**IAPB Refractive Error Program Committee**

**Strategy for**

**The Elimination of**

**Vision Impairment from Uncorrected Refractive Error**

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**SUMMARY**

The Refractive Error Program Committee (REPCom) of the International Agency for the Prevention of Blindness (IAPB) has produced this Strategy to assist any government, public health system, private health system, research institute, non-government organization, health practitioner, lay-person or community who seeks to reduce blindness and vision impairment caused by Uncorrected Refractive Error (URE).

URE is the largest global cause of vision impairment. URE was estimated to impair the distance vision of 153 million people in 2004 (8 million of these people were blind).2 These figures do not include any estimate of near vision impairment. Any type of refractive error, depending on magnitude and other factors, can affect near vision. Presbyopia specifically affects near vision. Uncorrected presbyopia was estimated to impair the near vision of 517 million people in 2005.3

URE may result in lost education and employment opportunities, lower productivity and impaired quality of life.1, 4, 5 As such, refractive care is an integral component of health systems and poverty alleviation efforts.

A meaningful solution involves more than the distribution of 670 million pairs of spectacles. Assessment of individuals who have refractive errors, particularly those aged 45 years or over, provides an opportunity to identify other potentially blinding conditions (such as glaucoma and diabetic retinopathy) before they cause permanent vision loss. Public, private, social entrepreneurship and other models for delivering refractive services all have a role in contributing to empowerment of local communities and sustainability of primary eye care services.

REPCom views the following areas as pivotal to the global effort to eliminate refractive error blindness and vision impairment:

1. **Definitions and Protocols.** Global blindness prevention efforts benefit from using internationally agreed definitions and protocols to guide service delivery and education in areas relevant to the alleviation of refractive blindness and vision impairment.
2. **Consolidating and Updating the Evidence Base.** Overcoming gaps in refractive error knowledge and monitoring progress by prioritizing the following areas:

* Epidemiology (including distance and near vision impairment due to uncorrected refractive error);
* Economics (including the economic burden of URE and the cost-effectiveness of interventions);
* Quality of Life and cost-utility (including identification or development of appropriate tools, and measurement of the impact of refractive correction);
* Coverage (including services and spectacles);
* Techniques and instruments (including VA charts, low-cost auto-refractors, and blur function), and
* Best-practice models (identification of them via measures of efficiency and efficacy, analysis of what makes them good, how to generalize them and replicate their success in other regions).

1. **Service Delivery Systems and Consumer Demand.** Defining strategies for the global elimination of refractive error blindness and vision impairment via:

* Effective screening and refraction examinations;
* Availability of affordable spectacle correction for individuals who have refractive error blindness or vision impairment;
* Visual health promotion to build individual and community awareness about refractive error, the benefits of correction and the availability of services;
* Detection and appropriate referral of individuals who have eye or vision problems beyond the scope of the provider’s training, with particular emphasis on conditions prioritized by local eye care plans; and
* Eye health promotion that achieves community education (aimed at engaging individuals, families and communities who have uncorrected refractive error), service improvements (aimed at practitioners to enable increased quality and quantity of services), and advocacy (aimed at funders and legislators who can facilitate growth of services).

1. **Human Resources.** Recommendations for training needs and competencies of the cadres who will do the work of eliminating refractive error blindness and vision impairment.
2. **Infrastructure, Technology and Global Supply Strategies.** Requirements, suggestions and guidelines in the following areas:

* Refraction service requirements at primary, secondary and tertiary levels;
* Technology for refractive devices, spectacles, and optical dispensing laboratories;
* Enable NGOs and governments to organize efficient and cost-effective manufacture, delivery and supply of services and spectacles to people and areas carrying the largest burden of refractive error blindness and vision impairment.

1. **Integration of Refractive Services into National Blindness Prevention Plans.** Identifying strategies for integrating refractive services into national and regional plans, ways to develop and share the tools needed to eliminate refractive error vision impairment, and identify potential vehicles for implementation.

**1 DEFINITIONS AND PROTOCOLS**

**1.1** **Glossary of Terms**

AMD Age-related Macular Degeneration

APEDS Andhra Pradesh Eye Disease Study

BMES Blue Mountains Eye Study

CBMI Christian Blind Mission International

DALY Disability Adjusted Life Year

DCEC District Comprehensive Eye Care

ETDRS Early Treatment of Diabetic Retinopathy Study

GRC Global Resource Centre

HR QoL Health Related Quality of Life

IAPB International Agency for the Prevention of Blindness

ICEE International Centre for Eyecare Education

IVI Impact of Visual Impairment

KAP Knowledge Attitude Practice

logMAR logarithm of Minimum Angle of Resolution (a unit for specifying VA)

LVPEI LV Prasad Eye Institute

MLOP Mid-Level Ophthalmic Personnel

NGO Non-Government Organisation

NVR QoL Near Vision Related Quality of Life

QALY Quality Adjusted Life Year

QoL Quality of Life

RMS Ready-Made Spectacles

SSI Sight Savers International

NEI National Eye Institute (of the National Institutes of Health, USA)

RAAB Rapid Assessment of Avoidable Blindness

REPCom Refractive Error Program Committee

RESC Refractive Error Studies in Children

URE Uncorrected Refractive Error

VA Visual Acuity

VC Vision Centre

VFQ Visual Function Questionnaire

VI Vision Impairment

VOSH Volunteer Optometric Services to Humanity

WCO World Council of Optometry

WHO World Health Organization

**1.2** **Definitions of Vision, Visual Acuity, Vision Impairment and Blindness**

The ongoing process of terminology standardization has lead to some inconsistencies between published literature and governing bodies such as the WHO. As at August 2008, the following definitions are recommended. They are based on World Health Organization policy, published evidence, REPCom consensus, or a combination of these where conflicting definitions exist. They highlight or expand on previously published definitions directly relevant to refractive care. It is noteworthy that future developments may include linking functional status to visual acuity (VA).

***Unaided Vision:*** VA without optical correction.6

***Presenting Vision:*** VA with habitual optical correction.2, 7

(For a person who does not use spectacles, presenting and uncorrected VAs are always the same)

***Best-corrected VA:*** VA with optimal spectacle correction in place.2

***Moderate Vision Impairment*:** Presenting vision worse than 6/18 but equal to or better than 6/60 in the better eye.2, 8

***Severe Vision Impairment*:** Presenting vision worse than 6/60 but equal to or better than 3/60 in the better eye.2, 8

***Blindness*:** Presenting vision worse than 3/60 in the better eye.2, 7-9

***Vision[[1]](#footnote-1) Impairment (VI)*:** Presenting vision worse than 6/18 in the better eye.2, 8, 9

(Additionally, a consensus of the Refractive Error Working Group of the World Health Organization (informal meeting in Geneva, 3 – 5 July 2000) suggested lowering the cutoff to 6/12 in the better eye for children younger than 16 years of age)1

***Low Vision*:** VA worse than 6/18 but better than or equal to light perception in the better eye, or a binocular visual field of less than 10 degree from the point of fixation after standard treatments (including best available optical correction).7, 8, 10

(*Low Vision* implies VI even after management of any treatable conditions (e.g. correction of refractive error, or cataract surgery), but that the person has potential to use vision for planning and/or execution of a task)

***Blindness at near:*** Presenting vision at the individual’s required working distance that is worse than N64 in the better eye (this print size held at 40cm provides the same angular subtense as distance VA of 3/60. (REPCom consensus)

(A future change could be driven by research advocated in Section 2.5 – changing to a near acuity corresponding to a basic functional need such as ability to identify faces)

***Vision impairment at near:*** Presenting vision at the individual’s required working distance worse than N8 in the better eye. (REPCom consensus)

(REPCom suggests object size at preferred working distance as a more logical definition than angular subtense at a set 40cm for near. Furthermore, N8 is a common newspaper print size across the world, which although only equivalent to 0.4 (6/15) rather than 0.5 logMAR (6/18) when held at 40cm, makes it a more practical choice. This is also consistent with a report that quality of life is more sensitive to near VI than distance VI.11)

Some countries have different cutoff values (e.g. blindness defined around 6/60 rather than 3/60), which exist for scientific, historical, legal and/or social reasons. We do not advocate changing regional, national or local definitions. However we do advocate collection of both data types so that global patterns can be observed. For example, a blindness prevalence study could find that “Country-defined blindness prevalence was x%, while WHO-defined blindness prevalence was y%”.

Given variations in units used to define VA in different jurisdictions, a conversion table is provided in **Annex 1**.

It should also be noted that vision impairment and blindness definitions are not necessarily advocated as cutoffs that determine spectacle wear versus non-spectacle wear. Ideally there would be an objective measure of the impact of URE on broad visual function (the sum of the effect on a variety of tasks which combine to describe the overall effect of URE on an individual’s life in a way that a simple VA measure does not). Since this ideal functional vision impairment measure does not exist, vision impairment and blindness cutoffs are the best available way to estimate the epidemiology of the more severe effects of URE. Vision impairment cutoff could be used as a guide for prescribing spectacles in places of limited resources. In contrast, patient/client choice should be the deciding factor in user-pays systems. A variety of compromises can be applied in adequately resourced, subsidized systems. Treatment Guidelines are provided in Section 1.5.

**1.3** **Cadres Involved in Refractive Care**

A variety of cadres provide refractive care across jurisdictions, and often there is a cross-over of responsibility within jurisdictions. It is worth noting that although conflict exists between some cadres in some jurisdictions, the magnitude of the problem of URE means that there is more refractive care required in the world than can be provided by all current carers put together. The following provides a basic definition of some cadres providing refractive care.

* **Optometrists** have a range of responsibilities in different jurisdictions, although refraction and detection of eye disease is common to all. Optometrists are usually university trained for 4 or more years, and work in public, private and NGO settings. Associated ophthalmic dispensers or spectacle technicians often supply spectacles after an optometrist has refracted a patient/client.
* **Ophthalmologists** can theoretically refract in all jurisdictions, although their workload of other eye care duties means that in practice refractive care is more commonly provided by associated MLOP.
* **Mid-Level Ophthalmic Personnel including vision technicians, ophthalmic assistants, orthoptists, ophthalmic nurses and others** most commonly provide refractive care in association with an ophthalmologist, but work independently in some jurisdictions. They sometimes provide complete refractive care (refraction and spectacle dispensing), but often only refract and provide an optical prescription which a patient/client must fill at a private optician to complete their refractive care.
* **Opticians** refract in some jurisdictions, but more commonly supply spectacles made to an optical prescription supplied by a client from an optometrist, an ophthalmologist or MLOP. Opticians usually work in for-profit situations.
* **Ophthalmic dispensers and spectacle technicians** are responsible for a variety of tasks centered on constructing and dispensing spectacles. Training is usually done on-the-job and/or short-course.

Governments should give due consideration to appropriate registration of cadres involved in refractive care. Government health care systems should make appropriate use of each of the available cadres.

**1.4** **Instrumentation, Techniques and Measurement Methods for Refractive Care**

The following provides a general guide to the instrumentation, techniques and measurement methods of refractive services. It is not meant as a complete guide to all possibilities or to provide textbook level of detail.

* **VA charts** (for both distance and near assessment) should have logMAR or ETDRS format.8 The difference between successive lines on a chart of this format is equivalent regardless of position on the chart – a requirement for the Standardized Treatment Guidelines provided in Section 1.3.

**Appropriate optotypes** should be available. Snellen Letters of the Latin alphabet are not adequate where a different alphabet is used, pre-literate children are to be assessed, or there is significant non-literacy in the community. The aims for alternative optotypes should include testability with the population to be assessed, equal visibility of the symbols used, adaptability to verbal and non-verbal (e.g. pointing) responses, and published validation research.

* + Examples of non-Snellen optotypes include Arabic numbers, Lea Symbols (sometimes called LH Symbols, designed by Lea Hyvärinen), Landolt C’s and Tumbling E’s
  + HOTV charts have also been validated as a matching task that works for pre-literate children12
  + Lea Symbols have superior testability in under 5 year olds13, 14
  + Differential visibility of the Tumbling E’s vertical options (up or down) compared to its horizontal options (left or right) effectively makes it a 2 alternative forced choice task at threshold (rather than 4 alternative for Lea Symbols or HOTV tasks), however validity appears uncompromised for adult patients15
  + Tumbling E’s are generally regarded as the most recognised non-literate VA task in the world and gain some level of testability from this

Printed charts are adequate, but should:

* + Have at least 80% contrast between the black letters and the white background8
  + Avoid edge-of-character pixilation
  + Avoid surface reflections
  + Be adequately illuminated (between 80 and 160 cd/m2, or standard indoor illumination)8
* Distance VA should be measured three times; first with **Both Eyes**, then with the **Right Eye** (with the left eye adequately occluded), then with the **Left Eye** (with the right eye adequately occluded).
  + Adequate occlusion means using the palm of the patient’s hand rested gently on bones surrounding the eye on all sides, or a blank card of sufficient size, or an effective custom-made occluder. It does not include winking, resting fingers against a closed eye, or holding fingers in front of the eye to be occluded.
* A comparison of **refractive techniques** is provided in Section 5.1.
  + Cadres performing refractions should be able to reliably perform at least one objective refraction technique (e.g. retinoscopy, autorefraction), and have access to necessary equipment (e.g. retinoscope, trial lens set and trial frame, or autorefractor).
  + Ability to perform reliable subjective refractions is also important.
  + Ability to determine near addition for correction of presbyopia (via near retinoscopy, subjective response or another reliable method) is essential.

**1.5** **Standardized Treatment Guidelines**

Wherever resources permit, refractive care should be provided on an individual needs basis. Some individuals have high acuity needs and will be profoundly impaired in their activities of daily living by small amounts of URE. Other individuals have little or no need for fine visual acuity tasks and cope well with large amounts of URE. However, where resources are limited it is useful to objectively prioritize the people most in need of refractive care. The following **Indications for Correction** provide a way to objectively prioritize refractive care in situations of limited resources, but should not override individual needs where resources permit.

**Indications for Correction** are based on vision and VI definitions in Section 1.1. Treatment Guidelines are based on a combination of symptoms, the magnitude of refractive error, presenting distance & near vision, best-corrected distance & near vision, & other related ophthalmic factors. Decision pathways for the following Treatment Guideline descriptions are provided in **Annex 2**:

* **Correction for myopia** is indicated if an appropriate refractive technique (e.g. retinoscopy) indicates significant myopia\*, PLUS one or more of the following:
* A patient reports difficulty with distance vision,[[2]](#footnote-2)
* Minus powered lenses improve vision by 2 logMAR VA lines or more.

\* The Refractive Error Working Group of the World Health Organization (informal meeting in Geneva, 3 – 5 July 2000) suggested “significant myopia” was -0.50DS or more for children, or -1.00DS or more for adults.1 Alternatively, any amount of myopia combined with BOTH dot points could also be considered an indication for correction.

* **Correction for hypermetropia** is indicated if an appropriate refractive technique (e.g. retinoscopy) indicates significant hypermetropia\*\*, PLUS one or more of the following:
* A patient reports difficulty with (far or near) vision, discomfort with concentrated visual effort, and/or an esotropia,ii
* Plus powered lenses improve vision by 2 logMAR VA lines or more, and/or noticeably improve comfort,
* There is amblyopia (and the patient’s age suggests the amblyopia is potentially treatable), or esotropia or large esophoria (and the patient has some potential for normal binocularity).

\*\* The Refractive Error Working Group of the World Health Organization (informal meeting in Geneva, 3 – 5 July 2000) suggested “significant hypermetropia” was +2.00DS or more at any age.1 Alternatively, any amount of hypermetropia combined with TWO OR MORE dot points could also be considered an indication for correction.

* **Correction for astigmatism** is indicated if an appropriate refractive technique (e.g. retinoscopy) indicates significant astigmatism\*\*\*, PLUS one or more of the following:
* A patient reports difficulty with vision, and/or discomfort,ii
* Cylindrical lenses improve vision by 2 logMAR VA lines or more, and/or noticeably improve comfort,
* There is a suggestion of amblyopia (and the patient’s age suggests the amblyopia is potentially treatable).

\*\*\* The Refractive Error Working Group of the World Health Organization (informal meeting in Geneva, 3 – 5 July 2000) suggested “significant astigmatism” was more than 0.75DC.1 Alternatively, any amount of astigmatism combined with TWO OR MORE dot points is also an indication for correction.

* **Correction for anisometropia** is indicated if an appropriate refractive technique (e.g. retinoscopy) indicates significant anisometropia#, PLUS one or more of the following:
* A patient reports difficulty with vision, and/or discomfort,ii
* Correctly-balanced lenses improve vision of the worse eye by 2 logMAR VA lines or more, and/or noticeably improve comfort,
* There is a suggestion of amblyopia (and the patient’s age suggests the amblyopia is potentially treatable).

# The Refractive Error Working Group of the World Health Organization (informal meeting in Geneva, 3 – 5 July 2000) suggested “significant anisometropia” was more than 0.50D.1 Alternatively, any amount of anisometropia combined with TWO OR MORE dot points is also an indication for correction.

* **Correction for presbyopia** is indicated if an appropriate refractive technique (e.g. retinoscopy) indicates distance refractive error has been corrected, PLUS two or more of the following:
* A patient reports difficulty with near vision, and/or discomfort,i
* Plus powered lenses improve near vision by 2 letter sizes (on a logMAR formatted near chart) at preferred working distance or more,
* Plus lenses for near vision noticeably improve vision and/or comfort.

**Methods for Correction** of refractive blindness and VI include spectacles (ready-made and custom-made), contact lenses and refractive surgery. Appropriate use of each is discussed in Sections 5.2 and 5.3.

**Review Schedules** for refractive care should consider a predicted rate of change in refractive status, the need to review complications of refractive correction (particularly if using contact lenses or refractive surgery), the predicted rate of change of amblyopia or strabismus, and the need to replace worn-out spectacles. Rate of refractive status change will depend on patient factors such as age, specific refractive error history, and associated factors (such as strabismus, amblyopia or cataract). Symptom changes or recurrence in a specific patient obviously should override average review schedules. Complications of correction will depend on the correction method used (spectacles, contact lenses or surgery). Organization of spectacle supply systems requires a judgment of the time until the average person requires spectacle replacement even in the absence of refractive change. It is reasonable (REPCom consensus) to expect spectacles to last children for 1 year and adults for 3 years (2 years if they are engaged in manual labor).

**2 CONSOLIDATE AND UPDATE THE EVIDENCE BASE**

**2.1 EPIDEMIOLOGY**

**Current Situation**

* The WHO global prevalence estimate of distance VI due to URE is 153 million people2
* Recent evidence for global prevalence of near VI due to URE is 517 million people3
* The IAPB Vision 2020 Action Plan 2006 – 2011 recommends repeating prevalence estimates in key areas at approximately 5 year intervals to measure program outcomes.

**Recommended Research Protocols**

Accurate data from studies employing rigorous epidemiological protocols, such as the WHO/ NEI “Refractive Errors Study in Children” (RESC) or the WHO “Assessment of the prevalence and socio-economic burden of near vision impairment caused by uncorrected presbyopia”, are desirable. REPCom recognizes, however, that the skills and resources required to conduct such demanding studies may exceed the resources available in some countries. The RESC protocols with acceptable adaptations are as follows:

* Randomly select approximately 30 clusters across a region, assess around 200 people fitting inclusion criteria in each cluster (i.e. about 6000 people in total);
* Measure distance presenting vision, uncorrected vision and best-corrected VA using an appropriate chart;
* Measure near presenting vision, uncorrected vision and best-corrected nVA using an appropriate chart at the individual’s preferred working distance (record the distance);
* Assess binocular vision with cover test at 0.5 and 3.0 m;
* If unaided VA is less than or equal to 6/12, perform retinoscopy, subjective refraction and/or auto-refraction (depending on situation/ available skills/ equipment); and/or cycloplegia using cyclopentolate 1% for retinoscopy and/or autorefraction;
* Assess ocular health using loupe, biomicroscope, direct ophthalmoscope, contact or non-contact indirect lens methods and/or binocular indirect ophthalmoscope (depending on situation/ available skills/ equipment).

In further recognition of limited resources, rapid assessment protocols can be considered where necessary. Formats based on the existing Rapid Assessment of Cataract Surgical Services (RACSS) or Rapid Assessment of Avoidable Blindness (RAAB) provide efficient epidemiological evidence of acceptable accuracy. Rapid assessment of refractive blindness and VI could be conducted separately or as part of comprehensive, national “**Rapid Assessment of Eye Care Needs and Services**”.[[3]](#footnote-3) Rapid assessment protocols allow epidemiology researchers to:

* Reduce the sample by 75% to approximately 1500 (exact calculations of sample size depend on variables such as expected prevalence, but as an example, a refractive error study in Timor Leste used 50 clusters of 30 people)32
* Use school-based rather than population-based sampling where 95% or more of the children attend school;
* Use VA measures and refraction as above, but decrease the quality assurance measures (do not aim to do retinoscopy AND subjective refractive AND auto-refraction with AND without cycloplegia);
* Eliminate non-essential clinical measurements (such as cover testing).

**Recommended Action**

* Prevalence of VI due to URE studies should be performed in enough key locations to enable updated global estimates in 2015 and 2020.

**2.2 HEALTH ECONOMICS**

**Current Situation**

* An estimate of global economic productivity loss associated with the existing burden of distance URE has been accepted for publication (Smith, Frick, Holden, Fricke and Naidoo, 2009, Bull WHO).
* Isolated estimates of the cost of providing an eye examination that includes refraction plus spectacle dispensing have been published.16 There is no published global analysis of the cost of providing refractive care.
* There is one published abstract and no papers defining the cost per QALY gained by providing refractive care.17

**Recommended Research Protocols**

Measurements of **Cost per QALY** ($/QALY) and/or **Cost per** DALY ($/DALY) would be useful for demonstrating cost effectiveness of providing refractive care, as it allows comparison between diverse interventional treatments (e.g. optical correction vs. heart surgery vs. hip surgery vs. methods to prevent Motor Vehicle Accidents). Scale and examples include:

* Treatments costing more than 100,000USD/QALY are NOT considered cost-effective, whereas treatments costing less than 20,000USD/QALY are generally considered acceptable.18
* Cost-utility of cataract surgery depends on where the surgery is performed (surgical costs vary), how the benefit is assessed (cost discounting and QALY gain), and on the duration of the assumed benefit. Cost-utility values for first eye cataract surgery varied from 9 – 1,600USD/ QALY in developing countries.19
* Cost-utility of cataract surgery averaged 2,020USD/QALY for the first eye, and 2,727USD/QALY for the second eye in the USA.19-21
* Cost utility of adult strabismus surgery is 1,632USD/QALY in the USA.
* Cost utility of adult penetrating keratoplasty for bilateral corneal disease (average pre-surgical VA of 6/48) is $11,557/QALY considered over 10 years post-surgery with allowances for graft survival and discounting.22

**Recommended Action**

* A global analysis of the cost of providing refractive care should be performed.
* $/QALY and/or $/DALY for refractive care in representative communities should be measured to demonstrate cost-effectiveness to the public health community.

**2.3 QUALITY OF LIFE AND COST-UTILITY**

**Current Situation**

* Many Quality of Life (QoL) and Cost-Utility measurement tools exist but none is ideal for measurement of the burden caused by URE. A review of available tools was presented to the February 2008 meeting of REPCom by the International Centre for Eyecare Education and is included in **Annex 3**.
* It is accepted that vision impairment decreases QoL.11, 23-27 It has been further suggested that near vision impairment has a larger impact than distance vision impairment.11
* However, there is contention over the specific effect of URE compared to other causes of VI. Some authors suggest the cause of VI is fundamental to QoL effect,28 others report that self-perception of visual disability is more closely related to visual function (particularly VA) than to eye disease.29
* A recent study showed a cause-effect relationship between correcting previously URE, and improved QoL and decreased symptoms of depression in nursing home residents in north America.30 Uncorrected presbyopia has also been shown to significantly impact on the QoL of rural east Africans.27

**Recommended Research Protocols**

REPCom recommends the following research opportunities:

* Measurement of what people with refractive corrections (for distance or near) in developed countries think their life would be like if they didn’t have their refractive corrections
  + Using a “Perceived QoL” (use either the NEI-VFQ or the IVI, plus the SF-12), and
  + Using a time trade-off QALY.
* Measurement of how people with URE (distance and/or near) in the developing world perceive their quality of life
  + Using adaptations of the NVR QoL, or IND-VFQ, or preferably design a completely new instrument from the ground up, and
  + Monitoring change over time (take a measurement at detection of URE, then repeat after 1 – 3 months of correction).

**Recommended Action**

* Better tools should be developed to measure the QoL and Cost-Utility effect of URE (distance and near).
* QoL, utility value and/or disability weight change should be measured for people receiving refractive error corrections for the first time, using appropriate tools.

**2.4 TREATMENT COVERAGE, UPTAKE AND COMPLIANCE**

**Current Situation**

* Scattered estimates of spectacle coverage have been published (including Pakistan, Banglasesh and Timor Leste).31-33
* Scattered studies of spectacle uptake (including the reasons behind it, e.g. cost, perception of need, lack of access) and spectacle compliance (including the reasons behind it, e.g. social acceptance, comfort, cosmesis, and a perception that spectacles would cause vision to deteriorate) have been published.34-36, 83

**Recommended Research Protocols**

REPCom recommends measurement of spectacle coverage for both distance and near vision in a range of communities.

* **Spectacle coverage (%)** = 100\* (met refractive error need) / ([met refractive error need] + [unmet refractive error need]).
  + “Met need” is defined as a person who has refractive error and/or presbyopia AND has spectacles that allow vision to be better than or equal to 6/18 at far and/or better than or equal to N8 at near
  + “Unmet need” is defined as a person who has presenting distance vision worse than 6/18 and/or near vision worse than N8 due to refractive error (either uncorrected or under-corrected)
  + Measurements around alternative cutoffs can be recorded in addition to 6/18 and N8 if desired. It would be logical to base alternative cutoffs on VA levels of local significance, e.g. driving license standards. Shah et al provide a specific example from Pakistan.33

**Recommended Action**

* Spectacle coverage data should be collected whenever prevalence studies are performed (including within rapid assessment protocols).
* Spectacle uptake and compliance data should be collected from representative service delivery programs.

**2.5 TECHNIQUES AND INSTRUMENTS**

**Current Situation**

* There is broad agreement that VA charts should have a logMAR (or ETDRS) format.8 Non-literate charts are more adaptable to different situations. Tumbling E, Landolt C, HOTV, number and Lea Symbol charts are examples of non-literate charts that appear to have similar performance for people aged over 5 years. Lea Symbol charts appear to have superior performance on children under 5 years of age.13, 14 Tumbling E charts are the most recognizable and widely used non-literate charts in the world.15
* Retinoscopy with trial frame and trial lenses are recommended for accuracy and adaptability, however cost and training requirements are high. Some handheld auto-refractors are promising,37 although there are concerns over cost, robustness and control of accommodation in children.38 Lower-cost alternatives are currently unproven.
* Ready-made spectacles are a cost effective option but should only be considered where resources (financial, human, equipment, supplies) do not permit custom-made spectacles. Ready-made spectacles appear adequate for many people in many situations,39, 40 however custom-made spectacles offer superior optical quality, better comfort and opportunities for local enterprise (rather than overseas import). The appropriateness of ready-made spectacles in some regions (such as Central Asia where high astigmatism appears common) is unknown. The efficacy of low-cost semi-customized spectacle options such as universal or modular spectacles is unproven.
* There is no proven alternative to drug-based cycloplegia for controlling accommodation in children, however access to and use of cycloplegic drugs is difficult for refractionists in many areas.

**Recommended Research Protocols**

VA charts:

* Compare published performance of Tumbling E, HOTV, number and Lea Symbol charts in both screening and acuity formats

Refraction devices:

* Compare performance for low-cost auto-refractors, blur function with trial lenses, blur function with focometer and mobile phoropters, with particular attention to control of accommodation in children

Spectacles:

* Determine the extent to which readymade spectacles can meet refractive error needs in diverse populations (including consideration of different age groups and different ethnic groups), with consideration of population acceptability, quality standards, supply strategies, efficient methods of determining inventory/ stock needs, and comparison to custom-made spectacles.
* Investigate low-cost semi-customized options such as universal spectacles

Accommodation control in children during refraction:

* Investigate alternatives to drug-based cycloplegia in children.

Determination of a visual acuity correlate of basic visual function that could serve as a cutoff for near-vision blindness (defined in Section 1.1):

* Investigate print size (e.g. N64 – equivalent to 3/60 when held at 40cm) that might correlate with a functional cutoff (e.g. facial recognition).

**Recommended Action**

* Research and develop locally manufactured, locally affordable instruments that are technically appropriate for an area (with consideration of robustness, maintenance, electricity supply, etc), followed by the promotion and use of the most appropriate instruments.
* Research and develop refraction techniques that are practical for different areas (there is a specific need for an alternative to drug-based cycloplegia for controlling accommodation in children).

**2.6 BEST-PRACTICE MODELS**

**Current Situation**

* There are few published descriptions outside the OECD, Pakistan and India of who currently performs refractions and what they achieve in terms of solving URE in their community
* The published descriptions of the successes and failures of spectacle distribution systems suggest that:
* Recycled spectacles perform poorly when total costs are summed and social acceptability is taken into account41
* A large percentage of refractive VI can be corrected using low-cost ready-made spectacles, or an abridged custom spectacle supply42
* There are few published descriptions of community attitudes to seeking refractive care, although those that have been published suggest that cost, poverty, convenience, accessibility, perceptions of the care available, peer-pressure, and culture are major barriers to seeking care.34, 43, 44

**Recommended Research Protocols**

Assess available Service Delivery Models (Section 3.1 provides examples), make recommendations on the most efficacious and efficient for eliminating refractive error blindness and vision impairment, or encourage the development of better models.

* Suggested criteria are for assessing models include simplicity, cost effectiveness, accessibility versus barriers to access, compliance with practice standards

Assess available spectacle distribution systems in different populations and circumstances to allow recommendations that adapt to circumstance:

KAP (Knowledge, Attitude, Practices) analyses should be performed wherever services exist but access is poor.45 Amongst other things, determine:

* Why people do/don’t access refractive care
* Why people (with VI from URE) do/don’t wear glasses
* Client/ household ability to pay for services and spectacles
* Strategies to address resistance to the introduction of new cadres of personnel

**Recommended Action**

Evaluate service delivery models and spectacle distribution systems, plus perform KAP analyses to enable services and eye health promotions to target communities in need.

**3 SERVICE DELIVERY SYSTEMS, ADVOCACY AND CONSUMER DEMAND**

**3.1 DELIVERY OF REFRACTIVE CARE**

Refractive care is an essential part of eyecare, but there are a variety of ways in which it can be provided. Matching an appropriate refractive care option to community needs and characteristics is an essential part of designing a successful eyecare system. For example, a refractive care option that functions well in London may not be appropriate for a remote island of Vanuatu or vice versa. In addition to matching community needs and characteristics, it is preferable for refractive care to be designed as part of national, coordinated eye care plans, rather than sporadic, isolated activities.

A selection of options, including their defining points, strengths and weaknesses (particularly their ability to integrate with other eye and health services), examples of the approach in action, community characteristics that would make the model specifically applicable, and steps involved in establishing the system, are provided below. Information relating to human resources, equipment and levels of service can be found in relevant sections. The strengths and weaknesses of the refractive care models across important facets of eye care are also shown in the table of **Annex 4**.

**Hospital-based Refraction Clinics**

* Refraction Clinics in District, Regional or National Hospitals provide 50% of refractive care in the developing world. Uses mid-level personnel (1 – 2 year trained refractionists) to deliver refractions in public hospitals – examples in Sri Lanka, Tanzania, Cambodia and countries of the Western Pacific do not supply spectacles (they only provide refractions)
* Strengths: established cadres, established systems, short training time (achieved because these practitioners do not have to practice independently) provides efficient development of HR, this is the community expectation for refraction in many places.
* Weaknesses: providing a service in a hospital that can adequately be provided in a community setting is inefficient; there is a disconnect between the community and the refractive care (it is worth noting that most people with refractive errors don’t consider themselves to be sick, so attending a hospital can be counter-intuitive); many hospitals do not supply spectacles, so there is further disconnect between being refracted and obtaining appropriate spectacles; reliance on external supply of spectacles often means the effort to refract is wasted; lack of career path for cadres involved; multi-tasking (when this role is filled by nurses and others with general training, their energy can be directed by management into other tasks).

**Multi-Level Pyramid Models**

* The LV Prasad Eye Institute Model (<http://www.lvpei.org/>) forms a pyramid with Vision Guardians at the base (providing basic eye care services to 5,000 people at the village level), then Vision Technicians (providing primary eye care to 50,000 people from within Vision Centres), then secondary eye care being provided to up to 1 million people from within Service Centres, then tertiary eye care being provided to up to 5 million people from within Training Centres, and finally a Centre of Excellence at the top of the pyramid covering a population of 50 million people.46
* The Aravind Model (<http://www.aravind.org/>) is another example with tertiary hospitals, community hospitals, managed care hospitals and community outreach.
* District health models used by many government health systems essentially provide multi-level eyecare, although some government systems lack the linkages between levels that are a strong feature of the LVPEI and Aravind Models.
* Strengths: recognizes the need for eye care to reach into communities; recognizes and accounts for lack of private services in poor, rural areas; structured method for allowing tasks to be divided amongst the available workforce (facilitates sustainability by ensuring that most of the community are cared for by cadres with short educations while the relatively few individuals capable of high-end tasks have time to deliver them); fully integrated between levels.
* Weaknesses: best-suited to densely populated areas such as parts of India (although it appears adaptable to moderately populated areas in Latin America (VERAS Project in El Salvador – unpublished), there is less evidence for adaptability to more sparsely populated and disparate areas such as parts of the Western Pacific); better linkages achieved in private and NGO management structures than in government systems.

**Free-market approach**

* Facilitate sale of spectacles as a commercial enterprise. This approach has lead to the availability of spectacles, particularly “magnifiers” for correcting presbyopia, in markets, pharmacies, book stores and on-line without prior refraction in some jurisdictions.
* Strengths: potential for fast roll-out, extended reach and extremely low cost by negating any HR needs or production capacity within communities.
* Weaknesses: prices set by market rather than regulated for affordability/ equitable access, unlikely to serve people with less common refractive errors (large amounts of anything, and even moderate amounts of astigmatism or anisometropia), unlikely to identify non-refractive eye conditions, unlikely to self-regulate for quality, unlikely to distribute throughout a country in a way capable of serving lower socio-economic or rural/remote populations.

**Developed Economy Approach**

* Optometry and ophthalmology provide essentially all refractive care in Europe, South Africa, Australia, New Zealand and North America (e.g. <http://www.optometrists.asn.au/>). Less established variations are used in other African countries, some Asian countries and some Latin American countries. Division of responsibility within the eye care system varies between jurisdictions. Division of responsibility between public and private (with and without insurance) varies between jurisdictions.
* Strengths: high quality care with good mainstream community access (provided that training and HR management are adequate).
* Weaknesses: requires significant and long-term investment in HR, significant infrastructure setup costs (although capable of self-sustainable function once capital investments are made), marginalized minority communities tend to have poor access (e.g. indigenous people, and people with mental health and/or substance abuse issues).

**NSW ICEE Aboriginal Eye Clinic Model**

* Adaptation of Developed Economy Approach to enable community control of primary eye care – agreements between a marginalized community and a central NGO delivers subsidized, professional-level eye care practitioners to community controlled environments.47
* Strengths: increases access to high quality eye care for marginalized minority communities.
* Weaknesses: adds an extra layer of complexity to the eye care system that could allow loss to follow-up, increases the training required to have a fully-functioning system, more resource intensive, requires subsidization from outside the community being served.

**Social Entrepreneur Model**

* Franchise and micro-consignment systems, such as those run by VisionSpring (formerly Scojo Foundation) in Latin America and Asia ((<http://www.visionspring.org/>)
* Strengths: ability to achieve fast roll-out and extended reach into communities, adaptable to varying levels of vision education for the social entrepreneurs, local capacity building/ job creation
* Weaknesses: unlikely to identify non-refractive eye conditions or refer appropriately (when used for both service delivery and appliance delivery), quality control depends on the strength of the links between different levels of the system

**Vision Centre Model**

* Adaptation of LVPEI Model with a specific focus on primary-level care including refractive care, and independent sustainability of primary eye care facilities. Examples include the **ICEE Vision Centre Model** (detailed in **Annex 5**) which has been implemented in Sri Lanka and Papua New Guinea, specifically adapts systems to facilitate delivery of low-cost spectacles, and can be adapted to include a social entrepreneurship component to assist sustainability where appropriate. The **Optical Centre Model of West Africa** integrates refractive care (including spectacle dispensing) and low vision into primary eye care centres.50
* Strengths: the focus on primary level care that includes refractive care ensures that these aspects are available within communities and are not lost amongst other services; social entrepreneurship component aids sustainability and adaptability of services, and availability of spectacles
* Weaknesses: efforts are required to integrate these Vision Centres with existing services, and ensure referrals reach the appropriate place with the appropriate urgency

**Outreach Model – Domestic and International variants**

* The Domestic Outreach Model uses refractionists trained within the country to provide all non-hospital refraction services in temporary school, religious centre or community centre locations (e.g. include the Community Optometry program in Tanzania)
* The International Outreach Model usually utilizes optometrists trained in developed countries to provide visiting services in temporary eye clinics in developing countries (Visiting Optometry Services to Humanity (VOSH), OptoNews Africa (ONA) Network and Vision Aid Overseas provide examples)
* Strengths: these are sometimes the only practically available model for areas where geographic and population density issues prohibit more permanent presence of refractive care
* Weaknesses: poor integration of services (e.g. referrals that can’t or don’t reach their destination), poor sustainability, absence of services between outreach visits, negative/disabling effect on local capacity (communities often prefer to wait for outreach visits as they are externally subsidized and usually free to the patient)48

**Delivery through District Health Systems**

* District Health Systems are generally government-run. Linkages between levels and sustainability of community level clinics have been difficult to maintain in many places. The **District Comprehensive Eye Care (DCEC) Model of Pakistan** provides comprehensive services by including refractive care with other primary eye care at the district level.49
* Strengths: when properly run (e.g. DCEC Model) they are accessible, sustainable, well-linked, efficient and comprehensive (including refractive care at each level of the system)
* Weaknesses: services are often split between levels so that comprehensive care is unavailable at any one level; services can be difficult to access and of poor quality

**Referral Pathways**

Each refractive care option requires establishment of referral pathways to facilitate care of patients who require diagnosis and management outside the skill set of the primary care practitioner.

* Referral pathways between all levels and types of eye care need to be clear, able to be followed by patients (regardless of socio-economic status, geographic location, gender, race, ethnicity or religion), and be consistently followed by practitioners
* Referral criteria depend on the skill set of the practitioner providing refractive care. Examples include:
  + Refer all patients with VI whose VA does not improve with pin hole
  + Refer all patients who have low vision
  + Refer patients as appropriate after diagnosis of eye disease via slit lamp biomicroscopy, indirect fundoscopy and/or other relevant investigations, or when in any doubt.

**Quality Assurance Measures**

It is worth noting that the main reasons for ceasing spectacle wear are poor vision with spectacles, perceived incorrect prescriptions, discomfort and inability to afford replacements.35, 51 This indicates that the quality of refractive services and spectacles should be regulated, and financial accessibility should be mandated. Regulations should include competency standards for refraction personnel (at the end of training, and to encourage maintenance of skills and performance), and spectacle standards.

* The method of regulating competencies will vary between jurisdictions and depending on the cadre providing refractive care. For example, competency of an Australian orthoptist might be assessed by technical proficiency at graduation, whereas a North American optometrist might be assessed on ability to solve refractive, vision and ocular health problems throughout their career via their professional registration body.
  + An example of Competency Standards for optometrists has been published.79
  + An example of Practice Standards expected in Australia has been published.78
* An example of Spectacle Standards is available from Standards Australia.80

**3.2 EDUCATION AND ADVOCACY**

Key audiences to eliminate disabling URE should be challenged. The key audiences, and ways to influence them, include:

* Community education aimed at high-risk groups and their communities
* Community education to raise awareness of refractive error and options for correction
* Use community-based educational programs to overcome common barriers to eye care52
* Reinforce positive attitudes towards the importance of eye care52
  + Advocacy aimed at governments (departments of health, education, finance, customs) and health officials
* Economics arguments and the relationship between Vision 2020 and the Millennium Development Goals should be emphasized to governments53
* An example of economic evidence is that there is a $5 return to the community for every $1 invested in eye care and/or prevention of vision loss54, 55
* Cost recovery through the sale of spectacles is an essential component of sustainability for refractive services (and often the entire spectrum of primary eye care)
  + Professional education for eyecare practitioners
* Continuing professional education to maintain awareness of the magnitude of URE
* Continuing professional development that imparts culturally sensitive and age-appropriate communication and trust-building skills for interactions with different sectors of the community, particularly minorities.52
* Encourage a team approach amongst providers to dealing with URE (particularly integration of URE into broader eye care)
* Continuing professional development that imparts ethics in refractive practice
* Particularly aim at involving private sector refractive care providers in the provision of free/subsidized services to the vulnerable groups
  + Advocacy aimed at corporations in the eye and vision care industry
* Emphasize the epidemiology of preventable vision loss around the world, noting the size of the market that is currently being ignored
  + Advocacy aimed at employers
* Emphasize productivity benefits of refractive corrections for employees
* Encourage eye safety in the workplace
  + Advocacy aimed at local and international non-government organizations
* Emphasize the link between Vision 2020 and the Millennium Development Goals so that the relationship between refractive care and poverty reduction is clear53
* Encourage LNGOs and INGOs to coordinate with each other and integrate any eye care activities within comprehensive National Plans
  + Advocacy aimed at donor agencies and donor communities
* Emphasize both economic and MDG outcomes of improving visual health within a community, as well as the achievability of improvements in the visual health of a community

Overall, education and advocacy regarding refractive error should aim to:

* + Increase knowledge of refractive error
* For the purpose of promoting people’s empowerment to make decisions about seeking care for blurred vision and improve uptake of services56
  + Mobilise resources through government policy shifts, industry investment and changes in community attitude
* For generating economic, industry, political, professional and community support to expand service provision and promotion56
* To provide school eye health programs, legislate vision standards for driving and certain occupations, mandate eye health and safety requirements for certain activities
* To allow cost recovery through spectacle sales so that primary eye care can achieve self-sustainability
* To allow duty-free importation of optical equipment and spectacles, and tax-exemption for spectacle sales
  + Increase the quality of eyecare
* To improve services, patient education and outreach services56
  + Improve linkages between refractive care, other eyecare, and other healthcare
* For clear referral pathways and resource sharing

Vision 2020 has a variety of advocacy resources and projects. These include World Sight Day, a public relations group, Vision 2020 web site, Vision 2020 newsletter; IAPB Regional Business Plans, and coordinated projects with international and professional organizations.

**3.3 BARRIERS FOR HEALTH PROMOTION TO OVERCOME**

Eye health promotion should convey the need for refractive and other eye care, and should be comprehendible regardless of cultural and linguistic background and educational status. Public health promotion campaigns on the benefits of spectacle wear and vision screening campaigns are crucial in ensuring that people are well informed and have access to refractive correction. Campaigns should be coordinated between regional, national and local levels.

Barriers to accessing refractive care include lack of awareness, difficulty accessing services, acceptability of services provided, lack of perceived need, fear (that treatment could worsen or weaken eyes, or fear of the process), gender and social issues, cosmesis, direct treatment costs, transportation costs and/or availability of transport, inability to take time off from family or work responsibilities, lack of somebody to accompany them, social acceptance of treatment (e.g. teasing of children wearing glasses), and fatalism (accepting vision loss as an unavoidable consequence of age, “karma” or “God’s will”).44, 57

It is important to recognize who doesn’t access refractive services at present and analyze why they don’t:

* With the exception of one study in South India,51 females appear less likely to access to eye care and spectacles than males.31, 43, 58-61
* Promotion of refractive services should be gender sensitive, and ensure that specific characteristics of the sociocultural roles of women be considered in order to improve uptake of services among women.43
* People with myopic refractive error appear less likely to be corrected.31, 60 People living in urban areas, who have higher education levels, are literate and who are in paid employment are more likely to utilize available services and wear spectacle correction.31, 51, 58, 60, 62
* Indirect costs of seeking eye care such as transport, time away from responsibilities and escort/carer support are often prohibitive to rural/remote people.43 It is critical for refractive services to recognize indirect burdens and develop strategies to lessen them (e.g. outreach services).
* Perceived cosmesis of spectacles and embarrassment in wearing spectacles may play a part in some populations.44
* Rural south Indians who had noticed vision problems but not sought treatment cited personal (42% of respondants), economic (37%) and social (21%) reasons for not seeking care.
* Poor people are less likely to be corrected.33
* The cost of services and spectacles may require regulating in some areas
* Distribution of services requires attention in some areas

Lack of awareness of eye problems and treatment options does not appear to be the principle barrier to seeking care in most communities. Providers should begin consideration of reasons for attendance/non-attendance from the perspective that the vast majority of people act rationally, but base their decisions on their own principles and evidence.63

* Bad news travels fast, so bad outcomes should be avoided where possible. As an example in refractive care, this may mean avoiding large anisometropic corrections in first presenting adults where amblyopia is unlikely to be treatable and vision gain is likely to be poor compared to cost and discomfort. Frequent spectacle prescription changes at a patient’s expense with minimal improvement of vision are unlikely to be good advertising. It is better to do nothing than to do harm.

**4 HUMAN RESOURCES**

**4.1 PERSONNEL DEVELOPMENT**

The overall objective should be to strengthen and/or develop essential refraction-related services for target populations by training new personnel and/or strengthening the skills of existing personnel in the areas of refraction, spectacle dispensing, spectacle manufacture, spectacle supply and distribution, visual health promotion and program management. These personnel need to be integrated into the existing eye care team and most will contribute to the provision of a comprehensive package of eye care services at primary and secondary level.

HR strategy for refractive care is recommended to involve three levels of care.1 At one extreme this could involve three dedicated cadres of refractive personnel linked to each other and to other eye care services by referral systems. At the other extreme, the three levels of refractive care could be allocated to existing eye care cadres with other responsibilities. Regardless of how an eye care system has evolved or is designed, it is necessary that refractive services receive attention (the scale of the problem of URE dictates this) and that they are integrated with the myriad of existing eye care personnel (for care outcomes and promoting sustainability of primary and secondary eye care systems).1

The core refractive care elements of these three levels of care are summarized below. An example of complete Competency Standards for optometrists has been published.79

**Community (primary level) refractive care**

Community, or primary level, refractive care can be performed full-time by personnel specifically trained in short courses (e.g. eye health workers, vision guardians), or part-time by personnel with broader training who also complete a relevant short course (e.g. community health workers, teachers, nurses). They may have eye health skills not listed here (e.g. ability to detect basic external eye disease such as conjunctivitis), but their refractive skills always include:

* Ability to **screen VA** using standard vision screening cards and pass/fail criteria
* Ability to **re-screen VA with pinhole** and understand that absence of improvement in vision impairment implies an ocular health problem
* Ability to organize and perform community-based **vision screenings**
* Ability to oversee self-selection of **readymade spectacles for near**
* Ability to **counsel**, deal with barriers to uptake, and encourage use and care of spectacles
* Ability to use test results to choose between discharge, readers & discharge, referral to mid-level personnel, or referral to professional personnel

And may additionally include:

* Ability to **re-screen VA with +2.00 DS** binocularly (either using readymade spectacles, lens flippers or trial lenses) and understand that absence of change in VA level implies significant hypermetropia
* Ability to deliver basic vision health promotion
* Ability to manage income from readymade readers

**Mid-level (secondary level) refractive care**

Mid-level, or secondary level, refractive care can be performed full-time by personnel specifically trained in one – three year courses (e.g. vision technicians, optometric/ ophthalmic assistants, ophthalmic technician/ technologist, optometry/ ophthalmic clinical officers), or part-time by personnel with broader training who also complete a relevant year of training (e.g. ophthalmic nurses). If working independently, they should have eye health skills not listed here (e.g. ability to detect blinding eye disease using ophthalmoscopy and/or slit lamp biomicroscopy), but their refractive skills include those for community providers plus:

* Ability to accurately measure logMAR VA
* Ability to use retinoscopy (with cycloplegia as necessary) and subjective refraction to decide an appropriate refractive correction
* Ability to detect strabismus and amblyopia
* Ability to perform community refractive needs assessments, advocate change where needed, increase community awareness of URE, and promote refractive services
* Ability to perform basic low vision protocols
* Ability to use test results to choose between discharge, spectacles & discharge, referral to professional eye care personnel, or referral for education/social welfare services for VI
* Ability to dispense spectacles (single vision and bifocals)
* Ability to supervise community level refractive carers

And may additionally include:

* Ability to manage refractive care systems including basic accounting, inventory control and marketing
* Ability to train community-level and other mid-level personnel
* Ability to participate in research and advocacy

**Professional (tertiary level) refractive care**

Professional, or tertiary level, refractive care is performed full-time by personnel specifically trained in courses of four of more years in length (e.g. optometrists, ophthalmology trainees, ophthalmologists). Personnel performing this level of refractive care should be governed by a registration board, with registration based on measures of competency. They should have eye health skills not listed here (e.g. managing or co-managing glaucoma and/or retinal disease), but their refractive competencies include those for mid-level providers plus:

* Ability to use available tests to manage complex refractive cases such as keratoconus, post-surgical refractive care, and difficult children
* Ability to safely and legally use topical cycloplegic medications for diagnostic purposes
* Ability to distinguish between refractive and non-refractive strabismus and amblyopia, and manage appropriately
* Ability to manage non-strabismic vergence disorders and pre-presbyopic accommodation problems
* Ability to fit and manage contact lenses
* Ability to provide complete low vision services
* Ability to dispense multi-focal spectacles
* Ability to train and supervise mid-level and other professional-level personnel

**4.2 PERSONNEL TRAINING**

Models for provider training should follow a thorough assessment of the local situation. Several approaches to refraction training exist. Assessment should be competency-based. The following are some options:

**Short modules in refraction (1 to 4 weeks)**

This approach has had limited benefits with most programs failing to impart an appropriate level of skill to trainees in a limited timeframe. Many of these cadres add four weeks of refraction training to their programs, but are not primarily serving a refraction role and therefore retention of skills are limited. Attrition in this group is very high and as such this strategy should be discouraged.

* Adjunct to ongoing eyecare training programs

**One year refraction training programs**

This style of program recruits either eye care personnel or non eye care personnel who are then trained over a year to provide refraction and low vision services, management of eye care programs, advocacy, training of primary eye care workers and detection and referral for ocular disease.

* The major challenge with these programs is the need to develop an appropriate career pathway for this cadre
* Efforts should be made to synergize their training with that of optometry programs

**Two or three year training programs**

These training programs include refraction training but utilization of these personnel depends on institutional need. The initial year of training is similar to a one year refraction course, but is followed with elective courses in specific areas of ophthalmic care. Trainees who complete an Advanced Refraction elective are usually recruited by hospitals as refractionists.

* The major challenge is retention within refractive care as many shift to work in other areas of eye care
* Multiple entry/exit education systems culminating in the option of extending to an optometry degree offer the best career pathway options for these personnel

**Four (or more) year training programs (usually an optometry degree course)**

In developing countries, these longer programs should have requisite exit from the program at planned intervals (multiple entry and exit model). After each training level, students provide service to under-served communities and gain practical experience before they are permitted to apply for further training. Return to the training program after the completion of any stage is voluntary and subject to established re-entry criterion. Each subsequent training stage imparts skills of higher breadth and depth.

* The first exit in these programs are usually equivalent to the one year trained refractionist mentioned above, although some countries require a minimum of two years before these cadres are recognised
* More students are recruited in the earlier years than in the later years thus creating a steady supply of refractionists for public sector posts
* Students completing four or more years of training should be competent to provide professional level refractive care integrated with broad primary eye care tasks (diagnosis and management of a range of eye disease)

**4.3 CHALLENGES TO HUMAN RESOURCE DEVELOPMENT**

The following issues should be considered at each stage of HR planning:

* The challenge of personnel retention – it is beneficial to counter (and allow for where it can’t be countered) loss of trained health personnel due to relocation, health problems including HIV / AIDS, lack of support from supervisors, lack of increased pay for increased responsibility and work, and career change
* The challenge of multi-tasking – existing health personnel may require assistance to balance refractive care roles with the other health problems to which they attend
* The challenge of sustainability – private providers may require subsidies to make a living serving communities with limited economic resources to pay for services and spectacles, while government systems should similarly differentiate expectations for service outcomes in different areas
* The challenge of career path – opportunities for career development and advancement should be provided to refraction personnel wherever possible
* The challenge of remote communities – support systems should be provided wherever possible for families in rural and remote locations (the aim should be to create rewarding jobs in rural/ remote areas, rather than balancing HR development so that bare minimum service outcomes are achieved by practitioners unable to leave because their training doesn’t allow them to pursue better paying jobs in urban areas)
* The challenge of maintaining standards – ensure effectiveness through maintaining functional equipment, appropriate work environments, and setting competency standards for practitioners
* The challenge of change – strategies to address resistance to the introduction of new cadres of personnel should be developed where needed
* The challenge of practitioner numbers – training programs should aim to achieve standardized practitioner/ population ratios in their communities, e.g. a minimum of 1 refractionist to 50,000 people by 202064, or 1 optometrist to 10,000 people (or fewer depending on uptake of services).81, 82
* The challenge of training – strategies should aim to establish more training institutes or initiate refractive training courses in existing technical/medical institutes, and additionally ensure that appropriate teaching resources and facilities are available to meet practitioner training requirements

**STRATEGY ADJUSTMENTS FOR UPSCALING THE PROVISION OF HUMAN RESOURCES**

HR remains a key challenge of VISION 2020 despite substantial early efforts. As a result, it seems necessary to reconsider current strategies. Strategy adjustments to allow up-scaling of refraction human resources include:

* Regionalization. The cost of establishing training institutions dictates the need for regional programs in refraction training. Such efforts have already been developed in Malawi, Mozambique, Guyana and the Pacific Eye Institute.65 This can provide a valuable source of refractionists for smaller countries without the resources and personnel to set up training institutions.
* Distance learning options for training. Training costs can be further rationalized using distance learning options. These systems achieve the bulk of theoretical training without face-to-face contact, then practical components are completed via local clinical exposures.

**5 INFRASTRUCTURE, TECHNOLOGY AND GLOBAL SUPPLY STRATEGIES**

**5.1 REFRACTION SERVICE REQUIREMENTS**

The following technique and equipment options exist for assessing refractive status in individuals. The variables listed across the top of the table can be given different weight by each jurisdiction in choosing the equipment option/s that best suits their situation. Costs are estimated in **Annex 5**.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Technique** | **Objectivity** | **Speed** | **Accuracy/ Reliability** | **Electricity Requirements** | **Mobility** | **Training Requirements** | **Equipment Requirements (Cost bracket)** | **Equipment Cost Efficiency rank (based on upfront cost, durability, maintenance req’s)** | **Suitability for Children without cycloplegia?** | **Level of care at which technique is req’d** |
| **Retinoscopy** | Objective = does not rely on patient responses | Fast | +/- 0.50D unless affected by media opacities or accommodation | Batteries | Good | High | Retinoscope, plus trial lens set and trial frame, OR phoropter, OR variable focus specs, OR readymade specs | Economical – low up-front cost, high durability, low maintenance | Sometimes | Secondary & Tertiary |
| **Subjective refraction** | Subjective = does rely on patient responses | Slow | +/- 0.25D but dependent on patient reliability | None | Good | High | Trial lens set and trial frame, OR phoropter, OR variable focus specs, OR readymade specs | Economical | Sometimes (only with experienced practitioners) | Secondary & Tertiary |
| **Blur function** | Can be biased to be either objective or subjective | Moderate | Unproven | None | Good | High | Trial lens set and trial frame, OR phoropter, OR variable focus specs, OR readymade specs | Economical | Yes – but needs validation | Secondary & Tertiary |
| **Auto Refraction** | Objective | Fast | Relies on both equipment and patient factors | Mains | Low | Basic | Auto-refractor | Expensive | No | Secondary & Tertiary |
| **Portable Auto Refraction** | Objective | Fast | Relies on both equipment and patient factors | Mains or batteries | Good | Basic | Portable auto-refractor | Expensive | No | Secondary & Tertiary |

The following facility options exist for custom-making spectacles. The variables listed across the top of the table can be given different weight by each jurisdiction in choosing the equipment option/s that best suits their situation. Costs are estimated in **Annex 5**.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Type of facility** | **Cost of facility** | **Cost of equipment** | **Cost of consumables** | **Flexibility** | **Water** | **Electricity** | **Waste** | **Accessability for equipment** | **Area (without dispensary)** | **Care Centre Level** |
| **Edging and fitting workshop Existing Rooms** | Low (possibly benches to support equipment) | Moderate | Low | Moderate | Plumbing required | Normal mains- multiple points | Low | No requirements | 3m  3.6m recommended minimum | Primary, Secondary & Tertiary |
| **Edging and fitting workshop Purpose Built** | Moderate (benches to support equipment) | Moderate | Low | High | Plumbing required | Normal mains- multiple points | Low | No requirements | 3m  3.6m recommended minimum | Primary, Secondary & Tertiary |
| **Surfacing lab Existing Rooms** | Moderate (plumbing for machines and benches to support equipment) | High | Moderate | Moderate | Plumbing required - machines need to be plumbed | Phase 3 power | High | Level access for heavy equipment- wide doors | Approximately 6m  6m recommended minimum | Secondary & Tertiary |
| **Surfacing lab Purpose Built** | High (plumbing for machines and benches to support equipment) | High | Moderate | High | Plumbing required - machines need to be plumbed | Phase 3 power | High | Level access for heavy equipment- wide doors | Approximately 6m  6m recommended minimum | Secondary & Tertiary |

**5.2 TECHNOLOGY GUIDELINES**

Technology should be used to support the expansion and improved quality of refractive care, but only in the context of comprehensive eye care – technology should not be used as a replacement for skilled people performing, or linked into, comprehensive eye care. ICEE’s Global Resource Centre (<http://www.iceegrc.org/>) is a potential supplier of affordable spectacles and ophthalmic equipment. Essential and appropriate technology that assists refractive care includes:

* Locally-affordable instruments
  + Retinoscopes, trial frames and trial lenses are recommended from among the options that are available, based upon current information and experience with validity, reliability, cost and feasibility
  + Alternatives such as low-cost auto-refractors may become available if their validity (particularly control of accommodation in children) is proven and should be considered where their use is appropriate
* Locally-affordable and available topical medications
  + Short-acting topical cycloplegic agents such as cyclopentolate hydrochloride (0.5 or 1.0%) are recommended
* Affordable spectacles
  + Purchasing, manufacture, distribution services, warehousing and inventory management for affordable spectacles should be accurate and efficient
  + Custom-made spectacles (preferred) and ready-made spectacles (only where resources do not permit custom-made) are recommended from among the options that are available, based upon current information and experience with validity, reliability, cost and feasibility
  + Quality standards (as equivalent to ISO standards as practical) should be maintained for both custom-made and ready-made spectacles.66, 80
  + Recycled spectacles should not be used.41 Other alternatives such as universal/adjustable spectacles should be considered if their efficacy is proven.
  + It should be noted that a majority of refractive error in many communities can be corrected appropriately with ready-made spectacles.39, 40

Optional technology for refractive services includes:

* Contact lenses
  + Appropriate practitioner skills, maintenance strategies and review schedules are required to achieve safe contact lens wear
  + It should be recognised that some conditions (e.g. keratoconus and post corneal graft) achieve better vision with contact lenses than spectacles
  + Contact lens and maintenance systems supply chains (usually separate to spectacle supply chains) are required to bring contact lens supplies to appropriate providers
* Refractive surgery
  + The high upfront cost of refractive surgery makes it currently inappropriate in most of the world

**5.3 GLOBAL SUPPLY STRATEGIES**

The following options exist for correcting refractive errors in individuals. The variables listed across the top of the table can be given different weight by each jurisdiction in choosing the equipment option/s that best suits their situation. Costs are estimated in **Annex 5**.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Refractive correction option** | **Cost** | **Quality of vision achieved** | **Cosmesis** | **Durability** | **Comfort** | **Manageability of Inventory** | **Care Centre Level** |
| **Recycled Spectacles** | High (although may appear low upfront cost, the real cost when collection, transport, sorting and storage is included is high) | Variable | Variable in theory (but in practice usually low) | Variable | Variable | Difficult | All |
| **Readymade Spectacles** | Low | Variable66 | Reasonable in most cases | Variable | Moderate | Easy | All |
| **Universal/ Modular Spectacles** | Moderate | Unproven | Variable | Unproven | Unproven | Moderate | All |
| **Custom Spectacles** | Moderate – High | Good | Good | High | High | Moderate | All |
| **Contact Lenses** | High | Good | Good | Anticipate regular replacement | Variable | Difficult | Secondary and Tertiary |
| **Refractive Surgery** | High | Good | Good | Strong wound healing in most cases | Variable | Easy | Tertiary |
| **Low Vision Devices** | Variable | Variable | Low | Variable | Dependent on aid | Difficult | Secondary & Tertiary |

It should be noted that there is considerable variation in costs and quality of wholesale spectacle supplies depending on where they are sourced. Supply chain alternatives should be investigated before committing to strategies and contracts.

**6 INTEGRATION OF REFRACTIVE SERVICES INTO MAINSTREAM HEALTH CARE**

The global prevalence of URE does not simply result from a lack of refraction and optical dispensing services. While these are undoubtedly two core components, various other factors interplay with these core components to contribute to the problem of URE:

* Lack of awareness and recognition of the problem at personal and family level, as well as at community and public health level
* Lack of personnel appropriate to enter refractive training
* Inability to afford refractive services
* Gender, social, cultural and other barriers that prevent access to service
* Cultural deterrents to compliance with treatment.

These factors can only be dealt with effectively if refractive services are integrated into national eye care plans, regional eye care plans and mainstream health plans. Strategies for integration of refractive services should be organized within 1) Management and Planning, 2) Training, 3) Advocacy and Communication, 4) Resource Mobilization, and 5) Collaboration Amongst Stakeholders.

**Management and Planning**

URE is a priority condition within the global initiative for the elimination of avoidable blindness, *VISION 2020: The Right to Sight*. However, many National VISION 2020 Plans were developed prior to this global acknowledgement of the significance of URE, and hence do not include intervention strategies for control of refractive errors. To improve refractive error control, National VISION 2020 Plans should include (depending on availability of appropriate evidence):

* Pilot or Demonstration Projects of refractive error control that can be monitored and evaluated,

Or,

* Refractive Error Programs that reflect an established evidence base or lessons learned from local Pilot Projects.

Consideration should be given to:

* Clear acknowledgement of the need for refractive care within each National VISION 2020 Plan (with defined referral pathways to and from other eye care services)
* Appropriate provision of refractive care at primary, secondary or tertiary levels of care, or preferably all three (preferably always combined with eye health screening or care)
* Adequate community screening services for URE (e.g. school screening), with clear referral pathways to appropriate refractive care cadres
* Clear acknowledgement of the role of optometrists, mid-level ophthalmic personnel, optical dispensers and other cadres involved in refractive care
* Linkages to education and rehabilitation (including whether low vision services are to be delivered by refraction cadres or others)
* Removing artificial separation between refraction and spectacles to allow onsite spectacle provision with cost-recovery in public systems (or alternatives such as public private partnerships to allow for integrated spectacle provision)
* Use of tools that calculate refractive care needs within a community (e.g. Aravind calculator)

**Training**

There is a paucity of both trained human resources and the availability of and access to training programs in optometry. Therefore, it is important that:

* The training curricula of existing cadres of the eye health workforce be reviewed, and modules on refractive care be embedded and integrated within existing training programs as appropriate using standard curricula for reference
* Existing curricula of refractive cadres be reviewed, and strategies for integration and community eye care be embedded within the training programs
* A directory of training institutions and their training programs in optometry be developed and circulated to all Ministry’s of Health and the respective National Coordinators for identifying and benefiting from opportunities for training within their respective regions

**Advocacy and Communications**

National VISION 2020 Plans have been developed in different countries. However they have not obtained the level of integration in the health system that is necessary for achieving the coverage and beneficial impact required. It is therefore vital that:

* National Health policies are reviewed to achieve the integration and facilitation of National Vision 2020 Plans including the refractive error and low vision components
* Advocacy strategies and appropriate communications are developed to support efforts to raise the profile of refractive care and specifically the use of spectacles as a solution to a major cause of VI
* These developments should be pursued at policy, planning and implementation levels
* Non-government (private and/or civil society) forms of refractive care delivery are embraced, regulated and promoted

**Resource Mobilization**

Inadequate financial support is a major impediment in designing and implementing national eye care plans. There are also non-financial impediments that need to be overcome in order to fully mobilize resources. Efforts should be made to:

* Identify the respective human, material and other non-financial resources
* Determine resource mobilization opportunities for programs on refractive errors
* Facilitate licensing that permits refractionists with necessary training to use diagnostic medications (e.g. topical cyclopentolate)
* Seek partnerships beyond the public sphere
* Confirm duty-free importation of the equipment and supplies necessary for refractive care (clinical equipment, diagnostic topical medications, optical workshop equipment, ready-made spectacles, and supplies for custom-made spectacles)
* Optometry Giving Sight (an IAPB program) was specifically developed to support programs seeking to correct refractive error

**Collaboration Amongst Stakeholders**

The process of integrating refractive care into national and regional blindness prevention programs and mainstream healthcare, should aim to encourage stakeholder collaboration. Partnerships should aim to reduce competition/conflict between stakeholders and support the development of eye care teams at all service levels. Key local stakeholders include:

* Providers from the public, private and non-profit sectors (providers may work inside or outside the eye-care field)
* Personnel working in the eye care field include ophthalmologists, optometrists, ophthalmic nurses, ophthalmic medical assistants, ophthalmic technicians, orthoptists and primary eye care workers
* Individuals with refractive error and their families
* Communities
* Relevant personnel working outside the eye care field include teachers and school health workers, general physicians, medical specialists, assistant medical officers, audiologists and speech therapists, occupational health workers and health care managers, social workers, youth workers, etc
* Government departments such as Health (re service integration, career paths for refractive personnel, etc), Education (re school screenings, low vision rehabilitation, etc), Finance (for tax exemption on spectacle sales for treating VI), and Customs (re importation of equipment, ocular medications and spectacles)
* Professional associations and health regulatory bodies

**Annex 1 – Visual Acuity Conversion Table**

The following conversion table is provided in recognition of the variations in units used to define VA in different jurisdictions.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Snellen fraction in metres** | **Snellen fraction in feet** | **Snellen decimal** | **MAR** | **logMAR** | **Print size at 40 cm\*** | **Significance** |
| 6/120 ≡ 3/60 | 20/400 ≡ 10/200 | 0.05 | 20.0 | 1.3 | N64 | Cut-off for WHO blindness |
| 6/95 | 20/320 | 0.06 | 16.0 | 1.2 | N50 |  |
| 6/75 | 20/250 | 0.08 | 12.5 | 1.1 | N40 |  |
| 6/60 | 20/200 | 0.10 | 10.0 | 1.0 | N32 | Cut-off for WHO severe VI |
| 6/48 | 20/160 | 0.13 | 8.0 | 0.9 | N25 |  |
| 6/36 | 20/125 | 0.16 | 6.3 | 0.8 | N20 |  |
| 6/30 | 20/100 | 0.20 | 5.0 | 0.7 | N16 |  |
| 6/24 | 20/80 | 0.25 | 4.0 | 0.6 | N12.5 |  |
| 6/18 | 20/60 | 0.32 | 3.2 | 0.5 | N10 | Cut-off for WHO VI |
| 6/15 | 20/50 | 0.40 | 2.5 | 0.4 | N8 | Cut-off for REPCom proposed near-VI |
| 6/12 | 20/40 | 0.50 | 2.0 | 0.3 | N6.3 |  |
| 6/9.5 | 20/32 | 0.63 | 1.6 | 0.2 | N5 |  |
| 6/7.5 | 20/25 | 0.80 | 1.3 | 0.1 | N4 |  |
| 6/6 | 20/20 | 1.00 | 1.0 | 0.0 | N3.2 | "Normal" VA |
| 6/4.8 | 20/16 | 1.25 | 0.8 | -0.1 | N2.5 |  |
| 6/3.7 | 20/12.5 | 1.6 | 0.6 | -0.2 | N2 |  |
| 6/3 | 20/10 | 2.0 | 0.5 | -0.3 | N1.6 |  |

\* N notation, as used in this Table, was recommended by the Faculty of Ophthalmologists of the UK to standardize near VA testing in 1951.76 The standardization included adopting New Times Roman as the font (giving the “N”), and specifying print size in points. Other near VA designations that are in use include M units, points, equivalent Snellen notation and Jaeger notation.6, 77

**Annex 2 – Treatment Guideline Decision Pathways**

**Correction for myopia:**

2) Presenting VA worse than the locally defined threshold of concern

Appropriate refractive technique indicates myopia

1) Patient reports difficulty with distance vision

Yes, significant myopia\*

No

3) Best-corrected VA 2 or more logMAR lines better than presenting VA

Correction for myopia is indicated if one or more of the following is correct

Correction for myopia is NOT indicated, although other URE may be present

Yes, but less than considered significant\*

Correction for myopia is indicated if two of the following is correct

\* The Refractive Error Working Group of the World Health Organization suggested “significant myopia” was -0.50DS or more for children, or -1.00DS or more for adults.1

**Correction for Hyperopia:**

2) Plus powered lenses improve vision by 2 logMAR VA lines or more, and/or noticeably improve comfort

Appropriate refractive technique indicates hyperopia

1) Patient reports difficulty with vision (near, far or both; constant or variable), OR discomfort with concentrated visual effort, OR an esotropia

Yes, significant hyperopia\*

No

3) There is amblyopia (and the patient’s age suggests the amblyopia is potentially treatable), or esotropia or large esophoria (and the patient has some potential for normal binocularity)

Correction for hyperopia is indicated if one or more of the following is correct

Correction for hyperopia is NOT indicated, although other URE may be present

Yes, but less than considered significant\*

Correction for hyperopia is indicated if two of the following is correct

\* The Refractive Error Working Group of the WHO suggested “significant hyperopia” was +2.00DS or more at any age.1

**Correction for Astigmatism:**

2) Cylindrical lenses improve vision by 2 logMAR VA lines or more, and/or noticeably improve comfort

Appropriate refractive technique indicates astigmatism

1) Patient reports difficulty with vision (near, far or both; constant or variable), OR discomfort with concentrated visual effort

Yes, significant astigmatism\*

No

3) There is amblyopia (and the patient’s age suggests the amblyopia is potentially treatable)

Correction for astigmatism is indicated if one or more of the following is correct

Correction for astigmatism is NOT indicated, although other URE may be present

Yes, but less than considered significant\*

Correction for astigmatism is indicated if two of the following is correct

\* The Refractive Error Working Group of the WHO suggested “significant astigmatism” was more than 0.75DC at any age.1

**Correction for Anisometropia:**

2) Correctly-balanced lenses improve vision of the worse eye by 2 logMAR VA lines or more, and/or noticeably improve comfort

Appropriate refractive technique indicates anisometropia

1) Patient reports difficulty with vision (near, far or both; constant or variable), OR discomfort with concentrated visual effort

Yes, significant anisometropia\*

No

3) There is amblyopia (and the patient’s age suggests the amblyopia is potentially treatable)

Correction for anisometropia is indicated if one or more of the following is correct

Correction for anisometropia is NOT indicated, although other URE may be present

Yes, but less than considered significant\*

Correction for anisometropia is indicated if two of the following is correct

\* The Refractive Error Working Group of the WHO suggested “significant anisometropia” was more than 0.50D at any age.1

**Correction for Presbyopia:**

2) Plus lenses improve near vision by 2 logMAR VA lines or more, and/or

Appropriate refractive technique indicates distance refractive error is corrected

1) Patient reports difficulty with near vision, and/or discomfort with near visual tasks

Yes

No

3) Plus lenses noticeably improve near vision and/or comfort

Correction for presbyopia is indicated if two or more of the following is correct

Correct significant distance refractive error as indicated

**Annex 3 – Quality of Life and Cost Utility Background**

The International Centre for Eyecare Education first presented the information in this annex to the Refractive Error Program Committee meeting in Chittagong, Bangladesh on 5 February 2008. The four broad options for measuring quality of life are health-related QoL, vision-targeted HR QoL, quality adjusted life years, and disability adjusted life years.

**Health-Related QoL (HR QoL)**

The most common Health-Related QoL tool used in vision research is the Medical Outcomes Study Short Form Health Surveys

* Major advantage: allow comparison across medical conditions
* Major disadvantage: non-specificity means they can miss effects of certain impairments that are important to people’s lives
* The Blue Mountains Eye Study and the Andhra Pradesh Eye Disease Study are the two most prominent ophthalmic studies to have used a HR QoL. Both found that severity of VI has a direct effect on every dimension, but they disagreed on whether refractive error affects scores as much as ocular pathology.25, 26

**Vision-Targeted HR QoL**

Commonly used Vision-Targeted HR QoL tools include the NEI-VFQ (Visual Function Questionnaire), NEI-RQL (Refractive Error Quality of Life), RSVP (Refractive Status and Vision Profile), IVI (Impact of Vision Impairment), QIRC (Quality of Life Impact of Refractive Correction) and NVR QoL (Near Vision Related QoL) questionnaires

* Major advantage: can be designed for specific conditions and specific communities, so have the best opportunity to pick up the actual effects of an impairment on people’s lives
* Major disadvantage: do not allow comparison to anything other than vision impairing conditions (even worse, some subsets of the Vision-Targeted HR such as refractive error instruments (e.g. NEI-RQL) cannot even be compared to other causes of VI (e.g. AMD))
* The NVR QoL and NEI-RQL questionnaires are the only instruments to have measured a QoL decrease from presbyopia.27, 67
* The NEI-VFQ is the most adaptable and widely used of the vision-targeted HR QoL instruments, but there are conflicting reports about whether it is sensitive to refractive error (conflicts possibly resulting from poor design/ misunderstanding the issues)28, 68
* The NVR QoL is the only tool designed specifically to measure QoL impact of uncorrected refractive error (near only)

**QoL measured using utility theory 1 (Quality Adjusted Life Years = QALYs)**

* Major advantage: allow comparison across anything that affects life
* Major disadvantage: so non-specific that answers are open to interpretation and it is debatable whether they mean anything real in a person’s life
* QALYs require the measurement of a utility value (ranging from 0.0 (death state) to 1.0 (perfect health state)), using a time trade-off method, before and after a treatment. QALY = (gain in utility value) x (duration of treatment effect)18
* QALY-based utility values averaged across patients with pathological causes of vision loss are about 0.25 for NLP, 0.50 for NLP – 3/60, and 0.65 for 3/60 – 6/60.23
* Initial cataract surgery has been measured to gain 1.25 QALYs, second eye cataract surgery gains 0.92 QALYs, strabismus surgery gains 2.61 QALYs.20, 21, 69 Strabismus surgery gains more QALYs because of the second variable in the equation (duration of treatment effect) – this will also work well for uncorrected refractive error and presbyopia.
* Utility value for glaucoma and retinopathy both appear directly dependant on VA (and not related to field loss, duration of disease or number of medications used)24, 70
* There are no published measurements for effect of uncorrected refractive error (distance or near) on utility value or QALY.

**QoL measured using utility theory 2 (Disability Adjusted Life Years = DALYs)**

* Major advantage: allow comparison across anything that affects life
* Major disadvantage: as a summary measure of population health reflecting both length of life lost to premature death plus time spent in unhealthy states, it is non-specific and of questionable real relevance
* DALYs require estimates of 1) age-specific incidence, 2) prevalence, 3) perceived severity of the disability, 4) duration of disability associated with nonfatal health outcomes, and 5) age at death due to individual diseases and injuries. Estimates 1 – 4 affect the Years Lost to Disability (YLD); estimate 5 affects the Years of Life Lost (YLL). All estimates except #3 come from public health data. Estimate 3 is a utility measure, but generally collected differently than for QALYs.71
* DALY utility value is called a ‘disability weight’, and ranges from 0.0 (no function lost) to 1.0 (all function lost = death).72
* Disability weights can be decided using a Person Trade-Off (PTO) exercise. PTO is a group exercise using healthy people. They are given descriptions (covering as many domains as possible, such as pain, mobility, cognition, sensation, mood) of people in various health states. Participants are then asked to execute an explicit trade-off between 1000 imaginary, healthy people, and each of the people in the described health states. The number of people with the disabling health condition is varied until the participant is indifferent to the choice. The ratio of (imaginary) healthy people to (imaginary) people with the disabling health condition provides the disability weight.71
* Relative order of most disease states is quite stable across cultures, but the absolute values change. Examples from Geneva include infertility 0.12 – 0.24, below the knee amputation 0.24 – 0.36, deafness 0.24 – 0.36, blindness (cause and level of residual vision not described – assume total blindness?) 0.50 – 0.70, and dementia 0.70 – 1.00.73, 74

**Annex 4 – Comparison of Eye Care Service Delivery Models/ Approaches**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Model/ approach | Refraction performed | Spectacles dispensed | Primary eye care provided | Adaptable to the public sector | Adaptable to the private/ for profit sector | Adaptable to the NGO/ not for profit sector | Integrated with comprehensive eye care services | Integrated with broader health systems | Coverage | Equity of access | Ease and speed of roll out | Cost of set up | Quality assurance | Affordability of spectacles | Gender equity |
| Hospital-based refraction clinic | Yes | Sometimes | No | Yes | No | No | Yes | Poor | Poor in community | Poor | Moderate | Moderate | Yes | Poor | No |
| LV Prasad Eye Institute | Yes | Yes | Yes | No | Yes | Yes | Yes | Yes | Extensive | Yes | Moderate | Moderate | Yes | Good | Yes |
| Free market approach | Usually | Yes | sometimes | No | Yes | No | No | No | Limited to where profit can be made | No | Easy & Fast | Low | No | Poor | No |
| Developed economy approach | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Tends to be better in urban than in rural/ remote areas | Except for marginalized minorities | Difficult & slow (HR limited) | High (due to HR cost) | Yes | Poor | Passively achieved in some locations |
| NSW ICEE Aboriginal Eye Clinic | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes | Specifically designed to improve coverage in marginalized communities | Yes | Dependant on target community, diplomacy and HR | Moderate | No | Good | No |
| Social entrepreneurship | No | Yes | No | No | Yes | Yes | No | No | Extensive | Yes | Easy & Fast | Low | No | Good | No |
| ICEE Vision Centre | Yes | Yes | Yes | yes | Yes | Yes | Yes | Yes | Extensive | Yes | Moderate | Moderate | Yes | Good | Intended |
| Vision guardian | No | Sometimes | No | No | No | Yes | Yes | No | 1/5000 high density population | Yes | Moderate | Low | Yes | Good | Situation dependent |
| Optishop approach | Yes | Yes | No | Yes | Yes | Yes | Yes | No | Hospital-based | Yes | Moderate | Moderate | Yes | Good | No |
| Community optometry (Tanzania) | Yes | Yes | Yes | No | No | Yes | Yes | Variable | Extensive | Yes | Moderate (HR limited) | HR dependant | No | Good | No |
| District Comprehensive Eye Care(DCEC) Pakistan | Yes | Not yet | Yes | Yes | No | No | Yes | Yes | Good | Yes | Depend on HR recruitment | Moderate | Yes | NA | Good |
| Optical Centre approach West Africa | Yes | Yes | Yes | Yes | No | yes | Yes | Yes | Extensive | Yes | Difficult | Moderate | Yes | Good | Limited |

**Annex 5 - VISION CENTRES**

**Affordable and accessible community level eye care**

This Annex describes the Vision Centre concept and is based on a submission made to AusAID by the Australian NGO Coalition on Blindness Prevention in Asia-Pacific in August 2008.

**BACKGROUND**

In 1999, the World Health Organization (WHO) and the International Agency for the Prevention of Blindness (IAPB) launched the joint initiative known as *VISION 2020: The Right to Sight*. The aim of *VISION 2020* is to eliminate the main causes of avoidable blindness by the year 2020.

The major priority areas for *VISION 2020* are the five major causes of avoidable blindness and impaired vision:

* Cataract
* Refractive error and low vision
* Trachoma
* Onchocerciasis
* Childhood blindness

These five conditions were chosen because they could be treated or prevented with effective known strategies in a cost-effective manner. Together these five conditions are responsible for 75% of all blindness and vision impairment in the world. However, intervention strategies are yet to reach many of the people most in need, as a result of inadequate service delivery capacity, human resources, affordable technology, equipment and infrastructure.

The leading cause of avoidable blindness is cataract, which accounts for 48% of global blindness. Uncorrected Refractive Error accounts for 12-25% of blindness and over 50% of all vision impairment.

The four types of refractive error are:

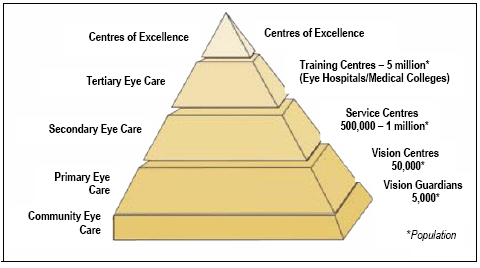
* Myopia or nearsightedness – difficulty in seeing distant objects clearly (image in front of the retina)
* Hyperopia or farsightedness – difficulty in seeing distant or close objects clearly due to an excessive need for accommodation or focusing (image behind the retina)
* Astigmatism – distorted vision, usually resulting from an irregularly curved cornea (meridional differences in image positions)
* Presbyopia – near vision impairment in older people (usually after age 45) due to inadequate accommodation (lens focusing power)

Globally, there are 153 million people with significant distance vision impairment (<6/18 in the better eye) as a result of uncorrected refractive error, or simply the need for glasses to see at far distances. WHO is yet to quantify the burden experienced by people due to near vision impairment created by presbyopia, but it is likely that many more people are affected than by distance refractive error[[4]](#footnote-4).

Refractive error is the most treatable cause of vision impairment and is easily diagnosed and measured. In most cases, a pair of spectacles is the only form of treatment or correction needed. Unfortunately though, millions of people in low and middle income countries do not have access to even these basic eye care services.

**A MODEL FOR EYE CARE DELIVERY**

The LV Prasad Eye Institute (LVPEI) in India has developed an innovative model (Figure 1), for the delivery of eye care in the developing world, which has been implemented very successfully in many places.

******

***Figure 1:******The LVPEI Model for eye care service delivery***

In this pyramid model, initial eye care screening is done by Vision Guardians (at a ratio of 1 per 5,000 people) at the village level. Primary eye care and refractive error services are provided by Vision Centres at the community level (1:50,000), while secondary and tertiary eye care takes place at the Service Centres (local or district hospitals, 1:500,000) and advanced care at Training Centres (1:5 million) or at the Centre of Excellence level (1:50 million).

In this way, eye care tasks are divided amongst the available workforce, so that the relatively few individuals capable of high end tasks are freed to deliver those.

A Vision Centre is an eye care facility that provides a range of eye care services, including:

* Eye examinations
* Refraction (i.e. determining the spectacle prescription required)
* Supply and dispensing of affordable spectacles
* Detection of potentially blinding diseases
* Treatment of minor eye problems and provision of first aid within the skill set of the Centre’s eye care staff
* Appropriate and barrier-free referral/ transfer of patients with more complex eye conditions to higher levels of the health care system

Depending on the size, staff capacity and activities of specific Vision Centres, they may also assist with:

* Coordination of community screening programs
* Assistance with other community eye care activities (such as Vitamin A campaigns and non‑surgical aspects of trachoma control)
* Post-operative patient care

Vision Centres are most effective if there is coordination, cooperation and integration of the Vision Centre services with other levels of service, including outreach, rural and regional hospitals.

Vision Centres are a way of extending eye care into the community. They could be located in a district hospital, a community primary care clinic or as a stand-alone entity, depending on local requirements and norms. Vision Centres are conceptually a series of functions normally carried out in a specific location.

In many parts of the developing world, quality eye care services are only available at regional hospitals – creating barriers of distance, cost and accessibility. The provision of eye examinations and spectacles within communities minimises these barriers.

Although Vision Centres can be located in district hospitals to deal with refractive and primary eye care, they still have a focus on improving community access to eye care. In general, however, they provide services in remote, rural and under-served areas in a small one- or two-room facility.

Across the developing world, blindness affects 1% or more of the population and significantly impaired vision 2.5 to 5%. Refractive error however affects 50 to 80% of the population. A Vision Centre, staffed by a 1-year trained person, can take care of uncorrected refractive error, meeting 70% or more of overall vision needs of the community. With an appropriately trained optometrist, a Vision Centre can cover 90% of the vision care and eye health needs and appropriately refer the other 10%. In this way, the cost-effectiveness and efficiency of National Vision and Eye Health programs can be improved as the load on hospitals is reduced.

**AN ADAPTABLE MODEL**

The Vision Centre model is adaptable for providing community-level eye care and can suit local circumstances in other countries. Vision Centres across the globe vary greatly to accommodate and complement the diverse range of health and eye care delivery systems in various countries, regions and communities in need.

The flexibility of the Vision Centre model is demonstrated in the following points:

* ***Service Population and Linkages.*** Each Vision Centre is designed to cater for the vision needs of a population of approximately 50,000 people. This ratio can be adjusted to accommodate local circumstances affecting accessibility and availability of services. Each Vision Centre seeks local integration with other health services, community development agencies, local NGOs and local government, plus regional integration with more comprehensive eye care services.
* ***Physical Infrastructure and Equipment.*** The essential elements for a Vision Centre are an appropriate, accessible location and equipment to provide primary eye care and refractive care. Local outcomes and referral pathways are then tailored to fit within existing eye care systems and protocols. Local circumstance also dictates how services are run – whether as outreach or from within a community clinic.
* ***Staffing and Procedures***. Each Vision Centre is staffed by an appropriately trained, preferably local, person. Depending on circumstances, this person may be an optometrist, a vision technician, an ophthalmic nurse or another cadre of mid-level eye care practitioner. The exact cadre, technology and techniques used at each Vision Centre can be varied depending on local, national and regional, and governmental and health system situation and requirements. Consistency of service and retention of personnel is greatly influenced by having local people trained to work at a Vision Centre in the same locality. As perceived by those using the Centre, success of the Centre is heavily influenced by the availability, timeliness and quality of the service.

**VISION CENTRE SUSTAINABILITY**

Vision Centres should aim to become self-sufficient in their management of resources and finances, through a combination of strategies:

* Engaging in local partnerships
* Integration of the Vision Centre within the existing health-care system/services in the region
* Cost recovery through reduced fees for spectacles to those in need, and by offering value‑added services to wealthier patients, when appropriate
* Committing sponsors for the Vision Centre
* Providing excellent services and follow-up

To ensure access to affordable, high-quality spectacles, each Vision Centre stocks a supply of affordable readymade spectacles. These are affordable and convenient in that they can be dispensed at the time of the eye examination. Approximately 30% to 50% of patients will require prescription, custom-made spectacles, for example for conditions such as significant anisometropia (unequal refractive error in the two eyes) and significant astigmatism. Many older patients require correction of both distance and near vision, but bifocal or progressive spectacles are not normally supplied at Vision Centres unless the centre is well advanced. Prescription spectacle lenses require an optical laboratory staffed by an optical workshop technician trained to edge and fit lenses to frames. One laboratory can service five or more Vision Centres.

Well established optical workshops associated with a Vision Centre or a cluster of Vision Centres will be able to create a cost recovery element that helps ensure self-sustainability. Sustainable and comprehensive eye care delivery systems can be created, where the supply of primary eye care and refractive error services can fund more costly initiatives, such as cataract surgery or the provision of low vision devices.

The Vision Centre model described here is in line with the guiding principles for a *VISION 2020* Action Plan, which can be summarised in the acronym ‘ISEE’:

**I**ntegrated – into existing health care systems

**S**ustainable – in terms of money and other resources

**E**quitable – care and services available to all people in need regardless of circumstance

**E**xcellence – a high standard of care throughout.

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**Annex 6 – Costs of Refractive Care Setup**

Sight Savers International provided the information (originally written by Trent Huon) in this Annex to the Refractive Error Program Committee. Costings are from early 2008. Budgeting advice for general ophthalmic equipment can be found in “Technology Guidelines for a District Eyecare Program”.75 It should be noted that these costs relate to cheaper, usually Chinese-made equipment with un-established quality assurance and durability. SSI are in the process of reviewing their recommendations and revised estimates may be available at a later date.

ICEE’s Global Resource Center (<http://www.iceegrc.org/>) is also able to supply spectacles and ophthalmic equipment.

It should be noted that this represents only the capital investment needed to setup a refractive care clinic. Running costs (such as staff costs, replenishing spectacle supplies, maintaining equipment) have not been budgeted here. Sustainable refractive care depends on running costs being covered by clinic income.

**Equipment**

Machines are readily available from China and at more competitive prices. Quality is fine.

A standard equipment list for an optical dispensary:

Auto edger + blocking stickers $2500

Hand edger $300

Pattern cutter + patterns $200

Centering Machine $150

Frame Heater $100

Lens Groover $200

Focimeter/ vertometer (choice of manual vs digital will depend on situation) $2500

Lens Tinting bath $100

Assorted tools $600

A standard equipment list for the refraction room:

Letter charts (logMAR letter, Tumbling E, Lea Symbol, numbers) $200

Near vision charts with Es, Numbers, letters in logMAR format and reading charts in local language $200

Trial Set $600

Trial Frame (preferably universal and of good quality) $800

Paediatric trial frame $600

Tonometer for glaucoma screening $6000

Ophthalmoscope/Retinoscope $600

Phoropter (only at tertiary level) $1000

Slit Lamp $2500

A standard equipment list for Accounts and Reception

Computer et al. $2500

Fax/Phone $300

Ledgers $50

**Source of lenses**

Internet orders from India or China $10 000, 2000 pairs, with cyl bifocal

Plastic or glass

Photo or White

Cylinder bifocals and progressives

Donated second-hand lenses should be avoided as they are difficult to sort, they are scratched and they reinforce the image in the West that everyone in Africa is a beggar. Some at Hohoe.

SSI have devised a standard start up list of lenses for the average “African prescription”. Misleading because it over simplifies the biggest problem in running a centre. Even after an initial order, it is nice to have a local or nearby manufacturer where you can “quickly” order lenses – i.e. 1 month turnaround. Developed world delivery to developing countries more likely to be monthly at best.

**Source of frames**

Fashion conscious world $6000, 2500 frames

Internet orders from Malaysia or China

$2000 1000 frames at $2, nice looking, average quality

$3000 500 frames at average $6, some $16 nice looking, better quality,

$1000 1000 frames at $1, plastic and metal, average looking, cheap. Hohoe.

Reading glasses are big business, readily available in Accra and Lagos for about $1.

**Source of Low Vision equipment**

Internet orders from Hong Kong Centre for the Blind, COIL in UK, Eschenbach in Germany, CBM contacts?

HK seems to be the cheapest: $700, 120 pieces ex HK

**Source of Staff**

The Gambia, 1 Optometrist/manager. The manager must be proactive in finding outlets for sales of optical products in urban centres. The manager must also be able to organise outreach to the more rural areas. Ideally once a month. If the manager is there regularly, this is quite possible.

2 refractionist, dispensers

1 accounts clerk/sales clerk

1 Part time driver/outreach hand

**Advice**

Patient Education Brochures should be produced for each new clinic.

**Drugs**

$100, depending if generic or proprietary.

Therapeutic and diagnostic. Depends on staff competency and vicinity of other eyecare providers.

**Source of external funding**

In Hohoe, we find it difficult to make ends meet from sales at the centre alone. Outreach provides some more funding, but we are normally going to more rural and impoverished areas, so that is not providing a sufficient solution to funding issues. Our corporate outreach has proved a far more affective money earner, though that is not strictly SSI work, it subsidises our rural operation.

**Bulk discounts**

If there are to be several centres opened, and all require all or only some of the above, it would be better to get it all at once. Certainly discounts are available on frames and lenses.

$37 300 + shop fit out (display cabinets etc), benches, chairs, tables, fridge, plumbing etc

Pick up, add $24 000.

**Annex 7 – Durban Declaration on Refractive Error and Service Development**

***Preamble***

Over 650 delegates representing eye care professionals, researchers, governments, civil society and industry from all over the world gathered at the Durban International Convention Center, from March 14-16 2007, to attend the first World Congress on Refractive Error and Service Development. The congress addressed a key public health challenge of our time, Uncorrected Refractive Error (the need for an eye examination and a pair of glasses), the leading cause of avoidable blindness and vision impairment across the world.

The meeting was hosted by the International Center for Eyecare Education (ICEE) with representation from the World Health Organization (WHO), International Agency for the Prevention of Blindness (IAPB), the World Council of Optometry (WCO), the International Council of Ophthalmology (ICO), the major international eye care non-governmental organizations, government, universities, institutions, eye care professionals and industry.

**WE THE DELEGATES RECOGNISE THAT:**

* 153 million people in the world have impaired distance vision because of Uncorrected Refractive Error;
* Many millions more people over the age of 45 years have impaired near vision (presbyopia) due to Uncorrected Refractive Error;
* Persons with blindness and vision impairment are entitled to the same basic human rights as are enshrined in all national and international standards, declarations and conventions;
* Uncorrected Refractive Error drives children and adults further into poverty by limiting their opportunities to education, employment and seriously impacts their quality of life and productivity;
* The link between poverty and visual impairment due to Uncorrected Refractive Error places a heavy economic burden on individuals, their families and communities;
* The paucity of services, personnel, training institutions, affordable glasses especially in the developing countries are the main contributing factors to Uncorrected Refractive Error.

**WE FURTHER ACKNOWLEDGE THAT:**

* WHO/IAPB launched the global initiative VISION 2020: the *Right to Sight*, to eliminate avoidable blindness and vision impairment;
* Prioritisation of Uncorrected Refractive Error as the major cause of avoidable blindness and impaired vision has come about through broad consultation of national and international alliances;
* Member states of the World Health Assembly in 2003 and 2006 passed resolutions WHA56.26 and WHA59.25 making blindness prevention a priority.

**WE DECLARE THAT:**

* We fully support the Global Initiative for the Elimination of Avoidable Blindness and Vision Impairment, VISION 2020: *The Right to Sight*.
* We will work together in developing comprehensive eye and health care services for the correction of refractive errors and provision of high quality and affordable glasses; and
* We will prioritize communities, countries and regions in greatest need and school age children and adults above 45 years, especially women.

**WE FURTHER COMMIT:**

* To increase global awareness of the magnitude of the unmet need for refractive error services among the professions, the health, private and corporate sectors, and governments and communities;
* To work towards collaboration between all professions and formation of partnerships and alliances to achieve the goal of elimination of blindness and vision impairment due to Uncorrected Refractive Errors;
* To advocate for the policies, services and resources required to address the issue of Uncorrected Refractive Errors;
* To advocate for the inclusion of vision services within health insurance schemes;
* To invest in the training and equipping of the essential eye care teams and their development to meet the needs of the underserved population;
* To encourage research to generate the evidence base for decision making, monitoring indicators, evaluation and appropriate service delivery models;
* To support the establishment of global procurement and distribution systems for making high quality affordable glasses available to communities in need;
* To support major initiatives for raising funds for the development and provision of refractive error services;
* To fast track eye care delivery programmes through the use of national consultation groups or task forces; and
* To disseminate information on best practice by many means including the holding of periodic world congresses.

**WE CALL UPON:**

The governments, professional bodies, manufacturers and suppliers, international organizations and civil society to:

1. Make refractive services a priority;
2. Support the development and deployment of the appropriate human resources, infrastructure and technology for the effective delivery of refractive services within the public sector;
3. rationalize the tariffs, duties and taxes imposed on spectacles, equipment for refraction and optical laboratory equipment;
4. support and facilitate organizations working towards the elimination of avoidable blindness.

**WE REAFFIRM OUR COMMITMENT TO:**

1. Advocate about the burden of Uncorrected Refractive Error to key policy and decision makers in order to enhance the allocation of resources
2. Improve the knowledge base and strengthen the organizational and institutional capacities of key stakeholders to implement initiatives aimed at promoting refractive error services
3. Document and promote best practice in service delivery at local, national and international levels to key stakeholders
4. Promote research in the prevalence of refractive error, the barriers to its correction and the most appropriate service delivery models
5. encourage closer coordination between government ministries, departments, civil society and consumer groups for purposes of undertaking campaigns to promote VISION 2020
6. undertake planning workshops on refractive error with key stakeholders
7. coordination with eye care training institutions and programs in Optometry, Ophthalmology and other relevant health personnel, to develop guidelines for socially and economically viable training programs and promote competency-based models

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1. It should be noted that WHO currently use the term “Visual Impairment”, however REPCom advocates “Vision Impairment” in line with recommendations from the disability community [↑](#footnote-ref-1)
2. The report of difficulty seeing and/or discomfort from URE should be based on an *informed choice*. The effect of the refractive correction should be demonstrated to each person who satisfies the other criteria for treatment using trial lenses in a trial frame. The practitioner should follow the demonstration with a statement and question to the effect of “you have ‘x’ condition that does ‘y’ to your vision and can be corrected with these glasses, do you think they will help you?” [↑](#footnote-ref-2)
3. REPCom recommends comprehensive eye care needs and services studies wherever possible, rather than isolated studies of single eye care topics. [↑](#footnote-ref-3)
4. International Centre for Eyecare Education estimates that around 500 million people were affected globally in 2007. [↑](#footnote-ref-4)