of distinction (Porter, 1989).

In England during the 18th century, despite some resistance, the title 'dentist' from French 'Dentiste' was adopted and similarly the shorter title optician (from French opticien) replaced spectacle maker.

Taking into consideration relevant developments in the field of medicine and dentistry in the 19th century, some opticians and spectacle makers in England and continental Europe would probably have realised that formal training leading to a socially acceptable and state recognised qualification and registration and also a regular journal devoted to their speciality was necessary.

In the 19th century, medicine and ophthalmology did not recognise opticians as professional people. In 1860, a clinical assistant named J. Soelberg Wells

from Moorfields Eye Hospital stressed the need for care in the choice of spectacles and referred to 'unscientific opticians' (Mitchell, 1981a). During this period people from different trades e.g. hawkers of pots and kettles and even publicans were allowed to set up as opticians or spectacle peddlers (Mitchell, 1981a).

The Worshipful Company of Spectacle Makers in England was approached by some opticians to set up a course of instruction in optics leading to a qualification, without any success. It was not surprising that on 2nd of April 1891 a journal appeared with the title 'The Optician' with the sub-title ' The Organ of the Optical, Mathematical, Philosophical, Electrical, and Photographic Instrument Industries; and Review of the Jewellery and Allied Trades'. The journal was produced by Messrs Hyatt-Woolf and Hayman from Fleet Street. Charles Hyatt-Woolf was the editor although no mention was made of the editor's name (Mitchell, 1981 b).

An editorial in August 1891 suggested certification for the opticians and the subsequent correspondents included a surgeon oculist opposed to the idea and especially to training in those areas requiring medical knowledge. However, another medical correspondent, although agreeing with his medical colleague, commented that some form of training was necessary. The title of the journal was changed in 1917 to 'The Optician and Scientific Instrument Maker and Journal of Optometry'. William Hardy joined 'The Optician' in 1925 as assistant to Charles Hyatt-Woolf (Crundall, 1981). By 1926 a sub-title 'The Optometrist and Optical Engineer' was adopted which was later dropped.

1.4 (c) Optometry in the United Kingdom after the late 19th century

The British Optical Association was formed in 1895 and the first examinations were conducted in 1896. In 1897 the Worshipful Company of Spectacle Makers began considering the possibility of examinations and the award of a company diploma. In March 1898 the SMC syllabus was published and in November 1898 the first examinations of the company were held at the Northampton Institute, the ancestor of the present day City University. Following a meeting with the British Optical Association Council, the Spectacle Makers Company added sight testing to its syllabus in 1904. This was an important historic development for professional optometry.

After 275 years, a craft guild had not only survived in Europe but was transformed into an examining body and had laid the foundations for professional development for future optometrists and providers of eye healthcare. Also in 1904 an optical association was formed in Scotland.

In 1906 a society of chemist-opticians was formed, followed by the beginnings of the National Association of Opticians in 1910. Although in 1903 it was announced in The Optician that regular classes in optical subjects were to start at the Northampton Institute; shortly before the first examination of the Spectacle Makers Company in November 1898 a course of instruction was provided at the Institute with the Company's help and Lionel Laurance as instructor. In 1905 an optical convention was held at Northampton Institute, a definite landmark in the early process of consolidation for the optometric

profession.

By 1902 optics was taught at the College of Technology in Manchester. In the mid 1920's the teaching of optics commenced at Bradford Technical College (Pickwell,1987) and by 1926 optics was also taught at Birmingham Technical School. By the mid 1930's optics was taught at Cardiff and Edinburgh and by 1941 in Glasgow. The first full-time course in ophthalmic optics commenced in 1904 at Northampton Polytechnic followed by another full-time course in 1928 at Manchester.

In 1905 a General Board of Opticians was formed in England with the hope of attaining statutory registration. Because of a decision taken by the Worshipful Company of Spectacle Makers to seek statutory registration independently, some disagreement with the British Optical Association followed and the board broke up.

William Hardy (editor of the Optician from 1938 until 1966) stated in 1981, in the 90th anniversary issue of the Optician, that 'between 1895 and 1904 nine organisations--all, except one, newly formed--were claiming to be representatives of opticians of the time, including jeweller and chemist opticians. A Scottish Optical Association came on the scene in 1904 and hard on its heels came the Institute of Ophthalmic Opticians, founded at a meeting in the house of Lionel Laurence' (Hardy, 1981). In William Hardy's historical article, although he mentions nine optical organisations, he does not give their names.

However, the fact that between 1895 and 1904 several optical organisations existed in the United Kingdom proves that there was widespread enthusiasm for the future of the optometric profession. An important event for the future of optometry was a court case in 1910 brought by a certain Miss Markham (a student aged 23) against an optician named R. Thomas (a member of the British Optical Association) from Manchester for failing to 'diagnose' conical cornea, a condition she was suffering from when she had consulted the defendant five times between 1907 and 1909. His defence was that opticians do not diagnose disease. Counsel for the defence stated that the action was in substance brought against `an ordinary tradesman' and optician who did not possess the skill of a distinguished Harley Street oculist (Mitchell, 1981a). The court case was eventually decided in the plaintiff's favour after a retrial. The court case, known as Markham vs. Thomas, was an event which influenced the training and the mode of practice in the field of optometry. The loss of the case prompted the British Optical Association to introduce examinations in ocular disease.

Between 1905 and 1958 two attempts were made in the UK (1927 and 1936) to secure statutory registration without success.

The Opticians Act of 1958 was a definite landmark for British optometry and for the development of world optometry. The use of diagnostic drugs was included in the act. It should be noted that the BOA examinations had included the use of drugs in refraction as far back as 1924 (Mitchell, 1981a). The Society

of Chemist-Opticians, formed in 1906, may have influenced British optometry in the use of diagnostic drugs. The responsibility for recognition of abnormal ocular conditions i.e. of ocular and related pathological conditions in optometric practice for the purposes of medical and ophthalmological referral was made a part of statutory requirement under the Opticians Act of 1958.

With the aim of developing clinical practice in optometry, a Refraction Hospital, ancestor of the present day Institute of Optometry, was formed in 1922 in London by the Institute of Ophthalmic Opticians. As previously stated the Institute of Ophthalmic Opticians was formed in 1904. In 1928 two more Refraction Hospitals were formed, one in Leeds and the other in Glasgow. However, these two institutions did not survive. In 1946 an Association of Optical Practitioners was launched following the amalgamation of the Institute of Ophthalmic Opticians and the Joint Council of Qualified opticians.

The transformation of polytechnics into colleges of advanced technology in 1956 and into universities in the mid 1960's were significant developments in the sphere of optometric education. Under the Opticians Act of 1958, practice of optometry was regulated by the General Optical Council (GOC). Registration with the GOC became a statutory requirement in order to practice optometry or dispensing optics legally in the UK. To become qualified as an optometrist an approved course of training had to be completed. Since the mid 1960's a Bachelor of Science degree is gained

after three years of full time study (four years in the case of Glasgow Caledonian). Currently the following British universities offer courses in optometry, accredited by the GOC :-. Anglia Polytechnic University, Aston University, Bradford university, Cardiff University, City University, Glasgow Caledonian University, University of Manchester Institute of Science and Technology and the University of Ulster. After graduation, a candidate must complete a pre-registration year and qualifying examinations of the College of Optometrists. The year involves full time training and experience of practice, approved by the College of Optometrists, under the supervision of a registered optometrist at a practice or a hospital.

With the transformation of the Worshipful Company of Spectacle Makers into an examining body for optometrists during the end of the 19th century and the early part of the 20th century, those only supplying or selling spectacles formed a guild of dispensing opticians in 1925. The British Optical Association had not considered that the dispensing aspect of optometry merited any examination until 1928, when a separate section was introduced as part of the optometric qualifying examination, which later also lead to a separate dispensing associateship. In 1929, the guild of dispensing opticians and the British Medical Association formed the National Ophthalmic Treatment Board (NOTB), in order to provide a medical ophthalmic service to the public as against a 'non-medical' optometric service. The National Ophthalmic Treatment Board was dissolved after 61 years.

Under the Opticians Act of 1958, the practice of dispensing optics was also regulated by the General Optical Council. To become qualified as a dispensing optician, an approved course of training had to be completed. Currently, there are several ways to train as a dispensing optician. Dispensing optics students are offered full time courses of three years duration (including pre-registration year), day release courses of three years duration (linked to employment with a qualified and registered dispensing optician or an optometrist) or distance learning courses provided by the Association of British Dispensing Opticians..

Full time and day release courses are offered at the following institutions:-

Anglia Polytechnic University, Bradford and Ilkley Community College, City and Islington College and Glasgow Caledonian University. A two- year full time or three-year part time course is offered at City and Islington College with biological sciences and clinical practice modules being taught by the department of optometry and Visual Science at City University. A full time course in optical management of three years duration, leading to a Bachelor of Science degree and the Fellowship Diploma of the Association of British Dispensing Opticians (ABDO) is also offered at the Anglia Polytechnic University.

Distance learning courses of three years duration are offered by the ABDO. Distance learning students attend the ABDO College at Godmersham (Canterbury), for two separate fortnights during each course year. The pre-registration year is counted as part of the course.

1.4 (d) Professionalisation of optometry in the United Kingdom

It could be argued that the rudimentary phase of professionalisation in British optometry began in 1629 with the formation of the Worshipful Company of Spectacle Makers; the real process of professionalisation, however, began in 1895 with the formation of the British Optical Association, the penultimate phase being the passing of the Opticians Act of 1958. With the transformation of the colleges of advanced technology into universities in the mid 1960's, providing optometric education with academic status, at least the structural aspects of the professioinalisation process reached concluding stages. However, with continuously changing characteristics the optometric profession is still evolving. The functional aspects of the professionalisation process in optometry have so far not reached the final stages.

It could be stated that in the United Kingdom the final phase of professionalisation means the obtaining of a royal charter by a professional organisation, mainly in the health care professions. A royal charter for a professional college in the optometric profession was suggested by 1972 (Agarwal,1972).

British optometry struggled for over 60 years before securing state recognition in the form of statutory registration and an impressive legislation by any standard. The Opticians Act of 1958 was comprehensive. However, the 'Report of the Interdepartmental Committee on the Statutory Registration of Opticians' (1952) under the chairmanship of Lord Crook, formed the basis of the Act of 1958. Although the act was passed in 1958, the participation of ophthalmic

opticians in the National Health Service in 1946 had already advanced the process of professionalisation in optometry, signifying state recognition of professional competence of the optometric profession. Since the fees for sight testing were directly paid by the state and there was a provision for the supply of spectacles with no charge to the patient, the inception of the NHS provided an unique opportunity for further development to the optometric profession in the UK, without parallel anywhere in the world, despite the fact that the 'supplementary ophthalmic service' was intended only as an interim measure until a full hospital service could be organised. However, the supplementary service was allowed to continue and was later replaced with the permanent General Ophthalmic Service, which is a testimony of professional competence in the delivery of eye health care by optometrists in the UK.

The amalgamation of the National Association of Opticians and the Institute of Optical Science (formerly the Institute of Chemist-Opticians) in 1956 and 1962 respectively with the British Optical Association provided an opportunity for consolidated development. However, a division in the mode and style of optometric practice continued especially on the question of the projected professional image. Many independent practitioners considered that a commercial outlook did not promote a health care professional image, either socially or inter-professionally. Issues like the display of optometric appliances; the use of shared professional titles, descriptions

and nomenclature; the continued existence of corporate bodies and advertising divided the members opinions.

1.4 (e) The Scope of Optometric practice in the European Continent

With the exception of the UK and Ireland the scope of optometric practice in most of the EU is not geared towards screening for ocular conditions causing visual impairment or blindness (Table 1.1). However, in the Netherlands an optometry degree course at the Hogeschool van Utrecht was recently accepted by the General Optical Council for registration as an optometrist in the United Kingdom. The titles optician and contact lens specialist remain unprotected in the Netherlands, anybody can open an optical establishment in the country and the contact lenses may be fitted in a fish and chip shop (Grit, 2002). It should be stated that in the UK although the titles ophthalmic optician and optometrist are protected under the present laws, it is not clear whether the title optician is also protected.

An optometry degree course in Norway is developing on the lines of British optometry and the Norway school has already invited the GOC as visitors for comments and advice. Norway also allows the use of some diagnostic drugs e.g. cycloplegics. Norway, although not in the EU, is mentioned in this work because UK optometry was chosen as a model. However, the scope of professional practice in optometry in most EU countries does not extend beyond objective and subjective refraction (Table 1.2) and the use of fluorescein only (Table 1.1).

In most EU countries any kind of medical diagnosis and the use of diagnostic, therapeutic or emergency drugs is not permitted legally.

The scope of optometric practice can be defined as professional activity necessary for the provision of complete professional services. However, in most European Union countries such activities are only partially permitted. Some optometric procedures are carried out only in the absence of any specific laws prohibiting such activities.

In some cases the laws which are considered either obsolete or unreasonable are simply defied. For example, although the Italian laws dating from 1928 forbid Italian 'Otticos' from correcting astigmatism, the laws are ignored.

In some countries prescribing and dispensing of spectacles and fitting of contact lenses to children is not permitted without a prior medical examination and approval by a medical doctor. In the field of contact lenses in some countries very specific rules are applicable(Table 1.3). For example in Austria one of the particular requirements for contact lens fitters is that permission from an ophthalmologist must be obtained prior to the fitting of a first pair if there appears to be any contra-indication in the wearing of contact lenses. In Finland the prescribing of spectacles and fitting of contact lenses is not permitted by 'Optikkos' if there is any history of surgical operation on the eyeball, if there is evidence of any eye disease and if visual acuity can not be corrected to normal standard with spectacle lenses.

In France the 1945 and subsequent laws from 1952 and 1953 provide the

French Optician-lunetier the monopoly to dispense corrective lenses. Although the use of the title Optometrist is an attempt on the part of French Opticians to develop Optometry in France, several restrictions apply and the scope of practice remains limited. For example, only medical practitioners are permitted to use an apparatus to measure refraction. However, such restrictions apply mainly in the use of auto-refractors. Although French Opticians are permitted to carry out refraction for reimbursement by the National Health Service (Securite-Sociale), a patient must have a medical prescription or must state that new spectacles were needed because of loss or breakage of the old ones. In Belgium the titles optician and optometrist are not legally protected and a Royal decree, concerned with the profession of healing arts excludes many professional activities in optometric practice. The restrictions include the examination of the state of health, the detection of diseases and deficiencies, establishing any diagnosis, the establishment or the execution of the treatment of a pathological, physical or psychological condition whether real or imagined.

However, like the most other EU countries, Optometrists/Opticians in Belgium are allowed to perform objective and subjective refraction, correction of visual defects and dispensing of optical appliances.

1.4 (f) The Scope of Optometric Practice in the United Kingdom

In the UK and Ireland, the scope of optometric practice includes

primary and diagnostic eye care. For over 50 years optometrists in these countries have been carrying out screening for ocular conditions causing visual impairment or blindness.

As previously stated. the Markham v Thomas case of 1910 had highlighted the need for training and examination in the recognition of ocular disease, and by 1923 the council of the British Optical Association had included this subject in the new Fellowship examinations.

In the following year the examinations had also included the 'effects of mydriatics, miotics and cycloplegics' (Mitchell, 1981a). In 1947, the Eye Services Committee, in its report to the Ministry of Health stated that 'it was apparent that what had hitherto been described in a general way as "sight-testing opticians" would in the permanent eye service expect to be given responsibilities beyond the testing of vision' (Giles, 1952). Crook's report (1952) recognised that an ophthalmic optician should be able to recognise or detect an abnormal ocular condition for medical referral. The report stated that 'the ophthalmic opticians must, of course, have knowledge of ocular abnormalities, as they may in the course of their professional duties suspect the presence of disease'.

Under the Opticians Act of 1958, optometrists are under statutory obligation to recognise ocular abnormalities and take necessary further action i.e. medical referral when necessary. The paragraphs 9(1) and 9(2) of the terms of service for ophthalmic opticians in the National Health Service (General

Ophthalmic Services) Regulations 1974 (as amended) stated that 'where an ophthalmic medical practitioner or ophthalmic optician is of the opinion that a patient whose sight he has tested '[9 (2) b]' shows on examination any abnormality of the eye or otherwise requires treatment outside the scope of the general ophthalmic services'; 'he shall so inform the patient's doctor'. The statutory obligations, under the above regulations, were made identical for both ophthalmic medical practitioners and optometrists and in order to recognise any ocular abnormality it was necessary to carry out a complete eye examination.

The General Optical Council notice N15 for the guidance of the profession also stated that there was 'an obligation greater than that under National Health Service (General Ophthalmic Services) regulations, which is only to inform the person's general medical practitioner'. From the guidelines it was inferred that the optometric professionals were expected to perform appropriate diagnostic tests during the course of a routine eye examination, as and when necessary. After performing diagnostic tests, optometrists were expected to differentiate between those eye conditions which required medical referral, and those which did not. The difference between recognition or detection and diagnosis of ocular pathology, however, was considered a matter of interpretation. It was also stated in 1952 in Crook's report, that *'several witnesses representing medical and ophthalmological organisations have informed us that there is no difference between the detection and the diagnosis of ocular abnormality, the two processes being inseparable'.*

Since the Crook's report of 1952, optometry in the UK has steadily moved forward as a profession complimentary to ophthalmology. Under the revised rules of the General Optical Council on referrals that came into force on 1 January 2000, optometrists are allowed to manage the eye conditions of their patients, and only refer when clinically necessary. The General Ophthalmic Services terms of service were similarly amended and optometrists are required to refer patients 'when appropriate'. In 2001, the College of Optometrists published a framework for optometric referrals. It was stated in the framework that referral is intended to be for those conditions (sight-threatening or health-threatening) that 'the optometrist might expect to see deteriorate within the period of time before the patient's next optometric visit' (Framework for Optometric Referrals, 2001). It was further stated by the College that there are three categories of referral decisions made by an optometrist: emergency referral, urgent referral and routine referral. Optometrists are now encouraged by the General Optical Council to work in close partnership with the Hospital Eye Service. Direct optometric referral to Hospital Eye Service, as and when appropriate, now falls within the scope of optometric practice in the UK.

1.4 (g) The titles used and status of Optometry in the European countries

Unlike medicine and dentistry, the status of optometry as a profession in most EU countries does not exhibit any uniformity or harmony (Table 1.4).

However, there appears to be uniformity in the type of title used which is either optician or other titles like Optiker, Optikko and Ottico, meaning optician in the language of the country concerned.

The titles used in Germany protected by law are Augenoptiker or Augenoptikermeister which literally mean optician of the eyes or master-optician of the eyes; almost a reminder of the social status bestowed by membership of medieval craft-guilds and in a way consistent with the scope of practice of optometry in the present day Germany. Although in Germany the title Optometrist is also used, other titles and professional descriptions used by German optometrists' include Diplom Ingenieur Fachhochsehule (School Diploma in Engineering) or Augenoptikergeselle (Adviser Optician), Statlich geprufter Augenoptiker (State examined Optician) or statlich anerkannter Augenoptiker (State accepted Optician), signifying state recognition of the optician. In Belgium the profession of optometry is practised with many restrictions placed under the regulations of the Ministry of Middle classes and by Royal decrees on the basis of the laws dating from 1964 and amended in 1966, 1975 and 1988. These decrees have laid down the conditions for the exercise of the profession of 'optician' in commercial and handicraft enterprises, small and medium business and small industry. It would appear from these Belgian Royal decrees referring to opticians in commercial and handicraft setting etc. that some deeply rooted notions about spectacle makers or sellers and the status of optics from the craft guilds of medieval

Europe still exist in the minds of lawmakers in Belgium and other EU countries, hampering the process of professionalisation in optometry.

1.4 (h) The use of the title Optometrist in the United Kingdom

Within the optometric profession in the United Kingdom, a fair proportion of the membership had favoured the title optometrist for several decades. The argument being that the title optician was shared by the non-optometric groups which included dispensing opticians and optical manufacturers and therefore it created confusion and it was an obstacle to further professionalisation. Also the literal meaning of the term optician was maker and seller of optical instruments and spectacles. The title optician could not have acquired a new 'exclusive definition' because it was shared by the makers and sellers of spectacles. Interestingly in its report to the Ministry of Health in 1947, the Eye Services Committee also noted that 'there should be some clear distinction between "sight-testing opticians" who measure errors of refraction and fit and supply glasses, and "dispensing opticians" whose function consists in the fitting and supply of glasses prescribed by others' (Giles,1952). Although the Opticians Act of 1958 did not in any way specify the title optometrist, it was erroneously assumed that a new legislation was required for the use of this title.

It was further assumed that the use of the title optometrist was deprecated by the General Optical Council and that it was not a protected title. On the

contrary, section 22 (1 b and 2 b) of the Opticians Act of 1958 had, by implication, protected all those titles and descriptions meaning or implying ophthalmic optician or dispensing optician (Lapsus Linguae, Lapsus Calami, 1976 b; Agarwal,1979). However, in a symposium held in 1961 at the International Ophthalmic Optical Congress in London, Dr. Sorsby, a medical practitioner and also a member of the General Optical Council, stated that he hoped British opticians would not adopt the term 'optometrist' because interpreted it meant one who measures the eyes (Transactions of the International Ophthalmic Optical Congress, 1961).

Merely on the grounds of literal interpretation, Dr Sorsby's comments were not valid because with a similar analogy the term ophthalmology literally meant the science of eyes and it did not describe the professional work of an ophthalmologist as accurately as the title ophthalmic surgeon did. Furthermore, the literal definition of a term may be different from the professionally and socially accepted definition. For example, non-medical personnel trained in psychology use the title psychologist, and those dispensing hearing aids often describe themselves as audiologists; although it could be argued that the correct titles are psychometrist and audiometrist, because other titles etymologically similar to psychologist and audiologist e.g. cardiologist, dermatologist, gynaecologist etc. are used by medically trained specialists (Lapsus Linguae, Lapsus Calami, 1976 b).

Before the inclusion of the title optometrist in the new Health and Social

Security Act of 1984, frequent comments in the optometric press by some members of the optometric profession in the United Kingdom rejected the title optometrist, often in a non-constructive and illogical manner (Lapsus Linguae, Lapsus Calami,1976 a and b, 1977; Agarwal, 1979). Some correspondents, for whatever reason, even resented a change of title from ophthalmic optics to optometry by the UK university departments (Anon, 1977). The young optometrists decidedly favoured a change of title and in 1979 formed a British Association of Young Optometrists.

Leaving aside any discussion on the etymology or philological derivation and literal meaning of the terminology and professional titles related to the eye, the term optometer was first used by William Porterfield (1696-1771), subsequently the description optometry was used by Landolt in 1877, although Verschoor in 1865 had already used the description 'Optometers en Optometrie' (Levene, 1977).

However, the title optometrist was fully accepted in North America earlier than in the United Kingdom. The impact of the Health and Social Security Act of 1984 was evident in the UK optometric profession. In 1987 the Association of Optical Practitioners changed its title to the Association of Optometrists and also in 1987 the British College of Ophthalmic Opticians (optometrists) became the British College of Optometrists. In 1995 the College of Optometrists was incorporated by a Royal Charter. The AOP publication 'Ophthalmic Optician' also changed its title to 'Optometry

Today'. The London Refraction Hospital, formed in 1922, also decided to become the Institute of Optometry. Despite the adoption of the terms optometry and optometrist, following the Health and Social Security Act of 1984, by the professional organisations, university departments and the membership in general, in the official communications from the National Health Service the title ophthalmic optician was still used, with the title optometrist in brackets (FPN 534 HC (91) 11 WHC (91) 21, dated April 1991). Taking into consideration that an important factor in the process of professionalisation is an exclusive identity, whether social, interprofessional or statutory recognition; the title 'Opticians Register' gives an erroneous impression of the lack of professional exclusiveness, since the professional responsibilities of optometrists are certainly different from those of dispensing opticians. The publication of separately bound registers by the General Optical Council with the titles optometrists and dispensing opticians would no doubt provide exclusive identities.

It should be noted that both medical and dental councils provide exclusive identity in their registers and even the Health Professions Council (formerly council for professions supplementary to medicine) publishes a separately bound register for each profession. However, socially and inter-professionally, British optometrists have succeeded in acquiring an exclusive identity in recent years. It is significant that it was stated by the Irish health minister in February 2003 that `the Register of Ophthalmic Opticians is to be known as the Register of Optometrists in response to the international acceptance of this denomination' (Seanad Eireann, 2003).

1.4 (i) Advertising and Corporate Practice in Optometry in the United Kingdom

Presently advertising professional services is permitted by the professional bodies and the state because of the general view that the quality of the delivery of professional care is a separate issue and not relevant to advertising. However, issues debated by optometrists and the professional bodies in the United Kingdom during the early 20th century included advertising and corporate practice in optometry.

Advertising of professional services and optometric appliances became an issue during the early days of the British Optical Association. In 1897 an optician named Barrett was expelled from the British Optical Association for 'appealing to the public in misleading advertisements in regard to the association' (Mitchell, 1981a). Despite several warnings Barrett had continued to advertise that he was the only optician in town licensed by the Board of Trade etc. In 1921 the British Optical Association Council passed a resolution that a new member will have to undertake, before the award of a professional certificate, not to advertise 'free sight-testing'. By 1934 the councils of the British Association and the Worshipful Company of Spectacle Makers had issued a joint statement on the application of a code of ethics. Members were not allowed to advertise *`ready to wear spectacles'*, free advice or free sight-testing, any special method of sight-testing, any form of self testing or sight-testing by post (Mitchell, 1981a). The Opticians Act of 1958 upheld these rules. Ironically, fifty years later, under the Health and Social Security Act of 1984,

some of these rules were deleted.

Historically, both political and professional environment had favoured stringent restraints on healthcare providers. Healthcare professions developed legal and ethical restrictions on advertising or other characteristics of commercial practice. The exhibition and demonstration of appropriate characteristics was expected from healthcare professions both socially and by the state. Within the last two decades, many regulations have come under scrutiny from the state proposing deregulation on the premise that they inhibit free market healthcare delivery, keeping prices high and productivity and innovation low. It was overlooked by the proponents of deregulation that social expectations from healthcare professions are different when compared with simple commerce. Opposition to deregulation is based on the grounds that quality of care deteriorates in a commercial environment

Restrictions on commercial practice in optometry arose as a result of professional purge of commercial elements in the early decades of last century. In 1920, the British Optical Association Council expressed concern when an unqualified person named Bloom with unqualified managers and a chain of forty optical shops was advertising as 'the largest firm of opticians in Britain'. Bloom was successfully prosecuted for fraud and was later convicted and fined.

Report of the interdepartmental committee (Crook's Report, 1952) with Lord Crook as chairman stated the views of the professional bodies that 'if opticians

wish to be regarded as professional men, they should not advertise at all' and recommended that the 'General Optical Council should regard advertising as one of the subjects demanding their urgent attention'. The Crook report also noted that window displays 'would not be consistent with the development of professional status'. Window displays of optometric appliances do not signify specialised education or professional training (Lapsus Linguae, Lapsus Calami, 1977). The continued existence of corporate bodies in optometry brought divisions within the optometric community. It was felt by many independent optometrists that corporate practice carried some definite drawbacks. For example it was considered not possible for optometrists delivering eye care in corporate employment to participate in professional policy and decision making. It was feared that business and even `professional' decisions of corporate bodies taken at board level by commercial people and non-optometrists may affect the professional work of an optometrist. The medical profession does not allow corporate practice (Lapsus Linguae, Lapsus Calami, 1985). Lack of independent professional identity in corporate practice was then considered a point against the professionalisation process. In corporate practices, even if the name of an employee providing professional service were displayed, the public would still consider that they were the clients of the corporation, despite the fact that an individual professional would have provided eye care services. Although an individual optometrist would carry the legal

responsibility for his professional work, very often the recipients of professional services with whatever kind of dissatisfaction would consider it right to contact the business hierarchy of the company. It is one of the characteristics of a true profession that the circumference of responsibility in professional practice is not confined to mere legal obligations; moral, ethical and social considerations being an integral part of professionalisation. In corporate situations, there is an inherent danger of economic considerations preceding other factors. Unlike the independent or partnership mode of practice, an optometrist in corporate employment would not be allowed to carry total responsibility by that corporation. Crook's report (1952) pointed out that opticians working for corporate bodies 'could sometimes be subject to conditions of employment not altogether compatible with professional freedom, particularly in so far as the function of sight testing is concerned'. It was also stated in Crook's report that 'new ophthalmic optical companies should not in future be formed. Those already in existence should be permitted to continue at the discretion of the General Optical Council and *'there should ultimately be no place for ophthalmic optical bodies corporate in the future.'*

It was further stated that ophthalmic and dispensing optical companies should not carry on any business other than that of ophthalmic or of dispensing optics, and in both cases a majority of the directors should be registered optometrists or dispensing opticians. The council should

maintain lists of such companies, from which they should have power to remove offending companies. They should also have power to prevent a disqualified optician from practising in the employment of a company. Lord Crook's report also stated that 'the council should discourage opticians from forming partnerships with people who are not registered opticians'.

1.5 Summary

This chapter traces the origins and development of the profession of optometry from the earliest times to the present day, looking at how the process of professionalisation began in the UK, how it developed, and what meaning it holds in present times. Significant events have been the Markham vs. Thomas court case of 1911, the introduction of examinations in ocular pathology by the British Optical Association, Lord Crook's report, the passing of the Optician's Act of 1958 and university education in optometry. Under the GOC revised rules on referrals that came into force on 1 January 2000, British optometrists are allowed to manage the eye conditions of their patients and only refer when clinically necessary. In 2001, the College of Optometrists published a framework for optometric referrals. The scope of eye health care work and regulatory status of optometry in the UK today is compared with its scope and status in the European Union.

Eye examinations by optometrists and ocular pathology

	Use of Diagnostic Drugs	Use of Fluorescein Only	Referral to Medical Practitioner	Diagnosis of Ocular Pathology	Monitoring of Ocular Pathology
Austria		◆			
Belgium		◆	◆		
Croatia					
Czech Republic					
Denmark		◆	◆		
Finland		◆	◆		
France		◆	◆		
Germany		◆	◆		
Greece		◆			
Hungary		◆	◆		
Ireland	◆		◆		
Italy		◆			
Luxembourg		◆	◆		
Netherlands			◆		
Norway		◆	◆	◆	
Poland			◆		
Portugal		◆	◆		
Slovenia					
Spain		◆	◆	◆	
Sweden		◆	◆	◆	
Switzerland		◆	◆		
United Kingdom (optometrists)	◆		◆	◆	◆

Key to Symbols:

= European Union = European Economic Area

= EU Applicants = Other

Table 1.1

Source: European Council of Optometry and Optics (1998)

Scope of eye examinations by optometrists

Eye examinations by optometrists are either done within the law of the country or are not specifically prohibited by the law

	Subjective Refraction	Objective Refraction	Use of Diagnostic Instruments	Prescription of Optical Appliances
Austria	◆	◆	◆	◆
Belgium	◆	◆		◆
Croatia	◆			
Czech Republic	◆*	◆*	◆*	
Denmark	◆	◆	◆	◆
Finland	◆	◆	◆	◆
France	◆	◆**		◆
Germany	◆	◆	◆	◆
Greece				
Hungary	◆	◆	◆	◆
Ireland	◆	◆	◆	◆
Italy	◆**	◆**		◆**
Luxembourg	◆	◆	◆	◆
Netherlands	◆	◆	◆	◆
Norway	◆	◆	◆	◆
Poland	◆	◆	◆	◆
Portugal	◆	◆	◆	◆
Slovenia				
Spain	◆	◆	◆	◆
Sweden	◆	◆	◆	◆
Switzerland	◆	◆	◆	◆
United Kingdom (optometrists)	◆	◆	◆	◆

* *only under supervision of ophthalmologist*

** *within limitations*

Key to Symbols:

= European Union = European Economic Area

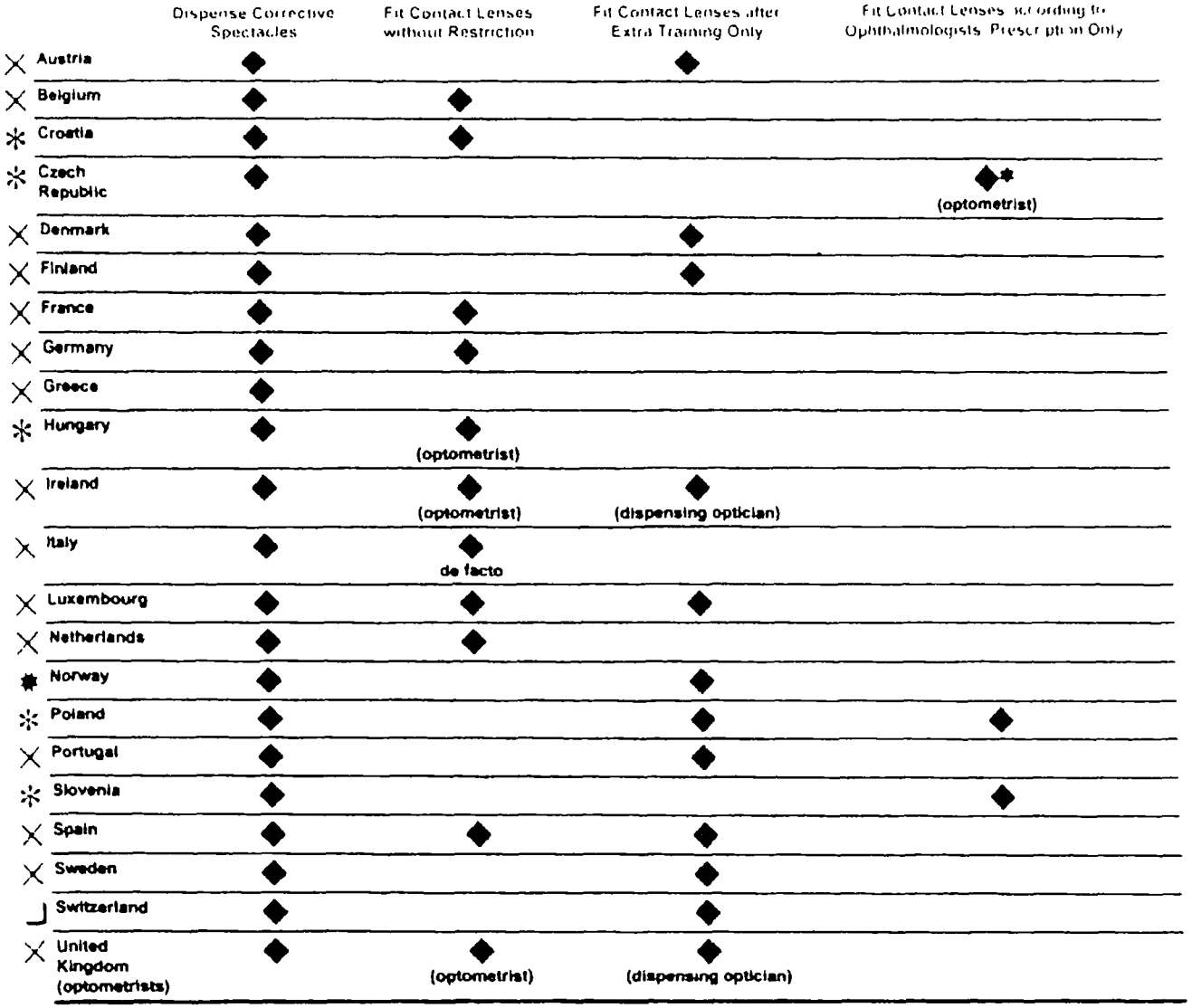
= EU Applicants = Other

Table 1.2

Source: European Council of Optometry and Optics (1998)

Dispensing of optical appliances by optometrists and opticians

Dispensing may involve the supply, adaptation, fitting and sale of optical appliance.



* *only under supervision of ophthalmologist*

Key to Symbols:

X = European Union ✸ = European Economic Area

⁂ = EU Applicants ⌋ = Other

Table 1.3

Source: European Council of Optometry and Optics (1998)

Regulatory status of optometric and optical profession

Opticians make, fit and sell spectacles. Optometrists examine eyes, perform refraction and sometimes detect disease, injury or abnormality of the eye. Optician-optometrists and optometrists are essentially the same profession

	Legally Recognised Optician	Legally Recognised Optician-Optometrist	Legally Recognised Optometrist	De Facto Optometrist
Austria		◆		
Belgium	◆			
Croatia	◆			
Czech Republic	◆	◆*		
Denmark			◆	
Finland		◆		
France	◆			
Germany		◆		
Greece	◆			
Hungary	◆	◆		
Ireland	◆		◆	
Italy	◆			◆
Luxembourg		◆		◆
Netherlands				◆
Norway			◆	
Poland	◆			◆
Portugal				◆
Slovenia	◆			
Spain		◆	◆	◆
Sweden			◆	
Switzerland	◆	◆		
United Kingdom	◆		◆	

* *can only practise under supervision of ophthalmologist*

Key to Symbols:

= European Union = European Economic Area

= EU Applicants = Other

Table 1.4

Source: European Council of Optometry and Optics (1998)

Chapter 2

Health Care Resources in the European Union

2.1 Introduction

Health care is one of the basic human necessities and an integral part of social organisation and welfare system for the population within any state. When the National Health Service was established in the United Kingdom over half a century ago, the concept of scarcity of resources was not even considered applicable to health care planning and delivery especially in British society. The ambitious planners were aiming for the creation of something unique and the best model for the world. The health service, easily accessible to the people in the UK was designed to fulfil socialistic and moralistic ideals with an overall caring perspective.

However, in recent years there has been a growing debate on the question of allocation and scarcity of health care resources and economics of providing adequate health care in many countries including the United Kingdom and other European Union member states. Health care related issues and problems including the global scarcity of professional people are periodically reviewed by the World Health Organisation, supported by epidemiological studies and followed by appropriate recommendations (WHO, Fact Sheet no. 213, 2000). Although scarcity of health care resources continues to be a subject of debate and discussion among health care planners and economists in many countries,

recipients of health care services and even some healthcare professionals may be oblivious to such high level discussions. The fact that scarcity of natural resources exists in the world has led some economists to compare it with health care resources (Fuchs, 1980). However, it is debatable whether such comparisons are valid. It is accepted by most people, including healthcare professionals, that appropriate technological and scientific knowledge should be applied to explore alternatives such as solar energy to continue power supply and that such projects are expensive Health care resources can not be regarded in the same light as natural resources despite that fact that consumers do expect the state to provide continuing health care. Unlike natural resources, perhaps the only alternative to health care is more health care.

Provision and allocation of health care resources requires a rational, critical and logical analysis and a proper understanding by the state of the importance and benefits of adequate funding in all areas of social organisation including health and welfare; and also social implications and economic consequences of inadequate funding and insufficient provision for different professional services for the people.

In the present times it is generally accepted that resources of any kind, including those applicable to health care delivery, are scarce and allocation of these resources is linked to complex state budgets, specialised and applied health care economics, demographic factors, epidemiological studies and professional manpower which requires fairly lengthy and costly education and training.

Therefore, any evaluation for the purposes of allocation of funds requires systematic analysis of available social and health related statistics, numerous critical calculations and crucial decisions, also taking into account the availability of the required number of professional people and technology suitable for the delivery of effective health care.

There are two basic patterns of health care in the European Union. Some countries provide National Health Services in which provision and financing is primarily within the public sector. Under the second system services are provided from private (usually non-profit) and public organisations financed mainly from compulsory health insurance. Within these broad categories there is considerable diversity in terms of financing, methods of organisation and the pattern of delivery of health care. For example the Netherlands has a mixture of public and private insurance, whereas in France most health insurance is controlled by the state. In Germany a large number of funds are held by occupation-related insurance schemes, whereas in Denmark funds are usually controlled by county administrations (Commission of the European Communities, Brussels, 1995).

2.2 Expenditure on Health Care in the European Union Countries

The population of the EU was approximately 374 million in 1997. With an enlarged EU on 1 May 2004 it will be over 450 million. In 1996, 23.7% of the EU population was under 20 years old, 20.8% of EU people were over 60 years

old and 3.9% were over 80 years old. In 1994-96 EU countries spent approximately between 6% and 10% of GDP on health care (10 to 15 % of public expenditure). The growth rate of the share of health care on GDP is considered equal to the growth rate of per capita health expenditures minus the growth rate of per capita GDP. This should be included as an explanatory variable (Barros, 1998).

GNP and GDP are useful tools for calculating national and domestic economic growth, expenditure and budgets. The GNP is identical to GDP except that the former includes income accruing to national residents from investments abroad. The GDP covers the total value of finished goods and services produced by the national economy for a specified time, usually one year. It does not include income from the domestic economy to resident non-nationals. Unlike the GNP, GDP does not include the accruing income to national residents from foreign investments. The GDP is based upon the domestic economy, calculated before allowance is made either for depreciation, consumption of capital or capital expenditure in production of goods. Because of diversity in output of finished goods and services and variation in methods of calculating costs, and the size of socio-economic inequalities in determinants of national products, caution must be exercised in comparing expenditure on healthcare in different European Union countries (Table 2.1). Counting of both raw materials and finished goods (double counting) has to be avoided for accurate economic evaluation of final products. Factors like the numbers of unemployed, the ageing population and expenditure on social services like social security benefits have to be taken into account before any meaningful comparisons

can be made of the expenditure on health care (Table 2.1).

The present UK government's spending target of 8% of GDP is less than that currently being spent on healthcare in the EU. Supposing the spending target in the UK were the same as the EU average, a 5% real annual growth in the NHS funding (after adjusting for inflation) would be insufficient to achieve it by the year 2006 (Towse & Sussex, 2000). To achieve the level of spending like the rest of the EU, the UK government would have to put 9.1% of its GDP (not 8%) into health care. This would require real increases in NHS spending of 7.7% to 8.7% per annum for the period 2001-2006 (Towse & Sussex, 2000). An average annual growth of 6.1% in real terms may not bring the UK up to the European Union average of spending on health care (Klein and Dixon, 2000). GDP or Gross Domestic Product may include the activities of economic operators in the economic territory of a country, regardless of nationality, depending upon the economic policies of the country. However, GNP or Gross National Product is the final measure of total output, without any duplication, in any economic territory during any specified period. GNP is predicated upon the nationality of the operators. GNP is also regarded as a convenient indicator of economic activity of a country. For most members of the European Union GDP and GNP are practically the same. A difference of just 1% between GDP and GNP has been known to exist in four European Union states *with only two exceptions. In Ireland GNP was known to be 13% below GDP and in Luxembourg GNP was 34% above the figure of GDP.* (Europe in Figures, 1992).

Health Care Expenditure in the EU

	Approximate Population in millions (1997)	Approximate Expenditure on Health Share % of GDP		
		1994	1995	1996
Austria	8.04	7.8	7.9	7.9
Belgium	10.13	8.1	8.0	7.9
Denmark	5.21	6.6	6.4	6.4
Finland	5.09	7.9	7.7	7.5
France	58.02	9.7	9.9	9.6
Germany	81.55	7.9	7.7	7.5
Greece	10.42	5.5	5.8	5.9
Ireland	3.57	7.6	.....	.....
Italy	57.24	8.4	7.7	7.6
Luxembourg	0.40	7.5	7.8	....
Netherlands	15.42	8.8	8.8	8.6
Portugal	9.91	7.8	8.2	8.2
Spain	39.17	7.3	7.6	....
Sweden	8.8	.....	.....	.....
UK	59	6.9	6.9	6.9

Table 2.1
Source OECD 1996

In 1993 in the EU countries, public spending accounted for three-quarters of total spending on health care. Between 1980 and 1996, public spending rose more slowly than total spending in the EU member states and the average annual growth rate of total health expenses exceeded GDP growth. In 1996 Germany and Luxembourg spent almost 50% more per person on health care than EU average and in fact over four times as much as Greece (Europe in Figures, 2000).

However, it has to be noted that any difference in health care expenditure growth across different countries must take into account difference in costs. Higher or lower costs in health care expenditure do not imply a higher or lower health care expenditure growth rate. It is possible that countries with a higher health care expenditure because of higher costs may have a lower health care expenditure growth on per capita basis.

2.3 Health Care Professionals in the European Union

Tables 2.2 - 2.5 provide the number of Physicians, Dentists, Pharmacists and Nurses per 100,000 inhabitants in the European Union states between 1985 and 1996. Between 1980 and 1996 the total number of physicians, dentists, pharmacists and nurses had risen in all member states. In 1996 the number of physicians per 100,000 people ranged from 174 in the UK to 569 in Italy (Table 2.2). The UK has the lowest number of physicians according to these figures. However, despite the fact that medical education is expensive, it has to be noted that some EU countries like Italy and Spain with the highest number of medical graduates have

unemployed doctors (Herzmann, 2003). Some Italian doctors never find work in medicine (Thorne, 1996).

In the UK on 31st March 2001 the total membership of the Royal College of General Practitioners was 18,917 (11,695 M; 7333 F) according to the Royal College of General Practitioners reference book 2001-2002. The figures quoted by the publishers of 'Europe in Figures' may have included those registered medical practitioners in the UK who are not members of the Royal College of General Practitioners.

Dentists range from 28 per 100,000 in Finland to 38 in Spain and around 104 in Greece and Sweden (Table 2.3). Belgium, Finland and Spain have the largest number of pharmacists per 100,000 people (Table 2.4). Nurses range from 2,130 per 100,000 in Finland to 348 in Portugal (Table 2.5). The EU pharmaceutical spending represents between 10% and 20% of total health care spending. France has the highest EU consumption of medical and pharmaceutical products per person and UK the lowest (Europe in Figures, 2000).

It is evident from above figures that there are major social and cultural differences in the dimension, provision and pattern of healthcare within the EU. It is debatable whether the concept of health and illness, the measurement of provision of health care, the number and social distribution of healthcare professionals and the explanation of the pattern of health care expenditure can ever be harmonised within the EU.

Physicians in the EU States per 100,000 inhabitants

	1985	1991	1994	1996
Austria	257.4	308.7	339	.....
Belgium	292.4	343.2	364.5	378.3
Denmark	253.9	.....	290.6	.....
Finland	.....	247.2	269.8	284.9
France	.....	271.7	281.7	.....
Germany	255.9	306.2	328.5	341.4
Greece	293.4	365.1	388.9	393.0
Ireland	162.2	170.3	199.7	210.8
Italy	380.3	504.5	547.4	569.7
Luxembourg	181.0	202.9	228.2	.....
Netherlands	222.7	.....	.....	.....
Portugal	243.7	286.9	293.6	301.4
Spain	331.7	394.4	414.4	421.9
Sweden	.....	289.9	.....	.....
UK	151.2	161.4	164.5	174.5

Table 2.2
Source : Europe in figures 2000

Dentists in the EU States per 100,000 inhabitants

	1985	1991	1994	1996
Austria	40.7	43.0	45.0	47.1
Belgium	60.0	71.4	69.0	69.9
Denmark	92.7	88.9	88.1	.....
Finland	.....	91.3	92.3	93.7
France	64.0	68.8	.....	.....
Germany	62.6	68.9	72.8	75.0
Greece	88.1	100.6	104.4	....
Ireland	33.0	38.3	41.9	44.5
Italy	.....	.....	59.9	.....
Luxembourg	45.9	51.5	49.6	.....
Netherlands	49.2	.....	.....	.....
Portugal	12.6	17.1	23.3	28.0
Spain	13.4	28.9	33.9	37.9
Sweden	.....	103.9	.....	.....
UK	37.3	38,3	40.7	41.7

Table 2.3
Source: Europe in figures 2000

Pharmacists in the EU States per 100,000 inhabitants

	1985	1991	1994	1996
Austria	41.5	46,0	50.0	
Belgium	107.6	123.5	132.3	137.3
Denmark	,,,,,,	,,,,,,	,,,,,,,	50.4
Finland	144.8	138.5	140.1	141.7
France	41.2	45.3	46.3	.....
Germany	46.3	52.2	53.9	55.7
Greece	60.4	75.2	78.3	.....
Ireland	58.3	62.3	65.4	70.5
Italy	.....	.....	.....	.....
Luxembourg	69.4	82.2	.....	.....
Netherlands	13.1	15.2	.....	.....
Portugal	41.6	59.9	63.9	68.4
Spain	79.7	96.9	103.1	110.1
Sweden	52.4	.....	.....	.....
UK	34.1	36.5	.....	.....

Table 2.4
Source: Europe in figures 2000

Nurses in the European Union States per 100,000 inhabitants

	1985	1991	1994	1996
Austria	630.5	761.7	845.9	,,,,,,,
Belgium	,,,,,,,,	,,,,,,,	,,,,,,,	,,,,,,
Denmark	581.7	887.7	.....	.....
Finland	1623.2	1879.0	2071.1	2129.9
France	.....	.....	.....	.....
Greece	.....	.....	.....	.....
Ireland	.....	.....	.....	.....
Italy	.....	.....	.....	.....
Luxembourg	.....	.....	.....	596.4
Netherlands	.....	.....	.....	.....
Portugal	239.7	298.0	323.5	347.8
Spain	.....	.....	.....	.....
Sweden	.....	.....	.....	.....
UK	.....	.....	.....	.....

Table 2.5
Source Europe in figures 2000

2.4 Eye Care Professionals in the European Union

Ophthalmology being a medical speciality, is fully identifiable both educationally and structurally within the European Union member states, providing a well established and internationally recognised professional service. However, in the field of optometry it can be easily observed that within the European Union there is considerable inequality of professional standards in the services provided and a lack of harmonisation. The standard of professional education and training, nomenclature of qualifications, titles, designations and scope of practice in optometry within the European Union remains diverse. However, as stated previously, there are signs that some progress is taking place in the area of optometric education, for example, as mentioned previously, the optometry degree from Utrecht, Netherlands were recently accepted by the General Optical Council for registration in the United Kingdom (Grit, 2002). Outside the EU but within Europe, the optometry degree course in Norway is being modelled on the lines of British optometry degrees and the GOC have already been invited as visitors. Optometrists holding Spanish university degrees can obtain British registration after successfully completing a GOC approved supplementary course in the UK (Martinez-Moral, 2002).

Optometrists in many EU countries are trained increasingly at universities and institutes of an equivalent level and courses normally last three or four years. This is the case in Finland, France, Germany, Ireland, Italy, the Netherlands, Portugal, Spain and Sweden. Elsewhere, optometrists are usually trained at a technical school

after high school, having gained either an intermediate high school certificate or a baccalaureat i.e. a final high school certificate. Usually a course lasts two or three years and includes a period of apprenticeship within an optical firm. Opticians are also trained at a technical school after leaving secondary school.

Compared with the UK, German optometric education remains deficient in biomedical aspects (Cagnolati, 2002). In Table 2.6 all those using the title Optometrist and similar professionals in optometry/optics are listed, despite any variation in the standard of education and scope of practice, variations in statutory regulations or a lack of appropriate statutory regulations. The figures from Table 2.6 are presented in Table 2.7 on the basis of eye care professionals in the EU states per 100,000 people. In 1996 the number of ophthalmologists per 100,000 people ranged from approximately 14.39 (highest) in Greece to 1.27 (lowest) in the UK (Table 2.7). It should be noted that in Greece, primary eye care is provided by ophthalmologists because optometric practice contravenes their national laws. In the UK, unlike other EU countries except Ireland, primary eye care is provided by optometrists. Because of variation in training standard in optometry and scope of optometric practice, the description `eye care professional' does not carry the same meaning in the continental EU countries as it does in the UK and Ireland. Therefore, any comparison of the numbers and distribution of eye care professionals in the EU may not provide information concerning the pattern of primary and secondary eye care.

Number of Eye Care Professionals in the EU (1996)
(Approximate figures)
Includes all those using optometrist or similar title despite variation in training standard and scope of practice as compared with the UK optometric profession

Country	Ophthalmologists	Optometrists/Opticians
Austria	560	1200 Augenoptiker-meister
Belgium	850	3000 Diploma Holders
Denmark	225	1900
Finland	380	1170
France	5400	10000
Germany	4000	10500 Augenoptiker-meister
Greece	1500	30-40 Optometrists 1200 Opticians
Ireland	31 Consultant Ophthalmologists 160 Ophthalmic Physicians	354 Optometrists 138 Dispensing Opticians
Italy	6000	30000 Diploma Holders 11000 Working
Luxembourg	31	41
Netherlands	420	1350 Optometrists 2250 Opticians
Portugal	650	330
Spain	3500	6000
Sweden	500	1550
UK	750	7000 Optometrists 3650 Dispensing Opticians

Table 2.6
Source ECOO 1996

Eye Care Professionals in the EU States per 100,000 inhabitants
Approximate figures 1996

Country	Ophthalmologists	Optometrists/Opticians
Austria	6.96	14.92 Augenoptiker-meister
Belgium	8.39	29.61 Diploma Holders
Denmark	4.31	36.40
Finland	7.46	22.98
France	9.30	17.23
Germany	4.90	12.80 Augenoptiker-meister
Greece	14.39	0.33 Optometrists 11.51 Opticians
Ireland	0.86 Consultant Ophthalmologists 4.48 Ophthalmic Physicians	9.91 Optometrists 3.86 Dispensing Opticians
Italy	10.48	52.41 Diploma Holders 19.21 Working
Luxembourg	7.75	10.25
Netherlands	2.72	8.75 Optometrists 14.59 Opticians
Portugal	6.55	3.32
Spain	8.93	15.31
Sweden	5.68	17.60
UK	1.27	11.86 Optometrists 6.18 Dispensing Opticians

Table 2.7
Based upon ECOO figures (1996)

2.5 A Panoramic view of Harmonisation of Professions in the European Union

Union of several states with social, cultural and political diversity and economic inequality is a relatively complex phenomena. The state is an autonomous social institution regarded as a formal entity and it is organised around several social functions which includes the provision of health and education, enforcement of law and order and providing for general welfare of people; thus the state consists of numerous and varied social institutions including those classed as professions. States enact statutes sometimes peculiar to their own social system, culture and traditions. States also tend to protect their culture and guard their boundaries from intruders and any external threat. With this background any suggestion of a full union of states with different cultures and traditions may arouse suspicion amongst people. Some people may fear a possible loss of their identity and erosion of their culture from a dominant or aggressive culture within the Union or a fear of economic dominance from a dominant or aggressive economy within the Union or a fear of any other form of domination.

Sir Winston Churchill used the phrase *'United States of Europe'* several times in the 1940's, during and after the second world war. For example in October 1942 Sir Winston used this phrase while writing to his Foreign Secretary and also publicly in Brussels in November 1945 and in Zurich in September 1946 (Wistrich, 1994; Agarwal, 1998 b).

The term 'European Federation' was also used during the second world war by several organisations e.g. Federal Union in Britain and the European Union of Federalists on the European continent. After the war the French foreign minister also used the term 'European Federation'. However, in 1951 six countries namely Belgium, France, West Germany, Italy, Luxembourg and The Netherlands signed the Treaty of Paris which set up the European Coal and Steel Community (ECSC).

Following the treaty of Rome in 1957 and the formation of a European Economic Community, the term 'European Union' came into usage after the Maastricht agreement of 1991. The Treaty on European Union, also known as the Union Treaty or the Maastricht Treaty was signed in 1991 and came into effect in November 1993. In March 1997 the total population of the European Union comprising 15 member states was approximately 372 million representing 8 per cent of the total world population (Roney 1998). Although these states as full members of the EU are given equal voting rights, there is a marked difference in the population figures. These states represent distinct social and cultural systems and different regulations concerning professions.

Taking into account the panorama of social and political issues and events and especially dissimilarities in training and structure of professions like optometry, the process of harmonisation of professions in the European Union remains a formidable task. The professional culture in the European Union remains diverse and additionally the level of development of the scientific and professional research and the standard

of available literature in different languages of Europe remains varied.

2.6 Harmonisation of optometric profession in the European Union

Harmonisation of all professions within the Union is one of the aims of the European Commission, despite any structural or functional dissimilarities which may exist in some professions. However, health care resources in the whole of the European Union can be divided into two categories. The first category comprises those health care professions such as medicine, dentistry and nursing which are structurally and functionally similar throughout the EU and classed as harmonised. In the second category professions such as optometry are structurally and functionally dissimilar and not fully harmonised.

Taking into consideration the diversity of the optometric profession in the EU, the announcement in 1998 by the Association of European Universities, Schools and Colleges of Optometry (AEUSCO), supported by the European Council of Optometry and Optics (ECOO), that a European Diploma of Optometry will be offered was probably not much of an event. A European Diploma of Optometry, designed to provide a kind of hegemony over the optometric profession in the EU, was a step towards harmonisation. The British Department of Health maintained a careful interest, without direct input, in these developments (Bowis, 1995).

The first examinations, conducted in English, French and German, were held in November 1998 in the UK, France and Germany. Out of 23 candidates, two successfully completed all parts of the examination. The General Assembly of the

European Council of Optometry and Optics, meeting in June 2001 at Helsinki (Finland), decided to award the contract to manage the European Diploma of Optometry to the German organisation, the Zentralverband der Augenoptiker (ZVA). The total number of candidates taking all or some parts of the examinations conducted by the ZVA in 2002-2003 was 30. Three candidates successfully completed all parts of the examination (Zeilhoff, 2004).

In November 2002 at the ECOO meeting, held at Budapest (Hungary), it was envisaged that the diploma will be available through several European optometry universities, to 'top up' their degrees to the diploma standard. It was further envisaged that each participating optometry school will be assessed by the ECOO and the qualification they issue will be considered equivalent to European Diploma by the year 2010. However, a diploma of this nature does not change the official status of optometry in the EU. Optometry is not legally recognised in most EU countries.

The level of optometric training and enactment of statutory regulations in an EU member country is a matter between the state, the medical profession, ophthalmologists and those who wish to describe themselves as optometrists.

The process of professionalisation in optometry has been diverse for a considerable period in all those countries which now constitute the European Union.

Harmonisation of professional optometry in the EU remains a slow and arduous process. It is realised by the all concerned that a political treaty can not impose instant harmonisation of different professional cultures. The treaty of Rome in 1957 did not result in any culmination of common optometric acts in the member states;

whereas in 1958 in the United Kingdom, although not a member of the European Economic Community at the time, a comprehensive act (Opticians Act of 1958) pertaining to the practice of optometry was passed by the British Parliament resulting in statutory registration of optometrists.

A lack of optometric education in Greece as against advanced education in the UK are examples of variations in the level of optometric education in the EU. The development of optometric education in the UK includes the creation of a chair of Ocular Medicine in 1997 and appointment of an ophthalmologist to that post in the Optometry department of the City University, London (Agarwal, 1997b). In 1995 a proposal was made to launch an ophthalmology and optometry post-graduate degree course in the United Kingdom, combining the academic resources of an ophthalmology department of a medical school and an optometry department of a university (Anon, 1994). In October 2002 an optometrist was appointed as a Professor of Ophthalmology at the University of Manchester. The aforementioned developments in the British optometric profession remain without any parallel in the other EU countries.

2.7 Mutual Recognition of Professional Qualifications in the European Union

The main legislation of the EU which affected the professions are the general directives (89/48 EEC and 92/51 EEC) for the mutual recognition of professional qualifications. Optometrists are considered under the first directive (89/48 EEC) and Dispensing Opticians under the second directive (92/51 EEC), However Sectoral

Directives provided mandatory and automatic recognition of qualifications within the EU states covering certain professions e.g. medicine, dentistry and veterinary surgery. Sectoral Directives such as the 1977 directive covered freedom to provide cross-border legal services and 20 years later, according to the 1997 directive, lawyers qualified in one member state are fully entitled to practice in another member state. The general directive of 1988 covered mutual recognition of professional qualifications. This directive covered professions regulated by the state or by a chartered professional association. The minimum education and training period required was accepted as three year's post baccalaureate full time education leading to a university or equivalent qualification. A commission study on recognition of professional qualifications and diplomas was completed in 1994.

Provided the education and training leading to a professional qualification from a EU member state was equivalent to that in another EU member state, then the qualification will be deemed as equivalent and the holder of that qualification will not have to re-qualify and will be allowed to become a member of that profession. However, if the education and training was considerably different either in content or time then the 'host' EU member state can require an aptitude test or a period of 'supervised practice' of not more than three years without any need for re-qualifying.

Under the first and second general directives the General Optical Council has already accepted the following qualifications in Optometry and Dispensing Optics from some EU member states on an informal basis as being equivalent to the scope of practice in the United Kingdom (Table 2.8).

European Union Directives on the Mutual Recognition of Qualifications

First and Second General Directives

Qualifications in Optometry and Dispensing Optics accepted by the GOC as being equivalent to the scope of practice in the UK

EU Directive	Profession	Country & Qualifications
First General Directive	Optometry	Republic of Ireland Optometry graduates or equivalent
First General Directive	Optometry	Germany Augenoptiker Meister together with he Masters in Clinical Optometry awarded by the Pennsylvania College of Optometry USA
First General Directive	Optometry	Austria Augenoptiker Meister together with the Masters in Clinical Optometry awarded by the Pennsylvania College of Optometry USA
First General Directive	Optometry	Netherlands Optometry graduates from the Utrecht University (Post 1998)
Second General Directive	Dispensing Optics	France Brevet de Technicien Superieur Optician-Lunetier

Table 2.8
Information supplied by the General Optical Council (2002)

2.7 (a) Mutual Recognition of Medical Qualifications

The basic principle of community law provided that the doctors have 'the right of establishment as a self employed or employed person in any member state of the European Union' subject to recognition of their qualifications. Simplified authorisation and registration procedure merely to provide medical services in another EU member state have also been provided. Recognition of medical qualification is mandatory and automatic only if it was acquired in a EU member state and listed in the directive.

Mandatory and automatic recognition of medical qualification for all EU member states only applied if the qualification entitled a doctor to practise general medicine or a medical speciality common to all EU member states and listed in the directive. If qualification in a medical speciality was common in some EU member states only and listed in the directive then recognition is mandatory and automatic only in those EU member states. Other medical specialities which are either not listed in the directive or are covered in respect of the 'host' EU member state, recognition is granted on a case by case basis, only after the host EU member state has made a comparison between the education and training received in the EU member state of origin and that which is available in the host EU member state. Applicants may in some cases be asked to undergo additional training.

In specific cases, especially older forms of training undertaken in some EU member states prior to implementation of directives or qualifications with different designations, recognition may be subject to certain requirements being fulfilled.

There is no provision for general recognition of training received in countries outside the EU member states. Such recognition, however, may be granted by EU member states and it is binding only on the EU member state that grants it and limited to the territory of that EU member state. The authorities of the host EU member state have three months to process an application and to take up the activity concerned. Any decision not to grant recognition must be a reasoned one and it must also be possible to appeal against such decisions in the national courts.

2.7 (b) Mutual Recognition of Dental Qualifications

The basic principle of community law provided that the dentists, like the doctors, have 'the right of establishment as a self employed or employed person in any member state of the European Union' subject to recognition of their qualifications. Simplified authorisation and registration procedure merely to provide dental services in another EU member state have also been provided. Recognition of dental qualification is mandatory and automatic only if it was acquired in a EU member state and listed in the directive. Mandatory and automatic recognition of dental qualification for all EU member states only applied if the qualification entitled a dentist to practise in a EU member state and is listed in the directive. For specialist qualification in orthodontics and oral surgery, if listed in the directive, recognition is mandatory and automatic only in those EU member states. Other dental specialities which are either not listed in the directive or are covered in respect of the 'host' EU member state,

recognition is granted on a case by case basis, only after the host EU member state has made a comparison between the education and training received in the EU member state of origin and that which is available in the host EU member state. Applicants may in some cases be asked to undergo additional training. In specific cases, especially older forms of training undertaken in some EU member states prior to implementation of directives or qualifications with different designations, recognition may be subject to certain requirements being fulfilled.

There is no provision for the recognition of dental training received in countries outside the EU member states. Such recognition, however, may be granted by EU member states. Such recognition is binding only on the EU member state that grants it and limited to the territory of that EU member state. The authorities of the host EU member state have three months to process an application and to take up the activity concerned. Any decision not to grant recognition must be a reasoned one and it must also be possible to appeal against such decisions in the national courts.

2.7 (c) Mutual Recognition of Qualifications in Paramedical Professions

First general directive on the liberal professions included optometry which required three year's post baccalaureate full time education leading to a state recognised qualification . The second directive included dispensing optics which required two year's full time or equivalent education after high school. These directives were different from sectorial directives which allowed medical, dental and veterinary practitioners mutual recognition and freedom of movement within

the EU. With the exception of General Care Nurses and Midwives, the paramedical professions are included in the general system for the recognition of professional qualifications in the EU member states. The profile of two professions with the same name and designation or with different names and designations in different EU member states may vary considerably.

The paramedical professions are subject to the rules and regulations in force in the EU member state in which the profession in question is practised; the authorities in that country lay down the conditions governing the right to take up and practice the profession. In most cases the paramedical professions are closely regulated; practitioners must be registered and enjoy a monopoly in providing treatment in their fields. In some EU member states specific professional activities may be restricted to medically qualified practitioners. For example only doctors are allowed to practise alternative medicine, chiropractic and osteopathy in Austria, Belgium, France and Italy. However, in some member states, persons not qualified as doctors holding other qualifications are also allowed to practise alternative medicine or other specialities. For example: Heilpraktiker (healers i.e. healer non-medical practitioners) in Germany; Chiropractors in Denmark, Finland and the United Kingdom; Osteopaths in Finland and the United Kingdom.

The paramedical professions listed in the general system for the recognition of professional qualifications include optometrists, dispensing opticians and orthoptists. Other paramedical professions included : care assistants, chiropodists, chiropractors, dental hygienists, diagnostic radiographers, dieticians, hearing aid

makers, laboratory technicians, occupational therapists, osteopaths, physiotherapists, masseur, psychologists, psychotherapists, speech therapists and specialist nurses.

2.7 (d) Mutual Recognition of Qualifications held by Specialist Nurses , General care Nurses and Midwives

In some member states general care nurses also carry out specialist nursing work. The recognition of qualification of specialist nurses, however, is covered by the general system which also covers the recognition of paramedical professional qualifications.

When a specialist nurse wishes to work in a member state where that specialist work is undertaken by general care nurses the applicants are given two options. General care nurses with specialist training who first acquired one of the general care nursing qualifications listed in the directive are allowed mandatory recognition.

In cases of those nurses with specialist training who did not acquire general care nursing qualification listed in the directive, the host EU member state must examine such training and compare with their own training requirements. In those cases where the difference between two professional qualifications is too great the general system does not apply. The basic principle of community law provided that General Care Nurses, like the doctors and dentists have 'the right of establishment as a self employed or employed person in any member state of the European Union' subject to recognition of their qualifications. Simplified authorisation and registration procedure merely to provide general care nursing services in another EU member state have also been provided. Recognition of General Care Nursing qualification is mandatory and

automatic only if it was acquired in a EU member state and listed in the relevant directive. If a general care Nursing qualification was recently acquired and entitled the holder to obtain registration in his/her home state then recognition in other EU member states is mandatory and automatic.

However, recognition of older forms of training obtained prior to implementation of directives or qualifications with different designations may be recognised subject to the fulfilment of certain requirements. In the event of any legitimate doubts about the authenticity of the nursing diploma held by the applicant, the host member state may ask the relevant authorities, in the member state of origin of the applicant or the member state from which he/she comes, to provide confirmation that the diploma is authentic and the holder fulfils the minimum training requirement under the directive. The authorities in the host member state are allowed three months to process an application. Any decision not to grant recognition must be a reasoned decision. Appeals can be made in the national courts against such decisions. There is no provision for the recognition of nursing training received in states outside the European Union. Recognition to such training may be granted by the EU member states but it is binding only on the EU member state that grants it and does not extend beyond the territory of the member state.

The basic principle of community law provided that Midwives, like the General Care Nurses, have 'the right of establishment as a self employed or employed person in any member state of the European Union' subject to recognition of their qualifications. Qualifications acquired in a EU member state and listed in the relevant directive

are eligible for mandatory and automatic recognition in all the EU member states.

2.8 Proposed New Directive from the European Union on the Mutual Recognition of Professional Qualifications

The European Parliament, the Council and the Commission at the time of the adoption of the proposed new directive number 2001/19/EC in May 2001 agreed that `it is important to have consolidated versions, easily accessible to everyone, of the legal texts applicable in the field of mutual recognition of qualifications'. The commission stated its intention to continue this work in two parts, initially to integrate the Sectoral Directive into a consolidated framework and then examine the `possibility of consolidating the Directives relating to the general system in order to continue simplifying the legislation and further facilitate the free provision of services with regard to the conclusion of Lisbon summit'.

The commission also created a high level task force on Skills and Mobility which produced a report in December 2001. The report stated that the ` EU and Member States should attach priority to increasing the speed and ease of professional recognition (for regulated professions) including conditions supporting more automatic recognition and introduce a more transparent and flexible regime *for the recognition of qualifications in the regulated professions by 2005'*. The commission further stated that a 'clear, secure and quick system for the recognition of qualifications in the field of the regulated professions is required to ensure free movement'.

This is important to help to ensure that employment vacancies are filled by qualified applicants and to ensure that there is regular supply of qualified service suppliers to meet market demand. The free movement of qualified professionals makes a particular contribution to the knowledge based society. Conditions of free movement have also proven to have particular importance in cases of *specific shortages of qualified personnel at specific times in different member states for such professions as Teachers, Veterinary Surgeons, Doctors and Nurses'.*

The European Parliament, the Council and the Commission are clearly aiming to consolidate the health care resources in the new directive by proposing a free, speedy and easier movement of various professionals within the European Union,. However, article 5 in the new Directive number 2001/19/EC which was adopted in May 2001, proposes that *'for the purposes of this Directive, where the service provider moves to the territory of the host member state, the pursuit of a professional activity for a period of not more than sixteen weeks per year in a member state by a professional establishment in another member state shall be presumed to constitute a provision of services'.*

Taking into account the dissimilarities in the training and scope of practice in optometry within the EU, this proposal clearly constitutes a threat to public health and is not likely to be accepted by the British optometric profession and the General Optical Council. Also, to monitor proposals of this nature, an Alliance of UK Health Regulators on Europe **(AURE*)** already exists in the UK.

The regulatory bodies in the UK have legal powers to establish, maintain and monitor

the standard of health and social care professionals and safeguard the health and well-being of patients and service users to ensure that members of the public have access to and are treated by adequately and suitably qualified and competent professionals.

It should be taken into account by all concerned in Brussels that Optometrists in the UK as primary health care practitioners have been determining ocular health of their patients for over half a century. In 1952, Lord Crook as chairman of the interdepartmental committee on the statutory registration of opticians reported that *'several witnesses representing medical and ophthalmological organisations have informed us that there is no difference between the detection and the diagnosis of ocular abnormality, the two processes being inseparable'.*

It has to be noted that the UK optometrists now diagnose and monitor ocular pathology and only refer patients when necessary. UK optometrists also participate in shared and delegated care of ocular conditions like glaucoma. and diabetic retinopathy which may cause visual impairment or blindness. In the field of ocular therapeutics, supplementary prescribing is part of British optometry and independent prescribing status is already on the agenda of the Department of Health.

The European Parliament, before allowing free and easy movement of optometrists in the EU, will have to take measures to harmonise education, professional structure, scope of practice and legal status of optometry in the EU. Professional titles, designations and nomenclature of optometric qualifications in the EU would also require harmonisation. Those legislators responsible for the laws governing health care

professions in the EU will have to look into the operational aspects of optometry as an autonomous health care profession for the enhancement of vision and prevention of visual impairment and blindness.

* The AURE (Alliance of UK Health Regulators on Europe) gathers representatives of UK regulatory bodies of the health professions covered by the commission proposal representing the General Medical Council, General Dental Council, General Optical Council, General Osteopathic Council, General Chiropractic Council, # Health Professions Council, Nursing and Midwifery Council, Royal Pharmaceutical Society of Great Britain, General Social Care Council and Pharmaceutical Society of Northern Ireland.

The Health Professions Council in the United Kingdom regulates 12 professions and these are art therapists, chiropodists/podiatrists, clinical scientists, dieticians, medical laboratory scientific officers (MLSOs), Occupational therapists, orthoptists, prosthetists and orthotists, paramedics, physiotherapists, radiographers and speech and language therapists.

Summary

Issues like harmonisation, mutual recognition of professional qualifications, speedy movement of professionals within the EU and health care expenditure are discussed in this chapter. Social and cultural differences in the dimension, provision and pattern of health care within the EU are highlighted. It is discussed whether the

concept of health and illness, the measurement of provision of health care, the number and social distribution of health care professionals and the explanation of the pattern of health care expenditure can ever be fully harmonised within the European Union.

Chapter 3

Economics of Eye Health Care Delivery

3.1 Introduction

Health economics based calculations, a relatively new concept in the field of health care, may provide different values for identical services and may cover several dimensions, often complex, affecting many aspects of health care delivery and different specialities including eye health care. On the basis of a disciplinary matrix of health economics any evaluation and measurement of various costs and benefits involved from the outcome of specific services provided to people, including different procedures and techniques, may include:- *cost-benefit analysis (CBA), cost-minimisation analysis (CMA), cost-utility analysis (CUA), cost-effectiveness analysis (CEA), opportunity costs, quality adjusted life years (QALY), handicap adjusted life years (HALY), disability adjusted life years (DALY), health related quality of life (HRQL) and healthy years equivalent (HYE).* Calculations may also include the costs of resources required and overall economics of providing adequate and appropriate healthcare to all patients. Costs may also include economics of training medical and other health care professionals.

However, it should be stated here that in the context of measurement of the cost of time in the provision of appropriate health care to patients, it is

debatable whether, in a healthcare environment, physical time should be considered synonymous with actual professional time (Agarwal, 2000 b). Any enforcement of time constraint in the provision of healthcare may not provide a satisfactory outcome because of unpredictability of actual time required in the clinical decision making process. It has to be noted that the economics of time management in the delivery of health care is a separate issue as compared with time and motion study; the latter is normally linked to the economics of industrial output and productivity which is defined as the ratio of output to input and generally relevant in a non-health care setting. In recent years there has been a phenomenal rise in interest in health care related economics, especially on the question of scarcity and allocation of health care resources by the health system policy makers, the health economists, politicians and also some other people probably not fully conversant or acquainted with the complexities of clinical decision making process and patient management. Some of these analysts utilise well established methods of evaluating costs by using those procedures, techniques and principles of economics which in fact have their origins in a non-health related work environment. Interestingly in 1844 a French engineer named Jules Dupuit (1804-66) proposed cost-effectiveness analysis in a non-health care setting (http://www. Britannica.com, 2003).and in the United States flood-control benefits had to exceed the cost under the 1936 US flood control act (http://www. britannica.com, 2003).

It would, therefore, not be surprising if there was a professional or policy decision disagreement or a lack of understanding between health economists and clinicians on matters affecting clinical decisions and patient welfare regardless of age and status of prognosis All those professionals involved in health care and clinical work are fully aware of the fact that there are circumstances when even clinical guidelines can not be followed strictly and complex professional skills and methods are often required for exploration and investigation of cases in diagnosing and solving clinical problems. Since differential diagnosis and clinical decision making is an intricate process, it would not be surprising if health economists, lay workers in the healthcare field, lay media researchers, business analysts and others find clinical variations confounding. In any event the idea of scarcity of resources in healthcare and at the same time expectations of high quality service and care from health care professionals seems contradictory.

Debate continues on the question of interposition and intervention by health economists in health care and any consequential advantages or disadvantages for the recipients of professional and clinical services.

Kernick (2000), giving his *medical viewpoint*, has commented that `the EBM/HE (evidence based medicine / health economics) industrial complex now employs a vast array of researchers armed with Government grants and contracts to find solutions to largely intractable problems. Resources that might otherwise be used in direct healthcare'. Kernick continues `using its ultimate instrument, economic

analysis alongside the randomised controlled trial, the burgeoning industry seeks to discover the essential truth without us so that our intervention can be directed by explicit guidelines derived from rigorous enquiry'. ' Things were not much better in the world of economics . Although still managing to suppress the fact that no one was actually taking any notice of economic evaluations, Homo-Economicus was not behaving as theory directed'.

'Then came the masterstroke. If patients could be duped into believing that the incessant outpouring of the modern medical machine - with all its trappings - is really needed, but that there is not enough to go round ..... then the technical framework of effectiveness and cost effectiveness would be welcomed as a true salvation and the paradigm would remain secure'.

In another *medical viewpoint* Loewy (1980) commented that '*of late an increasing number of papers in this* (New England Journal of Medicine) *and other journals have been concerned with "cost effectiveness"* of diagnostic and therapeutic procedures'. Inherent in these articles is the view that 'choices will be predicated not only on the basis of strictly clinical considerations but also on the basis of economic considerations as they may affect the patient, the hospital and society'. Loewy further stated *'It is my contention that such considerations are not germane to ethical medical practice, that they occupy space in journals that would be better occupied by substantive matter, and that they serve to orient physicians towards consideration of economics which is not their legitimate problem. It is dangerous to introduce extraneous factors*

into medical decisions, since consideration of such factors may eventually lead to age, social usefulness and other matters relevant to medical practice. The example of medicine in Nazi Germany is too close to need further elucidation'. Loewy continues 'It is incumbent on the physician (especially in a critical situation) to practice not cost-effectiveness but medicine that is as safe as possible for that patient under the particular circumstances. Optimisation of survival and not optimisation of cost-effectiveness is the only ethical imperative. To select diagnosis on the basis of cost-effectiveness is a deliberate statistical gamble; to use diagnostic tests in an unthinking medical fashion is poor medicine, not because of cost but because unthinking medicine is dangerous for the patient. Ethical physicians do not base their practices on the patient's ability to pay or choose diagnostic and therapeutic procedures on the basis of their cost. It may be argued that the welfare of society is threatened by escalating medical costs; indeed the argument at first appears to introduce a dilemma. Yet a large proportion of our ills are due to smoking, heavy drinking and overeating and the consequences of these indulgences consume a large portion of medical- care dollars. It is unfair to deprive those who have not been overindulgent of the best medical care while allowing the overindulgence of others to consume the available money. Furthermore, our society clearly has money to spend on luxuries and baubles. A physician who changes his or her way of practising medicine because of cost

rather than purely medical considerations has indeed embarked on the "slippery slope" of compromised ethics and waffled priorities'.

In our context it is necessary to review the basics of currently used cost identification, cost determination, cost evaluation and appropriate analytical methods in health care economics since these are equally applied by the health economists and health analysts to eye health care delivery. The main stated objective of health economics is to provide adequate health care to all citizens by choosing and prioritising appropriate procedures and interventions.

3.2 Identification, Measurement & Valuation of Costs in Health Care

Health care costs have to be identified, measured and valued and these can be direct, indirect and intangible. Direct costs are divided into fixed and variable. Indirect costs are normally estimated by using human capital method and willingness to pay (WTP) method. Intangible costs are not always quantifiable dependant upon the method used.; if a human capital method is used then time and productivity outcomes may be measured and when willingness to pay (WTP) method is used then implicitly intangible costs may be included in the monetary values. Sometimes it may be necessary to use cost utility analysis (CUA) method for measuring intangible costs.

Identification of costs requires an evaluation of the identified resources consumed which may be gross or detailed and then monetary values are

assigned to such resources. Measurement and valuation of costs will be discussed later in this work. Costs may be health care system based, patient based or external and not apparent. Health care system costs comprise administrative and operational and these include capital expenditure, property maintenance and running overheads, administration and office staff salaries, equipment, health care supplies, drugs and medicines; professional costs include salaries and fees paid to physicians, medical specialists and other health care professionals, laboratory and diagnostic testing and support staff time. Smith and Brown (2000) observed that `often direct costs come in the form of charges and the true medical costs may be obscured, or difficult to measure, since they do not empirically measure the forgone opportunity cost of using these resources for other purposes'. In some cases costs could also include hospitalisation, long term care and rehabilitation.

Patient based costs are those directly incurred by patients and their families and relatives and indirect costs are disability, loss of income, loss of employment and lost opportunity. Costs not easily measured or can not be measured are those attributed to grief, psychological causes, suffering and also pain. However, cost measurements will not be accurate if two establishments with similar overheads were providing service to people not equal in numbers. If one establishment e.g. an eye department in a hospital was very busy and the other was not then in such cases estimates have to be used. Luce and Elixhauser (1990) have stated that `the primary objective of

the economic evaluation of medical care technologies is to incorporate a consideration of resource consumption into decisions about their use. By an explicit examination of economic information, it is possible to assess the health benefits derived from the use of a technology relative to its costs. The costs and benefits of technologies can then be compared, making it possible to rationalise decision-making in an environment of limited resources'. According to these authors two types of economic information are relevant in our context. Information about economic costs included in providing the necessary technology and information with reference to the evaluation of economic consequences of using a technology.

3.2 (a) Study Perspective and Time Frame of Cost Analyses

The perspective from which the costs are to be measured is an important factor when conducting cost analyses. The perspective could be local, regional, national, international, routine governmental or state commissioned, managed care organisation (MCO) and health maintenance organisation (HMO) based, health insurance provider based or from the perspective of providers of healthcare services such as physicians, ophthalmologists and optometrists. In most cases the perspective of cost evaluation and analyses is governmental and societal for appropriate allocation of healthcare and related resources in order to maximise the healthcare benefits. It is equally important to specify the time frame over

which a healthcare intervention or programme is to be implemented since it can affect the costs and ultimately the benefits.

3.2 (b) Sensitivity Analyses

During cost evaluation or cost effective analysis, precise information or data may not be available for some variables or it may contain elements of uncertainty which may be accidental. Uncertainty may be present in all economic evaluations. Under such conditions estimates can be used on the basis of available information and such estimates are then subjected to a rigorous process called sensitivity analyses. However, under some circumstances especially when the use of resources is uncertain, costs can not be estimated with certainty. According to Smith and Brown (2000) sensitivity analyses are particularly useful in determining the robustness of the overall cost effectiveness analysis. Briggs, Sculpher and Buxton (1994) have stated that sensitivity analysis is not a single method; four types can be identified to analyse uncertainty in economic evaluations. These are simple sensitivity analysis, threshold analysis, analysis of extremes and probabilistic sensitivity analysis. Sensitivity analyses can help point out critical values above or below which the cost effectiveness of a programme can not be shown. This is known as threshold analysis. When two therapies are compared, high and low costs can be generated for both and examined under analysis of extremes. In an ophthalmic context using this method for example

extracapsular cataract extraction could be compared with phacoemulsification. Probabilistic sensitivity analysis allows the analyst to *'assign ranges and distributions to uncertain variables within evaluations that are being modelled using decision analytical techniques'* (Briggs et al, 1994).

3.2 (c) Cost Benefit Analysis (CBA)

It is reasonable to state that almost all health care cost evaluation methods and techniques are ultimately linked to Cost Benefit Analysis and welfare economics. CBA compares the value of consumed resources (the *cost*) with the value of outcome or results (the *benefit*). CBA is only possible when the benefits are also expressed in the same unit of measure as the costs which is usually a monetary unit. Normally CBA measures all the inputs and outputs of service, treatment and care in common currency units. In other words both numerator and denominator are measured in the same monetary unit. It then becomes possible to compare the *cost* of treatments and the entire health planning for the same or different health problems. The cost element covers the obvious financial costs of services and also other costs to the patient, patient's family and society in general. The other costs may include loss of earnings, benefits provided by the state, disruption of family life and loss of function through side effects of treatment and other manifestations of disease, illness and health related problems. The cost element may also include the cost of professional education and training

professionals providing different services.

Benefits include restoration of functions to the patient such as relief of pain, improvement in vision and enhancement of functions dependent upon vision, mobility and any consequential ability of the patient and family to contribute further for family benefit and society in general. However, the issue of benefit measurements becomes complicated when factors such as the age of the patient and quality adjusted life years (QALY) are also included. It is, nevertheless, realised that some benefits may not be easily measurable in monetary terms. For example it has been suggested that benefits could also include '*reassurance value*' (Drummond et al, 1999) arising from knowledge of a clinical procedure or a test. Opponents of this suggestion have argued that a person could exhibit anxiety if they did not feel reassured in the process of receiving health care. CBA could be described as benefit minus cost or as a ratio of cost to benefit. The net benefit could be a measure of the absolute benefit to society of any specific health care programme which obviously includes ophthalmic care The assignment of money or monetary valuation of health outcomes includes investment in a person's human capital, valuation related to revealed preferences and finally contingent valuation or studies examining stated preferences (Drummond et al, 1999).

The utilisation of health care programmes and services can be regarded as an investment in a person's human capital. Valuation under revealed preference examines the relationship between particular health risk associated with a

hazardous occupation and the rate of pay which employees are required to accept. *Miner's Nystagmus* (involuntary, regular, repetitive eye movement with variable frequency and direction) resulting from years of coal mining is a good example of specific health risk from a hazardous occupation. Other examples are *asbestosis* (a lung disease, a form of pneumoconiosis caused by fibres of asbestos inhaled by those who are exposed to the mineral) and *repetitive strain injury* (RSI, pain with associated loss of function for example in a limb resulting from its repeated movement or sustained static loading). Contingent valuation (stated preferences) examines hypothetical situations and willingness to pay (WTP) or willingness to accept (WTA) by those patients expecting to receive treatment. Uncertainty because of market value fluctuations and individual variations in WTP or WTA valuation are important factors in this type of valuation. The value of the normal healthy time generated can be quantified in terms of a person's renewed, increased or improved production in employment. However, many analysts and decision makers consider this kind of valuation unethical and find it rather difficult to measure human life or quality of life in monetary units (Weinstein and Fineberg, 1980), quoted by Drummond et al (1999). After receiving professional training in medicine, dentistry, optometry, nursing or any other health related discipline, professionals detest facing *'hard nosed, cold-blooded economist placing money values on human life and human suffering'* (Mooney, 1992). Despite any opposition to valuation of health outcomes it is

very often not realised by the critics that such valuations are carried out implicitly in daily life when decisions are made by individuals, societies and even governments that *'trade-off health objectives against other benefits'* (Drummond et al 1999).

Cost Benefit Analysis should not be confused either with cost comparison or cost saving studies. (Drummond et al.1999) citing the works of Zarnke et al. (1997) have stated that sixty percent of studies claiming to be CBA were in fact cost comparisons without any attempt to value benefits in monetary terms. In a study of Pertussis Vaccination cost saving evaluation and cost comparison was erroneously labelled as CBA (Koplan et al, 1979). The aim of CBA is to assess whether or not the benefits exceed the costs. An affirmative answer would simply indicate that in terms of social benefits the programme was worthy. CBA results should be useful in decision making for the allocation of health care funds efficiently and thus maximising efficiency in the delivery of health care. However, allocation problems may arise when *CBA* is confused with cost comparison or cost saving.

3.2 (d) Cost Effectiveness Analysis (CEA)

CEA estimates the value of resources consumed (the *costs*) per unit of outcome (the *effectiveness*). For the purpose of CEA costs are expressed in monetary units whereas the outcome is expressed as a clinical measure which can be described as cost per successfully treated patient; for example, cost

per eye for a cataract patient with a successful outcome following surgical treatment. The cost effectiveness ratio obtained is in fact a measure of the cost per unit of health effect. Smith and Brown (2000) have stated that *'in their simplest form, health effects might be regarded as the number of life years saved, or more particularly in an ophthalmological context, the number of sight years saved from vision loss and blindness'*. If health effects obtained by two treatment options are equal then cost considerations need to be assessed between both groups and the least costly options are likely to be regarded as the most efficient in terms of the allocation of resources. Cost-effectiveness can be described as the financial cost for an outcome or result of a service or procedure including any impact such a service may have on the community. Any evaluation of cost-effectiveness would cover the total cost of that service.

However, with the same or similar objectives there can be different or modified versions or different modes of providing such services; the differences may be procedural, structural and/or in the method of delivery. The health care economists and planners would naturally choose the most economical model provided the quality assurance element remains unaffected. In any event cost-effectiveness should not be considered a synonym for cheapness and it implies that alternatives were fully considered. Cost effectiveness relies on the basic economic concept of opportunity cost. Since resources are either limited or scarce, choices must be made. The lost

opportunity is described as opportunity cost. However, cost-minimisation is another form of evaluation for the purposes of comparing the cost of alternative treatments with identical outcomes.

3.2 (e) Cost Utility Analysis (CUA)

CUA can be described as a subset of CEA which uses quality adjusted effectiveness measures. CUA is an evaluation of common measure of the satisfaction derived from consumption of all services. Utility value can be appended to the expected outcome of a service or treatment and this can be described as QALYS, *an acronym* for Quality Adjusted Life Years. It consists of an average expectation of life after treatment and multiplied by an index of quality of life. Such an index is an evaluated average of a set of scores representing an aspect of life-quality namely pain and lack of mobility or visual impairment during the expected remaining years of typical patients. On this basis the score would be considerably less for a comatose patient for five years as against almost normally functional patient for a period of three years. An average total cost of treatment and care divided by QALYs provides cost per QALY. On this basis it then also becomes possible
(a) to compare treatments for the same disease in terms of cost per QALY and
(b) to compare cost per QALY for treatment of diverse conditions e.g. artificial hip replacement versus cataract surgery. Expectation of quality of life remains the key factor in QALYS.

3.2 (f) Cost Minimisation Analysis (CMA)

CMA estimates the value of resources consumed (the *costs*) for alternative treatments with similar outcomes. Following two similar treatments with similar efficacy, one may result in fewer adverse events or less adverse effects and consequently fewer health care resources are consumed; it would then indicate that this treatment achieves identical results at a lower cost, e.g. treatment of glaucoma with Beta-blockers as against other drugs.

3.2 (g) Cost of Illness Analysis

Cost of illness analysis attempts to measure all the treatment costs of any specific disease and also other associated costs over a given period of time, such as for example the annual cost of any cardiovascular disease or an ocular disease like glaucoma in terms of lost productivity and the costs incurred in screening, investigation, diagnosis, medical treatment and management. This kind of cost analysis could be used by those involved in decision making process for the allocation of funds for the management of various diseases and illnesses, periodical appraisal of the provision of specific clinical services and development of clinical services support system.

3.2 (h) Opportunity Cost

There may be a considerable difference in the availability and level of services provided between a wide range of publicly and privately supported

and funded health care plans, since resources are often limited and may operate under some form of budgetary restriction or economic constraint. Choices must be made between different resource allocations and alternatives have to be chosen constantly. The lost opportunity is then described as *opportunity cost.* According to Luce and Elixhauser (1990) 'The opportunity cost of an activity is the value of the alternative endeavours that might have been undertaken with the same available resources'.

In our context, when two or more *ophthalmic clinics* are compared, the opportunity cost of each is explicit or precisely expressed. If within the allocated resources 20 patients are treated in clinic A, as against 10 patients in clinic B, the opportunity cost of shifting the resources from A to B is the cost of treating 10 patients. When we refer to the cost-effectiveness of a single ophthalmic clinic, opportunity cost is either implicit or inferred. For example, it is highly unlikely that we could find better alternative uses for £200 worth of ophthalmic care that actually saved one patient's eyesight. On the other hand £2 million spent on eye care would have a high opportunity cost element because with £2 million worth of resources we should be able to do more than simply save one patient's eyesight. Alternative plans, procedures and methods for the implementation of eye care have to be explored and adopted to save the eyesight of people at a much lower cost without compromising the standard and quality of care. The resources worth £2 million could be apportioned or distributed to other uses in such a way that

it may save the sight of 20,000 people. It is obvious that the use of health care resources without alternatives would be less cost effective.

Opportunity cost is a basic economic concept with the objective of assigning monetary values to all alternative costs. Smith and Brown (2000) have stated that *`by producing more of one good there must be a reduction in the production of (or lost opportunity) of one or more other goods'*. On the question of opportunity cost valuation, Garber et al (1996) have stated that `the real cost to society of a resource consumed or freed up as part of a health intervention (or as a result of it) is the value of that resource in its next best use to society. Because resources are more scarce than the needs for which they can be used, doing more of a given health service employing more doctors or nurses, utilising more space and equipment for hospital beds, using more chemical or biological products means forgoing something else of value. In an ideal analysis from the societal perspective therefore, resources should be valued at an amount equal to their best alternative use -their opportunity cost.' Generally, in an open and fully competitive market, the price of any product or service could simply be regarded as equalling the opportunity cost valuation.

However, it should be stated that in the medical and healthcare fields because of historical reasons there has been no competition and this mode of care has persisted in our times. This has resulted in the existence of a real divergence of market prices and true cost attributable to several distorting

factors (Luce and Elixhauser, 1990). For example, less lucrative products and services may be subsidised from the earnings on more profitable ones and cross shifting may occur to some patients and their third party payers from those who are not able to meet their medical or healthcare bills. Additionally, part of the opportunity cost to the patient is the cost of the time required for undergoing investigation and treatment procedures and in this respect it has been proposed that 'the best approximation of the opportunity cost of time for working age adults is the wage, they are, or could be making in the paid work' (Smith and Brown, 2000).

These authors, however, have pointed out that this method ignores the inequality of wages between the sexes and various age groups. However, within the healthcare systems, both state owned and privately owned, the purchasers or the recipients of services including agencies and individuals may readily accept the charges set by the providers of healthcare services namely physicians, ophthalmologists, optometrists and others without comparing the prices. Luce et al (1996) have suggested that such prices may not be far from the true reflection of opportunity cost. They have stated that `the real cost to society of a given resource is its opportunity cost, the value of resource in its next best alternative use. For most purposes, market prices provide a reasonable estimate of opportunity cost. For example the wages of a registered nurse or the charge for an office visit generally provide an adequate measure of the value of the resource consumed'.

3.2 (i) Marginal Analysis

Taking into consideration that the healthcare resources are often limited and operate under budgetary restrictions, maximisation of benefits remains a crucial factor in resource allocation decisions. It should be noted that an important aspect of healthcare economics is additional or marginal effects of additional or marginal increase in resource expenditure. Marginal cost is, in essence, additional to total expenditure affecting costs and also benefits. Any cost, additional to total cost, resulting from an increased or additional output of one unit is considered marginal cost. It can also be described as marginal variable cost. Usually, the first unit of a resource is much more costly than the last unit from the same resource. For example, the full cost of a single cataract removal procedure e.g. phacoemulsification or extracapsular cataract extraction would be very expensive, whereas the marginal cost of performing 1000^{th} cataract operation within a specific period e.g. one year would be relatively small. However, average cost as distinct from marginal cost is based upon different calculations. For example, the cost of providing a single cataract removal operation is different from the average cost of cataract operations for the whole year. From cost calculation point of view this distinction becomes crucial because sometimes it is necessary to evaluate a cataract operation on the basis of marginal cost and other times on the basis of average cost. It is to be expected that a cataract patient or providers of health cover e.g. an insurer would be interested

in average cost, whereas a hospital or a clinic would be more interested in calculating marginal cost of a cataract operation. The stated charges or price of a service normally reflects its average cost, not its marginal cost (Luce and Elixhauser, 1990).

In general the average cost decreases as the output increases. However, when the output reaches its full capacity, inefficiencies may arise due to factors like congestion in the system leading to an increase in average cost. Ultimately, the recipients of professional services bear the cost of inefficiency in the system and remain oblivious at the same time. However, diversification of professional and clinical responsibilities with the provision of additional education and training to certain healthcare professionals like the optometrists may provide a cost-effective solution.

3.2 (j) Health Related Quality of Life (HRQL)

The term HRQL was used by Guyatt, Feeny and Patrick (1993) because it was realised that 'widely valued aspects of life exist that are generally not considered as health, including income, freedom and quality of the environment'. It was realised by these researchers that although low or unstable income, the lack of freedom or a low quality environment may adversely affect health, these problems often remain distant from a health or medical concern; when a patient is ill, diseased or visually impaired, almost all aspects of life can become health related. Health Status, functional status

and quality of life are three concepts often used interchangeably to refer to the same domain of *`health'* (Guyatt et al 1993). HRQL can be measured in two ways (a) *generic instruments* provide a summary of HRQL and include health profiles and instruments that generate health utilities and (b) *specific instruments* that focus on problems associated with single diseases, patient groups or areas of function. Questionnaires can be used to used to measure cross-sectional differences in the quality of life between patients at a point in time (discriminative instruments) or longitudinal changes in the quality of life within patients (evaluative instruments). Clinicians and health related policy makers, having recognised the importance of measuring HRQL, are expected to identify trivial, small, moderate and large differences from HRQL measurements. Investigations in HRQL have led to instruments suitable for detecting minimally important effects in clinical trials for measuring the health of populations and for providing information for policy decisions (Guyatt et al 1993).

'A new framework developed by the WHO divides HRQL into overlapping domains that begin at the level of the body's physiological or psychological function and extend to an individual's participation in real life situations' (Manuel and Shultz, 2003).

3.2 (k) Healthy Years Equivalent (HYE)

HYE measures the lifetime health profile of an individual. According

to Gafni (1994) HYE is `based upon the theoretical foundations of utility theory, stems directly from the individual's utility function, thus fully reflecting his or her preferences. It combines outcomes of both quality of life (morbidity) and survival (mortality) and thus can serve as common unit of measure for all programmes, allowing comparisons across programmes'.

A comparison was made between healthy years equivalent (HYE) and quality adjusted life years (QALY) by Mehrez and Gafni (1989) and the authors found that although QALY's are easier to measure, the measurement of HYE 'if properly conducted, results in a valid and reliable outcome by using tools of utility measurement'. These researchers used HYE definition by Torrance (1976) based upon health (function) continuum. Torrance stated that '*health is seen as a continuum running from death at the one extreme to perfect health at the other extreme, with the continuum representing the instantaneous total health of the individual*'. Instantaneous health was defined by Torrance as `*the level of functioning of an individual at a particular point of time*'.

Lifetime health profile of an individual can be described as a vector $Q = [qi]$ where qi is the *ith* element of the vector and qi is also the health state of the individual at the ith period covering the whole life. Perfect health is denoted by $\overline{q}$ and $\underline{q}$ as death. In an ophthalmic context healthy years equivalent could be replaced with normal eyesight years equivalent (NEYE). The lifetime ocular profile of an individual could be described as a vector $E - \{ei\}$ where ei is the *ith* element of the vector. Let ei be the visual state of

the individual at the ith period covering the whole life; denoting $\bar{e}$ as representing visual acuity 6/6 (20/20) with a normal field of vision with or without correction and $\underline{e}$ representing blindness. It is proposed that in an ophthalmic context normal eyesight years equivalent (NEYE) could be measured by employing similar methods used for measuring healthy years equivalent (HYE) and a lifetime ocular \ visual profile of an individual could be described for the purposes of economic evaluation. Economic analyses are primarily concerned with resource allocation and valuation of a specific health-related or wellness attribute. The most commonly used measure for the valuation of outcome in such analyses is QALY which combines qualitative and quantitative aspects of life in one dimension (Gafni, 1997).

3.2 (l) Willingness-to-Pay (WTP)

WTP or willingness to pay method in cost-benefit analyses or *CBA* can be obtained either by direct or indirect measurements. Under the first method direct questioning is carried out to determine the amount the person is willing to pay and it is expressed in common currency units. Under the second method the amount is inferred from the available information. According to Gafni (1991) 'the method of willingness to pay is one approach to the valuation of health benefits, which, if properly employed, is consistent with the principles of welfare economics and cost-benefit analysis'. The

author has stated that 'willingness-to-accept' (WTA) should also be used for the purposes of evaluating costs and benefits. A technique of economic measurement known as the contingent valuation method *(CVM)* is used to consider a hypothetical scenario by asking people WTP questions for the benefit of everybody and to determine the amount recipients of services may be willing to pay. This technique could be used to determine the amount people would be willing to pay to eradicate preventable visual impairment and blindness in a specified region. CVM could also be used by asking willingness to accept *(WTA)* questions (Diener et al, 1998).

3.2 (m) Problems Encountered in Cost Determination

Despite the fact that best attempt is made in cost evaluations, problems may still be encountered during the course of an economic analysis. Additional factors may have to be examined before determining the cost of a new product. For example, research and development (R&D) costs of new drugs should also be taken into account for cost measurements and resource allocations.

In our context, the price of a new drug for treating glaucoma, for example, should incorporate the costs incurred in research and clinical trials over a long period. However, during the trial period a drug may be more expensive because of clinical protocol and the price may have been overestimated. According to Luce and Elixhauser (1990) a commonly accepted method is to

use actual or expected costs because valuation of research and development costs is difficult and their allocation may not be accomplished satisfactorily. It may also be difficult to forecast the future efficiency and even efficacy of a new drug and after a period real or projected clinical evidence will affect the valuation. Changes in technology, research methods and treatment may also influence cost determinations and future planning for services. However, it is also possible that a new product may become more cost effective after a few years. Other valuation problems include omission, failure to include depreciation and double counting of costs. Omission of overheads will certainly provide incorrect costs and so will the failure to include depreciation of relevant equipment. Analysts may inadvertently include disability benefits during the course of analysing cost of illness; double counting will also provide inaccurate valuations.

Calculation of the loss of potential income causes problems because of disparity in earnings in different social groups. Those with lower expected income will have lower economic value for their lives as against those in the higher expected income bracket. Similarly those with a poor prognosis may be willing to pay (WTP) for necessary care as against those without such prognosis and relatively in a better state of health .

Smith and Brown (2000) have stated that `mortality costs' arise due to early death or changes in life expectancy `as a result of the presence or absence of a given healthcare intervention or programme' and `morbidity costs'

are attributed to `lost productivity due to time spent in recuperating or convalescing'. The cost of time spent by the members of family and others very rarely forms a part of cost analysis. Health economists continue to argue over the terms indirect cost and productivity cost and whether or not these should remain interchangeable.

There is a lack of agreement on the question of an acceptable definition of the term productivity cost. However, a definition provided by Brouwer et al (1997) and quoted by Rothermich and Pathak (1999) may be appropriate. Brouwer et al (1997) defined productivity costs as the `costs associated with production loss and replacement costs due to illness, disability and death of productive persons, both paid and unpaid'. Debate continues as to which productivity costs can be easily measured. Debate also continues on the question of indirect costs and whether direct and indirect costs should be combined during the course of cost analyses.

3.2 (n) Dynamic Modelling

Simulation techniques were used in computing over three decades ago which involved building a model of a system and testing the model instead of testing the system (George, 1965, 1972, 1973). The technique of heuristic programming was also applied which included short cuts, hypotheses and modelling in computing; additionally the techniques of *multiprogramming* and *ad hoc programming* were used. The ultimate aim was to make decisions

efficient and quick and steadily improve the standard of outcome. An alternative to simulation was equation solving which was not suitable for solving economic or biological problems (Hollingdale and Tootill, 1970). Arbib in 1964 pointed out the distinction between artificial intelligence and simulation which was between making a computer solve a problem anyhow or making it solve the problem like a human would. The general purpose digital computer could also be programmed to become 'isomorphic with any dynamic system whatever' (Ashby, 1964).

Dynamic modelling is a computer based operation with adaptive tools which provide for simulations to generate activity data for a given period. The generated activity data will include resource availability and also resource usage. Dynamic modelling examines the complex interaction between protocols and processes and also the causes and effects on the target population (Kirby and Peel, 1998).

Although greater confidence in results can be achieved by using larger sample sizes, it is not always possible to collect data relating to large populations because of high costs involved in such operations. Dynamic modelling is used to simulate results from representative smaller population samples. New protocols and practices, new ways of working and assessing and any impact of change on resources, waiting lists, contracts and budgets can be closely examined and tested using smaller samples. The outcome from computer based simulation can provide useful information to all those

responsible for scrutiny, allocation and management of scarce resources. Dynamic modelling can also provide feedback and verification of earlier works to a suitable panel such as the Delphi panel in the design of new models. The Delphi panel enables a wellness management model to be enhanced by incorporating real world practices; the use of Delphi panel techniques is a cost effective and reliable way of collecting information as a proxy for the real data. Delphi panels can provide valuable data by providing access to certain other data which may not exist anywhere else or by providing real world examples of clinical practices which by their nature can be extremely variable (Kirby and Peel, 1998).

All those involved in clinical, health care or related work are fully aware that as a matter of fact there are circumstances when clinical guidelines can not be followed strictly and complex professional skills and methods are required to investigate and solve a clinical problem. Clinical decision making is an intricate process and it would certainly not be surprising if business analysts, health economists and non-clinical workers in health care field find clinical variations confounding (Agarwal, 2000 a).

Dynamic modelling - Delphi panels could be very useful in such circumstances. It should also be noted that dynamic programming could be used for the purposes of testing data for *sequential, consequential* or *inferential decisions* in management and also risk management *in eye healthcare.*

3.3 Summary

In this chapter, costs in eye healthcare delivery with efficient use of resources and without compromising the quality of care are discussed. All healthcare cost evaluations are ultimately linked to cost-benefit analysis and welfare economics.

The cost-benefit analysis is a systematic, quantitative method of assessing healthcare costs and benefits. The purpose of a cost-benefit analysis is to support an efficient resource allocation plan for healthcare through an informed decision making process. The cost-benefit analysis should demonstrate that having considered two or more alternatives, the chosen alternative is the most cost-efficient and cost-effective without compromising the standard of service and quality of healthcare and within the budgetary constraints.

It could be argued that cost-effectiveness analysis is a simplified cost-benefit analysis. Cost-utility can be described as a subset of cost-effectiveness analysis which uses quality adjusted effectiveness measures. Marginal analysis covers marginal cost which is additional to total expenditure affecting both costs and benefits. Cost-minimisation with a view to efficient use of resources may be useful provided it is not regarded as a tool for cheapness and does not compromise quality or standard of healthcare.

When two interventions or therapies are compared, high and low costs could be generated for both and examined under analysis of extremes. Generally in any given system the average cost decreases as the output increases. When the output

reaches its full capacity inefficiencies may arise due to factors like overloading or congestion in the system leading to an increase in average cost. It should be possible to forecast such an event with dynamic modelling.

The concept of opportunity cost, the cost of opportunity foregone, is a basic element of economics now used in healthcare economics. It should be noted that healthcare economics originated in a non-health related environment and it is still evolving.

Chapter 4

Pattern of Eye Healthcare Delivery in the European Union

4.1 Introduction

Whereas the state is expected to provide suitable infrastructure and resources for all healthcare needs of all its citizens and an international healthcare agency like the World Health Organisation (WHO) is expected to authorise contingency and epidemiological studies to cover different aspects of public healthcare, it is ultimately the responsibility of a suitably trained practitioner or clinician from whichever field to provide the necessary professional care, sometimes onerous, on a one to one basis.

In the eye healthcare field, in addition to providing services for the enhancement of visual performance, the most obvious task for an optometrist is prevention or avoidance of blindness and visual impairment by providing appropriate primary and diagnostic eye care to the people.

In established market economies (EME) and industrialised countries, cataract, glaucoma, diabetic retinopathy and age related macular degeneration are generally considered the main causes of visual impairment and blindness. It should be noted that the established market economies (EME) of North America and Western Europe include the current EU member states, Australia, New Zealand and Japan. For the purposes of WHO studies and statistics, an acronym FSE is also used to describe the former socialist market economies of the Russian federation and Eastern Europe. On the basis

of economic development six other groups cover rest of the world (See Appendix 1). On a global basis, the major causes of visual impairment and blindness also include trachoma, malnutrition and congenital cataract causing childhood blindness. However, a large proportion of ocular conditions are treatable with appropriate interventions and according to WHO estimates revised in February 2000 (WHO, FS 213, 2000) about 80% of global blindness or visual impairment is avoidable hence the pattern of eye health care delivery anywhere in the world assumes a very special significance. The first World Health Assembly in 1948 adopted a resolution on the care of the blind, it was only in 1972 that the World Health Organisation authorised epidemiological studies relating to blindness. According to 1972 estimates, at that time blind people numbered between10-15 million globally (Weale, 1998). In 1975 the World Health Assembly approved studies for the prevention of blindness and in 1978 the World Health Organisation programme for the Prevention of Blindness (PBL) was formally established. The WHO also encouraged the International Agency for the Prevention of Blindness (IAPB) to work with non-governmental organisations (NGOs). By 1980 the WHO PBL programme began working on the development of a primary eye care model as part of primary healthcare (Thylefors, 1998). It should be noted that despite the fact that the World Health Organisation has recommended an international definition of blindness, countries may still have their own variations because of legal, economic, social and probably

cultural reasons. For example, there are two definitions of blindness presently in use in the UK. The Royal National Institute for the Blind (RNIB) uses VA< or =6/60 (VA < or =20/200; VA < or =0.1) and not the WHO visual acuity <3/60 (<20/400; <0.05) for classification as blind. Interestingly in the USA and Canada VA <or = 20/200 (VA<or=6/60; VA<or=0.1) is used for the purposes of legal definition of blindness.

In the UK the WHO definition is used on the official form BD8 for the purposes of certification and registration as blind or partially sighted. According to RNIB in 1985-86 out of every 100 blind people in the UK, 64 were not registered and 87 out of 100 partially sighted people were also not registered (Evans et al, 1996). The National Council for the Blind in the Republic of Ireland (NCBI) uses visual acuity 6/60 or less (20/200; 0.1 or less) for certification and registration as blind and not the WHO definition. In Finland, a modification of WHO definition is used for inclusion in the Finnish Register of Visual Impairment maintained by the Finnish Federation of the Visually Handicapped. The Danish Society of the Blind also uses a modified version of WHO definition of blindness. In Denmark, blindness is divided into three categories, social (VA 6/60 or less), practical (VA 1/60 or less) and total. However, even a small variation in the definition of blindness, especially the visual acuity, will provide variable statistical information on the causes of blindness and visual impairment and also the figures concerning the numbers of registered blind and partially sighted

people within the EU. Therefore, any statistical comparison within the EU for the purposes of management of avoidable blindness or visual impairment may prove to be inconsistent since statistical conclusions generally show sensitivity towards varied figures. Definition of blindness also varies within the EME. It would certainly be helpful if the EU member states could agree to have a common EU definition of blindness and visual impairment. However, the WHO definition of blindness (ICD 10) has already been incorporated into the International Statistical Classification of Diseases and Related Health Problems, generally referred to as the ICD.

4.2 (a) The Provision of Eye Healthcare Delivery in the EU

Although in most EU countries both primary and secondary eye care is provided by ophthalmologists, in the UK and the Republic of Ireland primary and diagnostic eye care is shared between family physicians, optometrists and ophthalmologists. Despite the fact that optometry degrees from Utrecht, Netherlands are now accepted by the GOC for registration in the UK and optometry degree holders from Spain can obtain British registration after successfully completing GOC approved additional training in optometry in the UK, the scope of optometric practice and the pattern of eye healthcare delivery in these states and elsewhere in the EU remains diverse and unlike the pattern found in the UK and the Republic of Ireland.

In some areas of eye healthcare in the UK, optometrists and GPs are

required to provide almost identical ophthalmic referral service, for example hospital referral for cataract patients (Johnston, 2003); both practitioners are expected to diagnose the condition and also discuss risks and benefits with patients before referring them for an ophthalmological review.

Family physicians in most EU countries provide a mixture of basic eye care and screening for ocular conditions requiring referral for ophthalmological services. To a large extent many aspects of eye care services provided by the British and Irish optometrists are similar to those provided by family physicians in most of the other EU states. In the UK and the Republic of Ireland GPs regularly seek diagnostic opinion from optometrists before referring a patient for an ophthalmological review and assessment.

A majority of British GPs regard British optometry as an invaluable resource of clinical expertise. A survey of the opinions of 800 British GPs regarding the services provided by the British optometrists was carried out by Agarwal at the City University in 1990 (Agarwal, 1996 a). In the survey, out of 396 replies, several GPs identified different clinical reasons for regular referrals to optometrists which included ophthalmoscopic assessment, glaucoma, diabetic retinopathy, diagnostic retinopathy, optic disc assessment and headaches without obvious neurological causes. In the survey almost 95% of respondent British GPs were satisfied with the services provided by optometrists, highly valuing clinical assessments made by optometrists and regarded optometry as a primary health care profession. One respondent GP

stated that optometrists were excellent at diagnosis and more eye pathology was detected by an average optometrist than an average GP. British GPs also indicated that they would welcome an extension of professional services provided by optometrists through additional training and certification.

It is a matter of fact that currently the role of optometrists in the delivery of eye care in most of the EU remains diverse and unlike the model found in the UK. British optometrists as primary healthcare practitioners already participate in shared care schemes monitoring the ocular complications of systemic conditions like diabetes and vascular hypertension. It is a significant change in the eye healthcare field and for British optometry that almost three decades later *shared care* is transforming into *delegated care.*

Under a new scheme known The Glasgow Integrated Eye Service (GIES), optometrists in the Glasgow area are now working even more closely with the GPs and ophthalmologists with full support of the local Health Board. Patients in Glasgow area have to wait for over a year to get a Hospital Eye Service appointment with an ophthalmologist. Under this pilot project GPs will formally refer selected patients to participating optometrists with a guarantee that patients will be seen within 48 hours. Optometrists will then be expected to follow an agreed protocol and following their own clinical assessment will decide whether or not a patient has to be referred for an ophthalmological review. Under the GIES scheme, refraction will not be a required element of patient assessment (OQ no. 45, 2003). This scheme will no doubt reduce

hospital waiting lists for those patients in the need of secondary ophthalmic care since most of primary eye care will be delegated to optometrists. Each participating optometrist will be expected to provide services under GIES for 700 to 1000 patients every year.

It is anticipated that similar schemes to provide delegated eye care will operate all over the United Kingdom in due course. However, another new development in the eye healthcare field has taken place in the historic county of Gloucestershire. In January 2000 at a workshop attended by all consultant ophthalmologists and over 90% of registered optometrists in the county, direct hospital referral by optometrists for cataract patients was launched involving optometrists, ophthalmologists and also general practitioners from Gloucestershire (Price, 2003). Under this scheme, following direct hospital referral of patients by optometrists, GPs will also provide additional clinical information directly to hospital concerned. The success of this scheme was evident from the fact that the Health Authority in the area agreed to introduce a referral fee for participating optometrists. Ongoing audit is used to confirm the quality and quantity of referrals. Optometrists also play an important role in educating patients. About one month after surgery, patients without clinical complications are seen in an *`optometrist-led fast track follow up clinic'* (Price, 2003). In a separate study, from the case notes of patients who had cataract surgery during 1997-98 in Peterborough, it was recommended that patients without complications can be discharged *`to the care of their optometrists on the first day following cataract surgery'* (Muthucumarana and Rimmer, 2000).

It has to be noted that for many years optometrists in the UK have performed ocular biometry i.e. axial length measurements, anterior chamber depth determination, lens thickness calculations and other measurements required to determine intraocular lens (IOL) power and selection of suitable IOL lenses. It is indeed significant that over the last 20 years British optometrists have actively participated in pre-surgical and post-operative cataract management and IOL selection process.

However, in an European Union context a review of four selected eye conditions namely *cataract, glaucoma, diabetic retinopathy and age-related macular degeneration*, being the major causes of blindness and visual impairment, may provide us with a basis for future planning in the management of these conditions, prevention or avoidance of blindness and delivery of appropriate eye healthcare with quality assurance in all EU member states.

4.2 (b) Management of Cataract in the Delivery of Eye Healthcare

Despite enormous global and regional variations in the incidence and prevalence of visual impairment and blindness due to cataract, it remains a major cause of blindness in almost every country in the world (Appendix 5 and 6). There are several ways of classifying cataract. Crick and Khaw (2003) have classified it on the basis of stage of development (e.g. intumescent, mature, hypermature), anatomical position of the opacity (e.g. cortical, nuclear,

subcapsular) and aetiology (e.g. diabetic, traumatic). Crick and Khaw (2003) have stated that 'in clinical practice all three classifications are used when describing a cataract e.g. marked corticosteroid-induced posterior subcapsular opacities'. Broadway et al (1999) have classified cataract by age (congenital or age-related), stage (early to hypermature), morphology (capsular, sub-capsular, cortical or nuclear) and aetiology. According to Dolin (1998), cataracts are generally categorised into congenital, trauma-related, secondary and age-related; aetiology and histology based classifications are also used. Chitkara (1999) observed that 'numerous individual causes of cataracts exist and often multiple factors act together, with plenty of scope for overlap between the groups. Some causes predispose to a specific morphologic variety of cataract, while other causes predispose to the common senile variety. Also a given cause may produce many different morphologic forms of cataract'. According to Chitkara (1999), classification of causes of cataract includes age-related, physical factors, radiation, systemic disorders, dermatologic disorders, endocrine disorders, central nervous system disorders, secondary and toxic causes.

Dolin (1998) has listed three types of risk factors associated with cataract. *Definite risk factors* include age, diabetes, gender (female), smoking, steroids and sunlight; *possible risk factors* include alcohol, oestrogen, hypertension, limited education, low body mass, low height, low weight, low social class, myopia, renal failure, rural residence, severe diarrhoea or dehydration,

and *possible protective factors* may include use of aspirin and antioxidant vitamins.

Glaucoma has long been regarded as a risk factor for cataract. Further studies are required to determine whether it is glaucoma or the treatment of glaucoma that may be considered as a risk factor (Dolin, 1998). However, it was concluded in a study by Kuppens et al (1995) that 'untreated primary open angle glaucoma or untreated ocular hypertension do not seem to increase significantly the risk of developing cataract'. According to Crick and Khaw (2003) ocular risk factors may include acute angle closure glaucoma, myopia, prolonged uveitis, retinitis pigmentosa, long standing retinal detachment and heterochromic cyclitis.

Cataract is primarily a disease associated with the ageing process although it has been observed that some families or ethnic groups may be more susceptible to this condition (West et al, 1998). Genetically determined isolated cataract accounts for approximately 10% of congenital cataracts (Hurst, 1992). In the Beaver Dam Eye Study (Heiba et al, 1995) segregation analysis was used to show that there may be recessive genes that predispose the population to both nuclear and cortical cataract (Hall and Rosenthal, 1999).

Age related cataract may not be preventable but blindness is usually avoidable. It was estimated in 1996 that in the UK 'between a fifth and a third of people aged 65 or 74 will develop some lens opacity over a five year period' (Effective Health Care, 1996). Approximately 5% people in the

age group 55-64 and 40% over the age of 75 develop cataracts (Klein et al, 1992 b). It was observed that 63% develop cortical type cataract, the most common in the UK (Brown and Hill, 1987). In a study by Minassian et al (2000) the backlog of people with vision impairing (<6/12) cataract in the 65 and older population in England was estimated to be 2.6 million. The WHO estimated that in 1990 out of 38 million blind people in the world, cataract (ICD 366) accounted for almost 16 million (41.8%) blind and a further 110 million visually impaired (Thylefors et al 1995; WHO/1990/PBL/94.40). By the year 2000 the numbers had increased to 40-45 million and approximately 20-22.5 million (50%) blind due to cataract (WHO, FS 213, 2000). These estimates are based upon the WHO definition of blindness i.e. best corrected VA <3/60 (<20/400; 0.05) or finger counting at 3m in the better eye or a visual field loss in each eye to less than 10 degrees from fixation. If, for the purposes of this estimate, we were to adopt the RNIB definition of blindness i.e. best corrected VA 6/60 or less (20/200; 0.10 or less) then the global percentage of blindness in general and due to specific causes like cataract would be considerably higher. The WHO cataract blindness estimate (1990) for the established market economies (EME) was 3.5% and for the former socialist economies (FSE) it was 8.3%, out of 38 million blind globally. The EME/FSE cataract blindness figures for later years are not available. As stated previously the established market economies are essentially an economic cluster of states which also includes all the current

EU member states. The WHO estimates have shown that blindness figures vary considerably between specific economies and territories, sometimes even 5-10 fold. However, within a territory or a country, estimated figures of blindness may be very different for a specific city or even an area within a city. In 1994 it was estimated by the International Eye Foundation that in Bulgaria in the Sofia district (urban and rural) 42% of blindness was due to cataract (IEF, 1994). This estimate was slightly higher than the WHO global figure for 1990 which was 41.8% (WHO/1990/PBL/94.40).

In England and Wales during 1990-91 cataract-induced blindness and partial sight (WHO definition) in all age groups was 3.3% and 7.0% respectively (Evans, 1995; Evans et al 1996). In an Irish study cataract accounted for 11% of blindness (VA < or = 6/60 or 20/200 or 0.1) and one third of these patients had an associated cause and one tenth had a cognitive deficit (Munier et al 1998). However, unlike the official British figures published by Her Majesty's Stationary Office, the following blindness figures for other EU countries were obtained mostly from non-governmental agencies e.g. blind associations and from published material in various medical journals covering some local areas and populations. There was no response regarding blindness figures from government departments and health ministries, ophthalmological , optometric, and optical societies and associations of most EU countries. The requested information was either not available or did not exist.

The Finnish Register of Visual Impairment (1993 annual statistics) did not

specify cataract separately. In a separate Finnish study only 1.3% were recorded as blind due to cataract on the basis of the WHO definition (Hirvela and Laatikainen, 1995). It was stated in another study from Finland that progression of visual loss in patients waiting for cataract surgery varied significantly and for many the extended delay caused remarkable disability for the remainder of their lives (Leinonen and Laatikainen, 1999).

In an Italian study based on the National Household Health Survey (NHHS) cataract accounted for 23 % of blindness in the southern region. (Nicolosi et al, 1994). It was observed that the causes of avoidable blindness were more frequently reported in southern than in northern Italy.

In the territory surrounding Turin, in north west Italy, the case notes of 4549 residents who were certified blind between 1967 and 1991 were examined with regard to cause of visual loss, age at onset, and the year of onset of VA <or =1/20, by Porta et al (1995). It was found from the case notes that 26.7% had already been certified blind due to cataract. The purpose of this search by the authors was to collect information on the causes of certified blindness before implementing permanent screening for diabetic retinopathy. However, these figures are useful in providing information concerning blindness due to cataract in northern Italy.

In a French study conducted at the Orleans regional hospital serving a semi-rural area in France cataract accounted for 13.3% of blindness in patients aged 60 years or older (Cohen et al 2000). It was reported in a study

from The Netherlands that 'adequate implementation of surgery to treat cataract could reduce visual impairment by one third' (Klaver et al, 1998). On the basis of 1992 figures from Organizacion Nacional de Ciegos (ONCE) cataract induced blindness in Spain was recorded as 3.4%. Incidence of blindness due to cataract in Wurttemberg-Hohenzollern, Germany between 1994-98 was recorded as 3.32% (Trautner et al, 2003). In a Swedish study poor visual acuity after cataract surgery was found in 22% patients, mostly as a result of concurrent age-related maculopathy, diabetes or glaucoma (Monestam and Wachtmeister, 1999).

Ageing is unavoidable and remains a significant factor in the prevalence of visual impairment and blindness in any given population. For any future planning for eye healthcare delivery it should be noted that the elderly population is increasing throughout the world. It is estimated that by the year 2020 in the established market economies and industrialised world in general, the elderly population will increase by 186% and in the rest of the world by 356%. The WHO estimates that by the year 2020, globally there will be 54 million blind people aged 60 or over.

In 1993 the blindness percentage for people aged 60 or over in the established market economies (EME) and the former socialist market economies (FSE) was 11.2% of the total blindness in the world (WHO/1990/PBL/94.40). The main obstacles to cataract surgery in eastern European countries were state budgetary limitations, insufficient supply of

consumables, under utilisation of operating theatres and poor diagnosis of surgical needs of patients (Kocur et al, 2002).

The WHO has envisaged a very likely increase in the number of people requiring cataract operations by the year 2020 and has actually adopted 2020 as its target year in the campaign for the prevention or avoidance of visual impairment / blindness (WHO, FS 214, 2000). The ultimate aim remains the elimination of avoidable blindness throughout the world.

In the United Kingdom an estimated 200,000 cataract operations are performed annually (Johnston, 2003). In England and Wales, a total of 132,866 cataract operations were performed in 1995-96 on people falling in the age range 65 and older (Minassian et al, 2000). In England the rate of cataract surgery financed by the NHS has been increasing since 1993, although there is considerable variation in the number of surgical interventions for cataracts between districts (Effective Health Care, 1996). A study conducted in 1994 in the northern region of England showed that there was considerable variation in the threshold for cataract surgical intervention. The level of visual acuity impairment due to cataract at which ophthalmologists decided to operate significantly varied between districts (Effective Health Care, 1996).

According to WHO the number of cataract operations per million population per annum (Cataract Surgical Rate or CSR) is a useful measure of the delivery of eye care since CSR varies in different economies, countries and even within a country (WHO, FS 214, 2000). The CSR in the UK is probably

between 4000 and 4500 i.e. about 100 operations per working week per million population (Wormald and Foster, 2004).

It is estimated that the number of people with cataract blindness will increase and more resources will be required for cataract surgery to avoid blindness. However, it has also been suggested that delaying the onset of cataract by 10 years could reduce the annual number of cataract operations by 45% (Hall and Rosenthal, 1999). This requires identifying avoidable risk factors for cataract. It is already known that there are certain attributes or factors, described as risk factors, which contribute in increasing a person's chances of developing a cataract. As stated previously some risk factors are considered almost definite and these include normal and premature ageing, sunlight (UV-B radiation), malnutrition and smoking (Dolin, 1998); and also alcohol abuse (Agarwal, 1997 a). Some of these risk factors like malnutrition, smoking and alcohol abuse could be avoidable. However, a majority of risk factors remain unavoidable e.g. renal complications, hypertension, low height, low weight, low body mass, socio-economic factors and environmental factors e.g. rural residence. Evidently, the risks involved in the onset of cataract are multi-factorial (West and Valmadrid, 1995).

Congenital cataract was found to be one of the three major causes of childhood blindness (12/99) in Scotland in the Royal Blind School in Edinburgh and it was the most common cause of partial sight or blindness in a nationally representative cohort of 15,000 ten year old children in Britain

(Lloyd et al, 1992). It is estimated that congenital cataract occurs in one in 10,000 births, excluding those with multiple abnormalities (Moore, 1994). The Royal College of Ophthalmologists (RCO) and the Royal College of Paediatrics and Child Health (RCPCH) have recommended that all babies should be screened for this condition. Congenital cataract needs to be identified within 6 to 8 weeks following birth for urgent ophthalmic intervention to avoid blindness (Barnard and Edgar,1996). Such cataracts may occur in isolation or as part of a congenital or inherited disease or syndrome causing blindness (Swann & Zahner, 1995).

Childhood blindness accounts for 3.3% of global blindness due to all causes including congenital cataract according to WHO estimates (WHO, FS 213, 2000). Infants born at weights 2500g or below have a three to four fold increased odds of developing infantile cataract (SanGiovanni et al, 2002). Clear guidelines for screening are needed to establish the incidence and prevalence of childhood blindness due to congenital, infantile and juvenile form of cataracts. It should be noted that Childhood is defined by the United Nations International Children's Emergency Fund (UNICEF) as a period of life from birth until 16 years of age.

According to a recent pilot study investigating `one stop' cataract surgery facility, British optometrists can accurately predict the need for cataract surgery without the need for general practitioner involvement (Gaskell et al, 2001). It was concluded from this pilot study that `one stop' cataract surgery

is feasible because of several benefits to the patients such as abolition of the need to visit the general practitioner for consultation and referral and the hospital pre-surgical assessment. There was a high level of patient satisfaction reported in a separate `one stop' cataract service study (1997-99) at the Bristol Eye Hospital (Hughes et al, 2001). Patients were satisfied with the service because only one hospital visit was required as against three.

In a separate study carried out at the School of Community Health Sciences at the Medical School in Nottingham, views of older people on key issues concerning cataract surgery were sought (Ross et al, 2003). The main issues were hospital waiting lists, complication rates from surgery and the use of junior surgeons. Most respondents thought that surgeon grade was not important whereas risk of damage to sight and/or waiting time were important. Potential cataract patients preferred a greater risk of complication combined with a short waiting rather than a low complication rate and a longer waiting list (Ross et al, 2003).

Additional resources are continually required for identification and management of risk factors in eye healthcare and also interventions at different levels of eye care. It is indeed debatable whether applying extra resources for maximising efficiency within the existing system always leads to real efficiency. For the avoidance of blindness and visual impairment, alternative methods of management of eye care have to be explored. It is understood that appropriately trained human resources are the core component

in the prevention, treatment and rehabilitation of avoidable blindness. Optometrists in the UK already receive superior professional education compared with many other countries in the EU and many countries in the world. In established market economies the cost of providing all forms of health care is high and continues to escalate. Therefore, it may be more cost effective and equally efficient if secondary eye care including specific surgical intervention is also provided by British and Irish optometrists with additional training and certification. It is realised that in the rest of the EU, raising educational and professional standards in optometry remains a priority before any harmonisation can take place.

In the United Kingdom the main issue regarding cataract surgery is not the quality of treatment but the waiting time for surgical intervention.

4.2 (c) Management of Glaucomas in the Delivery of Eye Healthcare

Identification of risk factors in glaucoma requires a carefully planned screening strategy because it is a collection of diseases which can cause irreversible loss of visual function and blindness. Glaucoma, of all types and forms is a major cause of blindness, second commonest in the world after cataracts. It is a major public health problem throughout the world affecting 65 million people and an estimated 7 million become blind due to glaucoma (O'Donoghue, 2001). Glaucoma is classified as open angle or angle closure type, and may also be described as primary or secondary. Developmental

glaucoma is also described as congenital glaucoma (Johnson, 1998).

It is reported that approximately 80% of glaucoma sufferers are primary open angle glaucoma (POAG) type (Tuck and Crick, 1997a). Epidemiological surveys in many countries have also indicated that 50% or more POAG patients remain undetected (Tuck and Crick, 1997b). POAG is a common ocular condition with a raised intraocular pressure causing damage to optic nerve fibres and resulting in irreversible damage to the field of vision. This insidious condition with an open anterior chamber angle is chronic, bilateral and asymptomatic i.e. people are usually not aware of irreversible damage to their field of vision. The Glaucomas mainly affect the middle aged and elderly, and account for 8-15% of blindness registration in the western countries (Tuck and Crick, 1998 b).

The risk factors for POAG include family history, elevated intraocular pressure, ageing, ethnicity, myopia, diabetes, systemic hypertension and evidence of vascular spasm such as migraine (Fraser and Wormald, 1999; Galloway and Amoaku, 1999; Lee, 1998; Johnson, 1998). There is an ongoing debate whether or not POAG is associated with diabetes (Johnson, 1998). People of African, Afro-American and Afro-Caribbean descent are reportedly more susceptible to POAG (Fraser and Wormald, 1999). Associated risk factors may include socio-economic, gender, smoking and alcohol abuse (Fraser and Wormald, 1999). Ocular risk factors are routinely assessed during an eye examination which would include ophthalmoscopy,

tonometry, perimetry, gonioscopy if necessary, determination of visual anomalies and an assessment of refractive errors. However, sometimes these tests may not provide conclusive evidence of glaucoma. It should be noted that IOP measurement is a poor diagnostic tool. At best it identifies the presence of a risk factor for glaucoma. The IOP level may be sufficiently elevated to justify repeated measurements and prophylactic hypotensive treatment, but an elevated IOP does not confirm a diagnosis of glaucoma. Also not all patients with glaucoma have an intraocular pressure above the normal range (Hitchings, 1996). Visual fields are often normal until a patient loses half of their nerve fibre layer and reliance on cupping of optic disc is often misleading (Sherman, 2000).

For investigation purposes, clinicians regard family history as an established indicator of primary open angle glaucoma. From the available twin and family studies the proportion of hereditary POAG can be in the range of 70-80% (Johnson, 1998). Other studies indicate that 10-50% POAG patients report a family history of this disease (Tielsch et al,1994). Since siblings share the greatest proportion of genes, that relationship is regarded as a predictor for inheriting POAG. It has been known that both dominant and recessive Mendelian inheritance patterns exist for POAG (Hill, 1995).

On the question of gender as a risk factor in glaucoma, the Baltimore (Tielsch et al, 1991), Beaver Dam (Klein et al, 1992c) and Roscommon (Coffey et al, 1993) studies did not find a significant difference in men and women. The

Rotterdam (Dielmans et al, 1994) and Barbados (Leske et al,1994) studies found men at greater risk, but the Dalby study (Bengtsson, 1981a) and the Australian Blue Mountain Eye Study (Mitchell et al, 1996) found higher risk for women. In 1980 in the west of Scotland, it was observed that blindness was caused due to glaucoma in 11.2% women as against 19.9% men (Ghaffour et al, 1983). However, these studies do not provide conclusive evidence that gender is a risk factor. It should be noted that variations in conclusions in these studies may be due to different study designs and research methods.

Whereas myopia is implicated with POAG, a high degree of hypermetropia may be related to closed angle type glaucoma both chronic and acute, usually determined by direct or indirect gonioscopy. People of Mongoloid origin may be more susceptible to closed angle type glaucoma (Johnson, 1998).

In England and Wales, between April 1990 and March 1991, on the basis of certifications (BD8 forms) it was found that 11.7% of blindness was caused due to glaucoma in all age groups (Evans, 1995; Evans et al, 1996). However, 12.9% were certified as blind in the age group 65 years and over. As stated previously, the BD8 figures are based upon WHO and not RNIB definition of blindness.

According to the WHO figures (WHO/1990/PBL/94.40), glaucoma accounted for 7.5% of total world blindness in the established market economies (EME) and 6.8% in formerly socialist economies (FSE).

Despite repeated requests for information on the incidence and prevalence of blindness due to glaucoma and other causes from the relevant agencies, organisations and government departments in the EU, even basic information was not available from most EU member states. However, the following information from a variety of random and non-governmental sources from some EU countries gives a general indication that blindness due to glaucoma in the EU ranges between 5-25%. Because of variations in blindness definition in the EU, it is not possible to make meaningful comparisons. The following statement from the European Blind Union (2003), based in Paris, is self explanatory: 'the numbers of blind and partially sighted people in European countries are based on estimates provided by the national members of the EBU and are an approximation of a highly complex reality. Lack of official statistics and varied legal definitions of blindness and partial sight make it particularly difficult to work out accurate numbers'.

On the basis of applications for membership during 1993 to the Danish Society of the Blind (VA < or = 6/60; VA < or= 0,1) 5% of blindness was caused due to glaucoma (Rosenberg and Klie, 1996). However, in 1993 edition of the Finnish register of Visual Impairment, 10% of visual impairment was recorded due to glaucoma.

In Germany, blindness certificates from the region of Oberbayern were studied to obtain data for the incidence, prevalence and causes of blindness in Bavaria and it was found that 17% of blindness was caused due to glaucoma

(Krumpaszky and Klauss, 1992). In the city of Hessia in Germany, blindness caused due to glaucoma was found to be 12.6% (visual acuity <or = 0.05 or equivalent visual handicap) according to 1996 figures based on blindness compensation payments (Graf et al, 1999). In this study VA < or = 0.05 (or equivalent visual handicap) was defined as 'substantial visual handicap'. In a separate population based study from Wurttemberg-Hohenzolern (Germany) on the incidence of legal blindness (VA<1/50) based on information from social services found glaucoma as the cause of blindness in 1.6/100,000 people (Krumpaszky et al, 1999).

In Italy 7% of blindness was recorded due to glaucoma according to the National Household Health Survey (Niclosi et al,1994). In the area surrounding Turin, in north west Italy, the case notes of 4549 residents who were certified blind between 1967 and 1991 were examined with regard to the cause of visual loss, age of onset, and the year of onset of VA <or=1/20, by Porta et al (1995). It was found from the case notes that 8.9% had already been certified blind due to glaucoma.

The 1994 estimate for France, provided by Federation des Aveugles et Handicapes de France, suggests that 5% of blindness was recorded due to glaucoma (FAHV, 1996).

Bengtsson (1981b) reported that in Sweden the prevalence rate of glaucoma associated with visual field loss increased with ageing and reached a rate of 4-5% in people over the age of 75.

The highest glaucoma blindness figures (25%) from an EU member state were recorded in Roscommon County in Ireland (Coffey et al, 1993). In this study a total of 2186 people over the age of 50 were examined, which represented a 99.5% response rate. However in another study concerning the causes of blindness in the adult population of the Republic of Ireland the figure recorded was 16% (Munier et al, 1998). The difference in Roscommon figures was attributed to 'actual differences between geographically separate areas' (Tuck and Crick, 1998a).

Glaucoma diagnosis requires extra vigilance in the identification of risk factors, repeated tests and long term surveillance of ocular health of all those patients suspected of having glaucoma. Complex clinical skills are required for treating glaucoma. It has already been estimated that the elderly population in every country will increase and so will the blindness figures due to glaucoma. It is certainly not practical to expect a total of 750 British ophthalmologists to provide a mixture of primary and secondary eye care to almost 60 million people in the UK.

Furthermore, GPs in the UK are not geared or equipped to provide a deliberate and disease-specific screening, early detection or assessment of ocular conditions like *'diabetic retinopathy or open angle glaucoma'* (Smeeth, 1998). These conditions may remain undiagnosed especially when patients have not reported any symptoms. Smeeth (1998) has rightly pointed out that 'unreported or undiagnosed visual impairment is common among older people

and is associated with considerable morbidity. Testing for visual acuity is easy and quick but may not accurately reflect the level of functional disability caused by the visual problem in everyday living'.

In a recent paper by Tuck and Crick (2003) it was projected that the number of POAG cases in England and Wales is `estimated to increase by a third over the 20 years to 2021 and then continue upwards at a similar pace to 2031'. These authors have commented that `to cope with additional pressures, a thorough reappraisal of the present system for detection, referral, diagnosis, treatment and monitoring of the disease is likely to be required'.

The concept of shared eye care in the UK is now almost three decades old (Burns-Cox, 1995). Harrison et al (1988), writing in the British Medical Journal, stated that the 'use of a community based service to screen for glaucoma could save unnecessary consultant outpatient appointments'. In 1995, Burns-Cox stated that 'optometrists are those chiefly responsible for detecting ocular hypertension and glaucoma. Sixty thousand out of the 6.3 million NHS eye tests carried out each year are for this diagnosis'.

Development of high quality shared eye care supports providers of both primary and secondary care. 'Shared care between optometrists and those medically qualified is highly relevant to suspected glaucoma' (Burns-Cox,1995).

In the Bristol Shared Care Glaucoma Study it was concluded that `trained community optometrists are able to make reliable measurements of the factors

important to the assessment of glaucoma patients and glaucoma suspects' (Spry et al, 1999). In a follow up study two years later it was concluded that 'there were no marked or statistically significant differences in outcome between patients followed up in the hospital eye service or by community optometrists' (Gray et al, 2000).

In another study (Theodossiades and Murdoch, 1999), it was concluded that the positive predictive value of optometric referrals was highest when the three screening tests (intra-ocular pressures, optic disc assessment and perimetry) were performed.

It was stated in a study by Banes et al (2000) that an 'optometrist was capable of undertaking routine glaucoma assessment and of making good clinical decisions'. In this study 54 patients were recruited and clinically assessed by an optometrist. Subsequently a research fellow i.e. an ophthalmologist, assessed the same patients independently. The results of the study showed that 'there was a high level of agreement between the optometrist and the 'gold standard' of experienced ophthalmologist, in all aspects of patient evaluation and management'. The study suggested that 'by using everyday clinical skills, in combination with a structured training programme, optometrists in the future could make a valuable contribution to patient care in glaucoma clinics'.

In a Manchester based glaucoma referral refinement study by Henson et al (2003), patients with suspected glaucoma were referred by their optometrists

to a group of specially trained community optometrists with a view to hospital referral, under an agreed protocol, instead of being referred to their general medical practitioner. The number of suspect glaucoma cases referred to the Manchester Royal Eye Hospital was reduced by 40%, thus saving hospital resources.

Clinical management of glaucoma is indeed a distinct sub-speciality. Choplin and Lundy (1998), ophthalmoogists and editors of 'Atlas of Glaucoma', have stated that 'to try to describe multiple disease, conditions, and scenarios in a widely disparate group of patients with a single term *glaucoma* is subject to frustration. *Glaucomologists* do not deal with a single disease'.

The Department of Health has already embarked on its plans for optometrists to prescribe therapeutics for treating patients with eye disease (Anon, 2003). The competency framework for supplementary and independent prescribing optometrists, was prepared by the National Prescribing Centre under contract from the General Optical Council (Anon, 2004). With the present level of training, British optometrists, with further specialisation in glaucoma management especially diagnosis and treatment, would be ideally suited to provide a cost-effective and efficient service. In the rest of the European Union, optometrists with appropriate training and support from their governments and the medical profession, will have to assume a much bigger role in the surveillance and management of glaucoma.

4.2 (d) Management of Diabetic Retinopathy in the Delivery of Eye Healthcare

Retinopathy is a predictable complication of diabetes and a major cause of blindness in the world. Factors associated with increased risk of diabetes include ageing, obesity, ethnicity, alcohol abuse, smoking and a lower socio-economic status. Diabetes which starts in childhood or adolescence is usually more severe than that beginning in middle or old age. Duration of diabetes is a good predictor of diabetic retinopathy and several other ocular complications like cataract, glaucoma, vitreous haemorrhage and retinal detachment.

Susceptibility to diabetes may also depend upon genetic factors but the pattern is not likely to follow a Mendelian characteristic either for insulin dependent or non-insulin dependent diabetes (Klein and Klein, 1998). Interestingly in a study of maternally inherited diabetes and deafness (MIDD) it was found that 86% of patients who received an ophthalmological examination had macular pattern dystrophy (Guillausseau et al, 2001). In MIDD patients, bilateral macular pattern dystrophy (MPD) was characterised by linear pigmentation surrounding the macula and optic disc (Massin et al, 1999).

Ethnicity is considered as an increased risk factor in the incidence of diabetes because people of certain ethno-racial groups like those of south Asian origin or descent have shown a higher prevalence of diabetes mellitus (Manuel

and Schultz, 2003). However, such conclusions are generally sensitive to considerations like study designs, protocols for examination and documentation. These factors and changing demography may explain variability in results pertaining to ethnic groups. Manuel and Schultz (2003) have commented that 'there is no *gold standard* for assigning an individual to an ethnic group or for determining someone's ethnicity as part of a population based survey'. Generally an ethno-racial status is determined on the basis of common origin and culture. However, it is debatable whether culture remains a valid criteria for such studies in view of migration of people all over the world, often leading to a compromise in their culture and life style. A study of Japanese Americans found 'lower rates of retinopathy than in Japanese who reside in Japan' (Klein and Klein, 1998).

It has been suggested that elevated systolic blood pressure may be a moderate risk factor for diabetic retinopathy (Benson, 1999). It has also been suggested that high blood pressure independent of coexisting nephropathy is not a strong risk factor for diabetic retinopathy (Benson, 1999). In diabetic women who start a pregnancy without retinopathy, there is a 10% risk of developing non-proliferative diabetic retinopathy (Benson, 1999). Those with non-proliferative diabetic retinopathy at the onset of their pregnancy associated with systemic hypertension tend to show characteristics of proliferative diabetic retinopathy i.e. progression with haemorrhages, cotton wool spots and macular oedema. High risk groups include women with a history of

gestational diabetes mellitus (GDM) or who have delivered a baby that weighs more than 9 pounds or 4 kg (Levene, 2003). It has been reported that there is an up to 50% risk of future diabetes in women with GDM (Gadsby, 2002). Children of women with a history of GDM may also be at risk of developing diabetes (Dornhorst and Rossi, 1998).

Diabetic retinopathy usually starts developing in those people who have had diabetes for 5-10 years or more and retinal lesions such as microaneurysms, dot and blot and flame shaped haemorrhages usually appear after this period. After 10 years, about 55% of those patients not having insulin treatment i.e. non-insulin dependent diabetes mellitus (NIDDM or type two) are likely to show retinal lesions as against 70% of insulin dependent diabetes mellitus patients i.e. IDDM or type one (Klein and Klein, 1998). It should be noted that in 1999 the WHO renamed IDDM and NIDDM as type 1 and type 2 diabetes. The majority of diabetic patients are type two which is more common than type one. It was estimated that in 2001 there were 151 million people with diabetes worldwide and over 90% of these had type 2 diabetes (Levene, 2003).

After a period of five years or more, mild retinal lesions slowly start developing usually in the form of soft exudates and cotton wool spots. At the next stage pre-proliferative retinopathy may appear leading to proliferative retinopathy and maculopathy. Proliferative diabetic retinopathy (PDR) often develops in poorly controlled diabetics (Galloway and Amoaku, 1999).

It should be noted that the old classification of diabetic retinopathy was enlarged by the ETDRS (1991) or Early Treatment Diabetic Retinopathy Study. The ETDRS (1991) classification covers 13 levels from no retinopathy to PDR characterised by neo-vascularisation and vitreous haemorrhage. The ETDRS (1991) and other ongoing studies like the Diabetes Control and Complications Trial Research Group (DCCT, 1995), the United Kingdom Prospective Diabetes Study Group or UKPDS (Kohner et al, 2001) and the Diabetic Retinopathy Study (DRS, 1976, 1978) have provided guidelines for the management of diabetic retinopathy. Generally after 20-30 years, the incidence of diabetic retinopathy rises to 95% and 30-50% of these patients develop PDR (Benson, 1999). In almost every diabetic patient, duration of diabetes is clearly a predictor of diabetic retinopathy. Retinal lesions account for almost 80% of blindness in diabetics and the remaining 20% may develop cataracts (Crick and Khaw, 2003).

Diabetes remains a major cause of visual impairment and blindness in all regions of the world including the established market economies and industrialised countries. Diabetes prevalence figures are mostly estimated. In 1999 the WHO recommended a new definition for diagnosing diabetes as a result of epidemiological studies which have shown that there is a closer relationship between a fasting glucose value of 7mmol/l and the two hour value of 11.1mmol/l. In the new definition the cut off point for diagnosing diabetes using a fasting plasma glucose has been lowered from 7.8mmol/l to 7.0mmol/l (WHO, 1999a).

Amos et al (1997) projected the prevalence of diabetes worldwide for the years 2000 and 2010.as 151 million and 220 million people respectively. Although it was estimated that in 2001 there were 151 million people with diabetes worldwide (Levene, 2003), the WHO estimated 171 million diabetic sufferers worldwide during the same year (IHF, 2001). Three years later in an estimate from the International Diabetes Federation (IDF) this figure had risen by 23 million people. In August 2003, the IDF stated in a press release that 'some 194 million people worldwide or 5.1% of the adult population, have diabetes and this is expected to escalate to 333 million, or 6.3%, by 2025' (IDF, 2003). In the press release it was also stated that `some 314 million people worldwide, or 8.2% of the adult population, are estimated to have impaired glucose tolerance (IGT), a state which often precedes diabetes'.

Amos et al (1997) projected the prevalence of diabetes for Europe for the years 2000 and 2010 as 26 million and 33 million people respectively.

The WHO estimates for the prevalence of diabetes (1980-1997) in selected European countries.(WHO, 1999b) are incomplete (missing data) and only cover 8 EU countries. It is, therefore, not possible to make any meaningful comparisons.

In March 1997, the European Association for the study of Diabetes (EASD) stated in a press release that there were over 10 million people with diabetes in Europe (EASD,1997). In April 2004, in a joint press release, the International Diabetes Federation and the Diabetes Federation of Ireland stated that

'approximately 60 million people live with diabetes in the enlarged Europe, over 50% of whom are unaware of their condition' (DFI, 2004). In 1997 the population of the EU (15 member states) was approximately 374 million and it was estimated that over 10 million people were living with diabetes. With an enlarged EU (25 member states) the population in May 2004 was approximately 450 million. In seven years since 1997, with 75 million more people in an enlarged EU, the estimated number of people with diabetes shows a massive increase. It would be simplistic to conclude that the states entering the EU in 2004 mostly consisted of people with diabetes . However, these estimates suggest that diabetes may be expanding as an epidemic in the EU. As stated previously, such conclusions are generally sensitive to considerations like study designs, protocols for examination and documentation. Also the size of socio-economic inequalities in determinants of diabetes in the EU is not known. Passa (2002) has stated that `Diabetes trends in Europe are alarming; health care professionals involved in diabetes care must be made aware of these detrimental trends, and healthcare delivery to patients with diabetes must be improved'.

It was reported that the European Union, in their draft 6th framework in 2001, decided to drop diabetes as a specific target disease along with cancer, cardiovascular disease and neurological diseases. The President of the EASD (European Association for the Study of Diabetes) described the EU resolution as a `potentially disastrous decision for Europe' (Nerup, 2001).

In a study, the prevalence of diabetes known to GPs (family physicians) between 1999-2000 in eight European countries was investigated by a group of researchers (Fleming et al, 2004). It was found that all age prevalence was lowest in Slovenia and highest in Belgium. It should be noted that since 1989, the Belgian Diabetes Registry is studying all types of diabetes presenting before age 40 in Belgium and provides a paradigm of how diabetes registries may also contribute to the advancement of knowledge on disease heterogeneity, aetiology, prediction and prevention (Gorus et al, 2004). Diabetes registries have demonstrated that the lifetime risk of diabetes amounts to at least 10% in the western world (Gorus et al, 2004). It is proposed by de Beaufort et al (2003) that `monitoring risk factors for diabetes and its complications will offer the possibility to evaluate the development in time, as well as the influence of possible interventions'.

In a study on the age-and sex-specific prevalence of diabetes and impaired glucose regulation (IGR), in 13 cohorts from 8 European countries, according to the revised WHO criteria for diabetes, it was found that most European populations have a moderate to low prevalence of diabetes and impaired glucose regulation. However, it was concluded that diabetes and IGR will be underestimated in Europe, particularly in women and in elderly men , if diagnoses are based on fasting glucose determination alone (DECODE, 2003). It is estimated that in the established market economies and industrialised countries diabetes in the elderly people may prove to be `*the most important*

epidemic in the 21st century' and approximately 20% of the population aged 75+ will develop this disease (Sclater, 2003). It is projected that the number of people with diagnosed diabetes may increase by 165% by the year 2050; the largest increase is projected for the 75+ age group: 275% in women and 437% in men (Sclater, 2003).

Several newly industrialised countries and emerging economies are now witnessing a rapid increase in diabetes and related complications like retinopathy in their populations. This may partly be due to the fact that people in newly industrialised countries have adopted a western life style and diet. However, there is a huge geographical variation in the prevalence of type two diabetes in different ethnic groups in different economies, ranging from 50% in Pima American Indians in Arizona, to less than 2% in African Bantu tribesmen in Tanzania (Gregory, 2003).

The WHO estimates of major causes of blindness, as *per demographic regions* (see appendix 5 and 6), due to *'other disorders'* have included most causes of blindness excepting glaucoma and cataract and these have accounted for 89% of blindness in the EME countries and 84.9% in the FSE countries (WHO/1990/PBL/94.40). The WHO has stated that whereas cataract is the most important cause of blindness in all developing regions, *'other disorders' (e.g. diabetes, macular degeneration, etc.) largely dominate in the 'Established Market Economies'* and in the *'Former Socialist Economies of Europe'* (WHO/1990/PBL/94.40).

The WHO has further stated that there were '*several shortcomings in the models developed for disease estimates due to paucity of population-based data on the prevention of blindness particularly for 'Established Market Economies', 'Former Socialist Economies of Europe' and 'Latin America and the Caribbean'* (WHO/1990/PBL/94.40).

The following information from a variety of sources in some EU and FSE countries gives a general indication that blindness due to diabetic retinopathy in these regions probably ranges between 9-16%. It was not possible to determine the protocol for examinations, method of documentation and study designs for this information, therefore any comparison of figures remains invalid. It should also be noted that official blindness figures for diabetic retinopathy from most EU and FSE countries are not available. Lack of official statistics combined with a lack of uniformity for definition of partial sight and blindness in the EU makes it difficult to compare various causes of blindness.

In the 1993 edition of the Finnish register of Visual Impairment, 9% of visual impairment recorded was due to diabetic retinopathy and in the age group 18-39 years old 12.6% of visual impairment was due to proliferative diabetic retinopathy (PDR). The figures for the older age group 40-64 were recorded as 11.3% for PDR and 3% for non-proliferative type diabetic retinopathy. It would appear that within the established market economies Finland has a high incidence of diabetes mellitus (approximately 30-49%

higher than Japan) and it increases in Finnish children by 5.6% in the age group up to four years (North, 1998).

In a study from Karolinska Institute conducted during 1992-95 in Stockholm County in Sweden, diabetic blindness in the age group 18-84 years was recorded in 2.2 % cases in 1995 (Wandell et al, 1998). In another study from Sweden conducted by Henricsson et al (1996), 2133 diabetics were screened and examined during 1990-95 on the basis of VA <or=0.1 for blindness or VA <or=0.2-0.4 for visual impairment. According to these researchers `multivariate analysis showed a statistically significant association between blindness/visual impairment, and old age, long duration of diabetes, and poor glycaemic control' and `retinopathy was the major cause of blindness and visual impairment in patients with diabetes' (Henricsson et al 1996).

According to the Copenhagen City Eye study from Denmark conducted during 1986-88 it was found that 9.52% diabetics suffered from unilateral blindness (age group 60-80 years) on the basis of the Danish definition of blindness (VA 0.1 or worse) known as the National Criteria of Blindness (Buch et al, 2001). In a previous study from Denmark published in 1996 it was found that diabetic retinopathy caused 8.4% blindness (VA<or=6/60) on the basis of 1585 membership applications to the Danish Society of the Blind (Rosenberg and Klie, 1996). The authors noted that a change of definition to VA<6/60 would have reduced the number of formally blind by 32% and the WHO definition (VA <3/60) would have further reduced the percentage of

formally blind. On the basis of the WHO definition only 35% (562 subjects out of 1585 membership applications) would have been considered blind (Rosenberg and Klie, 1996).

In the city of Hessia in Germany, blindness caused due to diabetic retinopathy was reported as 15% according to 1996 figures (VA < or = 0.05 or equivalent visual handicap) based on blindness compensation payments (Graf et al, 1999). In the upper Bavaria 13% of blindness was reported due to diabetic retinopathy (Krumpaszky and Klauss, 1992).

A separate population - based study from Wurttembrg-Hohenzollern in Germany on the incidence of legal blindness (VA <1/50) based on materials from the social services found diabetic retinopathy to be the cause of blindness in 2.01/100,000 people (Krumpaszky et al, 1999). In another separate study the files of all newly registered blindness-allowance recipients in Wurttemberg-Hohenzollern in 1994-98 were reviewed and it was found that 2.13/100.000 suffered from blindness (VA <1/50) due to diabetic retinopathy (Trautner et al, 2003). However, it was concluded from this study that secondary prevention measures should be intensified.

In the Italian blindness figures published in 1994 diabetes was not mentioned; it was simply recorded that the most frequent causes of blindness (33%) among the registry of the blind and the welfare lists of the Ministry of the Interior were retinal diseases (Nicolosi et al 1994). However, between 1967-1991 in the province of Turin in north west Italy 13.1% cases were recorded

as having bilateral blindness due to diabetic retinopathy (Porta et al, 1995).

In a study from Greece conducted at a teaching centre of the university eye clinic at Patras from 1989-1999, although blindness figures were not given, it was found that 71.7% diabetics had non-proliferative retinopathy and 10.4% had proliferative diabetic retinopathy (Pharmakakis et al, 2002).

Data on visual impairment and blindness in patients attending ophthalmology clinics at the Orleans regional hospital centre serving a semi-rural area in France were studied and it was found that 16.6% of severe visual impairment in patients over 60 was caused due to diabetic retinopathy (Cohen et al, 2000).

In another estimate from France 16% of blindness was recorded due to diabetic retinopathy (FAHV, 1996).

In a recent study from Spain on the prevalence of diabetic retinopathy in the province of Valladolid, screening for diabetic retinopathy in the rural areas was found to be deficient (Lopez et al, 2002). Diabetic retinopathy was found in 48.6% of IDDM and 14.7% of NIDDM patients; blindness figures were not given. However, according to Organizacion Nacional De Ciegos (National organisation for the blind) in 1992 diabetic retinopathy was the cause of blindness in 18.9% from a total of 3714 registered blind (ONCE, 1994).

In a Portuguese study it was stated that in advanced retinopathy laser photocoagulation is effective in decreasing deterioration by 50% (Cunha-Vaz, 1998).

Figures for diabetes induced blindness from two FSE countries ranged

between 6-15%. In Poland at the Cracow branch of the Polish Association of the Blind, diabetes accounted for 6.2% cases (Pantoflinski et al, 2001). In 1993 it was estimated that in Bulgaria in the Sofia district (urban and rural) 15% of blindness was caused by diabetic retinopathy (IEF, 1994). It was concluded from an international study on eye healthcare services in eastern Europe that more specialist doctors were required, screening for diabetic eye complications needed improvement and technical equipment was required (Kocur et al 2002).

In England and Wales, between April 1990 and March 1991, on the basis of certifications (BD8 forms) and registration it was found that 3.4% of blindness was caused due to diabetic retinopathy in all age groups (Evans et al, 1996). However, 11.9% were certified as blind in the age group 16-64 years. As stated previously, the BD8 figures are based upon WHO and not RNIB definition of blindness.

It was stated earlier that by the year 2020 in the established market economies the elderly population will increase by 186%. Visual impairment and blindness due to diabetic retinopathy is also likely to increase proportionately.

A consultant physician (Winocour, 2003) recently commented that 'there has been a marked increase in the incidence of diabetes which is threatening to reach epidemic proportions'. Winocour further commented that 'efforts to create unrealistic targets also create more unsettling pressures in health care systems. In the UK the hospital waiting list debacle has led to fabrication of

data'. In the next 10-15 years the incidence of diabetic retinopathy and blindness as a consequence is also likely to reach epidemic proportions, if it has not reached that level already.

In the UK there are approximately 1.5 million people with known diabetes and another one million in whom diabetes is not diagnosed as yet (Levene,2003). The incidence of type 2 diabetes is rising dramatically due to the large increase in obese people in recent times and increased longevity (Wallace, 2002). It is projected that due to population ageing, in 2036 there will be approximately 20% more cases of type 2 diabetes than in 2000 (Bagust et al, 2002). It is predicted by these researchers that in the next 30 years type 2 diabetes will present a serious clinical and financial challenge to the UK NHS.

The emergence of type 2 diabetes in children has also been causing concern in industrialised and industrialising countries (Fagot-Campagna, 2000). Two decades ago type 2 diabetes was described in children of specific groups e.g. the Pima American Indians (Matthews and Wallace, 2002). Type 2 Diabetes is increasing rapidly worldwide at a younger age (Silink, 2002). Keiss et al (2003) have stated that `there is high hidden prevalence and a lack of exact data on the epidemiology of the disease in Europe'. According to these researchers `in Germany only 70 patients below the age of 15 years were identified in the systematic, nationwide DPV (Diabetessoftware fur prospektive Verlaufsdokumentation) diabetes survey, but our calculations suggest that more than 5000 young people in Germany at present would meet

the diagnostic criteria of type 2 diabetes'. However, in an Austrian study it was concluded that type 2 diabetes is `rare but exists in children under 15 years in Austria' (Rami et al, 2003).

In a recently published paper (Ehtisham and Barrett, 2004), from Birmingham Children's Hospital, it is stated that until recently only type 1 diabetes was assumed to be the diagnosis of almost all children. The first cases of type 2 diabetes reported in the UK children was in the year 2000 (Ehtisham et al, 2000). Affected children were overweight or obese, often female, pubertal, predominantly of ethnic minority (South Asian) origin and had a family history of type 2 diabetes. According to Levene (2003) the prevalence of type 2 diabetes is 'particularly high in populations that have changed from a traditional to a modern life style, such as migrant Afro-Caribbeans and Indo-Asians in the UK'. The underlying cause of type 2 diabetes is likely to be related to the epidemic of childhood obesity (Ehtisham and Barrett, 2004; Renders et al, 2003; Silink, 2002). Many children do not feel they have an illness as they are asymptomatic at diagnosis. Out of 28 children, one developed cataract seven years after diagnosis. (Gold, 2002). The increasing incidence of childhood obesity in the UK and `the inevitable rise in type 2 diabetes from an early age is likely to have a major long term impact on the healthcare system in the UK' (Drake et al, 2002).

In 1984, in a randomised controlled trial of routine hospital clinic care versus routine general practice care for type 2 diabetes, it was found that routine care in general medical practice was 'less satisfactory than care by the hospital diabetic clinic' (Hayes and Harries, 1984).

In a recent study 'the problems and barriers perceived by GPs whilst providing diabetes care in primary care in England and Wales' were identified following a 'descriptive postal survey using a self-administered questionnaire' (Agarwal et al, 2002). The authors highlighted in the study that the *'greatest barriers'* to GP practices providing *'desirable care'* were *'lack of time/under-funding and keeping up to date in the area of diabetes, followed by lack of space, inadequate chiropody, dietetics, ophthalmology and access to secondary care'.*

GPs in the UK are neither geared nor equipped to provide an eye disease-specific screening, early detection or assessment of ocular conditions like diabetic retinopathy (Smeeth, 1998). Additionally, GPs may not gain sufficient experience to diagnose retinopathy with confidence (Mason & Drummond, 1995; Mason, Drummond and Woodward, 1996). It is generally recognised that while British optometrists receive around 300 hours of instructions in ocular examination as part of their training and certification, medical schools may provide approximately 10 hours of training in retinal observation for the future GPs (Mason and Drummond, 1995).

Taking into account the above mentioned pattern of clinical training, a recent comment made by a GP that *'Opticians are as good as doctors at finding retinopathy'* (Warren, 2002) would appear somewhat outdated and rather condescending. Interestingly, it was noted by two ophthalmologists in 1985 that optometrists then had the skill to detect diabetic retinopathy at a treatable

stage (Burns-Cox and Hart, 1985). In a study in 1988 it was found that optometrists were 'more likely than general practitioners to diagnose retinopathy requiring photocoagulation' (Harrison et al, 1988). It is estimated that 20% of patients would have developed retinopathy by the time diabetes is diagnosed by their GPs (Davison, 2003). It is generally agreed within medicine that GPs lack confidence in their training in ophthalmology (Smeeth, 1998).

In 1976, the preliminary report of the diabetic retinopathy study research group stated that photocoagulation treatment prevented severe visual loss in eyes with proliferative retinopathy (DRS,1976). By 1978 two shared care schemes were set up in England (in Poole, Dorset and in Frenchay, Bristol) for the purposes of timely screening for diabetic retinopathy and retinal photocoagulation treatment to prevent blindness (Burns-Cox, 1995). Participants in the schemes included optometrists, general medical practitioners (family physicians), diabetic physicians and ophthalmologists. Since then British optometrists have been participating in shared care schemes, both community based and Hospital Eye Service based, developed *under an agreed protocol and supported* by the Royal College of Ophthalmologists, Royal College of General Practitioners and the College of Optometrists. Shared care schemes optimise provision of primary and secondary eye care resources and meet local requirements for the benefit of patients. Under the scheme patients visit optometrists for particular procedures. Organisers of shared care schemes may devise a plan, if necessary, with a locally agreed protocol.

Three researchers from Moorfields Eye Hospital evaluated new optometric referrals in a busy out-patient clinic. The results of clinical appraisal showed a high level of diagnostic accuracy which suggested that the role of hospital optometrists may be successfully extended 'to include some aspects of patient evaluation not typically undertaken' (Oster et al, 1999).

It was concluded in a study by Hammond et al (1996) that optometrists with suitable training would be an effective body to screen for diabetic retinopathy. In another study it was concluded that `suitably trained and accredited community optometrists performed well when screening for diabetic retinopathy' (Prasad et al 2001). A recent study at the University of Leeds confirmed that `the prevention of diabetic complications will not only benefit patients, but potentially reduce overall healthcare expenditure' (Williams et al, 2002).

Consultant ophthalmologists, the implicit gold standard for identifying serious retinopathy, can not realistically provide eye screening to all those individuals diagnosed with diabetes. In 1994 there were an estimated 433 whole-time consultant ophthalmologists in England, approximately one for every 1100 diabetics (Mason & Drummond, 1995; Mason, Drummond and Woodward, 1996). In 1996 there were approximately a total of 750 ophthalmologists in the UK for a population of almost 60 million people i.e. 1.27 per 100,000 inhabitants.

An early diagnosis of diabetes combined with regular screening for ocular

manifestations, especially the interior of the eye for vitreous, retinal and macular lesions, is essential in the management of diabetes related complications. Timely evaluation of diabetic retinopathy is crucial for appropriate ophthalmic intervention like retinal photocoagulation for the avoidance of visual impairment and total blindness.

Effective measures must be taken by the state to combat serious public health implications of the real and projected increase in the incidence of diabetes and related complications in the UK. Clearly British optometrists could be given greater responsibilities and appropriate resources for assessment, surveillance and diagnosis of diabetic retinopathy which should include screening with retinal photography and if necessary fluorescein angiography. British optometrists could also be actively involved in the treatment processes such as laser photocoagulation to avoid the risk of severe vision loss due to proliferative diabetic retinopathy and macular oedema. The effectiveness of laser photocoagulation is best before any loss of vision occurs and falls sharply if applied later (Burns-Cox et al, 1985; Hux et al, 2003).

The main objective of the St. Vincent declaration of October 1989 was reduction of diabetes-induced blindness in Europe by one third within five years (Anon, 1990). The declaration was made under the auspices of the World Health Organisation (Europe) and the International Diabetes Federation (Europe). Thus far the aims of the St. Vincent declaration of 1989 have not been achieved (Horle et al, 2002).

In order to avoid an increase in visual impairment and blindness in the EU, all member states will have to carry out a complete reappraisal of the system of delivery of eye healthcare for the population.

Maximisation of efficiency within the existing healthcare system has failed to produce desirable results. Development of appropriate human resources e.g. properly trained and licensed optometrists throughout the EU for effective screening of diabetes-induced visual impairment and timely treatment needs to be given priority.

4.2 (e) Management of Age-Related Macular Degeneration in the Delivery of Eye Healthcare

Age-related macular degeneration (AMD) leads to irreversible loss of central vision causing difficulties in normal activities of life like driving, reading and increased risk of falls and injuries for the sufferer. AMD usually causes serious physical, social and emotional problems, significantly impairing quality of life. Despite the fact that AMD has fairly extensive ocular morbidity because it is widely prevalent in the established market economies, the precise aetiology or pathogenesis of this condition is not fully understood (Ambati et al, 2003; Edwards et al, 1999). Furthermore, the size of socio-economic inequalities in determinants of ocular morbidity for conditions like AMD in different EU countries is not known. The main risk factors for AMD include ageing, gender (female), ethnicity (mostly caucasians), smoking, dietary deficiencies, systemic hypertension and strong family history. A

significant genetic influence in AMD was confirmed from two separate twin studies (Gottfredsdottir et al 1999; Hammond et al, 2002).

The early stages of AMD are characterised by soft drusen and lesions of retinal pigment epithelium (RPE). In the later stages AMD is distinguished by the presence of well defined areas of retinal pigment epithelium loss (geographical atrophy), choroidal neovascularisation (CNV), pigment epithelial detachment and disciform scarring i.e. fibrous scarring of the macula (Gottleib, 2002). AMD is either dry or wet; the latter is characterised with neovascularisation causing central vision loss and usually requires urgent ophthalmological intervention. It was found that after 3 years, 63% of untreated CNV patients showed mean visual acuity in the region of <6/60 (<20/200) and in some cases even worse than 6/240 or <20/800 (Gottleib, 2002).

Investigation of AMD consists of retinal and choroidal angiography using dyes like fluorescein and indocyanine green and a specially designed fundus camera with filters for an accurate diagnosis. The modern techniques of digital angiography and tomography allow a better view of choroidal neovascularisation. Prior to a full retinal investigation Amsler grid is used to detect visual distortions and abnormalities. Patients are encouraged to use Amsler grid for self monitoring. Another method, described as the Macular Computerised Psychophysical Test (MCPT), using hyperacuity also allows evaluation of central macular visual field (Loewenstein et al, 2003).

Interventions like thermal laser photocoagulation, photodynamic therapy with Verteporfin or transpupillary thermo therapy may delay serious visual impairment in eyes with choroidal neovascularisation. The effectiveness of photodynamic therapy is currently being assessed by the National Institute of Clinical Excellence (NICE) and the widespread availability of this somewhat expensive treatment has become a political issue.

Other interventions include radiography, submacular surgery, macular translocation, proton beam / scleral plaque, external beam radiation and food supplements / nutrients like lutein (Chopdar, 2003). Treatment may be appropriate in some cases and may halt or slow down the progression of the disease. Oxidative damage to retina may be a risk factor and dietary or supplemental antioxidants may play a protective role. The Age-Related Eye Disease Study (AREDS) reported a beneficial effect of high-dose supplements, taken for approximately six years, in delaying the progression of intermediate AMD to advanced AMD (McBee et al, 2003). AREDS and subsequent research on dietary intake or supplement use have not indicated a protective role of antioxidant or supplement use in the incidence or prevalence of early AMD and number of cases were insufficient to investigate effects on late AMD. Persons with intermediate AMD and without contraindications may consider using antioxidant and zinc supplements (McBee et al, 2003). The lutein supplementation antioxidant trial (LAST) was conducted to determine whether nutritional supplementation with lutein or lutein together with a broad

spectrum of antioxidants, vitamins and minerals improves visual functions and symptoms in atrophic age-related macular degeneration (Richer et al, 2004). It was concluded that although visual function is improved, further studies are needed to assess long term effects of this treatment. The findings of the LAST `support a possible therapeutic role of lutein in AMD' (Bartlett and Eperjesi, 2003). However, Blodi (2004) stated that `nutritional supplements are not without risks and their effects must be diligently and accurately monitored'. The value of lutein and zeaxanthin remains uncertain, although one or both of these carotenoids may be better than carotene (Jampol, 2003). However, no technique or treatment has yet offered cure of this condition (Gottleib, 2002).

AMD still remains a leading cause of visual impairment and blindness mostly in the EME and industrialised world. The WHO has already acknowledged that the `lack of relevant epidemiological data makes it impossible to present separate specific statistics for a number of well known causes of blindness like age-related macular degeneration' (WHO/1990/PBL/94.40). The WHO has further acknowledged that `age-related macular degeneration will be increasingly prevalent with the *greying* of the world population' and that age-related macular degeneration (AMD) is a major cause of blindness in older people in the established market economies. In England and Wales during 1990-91 on the basis of ophthalmological certifications (BD8 forms), 48.5% of blindness in all age groups was recorded due to age-related macular

degeneration (Evans, 1995; Evans et al, 1996). During the same period in the age group 65 years and above, 54.5% were certified as blind due to AMD. In another study it was found that choroidal neovascularisation (CNV) accounted for 3.5% white British patients as against only 0.1% patients of black African descent in a similar age group (Gregor et al, 1978).

In the Republic of Ireland AMD accounted for 16% of blindness on the basis of registrations with the National Council for the blind (Munier et al, 1998). The criteria used for registration was best corrected VA 6/60 (0.1) or less in the better eye or a visual field restricted to 20 degrees or less. Owen et al (2003) have reported that the pooled data from several studies showed that the prevalence of visual loss due to age-related macular degeneration increased exponentially from the age of 75-85 years, with 3.5% exhibiting visual impairment beyond the age of 75 years. It was estimated that currently in the UK there are 214,000 people with visual impairment caused by AMD eligible for registration as partially sighted or blind and this number is expected to increase to 239,000 by the year 2011 (Owen et al, 2003).

In the EU countries more than 50% of blindness is caused due to AMD in the 60+ age group. These figures vary because of the difference in blindness criteria and definitions used within the EU. However, it was concluded from the Rotterdam study that AMD was the major cause of the prevalence of blindness in persons 75 years or older (Klaver et al, 1998).

In the Finnish Register of Visual Impairment (1993 statistics) blindness due to

AMD in the 65+ age group was recorded as 51.7%. In Finland in the county of Oulu in a separate epidemiological cross-sectional population study of inhabitants (70 years or older) 4.6% of blindness was recorded due to age-related maculopathy (Hirvela and Laatikainen, 1995).

In Germany, in the Upper Bavaria, in a review of blindness certificates to ascertain the causes of blindness, it was found that 28% of blindness (all age groups) was caused due to AMD which was considered a leading cause of visual impairment and blindness (Krumpaszky and Klauss, 1992). In 1996 on the basis of a study carried out in Hessia in Germany, the most frequent cause of blindness (41%) was AMD (Graf et al, 1998). In a separate study, also in Germany, the causes of legal blindness (VA <1/50) were analysed in Wurttemberg-Hohenzollern based on data from social services in 1994 and the major cause of blindness (3.92/1000,000) was AMD (Krumpaszky et al, 1999). Also in Germany the files of all newly registered blindness allowance recipients in Wurttemberg-Hohenzollern between 1994-1998 were reviewed and it was found that 5.29% suffered from blindness (VA < or = 1/50) due to AMD (Trautner, 2003). The most single cause of blindness recorded was macular degeneration in that study. It should be noted that data on blindness allowance recipients or blind registers only provide information on the incidence of certification and not the incidence or prevalence of AMD.

In an interesting study from Denmark AMD was investigated in the age group 60-80 years on the basis of VA 6/9 or less. A visual impairment in the region

of 6/9-6/12 was described as the tip of an iceberg (71.7%) and as the predominant base; partial impairment 6/18-6/36 as an interjacent area (15%) and the major impairment or blindness (6/60 or less) in the remaining 13.3% (Vinding, 1990). In a separate study also from Denmark, on the basis of membership applications in 1993 to the Danish Society of the Blind it was found that the majority of applicants (92%) were 60 years or over and AMD was recorded as the major cause of blindness (VA <or =6/60) in 78% applicants (Rosenberg and Klie, 1996).

In Denmark, in the Copenhagen City Eye Study the prevalence rates of bilateral and unilateral blindness using WHO criteria (VA <3/60 or <0.05) were recorded as 0.53% and 3.38% respectively. On the basis of National Criteria (NC) of blindness (VA <or=6/60; VA <or=20/200; VA <or=0.1) the figures rose to 1.06% (unilateral) and 4.4% (bilateral). However, using NC as the basis, AMD was the main cause of blindness accounting for 60% of all blind people in the age group 60+ years (Buch et al, 2001).

An observational study was carried out in two French centres on patients aged 60 years or older with an exudative form of AMD and a distance VA <or=20/40 in the best eye. It was concluded that early detection and treatment of patients with AMD was necessary, supporting the argument that costs are higher in patients with the lowest visual acuity (Bonastre et al, 2003). In another French study at an ophthalmology clinic in Orleans, in the age group 60 or over, AMD was the leading cause of severe visual impairment

(VA 6/60 or less in the better eye) in 48% patients (Cohen et al, 2000). The Beaver Dam Eye Study concluded that age-related maculopathy is common in older people and poses a substantial public health problem (Klein et al, 1992 a). The Age-Related Eye Disease Study Research Group has recommended that persons older than 55 should have their eyes examined with pupils dilated to determine the risk of developing advanced AMD (AREDS, 2001).

According to a recently published survey by the AMD Alliance International conducted in North America and Europe, there is a low public awareness of AMD which may influence early detection of this disease and may result in people not receiving prompt medical attention (Rosenthal and Thompson, 2003). It was found that 70% of respondents were not familiar with AMD and only 2% were aware that AMD is the leading cause of blindness. In a recent British study by Owen et al (2003) it was concluded that the prevalence of AMD is `likely to increase with time'.

Large scale health related problems require resources and are often regarded as social problems. Age-related macular degeneration is a health-related problem of social magnitude mostly in the established market economies. As stated previously, the elderly population is growing throughout the world. Measures like self monitoring by using the Amsler grid are indeed useful but will not solve the real problem of increasing visual impairment or blindness due to AMD. All societies have to accept the fact that health-related problems require proper economic backing and most importantly adequate professional

resources. The question is not simply that of organising regular retinal screenings to identify a disease like age-related macular degeneration. Adequate manpower (or womanpower) is also required to treat this condition. Ultimately British optometrists will have to be given more responsibilities. Eventually optometrists in the rest of the EU will have to follow suit with proper professional training, certification and support .

4.3 Summary

Within the established market economies and former socialist economies, the European continent incorporates a large diversity of social and political traditions and also professional cultures in spite of geographical proximity of states. In the European Union, education and professional training also evolved differently from one country to the other.

The definition of blindness varies between different EU member countries. Accurate blindness figures from most EU countries are not available (see Appendix 4). With reference to blindness figures there was no response from various organisations and government departments of most EU countries. Presumably the requested information was either not available or did not exist. Blindness registration information from an EU country may provide insufficient data on the incidence of certification based upon blindness definition used for the purposes of registration for blindness allowance. This type of information, if available, does not provide data on

the prevalence of ocular diseases causing visual impairment and blindness.

This chapter covers the management of four eye diseases in the European Union: cataract, glaucoma, diabetic retinopathy and age-related macular degeneration, being the major causes of visual impairment and blindness. However, there is no uniformity in the management of ocular pathology by optometrists in the EU. Although referral to medical practitioners by optometrists is allowed in most EU countries, monitoring of ocular pathology by optometrists is only allowed in the United Kingdom. Under the GOC revised rules on referrals that came into force on 1 January 2000, optometrists are allowed to manage the eye conditions of their patients, and only refer when clinically necessary. Shared care, delegated care, decision on referrals, direct referral to hospital eye departments and supplementary prescribing are all part of British optometric practice. Independent prescribing status for British optometrists is already on the agenda of the Department of Health and the General Optical Council. Presently, the role of optometry in the management of ocular pathology in the United Kingdom and the rest of the European Union are separate issues.

Chapter 5

Optometry and Eye Healthcare in the EU: a British Perspective, a Perspective for the Future and Conclusions

5.1 Optometry and Eye Healthcare in the EU: A British Perspective

Professionalisation is a continuous and logical process necessary for the development of all professions, both structurally and functionally, leading to a recognised professional status and autonomy on the basis of training, specialised knowledge and delivery of quality service. In the context of evolution and sociology of healthcare professions like optometry, the past experience clearly indicates that the process of professionalisation is slow, non-linear, tortuous, requiring decades and even centuries of cumulative effort.

There are several key issues concerning the status, structure and performance of optometry as a profession in the European Union which need addressing. The crucial factors in these issues include a lack of uniformity in the level and standard of academic and professional education, the level of professional work in accordance with the existing laws in the EU member states and the relationship of optometry with medicine and ophthalmology.

In most of the EU optometry as a profession is either non-existent or exists as a dispensing optics based technical skill or as an auxiliary occupation to medicine and ophthalmology. For example in France there are virtually no optometrists; 6500 opticians and 1500 orthoptists in France carry out

delegated tasks, ancillary to ophthalmology, in the area of low vision aids, binocular vision, visual fields and electrophysiology (Sahel, 1998). In the UK optometry is an autonomous eye healthcare profession complimentary to medicine and ophthalmology with a well established and fully recognised social and inter-professional status.

In the United Kingdom, Ophthalmology is regarded as a 'consultant led practice of ophthalmic *surgery*' (Kirkness, 2002). Approximately 7000 British optometrists provide an increasing amount of primary eye healthcare working very closely with General Practitioners (Family Physicians) and ophthalmologists. In the EU countries primary eye care is provided by ophthalmologists. Furthermore, it is debatable whether the primary eye care mode of practice of an average ophthalmologist in the EU should be equated with that of largely secondary eye care provided by an average British ophthalmologist. In countries like Germany sometimes there are three ophthalmologists in practice in a small town with a population of no more than 10,000 (Kirkness, 2002). Patients are usually referred by these ophthalmologists for surgery to the nearest university clinic or a cataract centre. In contrast in the UK similar professional services are normally provided by optometrists.

In the Netherlands, data from a national survey was used to explore the position of ophthalmologists, general medical practitioners (family physicians), optometrists, orthoptists, and opticians as 'the gatekeepers in

vision care'. Opinions from patients in the Netherlands indicated a preference for professional services from a medically qualified gatekeeper like a GP (family physician) or an ophthalmologist rather than a non-medical person such as an optometrist (Stevens et al, 2002).

In contrast, the UK optometrists are expected to play a bigger role than that of the gatekeeper. For example the UK optometrists are expected to evaluate patients for cataract surgery (Gaskell, 2001; Hughes, 2001) and diabetic retinopathy treatment (Hammond et al, 1996; Prasad et al, 2001). Under the National Health (Primary Care) Act of 1997 British optometrists are allowed to monitor ocular pathology and refer patients directly to hospitals by using their professional judgement under the revised regulations of the General Optical Council which came into force on 1 January 2000. In glaucoma management community optometrists in the UK provide a comparable service to that provided by hospital eye service (Riad et al, 2003).

The extension of prescribing rights to new professional groups was the subject of a UK government-commissioned review, which cited British optometrists as potential candidates (Mason and Mason, 2002). A survey by these authors indicated that optometrist participation in the UK could increase patient access to ocular therapeutic care by between 29% and 50%. The Department of Health in the UK has already embarked on its plans for optometrists to prescribe therapeutics for treating patients with eye disease (Anon, 2003).

The competency framework for supplementary and independent prescribing

optometrists, was prepared by the National Prescribing Centre under contract from the General Optical Council (Anon, 2004).

Within the last two years, Ireland and The Netherlands have allowed the use of diagnostic, not therapeutic, drugs by optometrists. In February 2003 the Irish Parliament discussed whether optometrists in Ireland could, in future, be allowed to use therapeutic drugs. With the exception of the UK, none of the other European Union countries allow optometrists to use therapeutic drugs. It seems unlikely that in the foreseeable future, training in ocular therapeutics for optometrists will be allowed in the rest of the EU countries, possibly because of medical and ophthalmological attitude towards optometry, a kind of professional `tribalism' or `territorialism' in the EU or the medical profession may be exercising disproportionate influence on the policy makers in the EU. However, there is no justification in not allowing optometry to develop on the lines of the British model throughout the EU.

It should be noted that after receiving expensive medical education some EU countries like Italy and Spain have unemployed doctors (Herzmann, 2003). In Greece, full optometric practice contravenes the national laws. It seems inconceivable that in a socially and technologically advancing world, full practice of optometry which in the UK and Ireland (and countries like the US, Canada and Australia) is a well established and effective method of screening for ocular conditions to avoid visual impairment and blindness in the population, actually contravenes national laws of some EU countries.

In contrast, not too long ago, an eminent British ophthalmologist proposed the formation of community ophthalmic teams which will include optometrists. Writing in the British Journal of Ophthalmology he stated that British Optometrists 'by far the largest group, have much to contribute, primarily in the management of refractive disorders. However, their place in preventive ophthalmology is growing and the usefulness and quality of their work would certainly further increase if they were part of a community ophthalmic team. This would, with a realistic adjustment of their training, help to fulfil their medical ambitions' (Blach, 2001).

It appears that in many EU countries some archetypal concepts and deeply rooted notions of artisans and craftsmen including spectacle makers or sellers have survived from the craft guilds of medieval Europe. These notions may still exist in the thinking and attitude of some legislators responsible for the laws governing health care professions like optometry in the EU, seriously hampering the process of professionalisation and especially the caring aspect. In developed and advanced societies there is an awareness of a universal healthcare culture also covering most areas of health-related social problems. The borders of ethnocentrism have already been crossed and as a matter of fact we now share a common healthcare culture in the world. It appears that in some countries there is a lack of willingness on the part of lawmakers and others to share and implement those healthcare philosophies which are universal in nature, well tried and tested and necessary for the welfare of

people. In the eye healthcare field the obvious task for the policy makers is the eradication of avoidable visual impairment and blindness and not to succumb to pressures from any source by not accepting universal healthcare philosophies. It should be realised by all concerned that multiple forces are transforming the pattern of health-related problems. The increasing number of elderly people, the emergence of new diseases causing more health-related problems and changing demography due to expanded movement of people, require more healthcare resources. It has to be noted that ethical and quality healthcare is a constituent element of human rights and also an integral part of the social expectations of the recipients of professional services.

EU member states must reach a consensus about the core functions which have to be performed by the old established and the newer healthcare professions. Before the next stage of an enlarged European Union, strategic eye healthcare definitions, with a specific role for optometry, are required for all EU countries. Although in socio-economic or political terms the aim to harmonise all healthcare professions within the EU is laudable, in practical terms the proposal is fraught with serious problems especially for professions like optometry. Harmonisation implies uniformity with equality and neither of these exist in optometry in the EU. Taking into consideration the diversity of optometry within the EU, the Association of European Universities Schools and Colleges of Optometry (AEUSCO) supported by the European Council of Optometry and Optics (ECOO) launched a European Diploma in Optometry

about 5 years ago. Out of twenty three candidates, two successfully completed all parts of the examination. In 2002-2003, the total number of candidates taking all or part of the examination was thirty. Only three candidates successfully completed all parts of the examination. A diploma of this nature may be useful in terms of entry into British optometry but it does not solve the problem of inequality in optometric training or lack of statutory regulations within the EU. It does not change the present official status of optometry in most EU countries.

Optometry degrees from Utrecht in the Netherlands are now accepted by the General Optical Council for registration as an optometrist in the UK. Obtaining a degree from outside the UK for registration in the UK is a separate issue and it does not create equality in terms of scope and mode of practice under the medical or optometry acts or laws of the Netherlands which are different when compared with those of the United Kingdom. Significantly, ophthalmologists in the UK also felt that with the possible exception of Ireland, none of the other EU nations provided a well structured training in ophthalmology similar to that in Britain with the associated controls of both the local deanery and the Royal College of Ophthalmologists' quinquennial inspection (Kirkness, 2002). It was felt that none of the other EU countries have a `rigorous examination system and none as demanding as that in the UK or Ireland'. Becoming a specialist in ophthalmology takes four years in Italy but more than seven years in the United Kingdom (Herzmann, 2003).

In order to standardise ophthalmology, a Diploma of the European Board of Ophthalmology (EBO) was instituted about 5-6 years ago (Eustace, 1997). So far this diploma has not achieved much popularity. With this background it is not a surprise that British ophthalmologists and optometrists are gravely concerned about the following proposed legislation in the EU.

The European Commission has proposed a single directive for all professions including those from the healthcare sector, together with the setting up of an expert group primarily responsible for healthcare professions. Under the new rules it will be easier for healthcare professionals, including doctors, midwives, nurses and others to work in any EU country (Watson, 2002; Mead, 2003). However, under the new proposals healthcare professionals from one member state would be allowed to practise for up to four months without registration with the regulating authority in another member state.

It is argued by the critics of this proposal that this would prevent regulators from taking action against a person if a problem arose and they would not be able to prevent the professional from repeating the problem with another patient either in their own or another member state (Watson, 2002). Supporters of the new EU proposal maintain that in the event of a complaint against healthcare professionals like doctors, dentists, optometrists, pharmacists, nurses and others, the trading standards office and the department of health could easily forward all the information to the foreign regulatory body (Obi,

2003). This is a separate issue. One of the points against the proposal is inequality in the standards of practice within the EU in certain health-related professions. It should be noted that variations and inequalities in healthcare standards in the EU also carry medico-legal implications (Lynch, 2003). It is generally acknowledged that the healthcare systems of the existing members of the EU are diverse and that some EU laws may have profound consequences for the organisation of the national healthcare systems and may cause a major impact on health service provisions, despite the best attempt of national governments to retain control. (Duncan, 2002; Mossialos and McKee, 2002). On the question of the influence of the European Court of Justice (ECJ) on healthcare policies, debate continues whether 'the ECJ should be allowed to assume a vanguard role in health policy making by default' (Randall, 2001). It is claimed that the ECJ is moving faster than the member states in establishing free movement of healthcare professionals (Tremblay, 2003). However, mutual recognition of post-graduate medical qualifications within the EU remains unresolved. Despite the fact that GP training is well organised in the UK, membership of the Royal College of General Practitioners (MRCGP) is not transferable to all European Union member states. This has already resulted in Germany being taken to the European Court of Laws, but the matter remains unresolved (Herzmann, 2003).

There are approximately 70,000 (seventy thousand) unemployed doctors in Italy, and Spain has an excess of doctors resulting in little patient contact in

training (Herzmann, 2003). Many Italian doctors have more than one job and some never find work in medicine (Thorne, 1996). In Italy, the ratio of physicians is 583 per 100,000 people and nearly 39,000 doctors can not find jobs in various medical fields i.e. more than11% of the Italian medical profession (Calcopietro, 2002). In Spain the ratio of physicians is over 400 per 100,000 people and in Greece the ratio is over 300 physicians per 100,000 inhabitants (Forgacs,2002).

Under the new directive of the European Commission these doctors will be entitled to practice in Britain for 16 weeks at a time without registration. The Alliance of UK Health Regulators on Europe (AURE) which includes the regulatory bodies of medicine, dentistry, optometry, midwives and others have argued that no single body could 'incorporate the professional expertise of and range of knowledge necessary to oversee and manage issues relating to practice across all the health professions' (Watson, 2002). The first political battle against the proposal was lost in June 2003 at the European parliament in Brussels (Watson, 2003).

However, under the auspices of AURE, the British medical organisations, the Royal College of Ophthalmologists, optometric organisations and others will continue their fight against new European Union legislation which they believe poses a danger to patients in Britain. In a letter sent to selected Members of the European Parliament (MEPs) the BMA has warned that the proposed liberalisation of services is not appropriate for health professions. The BMA

noted that `a doctor treating patients in a country should always be accountable to that country's regulatory authority' (Watson, 2002).

Indeed this logical opinion applies equally to all healthcare professions. British standards in eye healthcare must be maintained and from a British perspective optometry in the EU must be reformed effectively and improve to British standards before any freedom of movement is implemented under any EU legislation.

5.2 Perspective for the future

It would appear that presently most issues under discussion affecting British eye healthcare are primarily concerned with cost and benefit analysis for the purposes of allocation of resources. This originates from an ongoing tussle between principles, priorities and pragmatism, almost bywords in the vocabulary of all those responsible for healthcare. The main objective of health policy makers is the successful conclusion of programmes from a medical and economic point of view. Health insurers would primarily be concerned with economics related to medical matters. Growth of medical care guaranteed by insurance is not related to public or social reform. Epidemics, when viewed from a health-related public welfare perspective, acquire a different meaning. Political and economic significance of disease may be different from social significance. With this kind of diverse background, the strategic difference originating from differing viewpoints may result in a clash of interests similar to that found between groups defining

pragmatism to suit their own working model.

In its most familiar, popular and broadest sense, pragmatism refers to actions and to those concepts which are useful, workable and lead to practical consequences. However, it may appear that in the context of the economics of healthcare, principles and pragmatism are two dissimilar philosophies which can be contradictory and in some instances may affect the choice of certain priorities.

Pragmatism as a concept is open to different interpretations, and decisions based upon the philosophy of pragmatism remain open to criticism. It is generally believed that the pragmatists may reject abstract philosophies and fundamental truth if these do not provide practical results and if ideas do not carry monetary values. Achieving goals and objectives and approving those policies which are successful economically are regarded as pragmatic and in this respect cynics might argue that even plurality of shifting truths may be acceptable to those people who think of themselves as genuine pragmatists.

In a healthcare setting duty of care may be different from deontological ethics which opposes pragmatism in its purest form and states that an action is right if it conforms to duty, and duty it must be without any exception and regardless of consequences. However, it has to be taken into account that there is a special relationship that exists between principles, priorities and pragmatism. In the context of healthcare professions, the relationship between healthcare, ethics and pragmatism may be in a sense described as

analogous to that found between syntax, semantics and pragmatics in the field of linguistics. This analogy is drawn here only for the purpose of comparing the relationship of these concepts. It should be noted that pragmatics, as distinct from pragmatism, is that branch of study in semiotics which deals with the positive relationship of the user with words, signs and symbols in social life (Agarwal, 1998 c). Supporters of pragmatism in healthcare would argue that a positive relationship exists between pragmatism and recipients of healthcare. The debate continues.

In 1995, the Royal College of Physicians (RCP) called for a national council to help determine priorities in the health service. In the RCP report *'Setting Priorities in the NHS: A Framework for Decision Making'* the president stressed the point that choices had to be made within the NHS since not everything that was possible was affordable (Smith, 1995). The RCP report further argued that equity for the whole population was more important than freedom of individual choices but there was a need for 'more open systems by which priorities can be made and much greater involvement by the public' (Smith, 1995). In a separate comment it was stated that a principal objective of the NHS is to maximise health of the people (Culyer, 1997). It was later argued by a different group that soliciting public opinion was a waste of money (Torgerson & Gosden, 2000) followed by another comment that the tax payers should always be asked (Cookson and Dolan, 2000).

On the question of healthcare, governments in the Netherlands and Sweden

also examined the national criteria for priorities with different conclusions. The Swedish commission rejected the benefit principle and the idea of deploying resources to help many people with mild disorders instead of a few with severe injuries or giving priority to those patients who are most profitable to society. In conclusion the Swedish commission emphasised human dignity, need and social solidarity and stated that all people have the same rights irrespective of their personal characteristics, the resources should be devoted to those in greatest need and the most vulnerable groups should be given special consideration (Klein, 1995).

However, the Dunning report of the Dutch commission recommended that all claims must pass a four point test such as necessity, effectiveness, efficiency and individual responsibility. Around the same time a commission from New Zealand, although outside the EU but within the EME, recommended a four point criteria for priority which were provision of benefit, value for money, fair use of resources and consistency with community needs.

With the exception of Sweden the others have attempted to include priority with principles and pragmatism at the same time in their recommendations. An element of scarcity of resources or rationing of healthcare services clearly shows in some of these recommendations.

It is debatable whether any kind of prioritisation or maximisation of efficiency in the existing system always produces the desired economic results and benefits. Imposition of `target setting and production line values' affects

professional judgement of doctors or the needs of individual patients' and 'excessive, intrusive audit and the imposition of *diktats* by the state leads to stifling of innovation' was the comment of the outgoing BMA chairman Ian Bogle (Beecham, 2003). He further commented that 'paranoid centralism.... will turn professionals into bean counters answerable not to their patients but to politicians, auditors, commissioners and managers'. Here pragmatism has been misinterpreted and ethics and principles disregarded in the name of efficiency.

The recently proposed reformation of NHS trusts into foundation trusts (Health and Social Care Act, 2003) allowing extra freedom for the management of healthcare affairs (Dixon, 2003) is unlikely to have any significant impact on the pattern of eye healthcare delivery in the UK.

A survey was conducted to determine the vision-related quality of life (VR-QOL) in an elderly UK population and a substantial national prevalence of VR-QOL impairment was found, linking ocular disease with social deprivation (Frost et al, 2001).

The president of the Royal College of Ophthalmologists already conceded in 1999 that in the United Kingdom and elsewhere, it is proving difficult to maximise all 3 components of the eternal triangle based on access for patients, affordability and quality; and 'the scope, success and expense of modern health care has increased demand to a level that may be difficult to sustain' (Jay, 1999).

Generally in any given system the average cost decreases as the output increases. When the output reaches its full capacity, inefficiencies may arise due to factors like overloading or congestion in the system leading to an increase in average cost. The recipients of professional services bear the cost of inefficiency in the system. Ultimately overloading leads to system failure. In a healthcare environment poor performance or critical incidents due to system failure can lead to permanent disability. An analogy may be found in the eye healthcare field in the UK.

It is recognised that in the UK many ophthalmologists provide their support to optometrists in the provision of eye healthcare. However, with the growing elderly population, changing demography and insufficient funds the UK will remain short of human resources in the management of sight threatening conditions and avoidance of increase in visual impairment and blindness unless very specific measures are taken. It is not realistic to expect approximately 750 British ophthalmologists to provide shared primary and all secondary eye care to 60 million people in the United Kingdom.

On the question of easing the burden on the hospital eye services in the UK, a consultant (McLeod, 2003) from Manchester Royal Eye hospital recently stated that a higher standard of ophthalmic primary care will not necessarily reduce the burden on the hospital eye service' and `suitably motivated optometrists' should be trained `to provide a more advanced level of ophthalmic primary care' because `there is whole lot of undiscovered eye pathology out there'. The role of primary eye care optometrist within a community setting is crucial in avoiding visual impairment and blindness.

5.3 Conclusions

The present professional status and future development of optometry in the United Kingdom and in the European Union are separate issues. Whereas optometry in Britain is working very closely with medicine and steadily moving forward as a profession complimentary to ophthalmology; with the exception of Ireland, *optometry* in the rest of the European Union countries is restricted by national laws, decrees and acts like L'Acte Medicale or Actus Medicus to those professional activities which are normally carried out by registered dispensing opticians in the United Kingdom. From a British perspective there are no equivalent working optometrists in the EU because the professional status and level of work of those using the title `optometrist' is different from that found in the UK. Optometrists in the UK are allowed to monitor ocular pathology, manage eye conditions of their patients and only refer when clinically necessary. Direct referral to Hospital Eye Service, encouraged by the General Optical Council, is part of British optometric practice. The Department of Health has already approved supplementary and independent prescribing status for British optometrists. The College of Optometrists provides a voluntary Continuing Education and Training (CET) scheme as part of Continuing Professional Development (CPD). The CET scheme, which will become compulsory, is designed to enable British optometrists to maintain and improve upon the standards of knowledge and competence after qualifying.

The issues concerning the future development of optometry in the UK and the rest of the EU are different and have to be addressed separately. Whereas optometry in the EU has to develop to a standard similar to that which presently exists in the UK, optometry in the UK has to move forward to provide professional services consistent with eye care needs and availability of eye healthcare services. As stated previously, it is certainly not realistic to expect 750 British ophthalmologists to provide shared primary and all secondary eye care to nearly 60 million people. Effective measures must be taken by the state to combat serious public health implications of visual impairment and blindness. Optometrists in the UK are practising in an environment of expanding roles. British optometrists, with appropriate training and certification, could be given greater responsibilities which could, for example, include procedures like fluorescein angiography and laser photocoagulation.

As stated previously, the present pattern of eye healthcare delivery and a perspective for the future in the UK and Ireland and the rest of the European Union are separate issues. Law makers in the EU have to be made aware of the fact that a political treaty of union of states does not produce instant harmonisation or reciprocity in professional standards. Professional cultures in the EU are diverse. EU member states must reach a consensus about the core functions which have to be performed by the old established and the newer healthcare professions. Before the next stage of an enlarged European Union,

strategic eye healthcare definitions, with a specific role for optometry, are required for all EU countries. Although in socio-economic or political terms the aim to harmonise all healthcare professions within the EU is laudable, in practical terms the proposal is fraught with serious problems especially for a profession like optometry. Harmonisation implies uniformity with equality and presently neither of these exist in optometry in the EU.

In conclusion, the responsibility for the specific task of ophthalmic intervention could be given to British optometrists with appropriate additional training and this would provide a pragmatic solution to a human resources problem in eye healthcare in the UK. Hopefully, such a model will be adopted by the future optometrists throughout the European Union provided they get full support from their governments and also from medicine and ophthalmology in their countries.

APPENDIX I

World Bank Economic Regions

Grouping of countries on the basis of World Bank Development Report

The world is divided into following eight groups on economic basis i.e. the types of economy and the stages of economic development. The WHO arranges and presents the published data according to the World Bank grouping of countries.

(1) **EME** : The established market economies of North America, and Western Europe which include Japan, Australia and New Zealand

(2) **FSE** : The former socialist market economies of the Russian Federation and Eastern Europe.

(3) **IND** : India is considered a separate economic region.

(4) **CHI** : China is also considered a separate economic region.

(5) **OAI** : Other Asian countries and Islands: includes all the other countries of south, south-east and east Asia and the islands of the pacific.

(6) **SSA** : Sub-Saharan Africa : all of Africa with the exception of western Sahara, Morocco, Algeria, Tunisia, Libya and Egypt, which are assigned to the Middle Eastern crescent.

(7) **LAC** : Latin America and the Caribbean includes Mexico, all of Central and South America and the Caribbean Islands.

(8) **MEC** : The Middle Eastern crescent, similar to the WHO Eastern Mediterranean Region, in that it encompasses Afghanistan and Pakistan as well as Saudi Arabia, the Gulf States and North Africa. Additionally it includes Israel, Turkey and the new Asian republics formed from the southern states of the former Soviet Union.

Note: The political group G8 consists of selected countries from EME & FSE and it is not in the WHO scheme of presentations.

References: (1) Johnson and Foster (1998), The Epidemiology of Eye Disease, edited by Johnson, Minassian and Weale, Chapman and Hall, 7-30.
(2) WHO (1990), Global data on blindness, an update, World Health Organisation, Geneva, WHO/PBL/94.40.
(3) The World Bank development Reports (1990-1993).

APPENDIX II

Conversion Table
For Notations Recording Visual Acuity

LogMar	Snellen 6m	Snellen 20ft	Decimal
1.0	6/60	20/200	0.10
0.9	6/48	20/160	0.125
0.8	6/38	20/125	0.16
0.7	6/30	20/100	0.20
0.6	6/24	20/80	0.25
0.5	6/19	20/63	0.32
0.4	6/15	20/50	0.40
0.3	6/12	20/40	0.50
0.2	6/9.5	20/32	0.63
0.1	6/7.5	20/25	0.80
0.0	6 6	20/20	1.00
-0.1	6/4.8	20/16	1.25
-0.2	6/3.8	20/12.5	1.60
-0.3	6/3	20/10	2.00

APPENDIX III

The World Health Organisation Classification of Blindness and Visual Impairment

Category of visual impairment	Visual Acuity With Best Correction Maximum less than	Minimum equal to or better than
1	6/18 20/70 0,3	6/60 20/200 0.1
2	6/60 20/200 0.1	3/60 (finger counting at 3m) 20/400 0/05
3	3/60 (finger counting at 3m) 20.400 0.05	1/60 (finger counting at 1m) 20/1200 0.02
4	1/60 (finger counting at 1m) 20/1200 0.02	Light Perception
5	**NO LIGHT PERCEPTION**	

Note: Categories 1 - 2 (Low Vision) Categories 3 -5 (Blindness)

Adapted from the WHO Recommended
Definition of Blindness and Visual Impairment
(1992)

Appendix IV

Ocular Morbidity in the European Union and European Blind Union Statistics

It appears that detailed data and statistics concerning ocular morbidity in the European Union member states is not available. Also the size of socio-economic inequalities in determinants of ocular morbidity in different European Union countries is not known. It is, therefore, not possible to compare ocular morbidity in the European Union.

Furthermore, blind registers only provide data on the incidence of certification based upon blindness definition used for the purposes of registration and blindness allowance. This type of information, if available, may not provide data on the incidence and prevalence of ocular diseases causing visual impairment and blindness.

The following statement (2003) from the European Blind Union (EBU) based in Paris is self-explanatory.

'The number of blind and partially sighted in European countries are based upon estimates provided by the national members of European Blind Union (EBU) and are an approximation of a highly complex reality. Lack of official statistics and varied legal definitions of blindness and partial sight make it particularly difficult to work out accurate numbers. In Particular the number of visually impaired elderly people is on the increase. Many of them do not consider it useful to start rehabilitation courses and as a consequence fall out of official registers. At European Union level the figures generally used by those involved in campaigning to promote the interests of visually impaired people is 7.4 million out of a general population of about 385 million'.

However, it should be noted that morbidity is defined as the state of being diseased and morbidity rate depends upon the incidence and prevalence of a disease in any given population. A measure of disease frequency may express morbidity rate and such studies can include the frequency of ocular diseases causing visual impairment and blindness The prevalence rate is defined as the proportion of a population having a disease at one point in time. The prevalence

rate is usually expressed as 1 in a million or 1 in 100, 000 or smaller for common diseases. The incidence rate is the proportion of a defined population developing a disease within the stated period. The incidence rate can be expressed as 1 in a thousand at risk.

The attached statistics and information compiled by the European Blind Union covering all the 15 EU member states only provides incomplete data on blindness and visual impairment.

List of Current EU Countries:

Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and United Kingdom.

The EU after 1 May 2004:

The EU will be enlarged on 1 May 2004 and the following countries from Europe will become part of it: Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, the Slovak Republic and Slovenia.

The EU in 2007:

The following are EU applicant countries: Bulgaria, Romania and Turkey. Bulgaria and Romania are expected to join the EU in 2007.

I. Total population : 8 015 000 (Jannuary 1994)

	Children(0-14)	Working age(15-64)	Elderly(over 65)	Total
Male	725 800	2 736 000	425 200	3 887 000
Female	687 500	2 667 800	772 700	4 128 000
Total	1 413 300	5 403 800	1 197 900	8 015 000

II. Total visually impaired population : 139 300 (identified)

Percentage(compared to total population) : 1,72

	Children	Working age	Elderly	Total
Male				
Female				>7 334*
Total	2 700	13 600	123 000	139 300

*This figure excludes Vienna, Salzburg and Carinthia

II.1 Blind population :

Legal definition of blindness :

	Children	Working age	Elderly	Total
Male				
Female				
Total				

II.2 Partially sighted population :

Legal definition of partially sighted :

	Children	Working age	Elderly	Total
Male				
Female				
Total				

III. Number of visually impaired people with additional handicap(s) :

IV. Total handicapped population (all handicaps) :

I. Total population : 10 100 600 (Jannuary 1994)

	Children(0-14)	Working age(15-64)	Elderly(over 65)	Total
Male	937 700	3 375 200	627 300	4 940 200
Female	893 100	3 322 900	944 400	5 160 400
Total	1 830 800	6 698 100	1 571 700	10 100 600

II. Total visually impaired population : Between 12 and 15 000 (identified)

Percentage(compared to total population) : 0,12/0,13

	Children	Working age	Elderly	Total
Male				
Female				
Total				12 000/15 000

II.1 Blind population :

Legal definition of blindness : (White cane)

After correction and in both eyes : visual acuity less than 1/10 of normal sight or visual field inferior to 20°

	Children	Working age	Elderly	Total
Male				
Female				
Total				

II.2 Partially sighted population :

Legal definition of partially sighted : (Yellow cane)

- Central visual acuity in both eyes less than 0,6 of normal sight - after correction

or global vision impairment in both eyes, with absolute sensitivity reduction to 1/100th or less of normal sight at equivalent age
or loss of peripherical vision, with residual visual field in both eyes inferior to 40°

	Children	Working age	Elderly	Total
Male				
Female				
Total				

III. Number of visually impaired people with additional handicap(s) :

IV. Total handicapped population (all handicaps) :

Data provided by the Danish Association of the Blind, March 2002

I. Total population : 5 368 354 January (2002)

	Children(0-14)	Working age(15-64)	Elderly(over 65)	Total
Male	515 664	1 804 632	333 850	2 654 146
Female	489 539	1 763 935	460 734	2 714 208
Total	1 005 203	3 568 567	794 584	5 368 354

II. Total visually impaired population : 53 700

Percentage of total population : 1 %

	Children (0-18)	Working age (19-60)	Elderly (over 65)	Total
Male				
Female				
Total	1 721	17 613	34 366	53 700

- In Denmark, only visually impaired children between 0 and 18 are registered. Therefore, figures provided for the other age groups are only estimates.
- Whereas the visually impaired population is evenly distributed between women and men up to 60 years of age, there are significantly more women in the age group above 60.
- Estimates by health researchers and disability experts indicate that the visually impaired population is evenly distributed between the blind and the partially sighted

II.1 Blind population : 26 850

Definition of blindness : Visual acuity lower than or equal to 6/60

	Children	Working age	Elderly	Total
Male				
Female				
Total				26 850

II.2 Partially sighted population : 26 850

Definition of partial sight : Visual acuity between 6/18 and 6/60, but with complications that cause the "value" of vision to be considered lower than or equal to 6/60

	Children	Working age	Elderly	Total
Male				
Female				
Total				26 850

III. Number of visually impaired people with additional disabilities :

966 children with additional disabilities (0-18 years of age).
No figures available for the other age groups for same reason as above.

IV. Total disabled population : 536 800 approx.

FINLAND

I. Total population : 5 171 302 (2000)

	Children(0-14)	Working age(15-64)	Elderly(over 65)	Total
Male (0-14)	481 142	1 749 103	292 781	2 523 026
Female	461 859	1 712 030	474 387	2 648 276
Total	943 001	3 461 133	767 168	5 171 302

II. Total visually impaired population : 81 300 (identified)

Percentage of total population : 1,57

	Children	Working age	Elderly	Total
Male	700	5 500	20 000	26 200
Female	600	4 500	50 000	55 100
Total	1 300	10 000	70 000	81 300

II.1 Blind population : 10 500 (estimated)

Definition of blindness : 's definition, group 3, 4 and 5

	Children	Working age	Elderly	Total
Male	300	2 000	3 000	5 300
Female	200	1 000	4 000	5 200
Total	500	3 000	7 000	10 500

II.2 Partially sighted population : 70 800

Definition of partial sight : WHO's definition, group 1 and 2

	Children	Working age	Elderly	Total
Male	400	3 500	17 000	20 900
Female	400	3 500	46 000	49 900
Total	800	7 000	63 000	70 800

III. Number of visually impaired people with additional disabilities :

0-6 years old children : 75 % multihandicapped

IV. Total disabled population :

I. Total population : 59 651 227 (July 2001)

	Children (0-14)	Working age (15-64)	Elderly (over 65)	Total
Male	5 698 604	19 424 018	3 900 579	29 023 201
Female	5 526 838	19 399 588	5 701 600	30 628 026
Total	11 225 442	38 823 606	9 602 179	59 651 227

II. Total visually impaired population : 140 000 *

Percentage of total population : 0,23

	Children	Working age	Elderly	Total
Male				
Female				
Total		68 000		140 000

* estimated at 1 200 000 if taking visual acuity less than 3/10 as criterium (percentage is then 2)

II.1 Blind population : 55 000

Definition of blindness Central visual acuity in the better eye less than 1/20 of normal sight, after correction

	Children	Working age	Elderly	Total
Male				
Female				
Total	2 000	18 000	35 000	55 000

II.2 Partially sighted population : 85 000

Definition of partial sight :

According to a November 1993 new scale, any person can obtain a disablement card when :

. his/her view is inferior or equal to 1/10 for each eye

or . nil at one eye and inferior or equal to 2/10 at the other

	Children	Working age	Elderly	Total
Male				
Female				
Total		50 000		85 000

III. Number of visually impaired people with additional disabilities :

IV. Total disabled population :

GERMANY (both former republics)

I. Total population : 81 338 100 (Jannuary 1994)

	Children(0-14)	Working age(15-64)	Elderly(over 65)	Total
Male	6 827 000	28 374 600	4 316 900	39 518 500
Female	6 480 700	27 295 500	8 043 400	41 819 600
Total	13 307 700	55 670 100	12 360 300	81 338 100

II. Total visually impaired population : 655 000 (identified)*

Percentage(compared to total population) : 0,8

	Children	Working age	Elderly	Total
Male				295 000
Female				360 000
Total			465 000	655 000

* Projected from 1990 figures (since 1990 partially sighted people are no longer entitled to any special allowance and thus no longer registered ; but in the former GDR they were granted a fixed allowance and could thus be numbered)

Out of these 655 000, 155 000 live in the former Federal Republic of Germany.

II.1 Blind population : 155 000

Legal definition of blindness : Visual acuity of 2 % or less of normal sight, and other impairments of visual acuity of the same gravity (i.e decreasing visual field size)

	Children (1-18)	Working age (18-65)	Elderly (over 65)	Total
Male				58 900
Female				96 100
Total	9 300	43 989	102 300	155 000 approx

II.2 Partially sighted population : 500 000*

* Projected from 1990 figures (since 1990 they are no longer entitled to any special allowance and thus no longer registered ; but in the former GDR they were granted a fixed allowance and could thus be numbered).

Legal definition of partial sight : Visual acuity of 5 % or less of normal sight, and other impairments of visual acuity of the same gravity (i.e decreasing visual field size)

	Children	Working age	Elderly	Total
Male				225 000
Female				275 000
Total				500 000

III. Number of visually impaired people with additional disabilities :

7/10 babies born blind had additional handicaps in 1992

IV. Total disabled population :

GREECE

I. Total population : 10 409 700 (Jannuary 1994)

	Children(0-14)	Working age(15-64)	Elderly(over 65)	Total
Male	941 800	3 508 100	691 000	5 140 900
Female	889 100	3 512 000	867 700	5 268 800
Total	1 830 900	7 020 100	1 558 700	10 409 700

II. Total visually impaired population : 22 000 (identified)

Percentage(compared to total population) : 0,21

	Children	Working age	Elderly	Total
Male				11 000
Female				11 000
Total		7 000		22 000

II.1 Blind population :

Legal definition of blindness : Visual acuity less than 1/20 of normal sight in both eyes - after correction.

There is no legal definition for low vision and there are no people registered as partially sighted in Greece.

	Children	Working age	Elderly	Total
Male				
Female				
Total				

II.2 Partially sighted population :

See II.1 above

Legal definition of partially sighted : See II.1

	Children	Working age	Elderly	Total
Male				
Female				
Total				

III. Number of visually impaired people with additional handicap(s) :

400 - 500 (adults and children)

IV. Total handicapped population (all handicaps) :

IRELAND

Data provided by the National Council of the Blind of Ireland, March 2002

I. Total population : 3 626 087

	Children(0-14)	Working age(15-64)	Elderly(over 65)	Total
Male	441 452	1 181 528	177 252	1 800 232
Female	417 972	1 171 253	236 630	1 825 855
Total	859 424	2 352 781	413 882	3 626 087

II. Total visually impaired population* : 17 000 approx.

Percentage (compared to total population) : 0,47

	Children	Working age	Elderly	Total
Male				
Female				
Total				17 000 approx.

* The National Council for the Blind of Ireland conservatively estimates that there are approximately 30 000 persons in the Republic of Ireland who are or may be eligible to be registered as blind or partially sighted.

II.1 Blind population : 6 448

Definition of blindness : "Best vision must be equal to or less than 6/60 in the better eye or the field of vision is limited, the widest diameter of vision subtending an angle of not greater than 20 degrees" (Certificate of Visual Acuity)

	Children	Working age	Elderly	Total
Male				
Female				
Total		1 500		6 448

II.2 Partially sighted population : 11 000 approx.

Definition of partial sight :

	Children	Working age	Elderly	Total
Male				
Female				
Total				11 000 approx.

III. Number of visually impaired people with additional disabilities :

IV. Total disabled population

ITALY

Data provided by the Italian Union of the Blind, January 2001

I. Total population : 57 138 500

	Children(0-14)	Working age(15-64)	Elderly(over 65)	Total
Male	4 465 000	19 548 100	3 725 600	27 738 700
Female	4 223 000	19 744 300	5 432 500	29 399 800
Total	8 688 000	39 292 400	9 158 100	57 138 500

II. Total visually impaired population : 110 793* / 368 000**

Percentage of total population : 0,19* / 0.64**

* Source : Institute for Social Security (July 2000)
This figure only includes the blind and partially sighted whose residual vision is not more than 1/20 in both eyes with lenses receiving an economic allowance according to the Italian legislation.

** Source : Institute for Statistics (1990/1993)
This figure includes, besides the blind and partially sighted whose residual vision is not more than 1/20 in both eyes with lenses receiving an economic allowance according to the Italian legislation, all the visually impaired who do not receive an economic allowance : namely those whose residual vision is more than 1/20 but suffer from such a severe visual impairment that they cannot see or count the fingers of a hand (provisional criterion). All the data of this surveying are assumed to be provisional.

	Children	Working age	Elderly	Total
Male	4 000	69 000	77 000	150 000
Female	6 000	63 000	149 000	218 000
Total	10 000	132 000	226 000	368 000**

II.1 Blind population : 58 370*** (December 1991)

*** Source : Ministry of Interior. Data from Institute for Social Security : none

Definition of blindness :
The current legislation provides that persons defined as suffering from total blindness are :
a) those with no sight at all in both eyes with lenses
b) those who have mere perception of light and shade

The Parliament will soon complete the evaluation of a bill which provides that persons defined as suffering from total blindness are :
c) those with no sight at all in both eyes
d) those who have mere perception of light and shade or the movement of a hand in both eyes or in the eye with better vision
e) those whose residual binocular peripheral vision is less than 3 per cent

	Children	Working age	Elderly	Total
Male				
Female				
Total				58 370***

II.2 Partially sighted population : 57 388*** (December 1991)

*** Source : Ministry of Interior ; Data from Institute for Social Security : none

Definition of partial sight **** :
The current legislation provides that persons defined as suffering from partial blindness are :
a) those whose residual vision is not more than 1/20 in both eyes, even with lenses

The Parliament will soon complete the evaluation of a bill which provides that persons defined as suffering from partial blindness are .
b) those whose residual vision is not more than 1/20 in both eyes or in the eye with better vision, even with lenses
c) those whose residual binocular peripheral vision is less than 10 per cent

	Children	Working age	Elderly	Total
Male				
Female				
Total				57 388***

**** Besides this category, the Italian legislation also recognises another category of partially sighted : those whose residual vision is not more than 1/10 in both eyes with correction lenses. The latter is not entitled to any economic allowance, but it is included in other protection schemes (such as compulsory employment).

III. Number of visually impaired people with additional disabilitie(s) : 16 640 *****

***** Source : Institute for Social Security (July 2000)
This figure shows the number of the visually impaired who receive economic allowances also for other impairment(s).

IV. Total disabled population :

LUXEMBOURG

I. Total population : 400 900 (Jannuary 1994)

	Children(0-14)	Working age(15-64)	Elderly(over 65)	Total
Male	37 300	138 800	20 800	196 900
Female	35 400	134 200	34 40	204 000
Total	72 700	273 000	55 200	400 900

II. Total visually impaired population :550 (identified),

Percentage (compared to total population) : 0,14

	Children	Working age	Elderly*	Total
Male				200
Female				350
Total	69	80	401	550

II.1 Blind population :

Legal definition of blindness : Visual acuity in better eye after correction less than 1/10 of normal sight, or visual field inferior to 10°.

	Children	Working age	Elderly	Total
Male				
Female				
Total				

II.2 Partially sighted population :

Legal definition of partially sighted :

	Children	Working age	Elderly	Total
Male				
Female				
Total				

III. Number of visually impaired people with additional handicap(s) :

IV. Total handicapped population (all handicaps) :

NETHERLANDS

I. Total population : 15 341 600 (Jannuary 1994)

	Children(0-14)	Working age(15-64)	Elderly(over 65)	Total
Male	1 439 300	5 343 800	802 800	7 585 900
Female	1 376 400	5 174 100	1 205 200	7 755 700
Total	2 815 700	10 517 900	2 008 000	15 341 600

II. Total visually impaired population : 158 000 (identified),

Percentage (compared to total population) : 1,03

	Children	Working age	Elderly*	Total
Male				
Female				
Total	2 200			158 000

II.1 Blind population : 16 000 (1988 survey)

Legal definition of blindness : Criteria used by the Act on Sheltered Employment (WSW) :

"Anyone obliged to read braille or make use of the spoken word".

	Children	Working age	Elderly	Total
Male				
Female				
Total				16 000

II.2 Partially sighted population : 142 000 (1988 survey)

Legal definition of partially sighted : Criteria used by the Dutch Union of the Blind and the Dutch Railways for delivery of a "guidance permit" (free circulation - on Public Transport - for the guide) : "People who, in spite of the use of glasses or contact lenses, have the disposal over less than 10 % of their normal visual field, and/or who have the disposal of a visual field that forms an imaginary corner in the largest id (bore) of no bigger than 20°.

	Children	Working age	Elderly	Total
Male				
Female				
Total				142 000

III. Number of visually impaired people with additional handicap(s) :

90 000

IV. Total handicapped population (all handicaps) :

Approx. 1 500 000 (physical handicap), 100 000 (mental handicap)

PORTUGAL

Data provided by ACAPO, March 2002

I. Total population : 10 355 824 (2001 Census)

	Children (0-14)	Working age (15-64)	Elderly (over 64)	Total
Male	849 162	3 435 729	715 073	4 999 964
Female	810 399	3 558 414	987 047	5 355 860
Total	1 659 561	6 994 143	1 702 120	10 355 824

II. Total visually impaired population : 163 500 approx. (2001 Census)

Percentage of total population : 1,6

	Children (0-16)	Working age (17-64)	Elderly (over 64)	Total
Male	6 100	51 600	19 600	77 300
Female	6 200	51 500	28 500	86 200
Total	12 300	103 100	48 100	163 500

II.1 Blind population : 17 500 approx.

Definition of blindness :
Visual acuity less than 1/10
Visual field less than 20°

	Children (0-16)	Working age (17-64)	Elderly (over 64)	Total
Male	600	5 600	2 100	8 300
Female	700	5 500	3 000	9 200
Total	1 300	11 100	5 100	17 500

II.2 Partially sighted population : 146 000 approx.

Definition of partial sight : None (ophthalmologists apply old WHO definitions)

	Children (0-16	Working age (17-64)	Elderly (over 64)	Total
Male	5 500	46 000	17 500	69 000
Female	5 500	46 000	25 500	77 000

Total	11 000	92 000	43 000	146 000

III. Number of visually impaired people with additional disabilities : 31 000

IV. Total disabled population : 634 408 people - 6,1 per cent (2001 census)

(The figure of 905 500 people suggested in 1995 survey is disputed by many)

SPAIN

I. Total population : 39 852 652 (November 2000)

	Children(0-14)	Working age(15-64)	Elderly(over 65)	Total
Male	3 098 043	13 667 147	2 723 277	19 488 467
Female	2 945 082	13 638 614	3 780 489	20 364 185
Total	6 043 125	27 305 761	6 503 766	39 852 652

II. Total visually impaired population : 150 000 - 200 000 estimated

Percentage of total population : 0,38 - 0,5

	Children	Working age	Elderly	Total
Male				
Female				
Total				150 000 - 200 000

II.1 Blind population : 59 186 (registered)

Definition of blindness :

Visual acuity less than 1/10th on the Wecker scale in both eyes, after the best possible optical correction,
or visual field not exceeding 10° in both eyes.

	Children	Working age	Elderly	Total
Male	2 436	18 429	9 297	30 162
Female	1 904	14 726	12 394	29 024
Total	4 340	33 155	21 691	59 186

II.2 Partially sighted population : 100 000 - 150 000

Legal definition of partial sight :

	Children	Working age	Elderly	Total
Male				
Female				

Total				100 000 - 150 000

III. Number of visually impaired people with additional disabilities :

10 355 (out of the 59 186 blind people)

IV. Total disabled population :

3 498 353 (estimate)

SWEDEN

I. Total population : 8 745 100 (January 1994)

	Children(0-14)	Working age(15-64)	Elderly(over 65)	Total
Male	839 200	2 830 600	651 100	4 320 900
Female	796 300	2 742 900	885 000	4 424 200
Total	1 635 500	5 573 500	1 536 100	8 745 100

II. Total visually impaired population : 103 000 approx. (identified)

Percentage (compared to total population) : 1,17

	Children	Working age	Elderly	Total
Male	1 500	10 300	29 000	40 800
Female	1 500	10 300	50 000	61 800
Total	3 000	20 600	79 000	103 000 approx

II.1 Blind population : 13 000

Legal definition of blindness : There is no legal definition ; different criteria are applied by different authorities.

The Swedish Association of the Visually Impaired (SRF) defines visual impairment as follows : "A person is visually impaired when his/her sight is reduced to such an extent that it leads to difficulties in reading ordinary script or orientating with the help of sight".

	Children	Working age	Elderly	Total
Male	200	1 300	4 000	5 500
Female	200	1 300	6 000	7 500
Total	400	2 600	10 000	13 000

II.2 Partially sighted population : 90 000 approx.

Legal definition of partial sight : See above

	Children	Working age	Elderly	Total
Male	1 300	9 000	25 000	35 300
Female	1 300	9 000	44 000	54 300

Total	2 600	18 000	69 000	90 000 approx

III. Number of visually impaired people with additional disabilities :

- One third of the visually handicapped have at least one additional disability.

IV. Total disabled population :

Not available.

UNITED KINGDOM

I. Total population : 58 801 500 (2001)

	Children(0-14)	Working age(15-64)	Elderly(over 65)	Total
Male	5 787 000	18 838 000	3 692 000	28 317 000
Female	5 485 000	18 710 000	5 447 000	29 642 000
Total	11 272 000	37 548 000	9 139 000	57 959 000

(Distribution in above table as of 1993)

II. Total visually impaired population :

1 066 740 (identified) ; 1,8 per cent of total population
354 153 (registered)

	Children (0-15)	Working age (16-64)	Elderly (65-74)	Elderly (over 75)	Total
Male					
Female					
Total	24 200	166 140	125 940	750 460	1 066 740

- 82 % of visually impaired people are 65 or over
- 1 in 7 over 75 and 1 in 3 over 85 have severe vision loss
- The number of blind adults (includes the elderly, as opposed to "children") living in private households is estimated to be 300 000, with 41 000 of working age
- The number of partially sighted adults (includes the elderly, as opposed to "children") living in private households is estimated to be 457 000, with 50 000 of working age

II.1 Blind population : 193 956 (registered)

Definition of blindness : Individuals are registered blind if they have :

a) a visual acuity of less than 3/60 Snellen
or b) a visual acuity of between 3/60 and 6/60 Snellen and a considerable contraction of their field of vision
or c) a visual acuity greater than 6/60 Snellen and a field contraction covering majority of the field.

	Children	Working age	Elderly	Total
Male				

Female				
Total				193 956

II.2 Partially sighted population : 160 197 (registered)

Definition of partial sight: Individuals are registered as partially sighted if they have :

a) Visual acuity of between 3/60 and 6/60 Snellen and a full field of vision
or b) a visual acuity of between 6/60 and 6/24 Snellen and a moderate contraction of their field of vision
or c) a visual acuity up to 6/18 Snellen, or even better, with a gross field defect.

	Children	Working age	Elderly	Total
Male				
Female				
Total				160 197

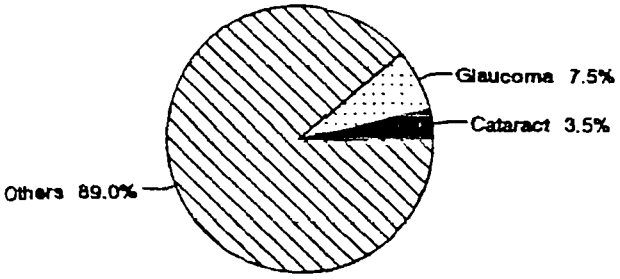
III. Number of visually impaired people with additional disabilities :

- 67 % of visually impaired people have another permanent illness or disability. Most frequently mentioned are :
arthritis (25 %), heart conditions (16 %), mobility problems (14%) and diabetes (9 %).
- 35 % of visually impaired people experience some difficulty in hearing normal speech (round 50 % of those over 75)
- 56 % of visually impaired children have at least one over disability.

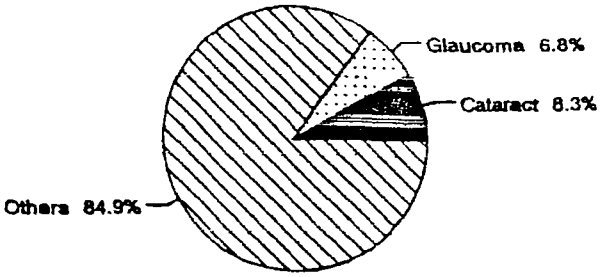
IV. Total disabled population :

Major Causes of Blindness per Demographic Region

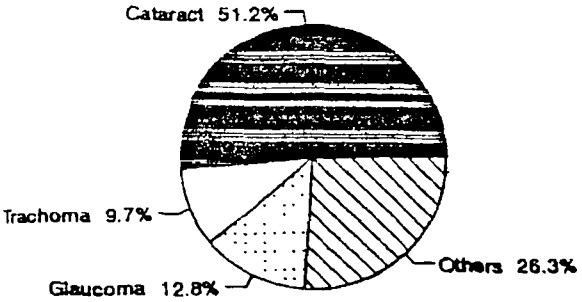
Established Market Economies



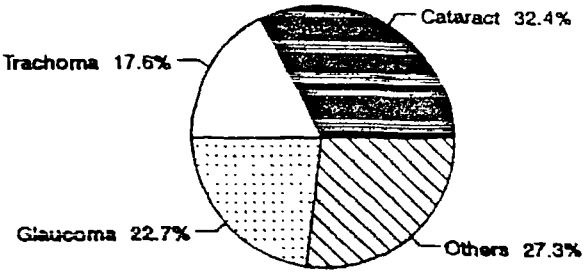
Formerly Socialist Economies of Europe



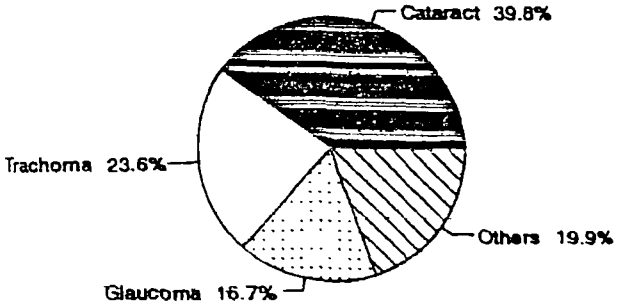
India



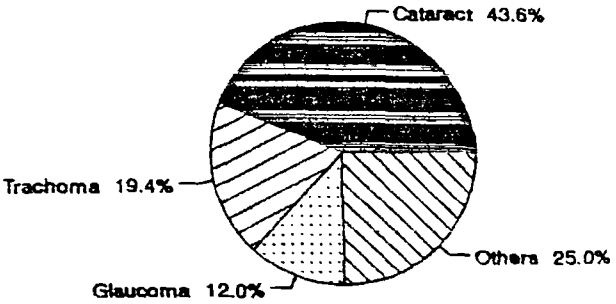
China



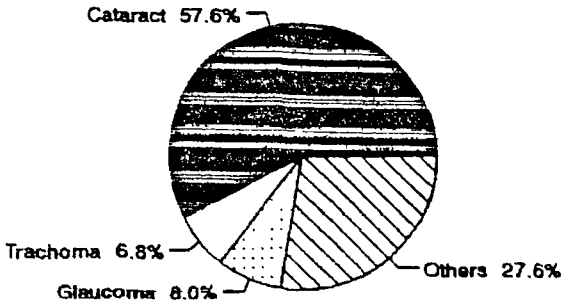
Other Asian and Islands



Sub-Saharan Africa

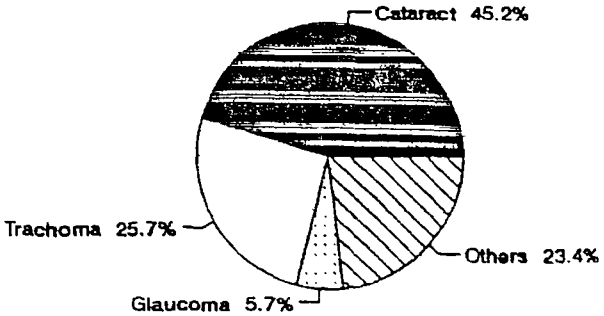


Latin America and the Caribbean



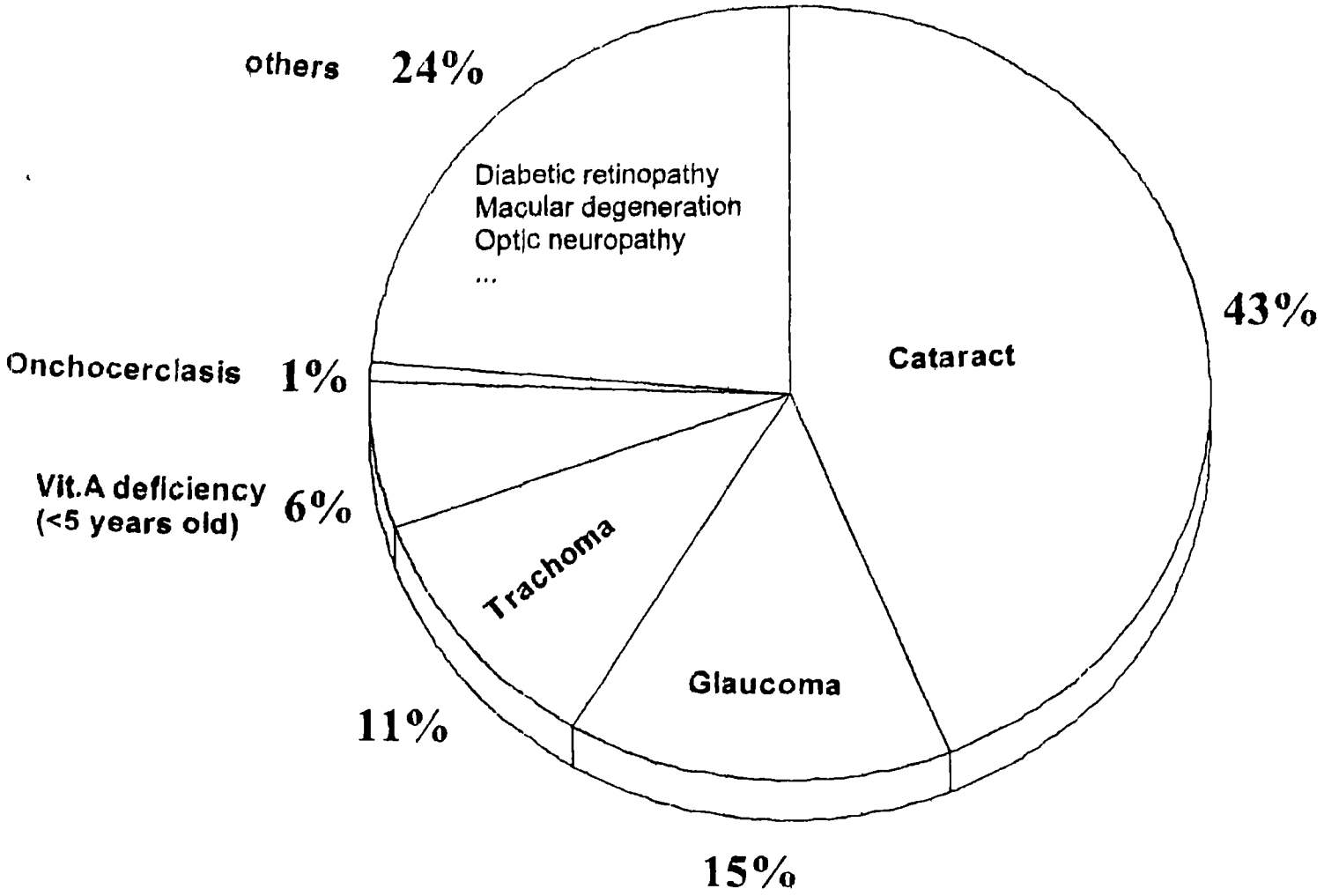
Middle-Eastern Crescent

(Including newly independent states in Asia)



Causes of Blindness, 1997 World-wide

Total number of blind people = 44,800,000



References

Agarwal, G., Pierce, M. and Ridout, D. (2002), The GP perspective: problems experienced in providing diabetes care in UK general practice, State of Diabetes and Diabetic care in the UK, Diabetic Medicine, Volume 19, Supplement 4, 13-20.

Agarwal, R. (1972), Some challenging thoughts, Optician, Oct. 27, 32.

Agarwal, R. (1979), Optometrist/Ophthalmic Optician, Ophthalmic Optician, July 7, 550.

Agarwal, R. (1995a), A royal charter for optometrists, British Journal of Optometry and Dispensing, 3 (3), 100.

Agarwal, R. (1995b), The title optometrist, British Journal of Optometry and Dispensing, 3 (4), 144.

Agarwal, R. (1996a), British optometry: medical practitioner's opinion survey. British Journal of Optometry and Dispensing, 4 (2) 50-52.

Agarwal, R. (1996b), Eye care by the year 2020, British Journal of Optometry and Dispensing, 4 (4), 128.

Agarwal, R. (1997a), Some ocular manifestations of alcohol abuse, British Journal of Optometry and Dispensing, 5 (2) 49-50.

Agarwal, R. (1997b), A chair of ocular medicine at the City University, British Journal of Optometry and Dispensing, 5 (4), 132.

Agarwal, R. (1998a), Alcohol abuse, British Journal of Optometry and Dispensing, 6 (2) 44.

Agarwal, R. (1998b), European diploma in optometry, British Journal of Optometry and Dispensing, 6 (3), 84.

Agarwal, R. (1998c), Ethics, pragmatism and optometry, British Journal of Optometry and Dispensing, 6 (4), 124.

Agarwal, R. (1999), End of a millennium, British Journal of Optometry and Dispensing, 7 (4) 124.

Agarwal, R. (2000a), Clinical decision making in optometric healthcare, British Journal of Optometry and Dispensing, 8 (1), 124.

Agarwal, R. (2000b), Efficiency in the delivery of optometric healthcare, British Journal of Optometry and Dispensing, 8 (2), 4.

Agarwal, R. (2000c), Optometry as an international profession, British Journal of Optometry and Dispensing, 8 (4) 120.

Age-Related Eye Disease Study Research Group (2001), A Randomized, Placebo-Controlled, Clinical Trial of High-Dose Supplementation with Vitamins C and E, Beta Carotene, and Zinc for Age-Related Macular Degeneration and Vision Loss, AREDS report no. 8, Archives of Ophthalmology, 119, 1417-1436.

Alliance of the UK Health Regulators on Europe (2002), Response to the current consultation on the European Commission's proposed directive on mutual recognition of professional qualifications (COM, 119, final of 7 March 2002, Appendix ED 25), Personal communication from Mrs. J. Dian Taylor, Deputy Registrar/Director of Education, General Optical Council, London.

Ambati, J., Ambati, B.K., Yoo, S.H., Ianchulev, S. and Adamis, A. P. (2003), Age-related macular degeneration: aetiology, pathogenesis and therapeutic strategies, Survey of Ophthalmology, 48(3), 257-93.

Amoaku, W. ((2003), Progress in arresting sight loss from age-related macular degeneration, Geriatric Medicine, 33(5), 37-42.

Amoaku, W.M.K. and Galloway, N. R. (1999), Common Eye Diseases and their Management, second edition, Springer.

Amos, A. F., McCarty, D. J. and Zimmer, P. (1997), The rising global burden of diabetes and its complications: estimates and projections to the year 2010, Diabetic Medicine, 14, Supplement 5, S1-85.

Anon (1977), A change of title by the universities, Ophthalmic Optician, July 23, 570.

Anon (1990), Diabetes care and research in Europe, the St. Vincent Declaration, Diabetic Medicine, 7(4), 360.

Anon (1994), Joint MSc degree on course for 1995, Optician, January 14, 207 (5434), 9.

Anon (2002), UK at the bottom of AMD services league table, Optometry Today, 42 (19) 11.

Anon (2003), Progress towards optometric prescribing, Primary Care News, Association of Optometrists, 1-4.

Anon (2004), Ready for supplementary prescribing, Primary Care News, Association of Optometrists, 1-4.

Arbib, M. (1964), Brains, Machines and Mathematics, McGraw Hill.

AREDS, see Age-related Eye Disease Study research Group.

Ashby, W. R. (1964), An introduction to cybernetics, Methuen.

AURE, see Alliance of the UK Health Regulators on Europe.

Bagust, A., Hopkinson, P.K., Maslove, L. and Currie, C.J. (2002), The projected healthcare burden of type 2 diabetes in the UK from 2000 to 2060, Diabetic Medicine, 19 (supplement 4), 1-5.

Banes, M.J., Culham, L.E., Crowston, J. G., Bunce, C. and Khaw, P.T. (2000), An optometrist's role of co-management in a hospital glaucoma clinic, Ophthalmic and Physiological Optics, 20(5), 351-59.

Barnard S. and Edgar, D. (1996), Paediatric Eye Care, Blackwell Science.

Baron, H., Gunkel, P. and Pawloski, G. (1994), Augenoptik/Optometrie in Europa, Schriftenreihe zur Augenoptik, Band 2, Zentralverband der Augenoptiker, Dusseldorf.

Barros, P.P. (1998), The black box of health care expenditure growth determinants, Health Economics, 7 (6), 533-544.

Bartlett, H. and Eperjesi. F. (2003), Age-related macular degeneration and nutritional supplementation: a review of randomised controlled trials, Ophthalmic and Physiological Optics, 23(5), 383-99.

Barty-King, H. (1986), Eyes Right, The story of Dollond and Aitchison (1750-1985), Quiller Press, London.

Basham, A. L. (1976), Asian Medical System, a comparative study, edited by Leslie, C., University of California Press.

Beecham, L. (2003), British Medical Association chairman criticises erosion of clinical autonomy, British Medical Journal, 327(7405) 8-a.

Bengtsson, B. (1981a), The prevalence of glaucoma, British Journal of Ophthalmology, 65, 46-9.

Bengtsson, B. (1981b), Manifest Glaucoma in the aged, Acta Ophthalmologica (Copenhagen), 59, 321-31.

Benson, W .E. (1999), Diabetic Retinopathy, Ophthalmology, edited by Yanoff and Duker, Mosby, section 8, chapter 20, 1-10.

Berlant, J.L. (1975), Professions and Monopoly, University of California Press.

Bernal, J.D. (1969), Science in History, 4 volumes, Pelican.

Blach, R (2001), The delivery of ophthalmic care: the practitioner, community ophthalmic teams and contract ophthalmology, British Journal of ophthalmology, 85(11), 1274.

Black, A (1984), Guilds and Civil Society, Mathuen, London.

Blanchard, D. (1995): Pope John XXI Ophthalmologist, Documenta Ophthalmologica, Advances in Ophthalmology, 89(1-2)75-84.

Blodi, B. A. (2004), Nutritional supplements in the prevention of age-related macular degeneration, Insight, 29(1), 15-6, quiz 17-8.

Bonastre, J., Le Pen, C. C., Soubrane, G. and Quentel, G. (2003), The burden of age-related macular degeneration: results of a cohort study in two French referral centres (Article in French), Pharmacoeconomics, 21(3), 181-90.

Bootle, S. (2000), To screen or not to screen - is that the question?, Diabetes Update, Diabetes UK, Winter edition, pages 21-23.

Bowis, J. (1995), Harmonisation of optometric standards in Europe, Department of Health, Whitehall, London, Personal communication from The Rt. Hon. Sir George Young, MP.

Bridges, J. H. (1897-1900), The Opus Majus of Roger Bacon, translation from Latin, Oxford.

Briggs A. H., Sculpher M. J., and Buxton, M. J. (1994), Uncertainty in the economic evaluation of healthcare technologies: the role of sensitivity analysis, Health Economics, 3(2), 95-104.

Broadway, D. C., Tufail, A. and Khaw, P. T. (1999), Ophthalmology, Butterworth Heinemann, 73-75.

Brotherston, J. (1971), Medical History and Medical Care, A symposium of perspectives (edited by Mclachlan, G. and McKeown, T.) Published for the Nuffield Provincial Hospitals Trust by the Oxford University Press, 87-125.

Brouwer, W.B.F., Koopmanschap, M. A. and Rutte, F F.H (1997), Productivity costs measurement through quality of life? A response to the recommendation of the US panel, Health Economics, 6, 253-259

Brown, N. A. P., and Hill, A.R. (1987), Cataract, the relationship between myopia and cataract morphology, British Journal of Ophthalmology, 71, 405-414.

Buch, H., Vinding, T., La Cour, M. and Nielsen, N.V. (2001), The prevalence and causes of bilateral and unilateral blindness in an elderly urban Danish population, The Copenhagen City Eye Study, Acta Ophthalmologica . Scandinavica, 79(5), 441-9.

Burke, R.B. (1929), The Opus Majus of Roger Bacon, Philadelphia.

Burns-Cox, C. J. (1995), Shared care, past and future, Ophthalmic and Physiological Optics, 15(5), 379-81.

Burns-Cox, C. J. and Hart, J.C. (1985), Screening of diabetes for retinopathy by ophthalmic opticians, British Medical Journal, Clinical Research Edition, 290 (6474),1052-4.

Cagnolati, W. (2002), Focus on Germany, Optician, 224 (5869), 21.

Calcopietro, M. (2002), Medical Doctors in Italy, a situation analysis, (Article in French), Cahiers de Sociologie et de Demogaphie Medicales, 42(1) 113-48.

Cameron, J.C. (1954), Mr Guy's Hospital, Longmans, London, 3-11, 220-21.

Carr-Saunders, A. M. and Wilson, P. A. (1964), The Professions, Frank Cass and Co. Ltd. London., 68, 155-57.

Champness, R. (1952), A short history of the Worshipful Company of Spectacle Makers up to the beginning of the 20th century, Apothecaries Hall, Blackfriars Lane, London, 1-10.

Chitkara, D.K. (1999), Cataract formation mechanisms, Ophthalmology, edited by Yanoff and Duker, Mosby, section 4, chapter 8, 1-8.

Chopdar, A. (2003), Age-Related macular degeneration (AMD), a guide for general practice, The Journal of Continuing Education for General Practitioners, Update (May 2003 supplement), 1-7.

Choplin, N. T. and Lundy, D. C. (1998), Atlas of Glaucoma, Martin Dunitz, page xiii.

Coffey, M., Reidy, A., Wormald, R., Wu, X., and Wright, L. (1993), Prevalence of Glaucoma in the West of Ireland, British Journal of Ophthalmology, 77, 17-21.

Cohen, D., Sartral, M., Nounou, P., Hamar, M., Drouard, ME., El Alamy, A., and Bendeddouche, K., (2000), Evaluation of moderate and severe visual impairments in patients attending an ophthalmology clinic, A prospective study of 1,172 patients (Article in French), Journal Francais d Ophtalmologie, 23(5), 437-43.

Commission of the European Communities (1995), Report from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the regions on the state of health in the European Community, Brussels, 19. 07. 1995, COM (95) 357 final, documents EN 05, catalogue number CB-CO-95-383-EN-C, Office for Official Publications of the European Communities, L-2985, Luxembourg.

Commission of the European Communities (2002), Proposal for a Directive of the European Parliament and of the Council on the recognition of professional qualifications, Brussels, 07.03.2002, COM(2002)119 final, 2002/0061 (COD), presented by the Commission of the European Communities.

Cookson, R. and Dolan, P. (2000), Priority Setting in Health Care, British Medical Journal, 321, 954.

Crick, R. P. (2003), Glaucoma prevalence in the European Union, personal communication.

Crick, R. P. and Khaw, P. T. (2003), A Textbook of Ophthalmology, World Scientific, 92-110.

Crook's Report (1952), Report of the Interdepartmental Committee on the Statutory Registration of Opticians presented by Lord Crooke, Her Majesty's Stationary Office, London.

Crundall, E.J. (1981), The Hardy Era, Optician, 181(4680), 18-24.

Culyer, A. J. (1997), The Rationing Debate, Maximising the health of the whole Community, The case for, British Medical Journal, 314, 667.

Cunha-Vaz, J. (1998), Lowering the risk of visual impairment and blindness, Diabetic Medicine, 15 (supplement 4), S47-50.

DCCT (1995), The Diabetes Control and Complications Trial, Progression of retinopathy with intensive versus conventional treatment in the DCCT, Ophthalmology, 102, 647-661.

DECODE (2003), Age-and sex-specific prevalence of diabetes and impaired glucose regulation in 13 European cohorts, Diabetes Epidemiololgy Collboratve Analysis of Diagnostic Criteria in Europe Study Group, Diabetes Care, 26(1), 61-69.

DFI (2004), Comprehensive European prevention strategy on diabetes called for at Dublin Conference, Press Release dated 8 April 2004, Diabetes Federation of Ireland, Dublin.

DRS (1976), Preliminary report on effects of photo-coagulation therapy, The Diabetic Retinopathy Study Research Group, American Journal of Ophthalmology, 81(4), 383-96.

DRS (1978), Photo-coagulation treatment of proliferative diabetic retinopathy: the second report of Diabetic Retinopathy Study Research Group, Ophthalmology, 85, 82-106.

Davison, R. (2003), Achieving optimum diabetes care under the new contract, Pulse, 63 (31), 30-32..

de Beaufort, C. E., Reunanen, A., Raleigh, V., Storms, F., Kleinebreil, L., Gallego, R., Giorda, C., Midthjell, K., Jecht, M., de Leeuw, I., Schober, E., Boran, G. and Tolis, G. (2004), European Union diabetes indicators: fact or fiction?, European Journal of Public Health, 13 (3 suppl), 51-4.

Dielman, T., Vingerling, J.R., Wolfs, R.C.W., Hofman, A., Grobee, D. E., and De Jong, P.T.V.M. (1994), The prevalence of primary open-angle glaucoma in a population based study in The Netherlands, Ophthalmology, 101, 1851-55.

Diener, A., O'Brien, B. and Gafni, A., (1998), Healthcare contingent valuation studies, A review and classification of the literature, Health Economics, 7, 313-326.

Directives 77/452/EEC and 77/453/EEC (27 June 1977), nurses' recognition and nurses' co-ordination directives respectively, Official Journal of the European Communities no. L 176 of 15 July 1977 (as amended by the act of accession of Greece, Official Journal of the European Communities no. L 281 of 19 November 1979; the act of accession of Spain and Portugal, Official Journal of the European Communities no. L 302 of 15 November,1985 and the act of accession of Austria, Finland and Sweden, Official Journal of the European Communities no. L 1 of 1 January 1995).

Directives 78/686/EEC and 78/687/EEC (25 July 1978), dentists' recognition and dentists' co-ordination directives respectively, Official Journal of the European Communities no. L 223, of 24 August 1978 (as amended by the act of accession of Greece, Official Journal of the European Communities no. L 281 of 19 November 1979; the act of accession of Spain and Portugal, Official Journal of the European Communities no. L 302 of 15 November,1985 and the act of accession of Austria, Finland and Sweden, Official Journal of the European Communities no. L 1 of 1 January 1995).

Directives 78/1026/EEC and 78/1027/EEC (18 December 1978), veterinary surgeons' recognition and veterinary surgeons' co-ordination directives respectively, Official Journal of the European Communities no. L 362, of 23 December 1978 (as amended by the act of accession of Greece, Official Journal of the European Communities no. L 281 of 19 November 1979; the act of accession of Spain and Portugal, Official Journal of the European Communities no. L 302 of 15 November,1985 and the act of accession of Austria, Finland and Sweden, Official Journal of the European Communities no. L 1 of 1 January 1995).

Directives 80/154/EEC and 80/155/EEC (21 January 1980), midwives' recognition and midwives' co-ordination directives respectively, Official Journal of the European Communities no. L33 of 11 February 1980 (as amended by the act of accession of Spain and Portugal, Official Journal of the European Communities no. L 302 of 15 November,1985 and the act of accession of Austria, Finland and Sweden, Official Journal of the European Communities no. L 1 of 1 January 1995).

Directive 81/1057/EEC (31 December 1981), Official Journal of the European Communities no. L 385 of 31 December 1981 (as amended by the act of accession of Spain and Portugal, Official Journal of the European Communities no. L 302 of 15 November,1985 and the act of accession of Austria, Finland and Sweden, Official Journal of the European Communities no. L 1 of 1 January 1995).

Directives 85/432/EEC and 85/433/EEC (16 September 1985), pharmacists' recognition and pharmacists' co-ordination directives respectively, Official Journal of the European Communities no. L 253 of 24 September 1985 (as amended by Directive 85/584/EEC, Official Journal of the European Communities no. L 372 of 31 December 1985; the act of accession of Spain and Portugal, Official Journal of the European Communities no. L 302 of 15 November,1985 and the act of accession of Austria, Finland and Sweden, Official Journal of the European Communities no. L 1 of 1 January 1995).

Directive 89/594/EEC (23 November 1989), Official Journal of the European Communities no. L 341 of 23 November 1989 (as amended by the act of accession of Austria, Finland and Sweden, Official Journal of the European Communities no. L 1 of 1 January 1995).

Directive 90/658/EEC (17 November 1990), Official Journal of the European Communities no. L 353 of 17 November 1990 (as amended by the act of accession of Austria, Finland and Sweden, Official Journal of the European Communities no. L 1 of 1 January 1995).

Directive 93/16/EEC (5 April 1993), the doctors' directive, Official Journal of the European Communities no. L 165, 7 July 1993 (as amended by the act of accession of Austria, Finland and Sweden, Official Journal of the European Communities no. L 1 of 1 January 1995).

Dixon, J. (2003), Foundation Trusts, British Medical Journal, 326, 1344-1345.

Dolin, P (1998), The Epidemiology of Eye Disease by Johnson, Minassian and Weale, Chapman and Hall, 103-18.

Dornhorst, A. and Rossi, M. (1998), Risk and prevention of type 2 diabetes in women with gestational diabetes, Diabetes Care, 21 (supplement 2), B43-9.

Drake, A.J., Smith, A., Betts, P.R., Crowne, E. C. and Shield, J.P.H. (2002), Type 2 diabetes in obese white children, Archives of Disease in Childhood, 86, 207-208.

Dreyfus, J. (1988), Invention of Spectacles and the Advent of Printing, The Library, 6th series, vol. x, no.2, 93-106.

Drummond, M.F., O'Brien, B.J., Stoddart, G. L. and Torrance G. W. (1999), Cost-benefit Analysis, Methods for the economic evaluation of Healthcare Programmes, Oxford University Press.

Duncan, B. (2002), Health policy in the European Union: how it's made and how to influence it, British Medical Journal, 324, 1027-1030.

Early Treatment Diabetic Retinopathy Study Research Group, (1991), Fundus Photographic risk factors for progression of diabetic retinopathy, ETDRS report number 12, Ophthalmology, 98, 823-833.

EASD (1997), Diabetes in Europe - a major health problem and a research opportunity, Press Release dated 3 March 1997 for a symposium held at Brussels on 6 March 1997, European Association for the Study of Diabetes, Dusseldorf.

ECOO (1996), Optometry in Europe, European Council of Optometry and Optics, London.

ECOO Blue Book (1998), Optometrists and Opticians in Europe, European Council of Optometry and Optics, London.

Edwards, M.G., Bressler, N.M. and Sharath, C. R. (1999), Macular Disorders, Ophthalmology, edited by Yanoff, M. and Duker, J. S., Mosby, (8) 28.1-28.10.

Effective Health Care (1996), Management of Cataract, Bulletin for decision makers on the effectiveness of health service interventions, Nuffield Institute for Health, University of Leeds, and NHS Centre for review and dissemination, University of York, 2 (3) 2.

Ehtisham, S., Barrett, T. G. and Shaw, N.J. (2000), Type 2 diabetes mellitus in UK children-an emerging problem, Diabetic Medicine, 17(12), 867-71.

Ehtisham, S. and Barrett, T. G. (2004), The emergence of type 2 diabetes in childhood, Annals of Clinical Biochemistry, 41 (Pt 1), 10-6.

Elliott, P. (1972), The Sociology of the Professions, Macmillan, London, 1-80.

ETDRS, see Early Treatment Diabetic Retinopathy Study Research Group.

Europe in Figures (1992), Office of the official publication of European Union, Luxembourg, page 223.

Europe in Figures (2000), Lifestyles in Europe, Our State of Health, Office of the official publication of European Union, (9.4), 81-88.

European Blind Union (1996), Personal Communication from the EBU, Paris.

European Blind Union (2003), Blindness information, www. euroblind. Org.

European Commission (2002), Free movement of goods, regulated professions (qualifications) and postal services, the results of the European Commission Consultation Exercise on the future regime of professional recognition, MARKT/D/3723/2002-EN, 6 February 2002, European Commission, Brussels.

Eustace, R. (1997), Standardisation of ophthalmic qualifications in Europe, British Journal of Ophthalmology, 81(1), 5-6.

Evans, J. (1995), Causes of blindness and partial sight in England and Wales 1990-91, Studies on Medical and Population Subjects Number 57, HMSO, London.

Evans, J., Rooney, C., Ashwood, F., Dattani, N. and Wormald, R. (1996), Blindness and Partial Sight in England and Wales, Health Trends, 28(1), 5-12.

FAHV (1996), Estimation du nombre d'aveugles en France, Federation des Aveugles et Handicapes Visuels de France, Paris, Personal communication.

Fagot-Campagna, A. (2000), Emergence of type 2 diabetes mellitus in children: epidemiological evidence, Journal of Paediatric Endocrinology and Metabolism, 13 (supplement 6), 1395-402.

Feltbower, R.G., McKinney, P.A., Campbell, F.M., Stephenson, C.R. and Bodansky, H.J. (2003), Type 2 and other forms of diabetes in 0-30 year olds: a hospital based study in Leeds, UK, Archives of Disease in Childhood, 88(8), 676-9, erratum in 89(1), 16.

Fleming, D.M., Schellevis, F.G. and Casteren, V. (2004), The prevalence of known diabetes in eight European countries, European Journal of Public Health, 14(1), 10-14.

Forgacs, I. (2002), The required number of physicians, is it an optimal figure, Cah Sociol Demogr Med, 42(2-3), 269-82.

Framework for Optometric Referrals (2001), Document published by The College of Optometrists, 4-16.

Fraser, S. and Wormald, R. (1999), Epidemiology of Glaucoma, Ophthalmology, edited by Yanoff and Duker, Mosby, section 12, chapter 1, 1-6.

Frost, A., Eachus, J., Sparrow, J., Peters, TJ., Hopper, C., Dvey-Smith, G. and Frankel, S. (2001), Vision-related quality of life in an elderly UK population; associations with age, sex, social class and material deprivation, Eye, 15, 6, 739-44.

Fuchs, V.R. (1980), What is CBA/CEA and why are they doing it to us?, New England Journal of Medicine, 303 (16), 937-8.

Gadsby, R. (2002), Diabetes and pregnancy, Doctor, 19 September, page 33.

Gafni, A. (1991), Willingness to pay as a measure of benefits, Medical Care, 29, 1246-1252.

Gafni, A. (1994), The Standard Gamble Method, what is being measured and how it is interpreted, Health Services Research, 29, 207-224.

Gafni, A. (1997), Alternatives to the QALY measure for economic evaluations, Support Care Cancer, 5(2), 105-11.

Galloway, N. R. and Amoaku, W. M. K. (1999), Common Eye Diseases and their Management, Springer, 82-83, 149.

Garber, A.M. (1996), Theoretical foundations of cost-effectiveness analysis, Cost effectiveness in health and medicine edited *by* Gold, Siegel, Russell and Weinstein, Oxford University Press.

Gaskell, A., McLaughlin, A., Young, E. and McCrital, K. (2001), Direct optometrist referral of cataract patients into a pilot `one stop' cataract surgery facility, Journal of the Royal College of Surgeons of Edinburgh, 46(3),133-7.

General Optical Council (2002), The GOC response to the European Commission's newly proposed directive on mutual recognition of professional qualifications, personal communication from Mrs. J Dian Taylor, Deputy Registrar/ Director of Education, General Optical Council, London.

General Optical Council (2002), The GOC response to the European Commission's staff consultation paper on the future regime for professional regulation, Appendix ED 20 (01), General Optical Council, London.

General Optical Council (2002), The GOC response to the Department of Education and Skills consultation on the European Commission's new proposal on mutual recognition of professional qualifications, personal communication (not for publication) from Mrs. J. Dian Taylor, Deputy Registrar/Director of Education, General Optical Council, London.

George, F.H. (1965), Cybernetics and Biology, Oliver and Boyd, 44-53.

George, F.H. (1972), Cybernetics in Management, Pan Books, 127-136.

George, F.H. (1973), The Brain as a computer, Pergamon Press, 8.

Ghaffour, I. M., Allan, D. and Foulds, W.S. (1983), Common causes of blindness and visual handicap in the west of Scotland, British Journal of Ophthalmology, 67, 209-213.

Giles, G.H. (1952), The Ophthalmic Services under the National Health Services Acts (1946-1952), Hammond & Hammond, London, 92, 106, 158.

Gold, L.(2002), A GP's guide to type 2 diabetes in children, Pulse, 62(9), 48-51.

Gorus, F.K., Weets, I., Couck, P. and Pipeleers, D.G. (2004), Epidemiology of type 1 and type 2 diabetes, the added value of diabetes registries for conducting clinical studies: the Belgian paradigm, Belgian Diabetes Registry, Acta Clinica Belgica (Bruxelles), 59(1), 1-13.

Gottfredsdottir, M.S., Sverrisson T., Musch, D.C. and Stefansson, E. (1999), Age related macular degeneration in monozygotic twins and their spouses in Iceland, Acta Ophthalmologica Scandinavica, 77(4),422-5.

Gottleib, J.L. (2002), Age-Related Macular Degeneration, Journal of the American Medical Association, 288(18), 2233-2236.

Gottschalk, L., MacKinney, L.C. and Pritchard, E. H. (1969), History of Mankind, Cultural and Scientific Development, UNESCO, George Allen and Unwin, London.

Graf, M., Halbach, E. and Kaufmann, H. (1999), Causes of Blindness in Hessia in 1996 (Article in German), Klin Montasbl Augenheilkd, 215(1) 50-5.

Graf, M., Halbach, E. and Kaufmann, H. (1998), Potential and limitation of blindness statistics with particular regard to the quality of ophthalmological expertises presented by the incidence of blindness in 1996 in Hessia, 96th DOG annual meeting, Department of Strabismology and Neuro-Ophthalmology, University of Giessen, Germany, 398.

Gray, S. F., Spry, P.G. D., Brookes, S. T., Peters, T.J., Spencer, I. C., Baker, I., Sparrow, J.M. and Easty, D. L. (2000), The Bristol Shared Care Glaucoma Study, outcome at follow up 2 years, British Journal of Ophthalmology, 84. 456-463.

Gregor, Z. and Joffe, L. (1978), Senile Macular Changes in the Black African, British Journal of Ophthalmology, 62(8), 547-50.

Gregory, R. (2003), Advances in type two Diabetes, Update, The Journal of Continuing Education for General Practitioners, 66 (5), 92.

Grit, F. (2002), Focus on the Netherlands, The Optician, 224 (5860), 14.

Guillausseau, P.J., Massin, P., Dubois-LaForgue, D., Timsit, J., Virally, M., Gin, H., Bertin, E., Blickle, J.F., Bouhanick, B., Cahen, J., Caillat-Zucman, S., Charpentier, G., Chedin, P., Derrien, C., Ducluzeau, P. H., Grimaldi, A., Guerci, B., Kaloustian, E., Murat, A., Olivier, F., Paques, M., Paquis-Flucklinger, V., Porokhov, B., Samuel-Lajeunesse, J. and Vialettes, B. (2001), Maternally inherited diabetes and deafness, a multicenter study, Annals of Internal Medicine, 134 (9,1), 721-728.

Gurunluoglu, R., Gurunluoglu, A. and Piza-Katzer, H. (2003), Review of the 'Chirurgia' of Giovanni de Vigo, estimate of his position in the history of surgery, World Jnl. Surg., 27(5), 616-23.

Guyatt, G. H., Feeny, D. H. and Patrick D. L. (1993), Measuring health - related quality of a life, Annals of Internal Medicine, 118, 622-29.

Hall, A. and Rosenthal, A.R. (1999), Ophthalmology, edited by Yanoff and Duker, Mosby, 4, 9.1, 9.2.

Hammond, C. J., Shackleton, J., Flanagan, D.W., Herrtage, J. and Wade, J. (1996), Comparison between an ophthalmic optician and an ophthalmologist in screening for diabetic retinopathy, Eye, 10 (1), 107-12.

Hammond, C. J., Webster, A.R., Snieder, H., Bird, A. C., Gilbert, C. E. and Spector, T. D. (2002), Genetic influence on early age-related maculopathy, a twin study, Ophthalmology, 109(4),730-6.

Hardy, W. E. (1981), Weekly recorder of British optics, Optician, 181 (4680) 32-39.

Harrison, R. J., Wild, J.M. and Hobley, A.J. (1988), Referral pattern to an ophthalmic outpatient clinic by general practitioners and ophthalmic opticians and the role of these professionals in screening for ocular disease, British Medical Journal, November 5, 297 (6657), 1162-7.

Hayes, T.M. and Harries, J. (1984), Randomised controlled trial routine hospital clinic care versus routine general practice care for type II diabetes, British Medical Journal (Clinical Research Edition), September 22, 289 (6447), 728-30.

Health and Social Security Act. (1984), General Ophthalmic Services, Her Majesty's Stationary Office, London.

Heiba, J.M., Elston, R. C., Klein, B.E.K. and Klein, R. (1995), Evidence for a major gene for cortical cataract, Invest. Ophthalmol. Vis. Sc. 36 (1), 227-35.

Henderson, J. (2003), Paediatric Optometry, Optician, 225, (5897) 20-25.

Henricsson, M., Tyrberg, M., Heijl, A. and Janzon, L. (1996), Incidence of blindness and visual impairment in diabetic patients participating in an ophthalmological control and screening programme, Acta Ophthalmologica Scandinavica, 74(6), 533-8.

Henson, D. B., Spencer, A. F., Harper, R. and Cadman, E.J. (2003), Community refinement of glaucoma referrals, Eye, 17(1), 21-6.

Herzmann, C. (2003), European doctors in the United Kingdom, British Medical Journal, 326, S9.

Hill, R. (1995), Open angle glaucoma, estimating susceptibility, British Journal of Optometry and Dispensing, 3 (3), 101-02.

Hirsch, M. J. and Wick, R. E. (1968), The Optometric Profession, Chilton Book Company, London, 45-83.

Hirvela, H. and Laatikainen, L. (1995), Visual acuity in a population aged 70 years or older, prevalence and causes of visual impairment, Acta Ophthalmologica Scandinavica, 73(2), 99-104.

Hitchings, R. A. (1996), Glaucoma, current thinking, British Journal of Hospital Medicine, 55(6), 312-14.

Hoffstetter, H. (1948), Optometry, Professional, Economic and Legal aspects, C.V. Mosby, St Louis, 269-294.

Hollingdale, S. H. and Tootill, G.C. (1970), Electronic Computers, Pelican, 80.

Horle, S., Gruner, F. and Kroll, P. (2002), Epidemiology of Diabetes induced blindness, (review in German), Klin. Monatsbl. Augenheilkd., 219(11), 777-84.

http:www.britannica.com (2003), Historical reference regarding Jules Dupuit (French engineer) with reference to Cost-effectiveness analysis, Encyclopaedia Britannica Premium Service.

http:www.britannica.com (2003), Historical reference regarding US Flood Control Act 1936 with reference to Cost-benefit analysis, Encyclopaedia Britannica Premium Service.

Hurst, J.A. (1992), Genetics of Blindness, British Journal of Hospital Medicine, 47 (7), 495-500.

Hughes, E.H., Forrest, F. and Diamond, J. P. (2001), `One stop' cataract surgery, the Bristol Eye Hospital experience 1997-99, Eye, 15 (3) , 306-8.

Hux, J.E., Booth, G. L., Slaughter, P.M., and Laupacis, A. (2003), Diabetes in Ontario, Institute for Clinical Evaluative Sciences, Canadian Diabetes Association, page xxxi.

IDF (2003), New report shows more than 300 million people at risk of developing diabetes, New diabetes figures, Press release dated 25 August 2003, International Diabetes Federation, Paris.

IEF (1994), International Eye Foundation, Unpublished Data from the World Health Organisation, personal communication.

IHF (2001), Early diabetes diagnosis set to reduce treatment costs, Informer, 23 March 2001, The official website (www. hospitalmanagement. net) for the International Hospital Federation.

Jacobovits, I. (1959), Jewish Medical Ethics, Philosophical Library, New York, xxi, 26-27, 114, 214.

Jampol, L. M. (2003), AREDS-Two Years Later, Archives of Ophthalmology, 121(11), 1634-1635.

Jay, J. (1999), Ophthalmology in the United kingdom, Archives of Ophthalmology, 117(10), 1407-8.

Johnson, G.J. (1998), The Epidemiology of Eye Disease by Johnson, Minassian and Weale, Chapman and Hall, 159-180.

Johnston, R. (2003), Electronic Clinical Systems, Cataract Audit and National Cataract Data-set, Refractive Eye News, Volume 1, No.6, 6-7.

Kanski, J. (1999), Clinical Ophthalmology, Butterworth Heineman, 403-418

Kernick, D. (2000), The empirical economics of healthcare, British Journal of Optometry and Dispensing, 8(2), 64.

Kernick, D. (2000), Should health economists carry a health warning ? British Journal of Optometry and Dispensing, 8(3), 95-97.

Kiess, W., Bottner, A., Raile, K., Kapellen, T., Muller, G., Galler, A., Paschke, B. and Wabitch, M. (2003), Type 2 diabetes mellitus in children and adolescents: a review from a European perspective, Hormone Research, 59 (supplement 1), 77-84.

Kirby, S. and Peel, S.(1998), Wellness Management, in Disease Management edited by Roy Lilley, Wiley, 71-87.

Kirkness, C. M. (2002), European Ophthalmology from a British Perspective, British Journal of Ophthalmology, 86(2), 128-9.

Klaver, C.C., Wolfs, R. C., Vingerling, J.R., Hofman, A. and de Jong, P. T. (1998), Age-specific prevalence and causes of blindness and visual impairment in an older population, the Rotterdam Study, Arch Ophthalmol, 116(5) 653-8.

Klein , B.E.K., Klein, R. and Linton, K. L. (1992 a), Prevalence of age related maculopathy, the Beaver Dam Eye Study, Ophthalmology, 99, 933-943.

Klein, R., Klein, B.E. and Linton, K.L.P. (1992 b), Prevalence of age related opacities in a population, the Beaver Dam Eye Study, Ophthalmology, 99, 546-552.

Klein, B.E.K., Klein, R., Sponsel, W. E., Franke, T., Cantor, L. B., Martone, J., and Menage, M.J. (1992c), Prevalence of glaucoma, The Beaver Dam Eye Study, Ophthalmology, 99, 1499-1504.

Klein, R. (1995), Priorities and rationing, British Medical Journal, 311 (7008), 761-62.

Klein, B.E.K. and Klein, R. (1998), The Epidemiology of Eye Disease by Johnson, Minassian and Weale, Chapman and Hall, 311-324.

Klein, R. and Dixon, J. (2000), Cash Bonanza for NHS, British Medical Journal, 320 (7239), 883-884.

Kocur, I., Resnikoff, S. and Foster, A. (2002), Eye healthcare services in eastern Europe, international study group (part 1), cataract surgery, British Journal of Ophthalmology, 86 (8), 847-850.

Kocur, I., Resnikoff, S. and Foster, A. (2002), Eye healthcare services in eastern Europe, international study group (part 2), cataract surgery, British Journal of Ophthalmology, 86 (8), 851-853.

Kohner, E. M., Stratton, I. M., Aldington, S. J., Holman, R.R. and Matthews, D. R. (2001), Relationship between the severity of retinopathy and progression to photocoagulation in patients with type 2 diabetes mellitus in the UKPDS (52), Diabetic Medicine, 18(3), 178-84.

Koplan, J. P., Schoenbaum, S.C., Weinstein, M.C. and Fraser, D.W. (1979), Pertussis Vaccine, an analysis of benefits, risk and costs, New England Journal of Medicine, 301, 906-11.

Krumpaszky, H. G. and Klauss, V. (1992), Causes of blindness in Bavaria, Evaluation of a representative sample from blindness compensation records of Upper Bavaria (Article in German), Klin. Montasbl. Augenheilkd, 200(2), 142-6.

Krumpaszky, H. G., Ludtke, R., Mickler, A., Klauss, V. and Selbmann, H. K. (1999), Blindness incidence in Germany, a population based study from Wurttemberg-Hohenzollern, Ophthalmologica, 213(3), 176-82.

Kuppens, E.V., van Best, J.A. and Sterk, C.C. (1995), Is glaucoma associated with an increased risk of cataract?, British Journal of Ophthalmology, 79(7), 649-52.

Lapsus Linguae Lapsus Calami, (1976 a), Ophthalmic Optician or Optometrist, Ophthalmic Optician, July 24, 642.

Lapsus Linguae Lapsus Calami, (1976 b), The title Optometrist, Ophthalmic Optician, November 27, 1001.

Lapsus Linguae Lapsus Calami, (1977), Choosing a title, Ophthalmic Optician, April 2, 290.

Lapsus Linguae Lapsus Calami, (1985), A disunited optometric profession, Optometry Today, November 23, 772.

Lee, P.P. (1998), Primary open angle glaucoma, in Atlas of Glaucoma edited by Choplin N.T. and Lundy D.C., Martin Dunitz, 103-114.

Leinonen, J. and Laatikainen, L. (1999), The decrease of visual acuity in cataract patients waiting for surgery, Acta. Ophthalmol. Scand., 77(6), 681-4.

Leske, M.C., Connell, A.M.S., Schachat, A. P. and Hyman, L. (1994), The Barbados Eye Study-prevalence of open angle glaucoma, Archives of Ophthalmology, 112, 821-9.

Levene, J.R. (1977), Clinical Refraction and Visual Science, Butterworth, viii, 3-119.

Levene, L. S. (2003), Management of type 2 Diabetes Mellitus in Primary Care, Butterworth Heinemann, iv.

Lighthouse, A. (2002), Age-related macular degeneration, Geriatric Medicine, 32(5), 17-18.

Lloyd, I. C., Goss-Sampson, M., Jeffrey, B.G., Kriss, A., Russell-Eggitt, I. and Taylor, D. (1992), Neonatal cataract, aetiology, pathogenesis and management, Eye, 6(2), 184-196.

Loewy, E.H. (1980), Cost should not be a factor in medical care, New England Journal of Medicine, 302(12), 697.

Lopez, I. M., Diez, A., Velilla, S., Rueda, A., Alvarez, A. and Pastor, C. J. (2002), Prevalence of diabetic retinopathy and eye care in a rural area of Spain, Ophthalmic Epidemiology, 9(3), 205-14.

Loewenstein, A., Malach, R., Goldstein, M., Leibovitch, I., Barak, A., Baruch, E., Alster, Y., Rafaeli, O., Avni, I. and Yassur, Y. (2003), Replacing the Amsler Grid, a new method for monitoring patients with age-related macular degeneration, Ophthalmology, 110, 966-970.

Luce, B.R., Manning, W.G. and Siegel, J.E. (1996), Estimating costs in cost-effectiveness analysis, Cost effectiveness in health and medicine, edited by Gold, Siegel, Russell and Weinstein, Oxford University Press.

Luce, B.R. and Elixhauser, A. (1990) Estimating costs in the economic evaluation of medical technologies, International Journal of Technology Assessment in Healthcare, 6, 57-75.

Lynch, S. P. (2003), European Healthcare Standards, British Medical Journal, 323 (7307), 248.

Malik, D.N. (1921), Optical Theories, 2nd Edition, Cambridge.

Manuel, D.G. and Schultz, S.E. (2003), Diabetes Health Status and Risk Factors, Diabetes in Ontario, Institute for Clinical Evaluative Sciences, Canadian Diabetes Association, 484-490.

Martinez-Moral, J. C. (2002), Focus on Spain, The Optician, 224 (5861), 26.

Mason, J. and Drummond, M. (1995) Screening for diabetic retinopathy by Optometrists, Effectiveness and Cost-Effectiveness, The University of York Centre for Health Economics, Discussion Paper 137, 1-23.

Mason, J., Drummond, M. and Woodward, G. (1996), Optometrist Screening for Diabetic Retinopathy, evidence and environment. Ophthalmic and Physiological Optics, 16(4), 274-285.

Mason, J., Drummond, M. and Woodward, G. (1996) Screening for Diabetic Retinopathy: British Medical Journal, 312 (7028) 441.

Mason, A. and Mason, J. (2002) Optometrist prescribing of therapeutic agents, findings of the Anonymous Enquiry of the Scope for Optometrist Prescribing (AESOP), Health Policy, 60(2), 185-97.

Massin, P., Virally-Monod, M., Vialettes, B., Paques, M., Gin, H., Porokhov, B., Caillast-Zucman, S., Froguel, P., Paquis-fluckinger, V., Gaudric, A. and Guillausseau, P.J. (1999), Prevalence of macular pattern dystrophy in maternally inherited diabetes and deafness, Ophthalmology, 106(9), 1821-7.

Matthews, D. R. and Wallace, T.M. (2002), Children with type 2 diabetes: the risks of complications, Hormone Research, 57(supplement 1), 34-9.

McBee, W.L., Lindblad, A.S. and Ferris, F.L. 3rd. (2003), Who should receive oral supplement treatment for age-related macular degeneration?, Current Opinion in Ophthalmology, 14(3), 159-62.

McLeod, D.(2003), Better methods to ease eye burden, Hospital Doctor, 12 June 2003, 13.

Mead, M. (2003), Midwifery and the enlarged European Union, Midwifery, 19(2), 82-6.

Mehrez, A. and Gafni, A. (1989), Quality Adjusted Life Years: Utility Theory and Healthy Years Equivalent, Medical Decision Making, 9, 142-149.

Millerson, G. (1964), The Qualifying Associations, a study in Professionalisation, Routledge and Kegan Paul, London, 17-23, 224-63.

Milner, .S.J., Bailey, C. and Deans, J. (2003), 'Fit for purpose' health impact assessment: a realistic way forward, Public Health, 117(5), 295-300.

Minassian, D.C., Reidy, A., Desai, P., Farrow, S., Vafidis, G. and Minassian, A. (2000), The deficit in cataract surgery in England and Wales and the escalating problem of visual impairment: epidemiological modelling of the population dynamics of cataract, British Journal of Ophthalmology, 84(1), 4-8.

Mitchell, M. (1981a), History of the British Optical Association (1895-1978), The British Optical Association Foundation, London.

Mitchell, M. (1981b), The early years, Optician, 181 (4680), 12-15.

Mitchell, P., Smith, W., Attebo, K. and Healey, P. R. (1996), Prevalence of open-angle glaucoma in Australia-The Blue Mountains Eye Study, Ophthalmology, 103, 1661-9.

Monestam, E. and Wachtmeister, L. (1999), Dissatisfaction with cataract surgery in relation to visual results in a population-based study in Sweden, J. Cataract Refract. Surg,. 25(8), 1127-34.

Mooney, G. (1992), Economics and Healthcare, 2nd edition, Harvester Wheatsheaf, New York.

Moore, B. D. (1994), Optometric Management of Congenital Cataracts, Journal of American Optometric Association, 65, 719-724.

Mossialos, E. and McKee, M. (2002) Healthcare and the European Union, British Medical Journal, 324, 991-992.

Munier, A., Gunning, T., Kenney, D. and O'Keefe, M. (1998), Causes of blindness in the adult population of the Republic of Ireland, British Journal of Ophthalmology, 82(6), 630-3.

Muthucumarana, D.J. and Rimmer, T.J. (2000), Cataract Surgery and the Optometrist, Eye, 14 (5), 777-8.

Nerup, J.(2001), A potentially disastrous decision for Europe, Practical Diabetes International, 18(7), 227.

Nicolosi, A., Marighi, P.E., Rizzardi, P., Osella, A. and Miglior, S. (1994), Prevalence and causes of visual impairment in Italy, International Journal of Epidemiology, 23(2), 369-364.

North, R.V. (1998), Early ocular and non-ocular indications of diabetes mellitus, Ophthalmic and Physiological Optics, 18(2) 167-172.

Obi, J.C. (2003), Totum Dependeat (Rapid response for Rory Watson's news roundup, 28 June 2003, Medical groups fight to stop doctors working for months without registration, British Medical Journal, 326, 1416.

O'Donoghue, E. (2001), Glaucoma, IOP as a modifiable risk factor, Geriatric Medicine, 30 (1), 43-45.

OECD (1996), Health Data, Organisation for Economic Co-operation and Development, Paris..

ONCE (1994), Causas de Ceguera de Los Affiliados a la Organizacion Nacional de Ceigos, Madrid, Spain, Personal Communication.

Oster, J., Culham, L.E. and Daniel, R. (1999), An extended role for the hospital optometrist, Ophthalmic and Physiological Optics, 19(4), 351-56.

Owen, C. G., Fletcher, A. E., Donoghue, M. and Rudnicka, A. R. (2003), How big is the burden of visual loss caused by age-related macular degeneration in the United Kingdom, British Journal of Ophthalmology, 87(3),312-17.

Pantoflinski, J., Kieltyka, A. and Szybinski, Z. (2001), Visual disability in Cracow Voivodeship (in Polish), Pol. Arch. Med. Wewn., 106(3), 847-51.

Pareti, L. (1965), The Ancient World, History of Mankind, Cultural and Scientific Development, UNESCO, George Allen and Unwin, London, 2(2) 7-736.

Passa, P. (2002), Diabetes trends in Europe, Diabetes Metabolism Research and Reviews, Supplement 3, S3-8.

Pharmakakis, N.M., Petropoulos, I.K., Peristeropoulos, P. A., Vantzou, C.V. and Koliopoulos, J. X. (2002), Evaluating the management of diabetic retinopathy in a teaching center, European Journal of Ophthalmology, 12(6), 488-94.

Pickwell, D. (1987), Optometry at Bradford, Ophthalmic and Physiological Optics, 7(4), 339-40.

Porta, M., Tomalino, M.G., Santoro, F., Ghigo, L.D., Cairo, M., Aimone, M., Pietragalla, G. B., Passera, P., Montanaro, M. and Molinatti, G. M. (1995), Diabetic Retinopathy as a cause of blindness in the Province of Turin, north west Italy in 1967-91, Diabetic Medicine, 12(4), 355-61.

Porter, R (1989), Health for Sale, Manchester University Press, 12-225.

Prasad, S., Kamath, G.G., Jones, K., Clearkin, L. G. and Phillips, R. P., (2001), Effectiveness of optometrist screening for diabetic retinopathy using slit-lamp biomicroscopy, Eye, 15 (5), 595-601.

Price, N. (2003), Changing the Cataract Pathway in Gloucestershire, Refractive Eye News, 1 (6), 14-15.

Rami, B., Schober, E., Nachbauer, E. and Waldhor, T. (2003), Type 2 diabetes mellitus is rare but not absent in children under 15 years of age in Austria, Austrian Diabetes Incidence Study Group, European Journal of Paediatrics, 162(12), 850-52.

Randall, E, (2001), EU health policy, the time for playing catch-up is over, British Medical Journal, 323, (7307) 248.

Renders, C. M., Delemarre-van de Waal, H. A., Dekker, J.M. and Hirasing, R. A. (2003), Insulin resistance and diabetes type 2 in overweight children (Article in Dutch), Ned. Tijdschr Geneeskd., 147(42), 2060-3.

Report of the Interdepartmental Committee on the Statutory Registration of Opticians. (1952), Her Majesty's Stationary Office, London.

Riad, S. F., Dart, J.K.G. and Cooling, R.J. (2003), Primary Care and Ophthalmology in the United Kingdom, British Journal of Ophthalmology, 87(4), 493-499.

Richer, S., Stiles,W., Statkute,L., Pulido, J., Frankowski, J., Rudy, D., Pie, K., Tsipursky, M. and Nyland, J. (2004), Double-masked, placebo-controlled, randomized trial of lutein and antioxidant supplementation in the intervention of atrophic age-related macular degeneration: the Veterans LAST study (Lutein Antioxidant Supplementation Trial), Optometry, 75(4), 216-30.

Roney, A. (1998), EC/EU Fact Book, Kogan Page, London, 1-2.

Rosen, E. (1953), Carlo Dati on the invention of spectacles, Isis, Cambridge, Mass., 44(135-6), parts 1 and 2, 1-10.

Rosen, E. (1956), The invention of eyeglasses, Journal of the history of medicine and allied sciences, Yale University, xi (parts 1 and 2), 13-16, 183-218.

Rosenberg, T. and Klie, F. (1996), Current trends in newly registered blindness in Denmark, Acta Ophthalmol. Scand. 74(4), 395-8.

Rosenthal, B. and Thompson, B. (2003), Awareness of age-related macular degeneration in adults, the results of a large scale international survey, Optometry, 74(1), 16-24.

Ross, M. A., Avery, A.J. and Foss, A.J. (2003), Views of older people on cataract surgery options, an assessment of preference by conjoint analysis, Quality and Safety in Health Care,12(1), 13-7.

Rothermich, E. A. and Pathak, D. S.(1999), Productivity-cost controversies in cost-effectiveness analysis, review and research agenda, Clinical Therapeutics, 21(1), 255-267.

Royal College of General Practitioners (2001/2002), Members' Reference Book, A15.

Sahel, J.A. (1998), On French ophthalmology, Archives of Ophthalmology, 116(10), 1364-1365.

SanGiovanni, J. P., Chew, E.Y., Reed, G.F., Remaley, N.A., Bateman, J.B., Sugimoto, T. A. and Klebanoff, M. A. (2002), Infantile cataract in the collaborative perinatal project: prevalence and risk factors, Archives of Ophthalmology, 120(11), 1559-65.

Schwab, L. (1987), Primary Eye Care in Developing Nations, The International Eye Foundation, Oxford Medical Publications, 46-48.

Sclater, A. (2003), Diabetes in the Elderly, the Geriatrician's Perspective, Canadian Journal of Diabetes, 27(2), 172-175.

Seanad Eireann (2003), Opticians (Amendment) Bill 2002, Second Stage, 11 February 2003, Volume 171.

Sherman, J. (2000), New Insights on Glaucoma for the New Millennium, British Journal of Optometry and Dispensing, 8(2), 50-56.

Silink, M. (2002), Childhood diabetes: a global perspective, Hormone Research, 57 (supplement 1), 1-5.

Smeeth, L. (1998), Assessing the likely effectiveness of screening older people for impaired vision in primary care, Family Practice, volume 15, supplement 1, S24-29.

Smith, A. F. and Brown, G. C. (2000), Understanding cost effectiveness, a detailed review, British Journal of Ophthalmology, 84(7), 794-98.

Smith, J. (1995), Royal College Calls for National Priorities Setting, British Medical Journal, 311, 767.

Spry, P.G.D., Spencer, I. C., Sparrow, J.M., Peters, T.J., Brookes, S.T., Gray, S., Baker, I., Furber, J.F. and Easty, D.L. (!999), The Bristol Shared Care Glaucoma Study: reliability of community optometric and hospital eye service test measures, British Journal of Ophthalmology, 83. 707-712.

Stevens, F. C., Van der Horst, F. and Hendrikse, F. (2002), The gatekeeper in vision care, an analysis of the co-ordination of professional services in the Netherlands, Health Policy, 60(3), 285-97.

St Leger, A. S., Schneiden, H. and Walsworth-Bell, J. P. (1992), Evaluating Health Services' Effectiveness, Open University Press, 5, 111.

St. Vincent Declaration (1989), Diabetes mellitus in Europe, A problem at all ages in all countries, a model for prevention and self-care, a meeting organised by the World Health Organisation and International Diabetes Federation in Europe, St. Vincent, Italy.

Swann, P .G. and Zahner, K. (1995), A dominantly inherited Congenital Lamellar Cataract, British Journal of Optometry and Dispensing, 3(4), 147-150.

Taylor, J.D. (2002), Deputy Registrar/Director of Education, General Optical Council, London, Personal communication with reference to the European Commission's proposed new directive on mutual recognition of professional qualifications within the European Union.

The Council of the European Communities (1988), Council Directive of 21 December 1988 on a general system for the recognition of higher-education diplomas awarded on completion of professional education and training of at least three year's duration (89/48/EEC), Official Journal of the European Communities, 24.1.1989, volume 32, number L 19/16.

The Council of the European Communities (1992), Council Directive of 18 June 1992 on a second general system for the recognition of professional education and training (92/51/EEC), supplement to directive 89/48/EEC, Official Journal of the European Communities, 24.7.1992, volume 35, number L 209/25.

The Council of the European Communities (1993), Council Directive of 5 April 1993 to facilitate the free movement of doctors and the mutual recognition of their diplomas, certificates and other evidence of their qualifications (93/16/EEC), Official Journal of the European Communities, 7.7.1993, volume 36, number L 165.

The Council of the European Communities (1995), Corrigendum to Council Directive 92/51/EEC of 18 June 1992 on a second general system for the recognition of professional education and training (to supplement the Directive number 89/48/EEC published in the Official Journal of the European Communities, number L 209 of 24.7.92), Official Journal of the European Communities, 25.1.1995, number L 17/20

Theodossiades, J. and Murdoch, I. (1999), Positive predictive value of optometrist-initiated referrals for glaucoma, Ophthalmic and physiological Optics, 19(1), 62-67.

Thorne, S. (1996), In Italy, a medical degree often means unemployment or underemployment, Canadian Medical Association Journal, 154(6) 889-90.

Thylefors, B., Negrel A.D., Pararajasegaram, R. and Dadzie, K.Y. (1995), Global Data on Blindness, Bulletin of the World Health Organisation, 73(1), 115-21.

Thylefors, B. (1998), The Epidemiology of Eye Disease by Johnson, Minassian and Weale, Chapman and Hall, 371-82.

Tielsch, J.M., Sommer, A., Katz, J., Quigley, H. A., Royall, R.M. and Javitt, J. (1991), Racial variations in the prevalence of primary open-angle glaucoma, Journal of the American Medical Association, 266, 369-74.

Tielsch, J.M., Katz, J., Sommer, A., Quigley, H., and Javitt, J. C. (1994), Family history and risk of primary open-angle glaucoma, Archives of Ophthalmology, 112, 69-73.

Torgerson, D.J. and Gosden, T. (2000), Priority Setting in Health Care, should we ask the tax payer, British Medical Journal, 320, 1679.

Torrance, G.W. (1974), Health status index models, a unified mathematical view, Management Science, 22, 990-1001.

Towse, A. and Sussex, J. (2000), "Getting UK healthcare expenditure up to the European Union mean" - What does that mean?, British Medical Journal, 320(7235), 640-642.

Transactions of the International Ophthalmic Optical Congress (1961), The British Optical Association, Crosby Lockwood, London, 670.

Trautner, C., Haastert, B., Richter, B., Berger M. and Giani, G. (2003), Incidence of blindness in southern Germany due to glaucoma and degenerative conditions, Investigative Ophthalmology and Visual Science, 44(3), 1031-4.

Tremblay, M. (2003), Next steps for European cross-border healthcare, British Medical Journal, 326 (7399), 1106.

Tuck, M. W. and Crick, R. P. (1997 a), The cost-effectiveness of various modes of screening for primary open angle glaucoma, Ophthalmic Epidemiology, 4(1), 3-17.

Tuck, M. W. and Crick, R. P. (1997 b), Screening for Glaucoma, Drugs and Aging, 10(1); 1-9.

Tuck, M. W. and Crick, R. P. (1998 a) The age distribution of primary open angle glaucoma, Ophthalmic Epidemiology, 5(4), 173-183.

Tuck, M. W. and Crick, R. P. (1998 b), Glaucoma, screening and diagnostic considerations, Dis Manage Health Outcomes, 4(4), 163-192.

Tuck, M.W. and Crick, R. P. (2003), The projected increase in Glaucoma due to an ageing population, Ophthalmic & Physiological Optics, 23 (2), 175-179.

Vinding, T. (1990), Visual impairment of age -related macular degeneration, an epidemiological study of 1000 aged individuals, Acta Ophthalmologica (Copenhagen), 68(2), 162-7.

Von Rohr, M. (1923), The Thomas Young Oration, contributions to the history of the spectacle trade from the earliest times to Thomas Young's appearance, Transactions of the Optical Society, xxv (2), 41-71.

Wallace, M. (2002), Key facts on type 2 diabetes diagnosis and management, Pulse, 62 (39), 60-61.

Wandell, P. E., Brorsson, B. and Aberg, H. (1998), Diabetic patients in primary health care, quality of care three years apart, Scandinavian Journal of Primary Health Care, 16(1), 44-9.

Warren, E. (2002), Diabetes learning objectives, Update, continuing education for General Practitioners, 64 (1), 17.

Watson, R. (2002), GMC opposes EU proposal to allow greater freedom of movement to doctors, British Medical Journal, 325 (7368) 795.

Watson, R. (2003), Medical groups fight to stop doctors working for months without registration, British Medical Journal, 326 (7404), 1416.

Weale, R. (1998), The Epidemiology of Eye Disease edited by Johnson, Minassian and Weale, Chapman and Hall, 25.

Weinstein, M. C. and Fineberg, H.V. (1980), Clinical Decision Analysis, WB Saunders, Philadelphia, 240.

West, S. K. and Valmadrid, C.T. (1995), Epidemiology of risk factors for age-related cataract, Survey of Ophthalmology, 39(4), 323-34.

West, S. K., Munoz, B., Schein, O. D., Duncan, D. D. and Rubin, G. S. (1998), Racial differences in lens opacities: the Salisbury Eye Evaluation (SEE) project, American Journal of Epidemiology, 148(11), 1033-9.

WHO (1990), Global Data on Blindness-an update, WHO/PBL/94.40, World Health Organisation, Geneva,

WHO (1999a), Definition, diagnosis and classification of diabetes mellitus and its complications, Report of a WHO consultation, part 1: Diagnosis and Classification of Diabetes Mellitus, World Health Organisation, Department of Noncommunicable Disease Surveillance, Geneva.

WHO (1999b), 'European Health for All' statistical database, Cumulative number of patients with diabetes (ICD-9, 250; ICD-10, E10-E14) at the end of the calendar year (data from national diabetes register, whenever available, or from routine reporting system), World Health Organisation, Geneva.

WHO, FS 213, (2000), Global initiative for the elimination of avoidable blindness, Blindness the Global picture, Fact Sheet number 213, World Health Organisation, Geneva.

WHO, FS 214 (2000), Control of major blinding diseases and disorders, Fact Sheet number 214, World Health Organisation, Geneva.

WHO, FS 215 (2000), Global Initiative for the Elimination of Avoidable Blindness, Human Resource Development, Fact Sheet number 215, World Health Organisation, Geneva.

WHO, FS 216 (2000), Global Initiative for the Elimination of Avoidable Blindness, Infrastructure and Appropriate Technology Development, Fact Sheet number 216, World Health Organisation, Geneva.

Wiet, G., Elisseeff, V., Wolff, P. and Naudou, J.(1975), The Great Medieval Civilisations, History of Mankind, Cultural and Scientific Development, UNESCO, George Allen and Unwin, London.

Williams, R., Van Gaal, L. and Lucioni, C. (2002), Assessing the impact of complications on the costs of Type II diabetes, Diabetologia, 45(7); S 13-7.

Winocour, P. (2003), How flawed is the NHS road map for diabetes, Pulse, 63 (23), 44-49.

Wistrich, E. (1994), The United States of Europe, Routledge, 24-29.

Wormald, R. P. and Foster, A. (2004), Cataract surgery, British Journal of Ophthalmology, 88, 601-62.

Zarnke, K.B., Levine, M.A.H. and O'Brien, B.J. (1997)., Cost benefit analysis in the healthcare literature, don't judge a study by its label, Journal of Clinical Epidemiology, 50(7), 813-22.

Zeilhoff, A. (2004), European Diploma, Zentralverband der Augenopotiker, Dusseldorf, Personal communication.