Introduction

This chapter aims to provide an overview of primary eye care in Asia including historical views of the establishment and development of optometry, the current situation of eye care distribution across the region, the epidemiology of visual impairment, and future perspectives. The countries covered are in the regions of the South and East China Seas particularly: Cambodia, China, Hong Kong, Indonesia, Japan, Korea, Laos, Malaysia, Taiwan, Thailand, and Vietnam.

Chapter Objectives

On completion of the chapter and study questions, the reader should be able to:

- Describe the legal status of optometry in most south and eastern Asian countries.
- Report the distribution of eye care providers in different south and eastern Asia regions.
- Discuss the epidemiology of vision and conditions in these areas and the coverage or lack of coverage by eye care providers.
- Explain advantages and disadvantages of current training and certification of eye care providers.

Optometry in the Philippines

History of Development and Education

The Philippines has, perhaps, the oldest optometry background in Asia. This is due to its history with Spain and the United States. Optometry in the Philippines began as a craft, then a trade and finally a profession.

There were no recognized written record of optometry and no laboratories for the production of prescription lenses prior to the 20th century in the Philippines. European trained Dr. Jose Rizal was the only known provider of refractions and spectacles. The most common remedy was most likely ready-made reading spectacles from Europe obtained by some wealthy Filipinos.

The first optometry clinic performing refraction was established in Manila in 1902. As the optical business grew, anyone could become involved in it without any technical training. The Board of Optical Examiners was created by legislation in 1913. The first optometric association, the Philippine Association of Optometrists came about in 1917. The Philippine legislature enacted the first regulatory law in optometry known as the Optometry Law of 1917, which was later amended in 1919. Through this Law, optometry was acknowledged as a profession.
Optometrists are certified by the Board of Optometry and are regulated by the Professional Regulation Commission (PRC). In 1957, the Republic Act No. 1998 was passed which amended the Optometry Law of 1917. The Board of Examiners in Optometry drew up a new set of rules and regulations, named the Code of Ethics for Optometrists. The Revised Optometry Law of 1995 updated and modernized many aspects of optometry including the use of diagnostic pharmaceuticals and provided for a six year optometry education program. Interestingly, the PRC Modernization Act of 2000 provides in its Section 20 a Repealing Clause that no longer requires mandatory attendance in continuing education programs in the renewal of professional licenses.

The Philippine College of Optometry was the first optometry school, which survived to 1925. Currently, there are six optometry schools in the Philippines offering a six-year Doctor of Optometry course.

**Professional Associations**

One of two professional associations, the Integrated Philippine Association of Optometrists (IPAO), focuses its projects on continuing education programs, public information campaigns, outreached clinic projects in rural areas, attending to violations of the ethics code and establishing liaison with international associations. The other professional association is the Optometric Association of the Philippines (OAP). The OAP is a member of the World Council of Optometry and the Asia Pacific Council of Optometry.

The Council of Deans of Philippine Colleges of Optometry (also known as the Optometry Council of Deans) exists and is dedicated to the upgrading and enrichment of the optometric curriculum, standardization of the quality of instruction, faculty and plant development.

**Scope of Optometry**

The legal definition of "Optometry", stated in section 3 and 4 of R.A. 8050 in 1995 includes:

1. Examining the human eye;
2. Analyzing the ocular function;
3. Prescribing and dispensing ophthalmic lenses, prisms, contact lenses and their accessories and solutions, low vision aids, and similar appliances and devices;
4. Conducting ocular exercises, vision training and orthoptics;
5. Installing prosthetics;
6. Using authorized diagnostic pharmaceutical agents;
7. Performing other preventative and corrective measures or procedures for the aid, correction, rehabilitation or relief of the human eye, or to attain maximum vision and comfort;
8. The counseling of patients with regard to vision and eye care and hygiene.

**Optometry in Hong Kong**

**History of Development and Education**

Optometry was first formalized as an academic discipline with the
establishment, in 1978, of the Optometry Section at the Institute of Medical and Health Care (IMHC) of the then Hong Kong Polytechnic, which later reached full university status in 1994.ii

A two-year part-time Certificate in Optometry was the first optometry program available to practicing opticians. For the traditionally trained refractionists or contact lens fitter, this course offered further practical and theoretical education. In 1984, a two-year part-time Higher Certificate in Optometry was introduced to upgrade the clinical skills of those who had completed the Certificate in Optometry. A three-year full-time direct entry Professional Diploma in Optometry also began in 1984.iii The current optometry program is a four-year full-time Bachelor of Science (Hons) degree and will become a five year program in 2012.

In 1986, the Optometrists Board of Hong Kong was established under the Supplementary Medical Professions (SMP) Ordinance, Chapter 359, providing for the registration, discipline and management of optometry practice. With the enactment of the Optometrists Regulations, Chapter 359 subsidiary legislation F, the registration optometrists commenced on 1 December 1994 while disciplinary control of the profession was effective on 1 April 1996.iv As is commonly the case when new legislation controlling a profession is enforced, those opticians who were already practicing the profession who were not formally qualified, were given ample opportunities to become qualified. A four-part register was set up to recognize the different levels of qualification of members of the newly controlled optometry profession.

Professional Associations

There are several professional associations in Hong Kong. The oldest is the Hong Kong Optometric Association which was established in 1965. These founding fathers championed many causes including the introduction of formal optometric education and legislative control of the practice of optometry. The Hong Kong Society of Professional Optometrists was formed in 1982 by a group of overseas trained optometrists. Today, it primarily represents the interests of optometrists who have formal tertiary training. The Hong Kong Association of Private Practice Optometrists was founded in 1999 by optometrists who are practice owners. All three associations often work together to promote eye care issues to the general public.

Scope of Optometry

In a healthcare consultation document in 2009, the Hong Kong government defines optometrists as “health professionals trained to provide comprehensive eye and vision care, such as eyesight correction and diagnosis of common conditions related to the eyes or vision. They are not medical doctors but may refer patients to an ophthalmologist for treatment when needed”.

The SMP Ordinance (1980), however, states:
An optometrist is a person trained in the practice of
1. Testing vision;
2. Prescribing optical appliances;
3. Fitting optical appliances; or
4. Supplying optical appliances on prescription.

In a statement to the Legislative Council in 1985, the Secretary for Health and Welfare explained that:

“this definition describes the work of the Optometry profession in sufficiently broad terms to ensure that it embraces all those engaged in optical work, who ought to be registered. This definition does not purport to describe all the work of an optometrist may do, but at the same time, it does not prevent him from performing additional functions, such as the detection of ocular diseases. By the same token, restrictions may be imposed, through regulations, on the type of work, which can be undertaken by different categories of optometrists.”

Optometry in Indonesia

History of Development and Education

The Indonesian term for Optometry or “Refraksi Optisi” began in 1978 when the profession was legislated. Ten optometry schools throughout the country offer a three-year diploma programme followed by a government examination in order to practice. The profession is regulated by the Indonesia Health Department. Renewal of a practicing license is required every five years with a letter of recommendation from the professional association IROPIN. There are approximately 5,990 registered optometrists in Indonesia.

Professional Associations

Two professional associations exist including IROPIN (Indonesia Optometrist Association), who is a member of the Asia Pacific Council of Optometry, and GAPOPIN (Indonesia Optical Association).

Scope of Optometry

Optometry practice involves “the examination of the human eye through the employment of subjective and objective procedures, including the use of instruments, tools, equipment, visual aids, machines and related devices, for the purpose of determining the condition and acuity of human vision to correct and improve by prescribing and dispensing of ophthalmic lenses, prisms, contact lenses and their accessories and solutions, frames and their accessories, and supplies for the purpose of correcting and treating defects, deficiencies and abnormalities of vision.”
Optometry in Japan

**History of Development and Education**

Five optometry schools exist in Japan contributing to the education and training of opticians/optometrists. The Kikuchi College of Optometry in Nagoya runs a four-year program. The Tokyo College in Tokyo has a three-year program, as do the World Optical College in Okayama; the Ohmi Watch, Optometry, Jewelry College in Shiga; and the Nihon Gankyo Giyutsu Senmon Gakko School in Osaka.

The Kikuchi College of Optometry was opened in 1978 in Nagoya as the first and still the only four-year college of optometry in Japan. Established as a proprietary school associated with the Kikuchi Optical Company, the school was organized to upgrade refracting opticians and to educate new opticians to international professional optometry standards.

The Japanese government does not legally recognize optometry as an independent profession. This absence of government recognition and regulation has made it difficult to set national standards for education and practice in optometry. In addition, the act of delivering eye care lies within the responsibility of the medical profession.

In 2001, in seeking government recognition of optometry, the All Japan Optometric and Optical Association (AJOOA) introduced a Self-certification System to enhance the knowledge and skills of refracting opticians/optometrists. Another purpose of this system was to gain social and consumer recognition of the educational requirement in becoming a certified optician. Since April 2007, the system certifies graduates from optometric schools with a 3-4 year curriculum.

**Professional Associations**

According to the WCO, there are two professional optometric organizations including the AJOOA and the Japan Optometric Association (JOA).

The JOA, formed in 1979, originated from the Kikuchi College of Optometry. The JOA's goal is to improve eye and vision care in Japan. And promote professional development through JOA-sponsored continuing education courses.

Optometry in Korea

**History of Development and Education**

In Korea, opticianry began at the Korean Glasses Technical High School, which was established in 1982. Following this, the first optometry school established, in 1984, was the Daegu Health College running a two-year course that later changed to three in 2000.

There are currently 45 optometry schools offering two to four-year courses, some with postgraduate programs. There are about 33,000 optometrists and opticians in the country.

The Korean legislature enacted the first regulatory law for
optometrists/opticians under the legislation for medical technicians or assistants in 1987. A practicing license can be obtained through the state examination to ensure that those who provide eye care services are properly trained and qualified.

The scope of optometry practice covers subjective refraction, dispensing, and perhaps some binocular vision assessments.

**Professional Associations**

Three professional associations exist including: the Korean Optometric Association, with 30,000 members; the Korean Ophthalmic Optics Society; and the Korean Vision Science Society.

**Optometry in China**

Optometry was relatively unknown in China until the 1990s. Even today, the majority of the population is unclear about what optometry is and how it is different from opticianry.

When vision is blurred, the people go to a “spectacles shop” to have spectacles fitted. The person who refracts in the spectacles shop is required to be licensed. Licensing is conducted by the Labor Bureau and a 5 tier registration system exists. The level at which the refractionist is registered depends on the level of training and the years of experience. The refractionist may learn the skills of refraction in a post-secondary college or an institution of higher learning where the length of training ranges from a few months to a few years. The vast majority of vision correction in the country is delivered by these spectacle shops.

At the other end of the spectrum are the optical or refraction units of hospital eye departments or eye hospitals. Spectacles are also available in these institutions and there is a perception that the quality of service is generally higher than in the spectacles shops. Those who prescribe spectacles here are medical doctors or optometrists although in the smaller or rural hospitals, refractionists are also employed.

Without a clear definition of optometry in China, optometry education comes in various threads. There are many colleges across the country offering sub-degree level opticianry and refraction courses. At the tertiary level, one of the oldest programs, conducted by the Tianjin Professional College, is well known throughout the country and its graduates are skilled in refraction. A newer program, from the Beijing Polytechnic University, has its roots in glass technology. Optometry programs from the Sichuan University, North Sichuan Medical College and Tianjin Medical University are based in medical schools but more aligned with allied health programs.

Another approach to optometry education is to base it on medical education. These programs are five-year Bachelor of Medicine (Optometry) programs and are offered at universities such as Sun Yat-sen University, Wenzhou Medical College, Shenyang Medical College, Fujian Medical University, Nanjing Medical University, and Kunming Medical University. Graduates of these 5 year programs are entitled to sit for the national physician examination and if successful, become licensed physicians.
Wenzhou Medical College was the first medical college in China to engage the West to understand optometry education in the late 1980s and early 1990s and today, is a leading provider of optometry education in China. It is also a strong proponent of the medical model of optometry.

Optometry in Singapore

History of Development and Education

Primary eye care in Singapore was formerly attended to by general medical practitioners, government outpatient clinics, school health clinics (principally for visual assessment of school children), opticians (who were practicing largely without formal training, learning their trade through apprenticeships), and very few qualified opticians and optometrists.iii

Three major milestones mark the development of optometry in Singapore. The first was the establishment of an optometry teaching unit at the Singapore Polytechnic in 1994, which yielded 40 diploma graduates in 1997. The second was the introduction of the Contact Lens Practitioners Board, formed by the Ministry of Health. In 1995, the enactment of the Contact Lens Practitioners Act was in response to the then growing incidence of contact lens-related microbial keratitis. This Act resulted in enhanced standards of care in contact lens management. The third was the passage of the Optometrists and Opticians Act in Parliament in 2007. Under this Act, optometrists with recognized qualifications and with at least a year of experience could be fully registered. Optometrists with less than a year of experience could be provisionally registered, and would have to work under supervision for a year before they could be fully registered. The Act establishes the Optometrists and Opticians Board to regulate optometrist and opticians.

Professional Associations

The Singapore Optometric Association, the Singapore Society of Optometrists, and the Singapore Contact Lens Society are the three professional associations here. The Singapore Optometric Association provides leadership for the local optometrists.

Scope of Optometry

The acts constituting "Optometry" or "The practice of Optometry" are specified as follows:

1. Refraction;
2. Prescribing of optical appliances;
3. Detecting abnormalities of the eye using the following methods:
   - Binocular vision tests;
   - Ophthalmoscopy or funduscopy;
   - Retinoscopy;
   - Slit-lamp examination;
   - Tonometry; and
• Visual field testing;
4. Any other time of practice of eye care which is part of the practice of opticianry.xiv

The Optometrists and Opticians Board is in the process of mandating the Continuing Education (CPE) program for all optometrists and opticians.

Optometry in Malaysia

Optometry education began under the Department of Ophthalmology at the National University of Malaysia with the aim to training personnel to assist in the delivery of eye care. It started as a diploma course in 1980. Later, in 1982, the course was changed to a Bachelor of Optometry degree.xv

In February 1984, the Association of Malaysian Optometristsxvi was formed to represent the interests of optometrists. In 1985, the Malaysian Association of Practising Opticians was formed to look after the interests of dispensing opticians.

The Malaysian government put into practice the Optical Act in 1991. The passage of this legislation defined optometry as the employment of methods for the measurement of the powers of vision, or the adaptation of ophthalmic lenses or prisms for the aid of the powers of vision, or both. The Act provides for a register of opticians and a register of optometrists. There is a lack of clarity in the country regarding the roles of dispensing opticians and optometrists. As a result, dispensing opticians perform those roles traditionally performed by optometrists in western industrialized economies. The Act allows the use of drugs for refractive purposes.

Optometry in Taiwan

Fifteen professional associations are connected with optometry in Taiwan although the profession is not legislated. There are 6000 trained and practicing optometrists in Taiwan who have received formal education and can perform refraction, contact lens fitting, and dispensing (including low vision aids).

Currently, there are four universities offering a four-year bachelor’s degree in optometry including Chung Shan Medical University, Central Taiwan University of Science and Technology, Yuan Pei University and Chung Hwa University of Medical Technology. Two further colleges offering an associated degree exist: the Jen-Teh Junior College of Medicine, Nursing and Management and the Shu-Zen College of Medicine.

Optometry in Thailand

A Doctor of Optometry program is offered at the Ramkhamhaeng University in Thailand with the assistance of Indiana University (USA).

According to the University, optometrists are defined as independent, primary healthcare providers who examine, diagnose, and manage diseases and disorders of the visual system, the eye and associated structures as well as diagnose related systemic conditions including:
- Vision conditions such as nearsightedness, farsightedness, astigmatism and presbyopia.
- Binocular vision conditions such as convergence insufficiency, which can cause discomfort and difficulty reading.
- Eye diseases such as glaucoma, cataracts, and retinal disorders.
- Systemic diseases such as hypertension and diabetes.

Optometrists prescribe and/or provide spectacles, contact lenses, low vision aids, and vision therapy. However, the profession is not legislated and the majority of the personnel delivering vision correction are refractionists/opticians. The body representing their interests is the Thai Optometric Association.

Asia Pacific Council of Optometry

The International Federation of Asian and Pacific Associations of Optometrists (IFAPAO), was founded in 1978 on the initiatives of Dr. Damien Smith, of Australia, and Dr. Claro Cinco, from the Philippines. Its mission is to influence and facilitate the development of primary eye care and vision care by optometrists, as well as optometric education. Biennial scientific meetings, the Asia Pacific Optometric Congress (APOC), took place at various locations throughout the region.

Reorganization of the International Optometric and Optical League (IOOL) into the World Council of Optometry (WCO) altered the role of IFAPAO. It became the regional organization for the Asia and Pacific region with representations on the WCO Governing Board. As a result, IFAPAO was renamed Asian-Pacific Council of Optometry (APCO) in 1995.

A list of optometry schools throughout Asia is available at the Asia Pacific Council of Optometry website.

Epidemiology

According to the World Health Organization (WHO) and the International Agency for the Prevention of Blindness (IAPB)’s global initiative, Vision 2020: The Right to Sight, the estimated number of 45 million blind people in the world will double to 80 million by 2020. Blindness is defined as a presenting distance visual acuity <3/60 in the better eye.

The South-East Asian Regional (SEAR) Vision 2020 launched on 30 September 1999 with three key strategies identified for successful implementation including:

1. Advocacy to increase awareness of blindness as a major public health problem.
2. Partnership in development and networking with countries, professional organizations, financial institutions, and nongovernmental organizations.
3. Integrated approach to the reduction of disease burden through the development of human resources and infrastructure.
However, the problems and constraints include: inadequate human resources and insufficient infrastructure, poor managerial capacity and dwindling resources. Furthermore, insufficient data and/or the duplication of data and data collection are weaknesses in the planning and monitoring of disease control in Asia.

Profile of Blindness in SEAR
- 25% of world’s population
- 33% of world’s blind
- 40% of world’s poor
- 50% of world’s childhood blindness
- 60% of world’s cataract backlog
- Highest number of blind persons among WHO Regions

Half of the world’s 1.5 million blind children live in SEAR. Every minute, four people here become blind. The number of blind persons will increase to 30 million at the current level of intervention.

In addition, SEAR has another 45 million people with low vision and different grades of visual impairment. Thus, there are approximately 60 million visually impaired persons in SEAR. Blind persons in SEAR are among the poorest in the world and society, consisting of women, the elderly and the marginalized. Blindness is estimated to cost the countries of SEAR $US5.6 billion annually in: lost productivity, special education and rehabilitation. It is economically destructive and is also a cause of many early deaths. The life expectancy among the blind is only two thirds that of the sighted. Almost 10 million people in SEAR die without their sight being restored, the majority dying within 10 years of becoming blind.

The distribution of blindness is not uniform in SEAR. Thailand has a low prevalence rate of 0.3 percent while Indonesia has five times higher prevalence and, in fact, one of the highest in the world, at 1.5 million cataract blind. Blindness costs Indonesia $US1 billion annually. Thailand’s low prevalence, a result of outstanding achievements of the Thai national programme for prevention of blindness, is comparable to developed countries. Meanwhile, the highest prevalence, in Indonesia, is comparable to Sub-Saharan Africa.

Ninety percent of blindness in SEAR is either preventable or curable at low costs. For example: cataract surgery costs $US15, trachoma blindness can be prevented at $US3, and 5 US cents of vitamin A capsules are sufficient to prevent xerophthalmia. Although the exact magnitude of blindness from uncorrected refractive errors is not known, the problem is sufficiently big to indicate the inadequacies of the healthcare systems in SEAR.

Table 1. Status of eye health in some SEAR and other Asian countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Prevalence of Blindness (%)</th>
<th>No. of blind persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>1</td>
<td>1 300 000</td>
</tr>
<tr>
<td>Bhutan</td>
<td>0.8</td>
<td>5 600</td>
</tr>
<tr>
<td>Cambodia</td>
<td>1.2</td>
<td>144 000</td>
</tr>
</tbody>
</table>
China 0.4 6 600 000
Indonesia 1.47 6 800 000
Japan 0.14 178 786
Korea 0.45 216 881 (including low vision)
Laos 1 63 200
Malaysia 0.29 82 122
Maldives 1.5 2 948 761
Myanmar 0.9 1 959
Nepal 0.8 325 918
Sri Lanka 0.5 92 920
Taiwan 0.6 137 526
Thailand 0.31 242 341
Vietnam 0.47 380 000

Table 2. Prevalence of Diseases causing Blindness

<table>
<thead>
<tr>
<th>Disease/Country (%)</th>
<th>Bangladesh</th>
<th>China</th>
<th>Indonesia</th>
<th>Myanmar</th>
<th>Nepal</th>
<th>Thailand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cataract</td>
<td>84</td>
<td>54</td>
<td>52</td>
<td>63</td>
<td>70</td>
<td>57</td>
</tr>
<tr>
<td>Age-related macular degeneration</td>
<td>3.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glaucoma</td>
<td></td>
<td>13.4</td>
<td>16</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other retinal disease</td>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refractive error</td>
<td>14</td>
<td>9.4</td>
<td></td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trachoma</td>
<td>4</td>
<td>2.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corneal opacity</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other corneal disease</td>
<td></td>
<td>5</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nutritional disease</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The leading cause of blindness in all SEAR countries is cataract, which accounts for 50-80% of blindness. Moreover, there is a 10-12 million unoperated cataract backlog. Trachoma and vitamin A deficiency are focally distributed.

Glaucoma and diabetic retinopathy are the emerging causes of blindness in SEAR.

**Cataract**

Table 3. Number of cataract blindness (prevalence except where indicated) in some SEAR countries and China

<table>
<thead>
<tr>
<th>Country</th>
<th>No. of cataract blind</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>738 816</td>
</tr>
<tr>
<td>Bhutan</td>
<td>3 777</td>
</tr>
<tr>
<td>Cambodia</td>
<td>19 000 (incidence)</td>
</tr>
<tr>
<td>China</td>
<td>2 500 000</td>
</tr>
<tr>
<td>Country</td>
<td>Population</td>
</tr>
<tr>
<td>----------</td>
<td>------------</td>
</tr>
<tr>
<td>Indonesia</td>
<td>6 546 053</td>
</tr>
<tr>
<td>Laos</td>
<td>34 800</td>
</tr>
<tr>
<td>Maldives</td>
<td>1 562 843</td>
</tr>
<tr>
<td>Myanmar</td>
<td>1 254</td>
</tr>
<tr>
<td>Nepal</td>
<td>291 508</td>
</tr>
<tr>
<td>Philippines</td>
<td>495 788</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>64 579</td>
</tr>
<tr>
<td>Thailand</td>
<td>136 296</td>
</tr>
</tbody>
</table>

It is estimated that SEAR would require about $US200 million annually to prevent or cure major blinding diseases. The prevention of blindness will result in a saving of $US5.4 billion annually.

The WHO in SEAR has expressed that a matter for concern is the professional barrier. Ten million cataract cases in SEAR exist due to the shortage of eye surgeons available to operate. General medical doctors and non-medical health personnel have been trained by ophthalmologists in some countries to lighten the cataract backlog. However, in other countries, millions suffer from cataract blindness, since ophthalmologists discourage medical graduates to operate.

The juggle between providing the best care for a few or providing good care for many remains the ethical dilemma. The shortage of ophthalmologists in most countries in SEAR is shadowed by the shortage in number of ophthalmic paraprofessionals. Furthermore, the majority of the SEAR population (80%) reside in rural areas, while most of the ophthalmic human resources (80%) concentrate in urban areas, resulting in an 80:20 imbalance.

**Refractive error**

A high prevalence of refractive error blindness of 0.59% exists in the Chinese over-50-years group using the definition of presenting distance visual acuity <6/60 in the better eye. Available data suggest that blindness in China due to natural refractive error is more common than that due to aphakia.
Table 4. Prevalence of blindness due to refractive error reported from population-based surveys in selected countries. Blindness definition 1 and 2 include presenting distance visual acuity <3/60 and <6/60 in the better eye respectively. RE = refractive error

<table>
<thead>
<tr>
<th>Year of Publication</th>
<th>Country</th>
<th>Age group (years)</th>
<th>Sample size</th>
<th>Blindness prevalence</th>
<th>RE blindness prevalence</th>
<th>Type of RE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blindness definition 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td>Pakistan</td>
<td>All</td>
<td>29 139</td>
<td>1.78%</td>
<td>0.20%</td>
<td>Aphakia, natural RE</td>
</tr>
<tr>
<td>1996</td>
<td>Turkey</td>
<td>All</td>
<td>7 497</td>
<td>0.40%</td>
<td>0.05%</td>
<td>Aphakia</td>
</tr>
<tr>
<td>1997</td>
<td>Lebanon</td>
<td>All</td>
<td>10 148</td>
<td>0.60%</td>
<td>0.08%</td>
<td>Myopia, hyperopia, aphakia</td>
</tr>
<tr>
<td>2001</td>
<td>India</td>
<td>All</td>
<td>10 293</td>
<td>1.34%</td>
<td>0.10% 0.01% 0.04% 0.05%</td>
<td>Myopia Hyperopia Aphakia RE-related amblyopia</td>
</tr>
<tr>
<td>Blindness definition 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td>China</td>
<td>&gt;50</td>
<td>5 342</td>
<td>4.37%</td>
<td>0.40% 0.19%</td>
<td>Myopia, hyperopia Aphakia</td>
</tr>
<tr>
<td>2001</td>
<td>India</td>
<td>All</td>
<td>10 293</td>
<td>1.84%</td>
<td>0.21% 0.03% 0.06% 0.06%</td>
<td>Myopia Hyperopia Aphakia RE-related amblyopia</td>
</tr>
</tbody>
</table>

Myopia

Myopia is emerging as a public health problem in Asia with increasing prevalence rates over the past decades. It appears that the myopia prevalence rates are higher in urban areas (Hong Kong, Singapore and Taiwan) compared with rural areas and highest in Asia among the Chinese population.

Data from 29 Chinese provinces showed that refractive error was the greatest cause of blindness here after cataract.
Table 5. Prevalence rates of myopia in children

<table>
<thead>
<tr>
<th>Author (year/country)</th>
<th>N</th>
<th>Study population</th>
<th>Definition of myopia</th>
<th>Prevalence rates of myopia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zhao (2000/China)</td>
<td>6 134</td>
<td>Aged 5-15 years in rural areas</td>
<td>At least -0.5D</td>
<td>Absent in 5-year-olds, 36.7% &amp; 55.0% in 15-year-old males &amp; females respectively</td>
</tr>
<tr>
<td>Pokharel (2000/Nepal)</td>
<td>5 526</td>
<td>Aged 5-15 years in rural villages</td>
<td>At least -0.5D</td>
<td>&lt;3% of all children</td>
</tr>
<tr>
<td>Dandona (2002/India)</td>
<td>4 074</td>
<td>Aged 7-15 years in rural villages</td>
<td>At least -0.5D</td>
<td>4.1% of all children</td>
</tr>
<tr>
<td>Murthy (2002/India)</td>
<td>6 447</td>
<td>Aged 5-15 years in urban New Delhi</td>
<td>At least -0.5D</td>
<td>7.4% of all children</td>
</tr>
<tr>
<td>Lin (1999/Taiwan)</td>
<td>11 178</td>
<td>Aged 6-18 years in schools in urban and rural Taiwan</td>
<td>At least -0.25D</td>
<td>12% at age 6, 56% at age 12, 84% in ages 16-18</td>
</tr>
<tr>
<td>Chua (1999/Singapore)</td>
<td>1 119</td>
<td>Aged 7-9 years</td>
<td>At least -0.5D</td>
<td>27.8% in 7-year-olds, 34.3% in 8-year-olds, 43.9% in 9-year olds</td>
</tr>
</tbody>
</table>

Table 6. Prevalence rates of myopia in adults

<table>
<thead>
<tr>
<th>Author (year/country)</th>
<th>N</th>
<th>Study population</th>
<th>Definition of myopia</th>
<th>Prevalence rates of myopia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dandona (1999/India)</td>
<td>2 522</td>
<td>All ages, 25% urban, 75% rural</td>
<td>At least -0.5D</td>
<td>19.4%</td>
</tr>
<tr>
<td>Wong (2000/Singapore)</td>
<td>1 232</td>
<td>Chinese 40-79 years</td>
<td>At least -0.5D</td>
<td>38.7%</td>
</tr>
<tr>
<td>Wu (2001/Singapore)</td>
<td>15 095</td>
<td>16-25 years military conscripts</td>
<td>At least -0.5D</td>
<td>82.2% in Chinese, 68.7% in Indians, 65.0% in Malays</td>
</tr>
</tbody>
</table>

Cambodia

With a population of 14 million people, 85% of whom live in rural areas, the prevalence of bilateral blindness in Cambodia is relatively high at 1.2% compared to other developing countries. Approximately 144,000 are blind in the country. An additional 4.4% of the population have low vision with acuity of <6/18 and ≥3/60 in the better eye.

The main causes of blindness are cataract, uncorrected refractive errors/aphakia, glaucoma, corneal scarring, or phthisis. Of these causes, 80-90% are preventable or treatable. Trauma due to landmine explosions and war-related injuries was the common underlying cause of phthisis and corneal scarring.

Approximately 28,800 Cambodians become blind yearly, 19,000 because of cataract alone. By 2020, the country’s population is projected to grow from 12 million to 19.5 million people. With increasing life expectancy, the number of people over the age of 60 is estimated to increase by 60% to 2 million further increasing the magnitude of the cataract backlog. The cataract surgical rate (CSR), that is, the number of cataract operations per million population in a year, as of 1999, stood at 6000.
Refractive Errors and Visual Impairment

Uncorrected refractive error and aphakia account for approximately 10% of blindness. This is a reflection of the country’s poor availability of refraction services and affordable spectacles. There are only 24 optometrists serving the country’s population.

57% of patients with refractive errors require presbyopic corrections, followed by myopia 29%, hyperopia 13% and aphakia 1%. Only six of Cambodia’s twenty-two provinces have permanent refraction services with trained refraction personnel. With over 80% of Cambodians living in rural areas, much of the population relies on infrequent provincial screening programs as their only access to refraction and spectacle provision.

The Cambodian Optometrists Association (COA) has been primarily responsible for delivering refraction training and provincial refractive error screening in the past. The need for COA to receive further training, skills development, professional mentoring, and systems strengthening was identified to enable COS to contribute to the development of refraction services as part of the Cambodian Eye Care Plan.

Table 6. Major causes of vision impairment in Cambodia

<table>
<thead>
<tr>
<th>Cause</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Blindness</strong></td>
<td></td>
</tr>
<tr>
<td>Cataract</td>
<td>67.4</td>
</tr>
<tr>
<td>Phthisis</td>
<td>6.1</td>
</tr>
<tr>
<td>Uncorrected refractive error</td>
<td>6.1</td>
</tr>
<tr>
<td>Corneal scar</td>
<td>5.3</td>
</tr>
<tr>
<td>Uncorrected aphakia</td>
<td>3.0</td>
</tr>
<tr>
<td>Trachoma corneal scar</td>
<td>3.0</td>
</tr>
<tr>
<td>Optic atrophy</td>
<td>3.0</td>
</tr>
<tr>
<td>Others</td>
<td>6.1</td>
</tr>
<tr>
<td><strong>Low Vision</strong></td>
<td></td>
</tr>
<tr>
<td>Uncorrected refractive error</td>
<td>49.8</td>
</tr>
<tr>
<td>Cataract</td>
<td>42.7</td>
</tr>
</tbody>
</table>

China

China has a blindness prevalence of 0.4%. This accounts for about 18% or 6.6 million of the world’s blind. The major causes of blindness in China include cataract, corneal diseases, trachoma, glaucoma and a number of factors contributing to blindness in children.

Cataract is responsible for approximately 54% of the country’s blind, or around 2.5 million people. Each year, around 400,000 people become totally blind because of cataracts alone. China is estimated to have the world’s most rapidly ageing population and has a national CSR of 450-460. This low CSR is a result of a serious imbalance between hospital charges for cataract surgery and patient’s ability to pay. It is generally accepted that a simple cataract operation in China can cost patients as much as their annual income.

Trachoma is still endemic in certain parts of China.
Blindness in children is mainly caused by vitamin A deficiency, measles, conjunctivitis in the newborn, congenital cataract and retinopathy of prematurity. Of an estimated 1 million blind children in Asia, some 400,000 live in China. Retinopathy of prematurity (ROP) blindness is emerging as a problem due to the ever-increasing survival of low and very low birth weight infants.\textsuperscript{xxxvii}

**Hong Kong**

The reported number of blind persons in Hong Kong is estimated to be around 14,000 each year. Approximately, a further 56,000 suffer from mild to moderate degree of visual impairment.\textsuperscript{xxxviii} In total, published data show that 1.8% of the Hong Kong population or 122,600 people experience some form of visual difficulty. Cataract is reported in one percent of the 7-million population.\textsuperscript{xxxix}

**Indonesia**

Indonesia has a blindness prevalence of 1.4% and one of the highest in the world. According to a national research, the leading causes of blindness include cataracts affecting 1.8% of the population, glaucoma at 0.5% and age-related macular degeneration at 0.13%. Also, 32% of the population suffer from refractive errors. Of these, 81.9% of those aged 6-16 years are uncorrected. Those aged 17-29 years account for 45.1% of all refractive errors with 80.2% corrected with spectacles.

**Japan**

According to the Japan Optometric Association, about one of every three persons, or about 40 million people, wear glasses or contact lenses in Japan. The overall prevalence of blindness according to a study of a Japanese adult population is 0.14%. The primary causes of blindness are optic atrophy, myopic macular degeneration, retinitis pigmentosa, and uveitis. The overall prevalence of low vision is 0.39%, being significantly greater in women and in the older population. The causes in descending order are cataract followed by glaucoma, and those of monocular blindness are myopic macular degeneration, glaucoma and trauma.\textsuperscript{xl}

**Singapore**

Data on visual impairment and blindness in Singapore are rather limited. The prevalence of visual impairment in Singapore adults of Chinese origin aged 40 to 79 years were reported as 1.1 and 0.5% respectively in a population-based study.\textsuperscript{xli}

In developing areas, the most common blinding conditions are infections (trachoma), dry eye scarring, and nutrition deficiencies (vitamin A) common in young as well as older ages.\textsuperscript{xlii} Improved health services have nearly eradicated trachoma, and vitamin A deficiency as well as leading to increased life expectancy. It is estimated that one in five Singaporeans will be
aged 65 and above by the year 2030. With this demographic shift, age related diseases such as cataract, age-related macular degeneration (AMD), glaucoma, and diabetic retinopathy are becoming of increased importance in Singapore.

**Prevalence of major blinding diseases in Singapore**

Cataract is found in nearly 80% of the elderly population. AMD is the second most common cause of blindness followed by glaucoma. In addition, retinal degeneration is the leading cause of registered blindness in Singapore due to a rise in prevalence of both AMD and diabetic retinopathy.

Singapore has one of the highest myopia rates in the world occurring in 40% of Chinese adult Singaporeans over 40 years old, and 80% in young adults. About half of Singaporean children develop myopia by the time they reach the age of 12 years. Singaporeans are also developing myopia at a much younger age. In addition, the rate of myopia progression amongst Singaporean children is far higher than that in most other countries. With one of the lowest infant mortality rates in the world, Singapore has a surge in the number of premature babies surviving leading to increased cases of retinopathy of prematurity (ROP).

**Taiwan**

The prevalences of blindness and low vision in Taiwan are similar to other developed countries. Reports estimated blindness and low vision to be 0.59% and 2.94% respectively. There is a significant increase in the prevalence of low vision from 0.83% at 65 to 69 years of age to 8.33% at age 80 years or older. The major causes of visual impairment include cataract at 59.2%, myopic macular degeneration at 12.5% and age-related macular degeneration at 10.4%. Of the leading causes of blindness, it is noteworthy that there is increased incidence of visual impairment from diabetic retinopathy.

Table 7. Prevalence of eye diseases.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cataract</td>
<td>59.2</td>
</tr>
<tr>
<td>Diabetic Retinopathy</td>
<td>35.0</td>
</tr>
<tr>
<td>Glaucoma</td>
<td>16.2</td>
</tr>
<tr>
<td>Myopic Macular Degeneration</td>
<td>12.5</td>
</tr>
<tr>
<td>Age-related Macular Degeneration</td>
<td>10.4%</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Age</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>65-69</td>
<td>48.0</td>
</tr>
<tr>
<td>70-74</td>
<td>57.1</td>
</tr>
<tr>
<td>75-79</td>
<td>72.8</td>
</tr>
<tr>
<td>80+</td>
<td>82.5</td>
</tr>
<tr>
<td>Total</td>
<td>59.2</td>
</tr>
</tbody>
</table>
Age-related macular degeneration is a common eye disease in the elderly Chinese people in Taiwan. Interestingly, the prevalence of exudative AMD is comparable to that in the Chinese people in the United States but is higher than in the Chinese people in China. The prevalence of early AMD was 9.2% and of late AMD, 1.9%. The prevalence of early AMD rose from 5.0% in the 65 to 69-year age group to 24.4% in those 80 years of age and older and for late AMD, from 1.0% to 9.0%.  

**Thailand**

Thailand with 0.31% prevalence of blindness has one of the lowest blindness rates in Asia. Launched in 1978, the National Programme for Prevention of Blindness focused on primary healthcare. Human resources development at mid-level; training of ophthalmic nurses and tertiary level ophthalmologist in the ratio of 2:1; strengthening of eye care services at primary level, development of ophthalmic training centres, are factors in contributing to the reduction of blindness prevalence from 1.14 to 0.31% as well as the integration of eye care into primary healthcare services.

Thailand's sound network of allied services as well as ophthalmic training programmes for health workers, including village health volunteers, public health nurse, ophthalmic nurses and medical officers has played a key factor in the success of lowering blindness rate in the country.

**Malaysia**

Table 9. Percentage distributions of causes of bilateral blindness and low vision in Malaysia

<table>
<thead>
<tr>
<th>Causes</th>
<th>Blindness (%)</th>
<th>Low vision (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refractive errors</td>
<td>4.1</td>
<td>48.3</td>
</tr>
<tr>
<td>Cataract</td>
<td>39.11</td>
<td>35.93</td>
</tr>
<tr>
<td>Retinal diseases</td>
<td>24.54</td>
<td>2.8</td>
</tr>
<tr>
<td>Corneal diseases</td>
<td>3.42</td>
<td>2.5</td>
</tr>
<tr>
<td>Glaucoma</td>
<td>1.77</td>
<td>1.8</td>
</tr>
<tr>
<td>Others</td>
<td>27.06</td>
<td>8.67</td>
</tr>
</tbody>
</table>

56.25% of all cases of bilateral blindness have avoidable or treatable causes including cataract, uncorrected refractive errors, aphakia and diabetic retinopathy. Additionally, of the people with low vision, 85.99% have preventable or treatable causes.

With a prevalence of blindness of 0.29%, it would appear that the rate in Malaysia is lower than that of the other countries in the same region. However, the prevalence of low vision is high at 2.4%. As a result, for every blind person in Malaysia, there are eight people with low vision. Based on the available global data from 17 countries on low vision, the WHO estimated that for each person blind, there are three people with low vision.

Trachoma and vitamin A deficiency are nearly non-existent here. Instead, cataract and retinal diseases were the major causes of blindness. Uncorrected refractive errors are the leading causes of low vision. As previous studies found that myopia population in Malaysia are younger than 50 years
of age, refractive errors will continue to be an important public health problem here.

**Philippines**

A national blindness survey, conducted from April 1994 to June 1995, illustrated that the prevalence of bilateral blindness in Filipinos is 0.70%, that is, 478,968 out of 68.4 million. Cataract, accounting for 77% of the blind population, glaucoma, and uncorrected aphakia were the most common causes found. Monocular blindness affects 1.09% of the population.

With a prevalence rate of 1.95%, bilateral low vision affects more than 1.3 million Filipinos. This is also mostly due to maturing cataracts which would further increase the 400,000 cataract backlog.

According to statistics, out of the remaining number of persons with non-cataract blindness, about 40,000 are of school age. Up to one hundred children lose their sight every week in the Philippines. Almost half of these cases are either treatable or preventable. Poor nutrition including vitamin A deficiency, measles, and premature birth are among the leading causes of preventable blindness in children.

Measles causes blindness through several mechanisms; furthermore, there is a close synergism between measles and vitamin A deficiency that can result in xerophthalmia, with corneal ulceration, exposure keratitis, keratomalacia, and subsequent corneal scarring or phthisis bulbi.

**Vietnam**

According to a survey conducted by the Vietnam Institute of Ophthalmology (VNIO) in 2007, about 380,000 or 0.47% of the population are blind while 1.6 million are suffering from poor vision. Refractive errors are also of major concern, accounting for 2 to 3 million people nationwide.

The healthcare problems range from lack of trained professionals, to limited resources, to geographical spread of care. It is estimated that only 10 ophthalmologist are available for every one million Vietnamese patients. Many ophthalmologists and eye care facilities concentrate in urban centres, leaving only nurses with minimal resources to service the 75% population in rural areas.

**The need for Optometrists in Asia**

With adequate number and appropriate deployment of optometrists, eye care service delivery mechanisms would be more efficient. The load for procedures such as refractive error correction, staging of cataracts and diabetic screening would be greatly reduced.

The comparable ratio of practitioner to patient, in developed countries, is one to 10 000.
Table 10. Number of optometrists required

<table>
<thead>
<tr>
<th>Country</th>
<th>Population in 1995 (000)\textsuperscript{ix}</th>
<th>No. of optometrists required</th>
<th>No. of optometry schools</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Eastern Asia</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>1 221 462</td>
<td>122 146</td>
<td>18</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>5 865</td>
<td>587</td>
<td>1</td>
</tr>
<tr>
<td>Indonesia</td>
<td>197 588</td>
<td>19 759</td>
<td>10</td>
</tr>
<tr>
<td>Japan</td>
<td>125 095</td>
<td>125 10</td>
<td>5</td>
</tr>
<tr>
<td>Korea, North</td>
<td>23 917</td>
<td>2 392</td>
<td>?</td>
</tr>
<tr>
<td>Korea, South</td>
<td>44 995</td>
<td>4 500</td>
<td>45\textsuperscript{x}</td>
</tr>
<tr>
<td>Taiwan</td>
<td>22 974</td>
<td>2 297</td>
<td>3</td>
</tr>
<tr>
<td><strong>South-East Asia</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cambodia</td>
<td>10 251</td>
<td>1 025</td>
<td>Refraction training courses available\textsuperscript{xii}</td>
</tr>
<tr>
<td>Indonesia</td>
<td>197 588</td>
<td>19 759</td>
<td>11</td>
</tr>
<tr>
<td>Laos</td>
<td>4 882</td>
<td>488</td>
<td>?</td>
</tr>
<tr>
<td>Malaysia</td>
<td>20 140</td>
<td>2 014</td>
<td>6</td>
</tr>
<tr>
<td>Philippines</td>
<td>67 581</td>
<td>6 758</td>
<td>6</td>
</tr>
<tr>
<td>Singapore</td>
<td>2 848</td>
<td>285</td>
<td>1</td>
</tr>
<tr>
<td>Thailand</td>
<td>58 791</td>
<td>5 879</td>
<td>1</td>
</tr>
<tr>
<td>Vietnam</td>
<td>74 545</td>
<td>7 455</td>
<td>?</td>
</tr>
</tbody>
</table>
Table 11. Status of Optometry Education

<table>
<thead>
<tr>
<th>Country</th>
<th>Top Level</th>
<th>Institution</th>
<th>Licensing</th>
</tr>
</thead>
<tbody>
<tr>
<td>China (including Hong Kong)</td>
<td>4 &amp; 5-year Bachelor Degree</td>
<td>State funded universities</td>
<td>Yes</td>
</tr>
<tr>
<td>Taiwan</td>
<td>4-year Bachelor Degree</td>
<td>Private institutions</td>
<td>No</td>
</tr>
<tr>
<td>Philippines</td>
<td>6-year Doctorate Degree</td>
<td>Private institutions</td>
<td>Yes</td>
</tr>
<tr>
<td>Japan</td>
<td>4-year Bachelor Degree</td>
<td>Private institutions</td>
<td>No</td>
</tr>
<tr>
<td>Korea</td>
<td>4-year Bachelor Degree</td>
<td>Private institutions</td>
<td>Yes</td>
</tr>
<tr>
<td>Malaysia</td>
<td>4-year Bachelor Degree</td>
<td>State funded universities &amp; private institutions</td>
<td>Yes</td>
</tr>
<tr>
<td>Singapore</td>
<td>3-year Diploma 2-year top-up to Bachelor Degree</td>
<td>State funded institution</td>
<td>Yes</td>
</tr>
<tr>
<td>Indonesia</td>
<td>3-year Diploma</td>
<td>Private institution</td>
<td>Yes</td>
</tr>
<tr>
<td>Thailand</td>
<td>4-year Doctorate Degree</td>
<td>State funded university</td>
<td>No</td>
</tr>
</tbody>
</table>

Conclusion

Optometry in Asia faces many problems as a result of cultural, social or historical circumstances. However, it can fully mature and develop through international co-operation for assistance and access to advanced resources and skills, experience and knowledge. In addition, more extensive establishments of professional associations and educational courses, as well as the passage of registration laws need to occur for optometry to achieve a level of sound professionalism leading to success in eye care in the region.
Study Questions

1. What are the major setbacks of optometry education in Asia?
2. How does the profession vary across the region?
3. Name the countries where optometry is legalised and not legalised.
4. What are the advantages of the certification of the profession?
5. What roles do professional associations play?
6. List the causes of blindness in third-world countries in Asia?
7. Additionally, what are the emerging causes of blindness in industrialized countries in Asia?
8. What are the issues surrounding cataract blindness?
9. Explain the barriers of blindness prevention.
10. Describe the distribution of eye care providers in Asia
11. How can optometry in Asia accelerate the process of its development?
12. What does the successful evolutionary process of optometry entail?
13. On what principles could models of eye care delivery systems be developed and sustained?

Take Home Conclusions

- Strategies for successful eye care
  - Development of an integrated approach for disease control.
  - Human resource development including infrastructure and technology.
  - Establishing partnership among countries, collaborating centres, professional organizations, financial institutions, non-government development organizations and WHO to mobilize additional resources.
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Optometry in Asia by Thai and Yap

Answers to Study Questions

1. What are the major setbacks of optometry education in Asia?
   a. Lacks uniformity
   b. Ranges from Diploma, to a Bachelor’s Degree to a Doctorate
   c. Limited resources

2. How does the profession vary across the region?
   a. Scope
   b. Legal status
   c. Consumer perception and recognition
   d. Standards of care

3. Name the countries where optometry is legalised and not legalised.
   a. Legalised in:
      i. Philippines

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xiii ICEE. Available at http://www.icee.org/where_we_work2/asia_pacific/cambodia.asp.

ii. Hong Kong
iii. Indonesia
iv. Korea
v. China
vi. Singapore
vii. Malaysia

b. Not legalised in:
   i. Japan
   ii. Taiwan
   iii. Thailand

4. What are the advantages of the certification of the profession?
   a. Disciplinary control
   b. Enhanced standards of care
   c. Acknowledgement of profession
   d. Possible appropriate deployment

5. What roles do professional associations play?
   a. Improve education
   b. Encourage legislative control of practice
   c. Promote eye health awareness

6. List the causes of blindness in third-world countries in Asia?
   a. Cataract
   b. Childhood blindness
   c. Trachoma

7. Additionally, what are the emerging causes of blindness in industrialized countries in Asia?
   a. Refractive error
   b. Glaucoma
   c. Diabetic retinopathy
   d. Age-related macular degeneration
   e. (Non-cataract, age-related vascular and degenerative conditions)

8. What are the issues surrounding cataract blindness?
   a. Most common cause of blindness
   b. Low surgical output
   c. Rapid increasing numbers due to ageing population
   d. Uncorrected aphakia
   e. Poor surgical outcome leading to low surgical uptake

9. Explain the barriers of blindness prevention.
   a. Limited, inadequate and inappropriate use of human resources
   b. Poor geographical spread of care
   c. Non-optimal utilization health facilities
   d. Poor financial allocations

10. Describe the distribution of eye care providers in Asia
    a. 80/20 imbalance
    b. 80% of population live in rural areas
    c. 80% of eye care professionals concentrate in urban areas

11. How can optometry in Asia accelerate the process of its development?
    a. Through international cooperation
    b. Via development of collective resources and skills
c. By gaining more breadth of experience
12. What does the successful evolutionary process of optometry entail?
   a. Recognition of a corporate entity among individual practitioners
   b. Establishment of strong united professional societies
   c. Commencement of educational programmes
   d. Passage of registration laws and legislative regulation
   e. Integration within formal university education
   f. Comprehensive scope of clinical service
   g. Inclusion of services in government programmes
13. On what principles could models of eye care delivery systems be developed and sustained?
   a. Promotive
   b. Preventive
   c. Curative
   d. Rehabilitative and restorative
   e. Services available to all, especially the marginalized and vulnerable
   f. Full utilization of knowledge and technology