Planning Eye Care for Children
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GUIDELINES FOR PEDIATRIC EYE HEALTH – PURPOSE

This document is prepared for use by anyone interested in developing a new, or improving an existing, children’s eye care facility. It aims to provide reasons why it is important to focus on childhood blindness, discusses World Health Organization (WHO) guidelines, and continues with a description of how to create a tertiary care facility dedicated to preventing, and when they occur, diagnosing and treating eye disease in children. These activities represent an important part of the fight against childhood blindness. This is intended to be a "living document". It can be modified, corrected, and updated as needed while we all move ahead in the fight against childhood blindness. All eye care providers have some stake in this effort. We encourage use of this document as a guide, and when appropriate, any user to point out deficiencies, and then contribute to improve its content.

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April 8, 2009
INTRODUCTION

Childhood blindness is a significant public health problem in the developing world, and is also a high priority for those engaged in the fight against preventable blindness. This document is prepared for anyone planning to establish or improve an existing children's eye health care facility. The plan is intended to be comprehensive, but there may be unintended omissions as well as evidence of the bias of those preparing the document. As such, certain plans and provisions would be modified according to local needs. This section lists the causes and impact of childhood blindness according to the consortium of non-governmental organizations (NGO) that make up Vision 2020. This is followed by a description of how a program can respond to these needs.

You should begin by reviewing the causes of childhood blindness worldwide as described by Vision 2020 and listed here. Then these causes of blindness should be compared with those occurring in your area. This information will be useful when planning programs for reducing childhood blindness.

This document can be used as a supplement to the curriculum for Pediatric Ophthalmology and other information pertaining to childhood blindness available at www.cybersight.org.

SUMMARY OF VISION 2020 TARGETS FOR THE CONTROL OF CHILDHOOD BLINDNESS

I. Specific disease-control measures

- Reduce the global prevalence of childhood blindness from 0.75 per 1,000 children to 0.4 per 1,000 children by the year 2020. (This would mean that the worldwide childhood blindness prevalence would approach that found currently in the higher income economies.)
- Eliminate corneal scarring caused by vitamin A deficiency, measles, and ophthalmia neonatorum.
- Eliminate new cases of congenital rubella syndrome.
- Provide appropriate surgery to all children with bilateral congenital cataract, with immediate and effective optical correction carried out in suitably equipped specialist centers.
- Ensure that all babies at risk for ROP have a retina examination by a trained observer a suitable time after birth, with appropriate referral for retinal treatment when required.
- See that all school children have a simple vision-screening examination, and that glasses are provided to all who have significant refractive error. This service should be integrated into the school health program.
II. Human resources development

- Ensure that prevention of childhood blindness is an explicit aim of all primary health care programs.
- Ensure that secondary-level eye clinics have facilities to provide appropriate glasses for children with significant refractive errors.
- Provide training so that there will be a suitable number of refractionists to better serve the population.
- Provide training so that there will be at least one worker to manage low vision for every 5 million by 2020.
- Ensure that one ophthalmologist is trained in the management of pediatric eye conditions for every 10 million people by 2020.*
  (In India and China that would mean 24 by 2010 and 120 by 2020. By comparison there are 686 pediatric ophthalmologists in the United States for a population of 300 million or approximately one per half million. This is very likely the saturation number in a market economy.)

III. Appropriate technology and infrastructure development

- Ensure the development of low-cost high-quality low vision devices that would be widely available even in low-income countries.
- Establish a network of specialist “child eye care” tertiary centers that encourage a child friendly approach.

COMPARISON OF VISION 2020 TARGETS AND PROGRAM RESPONSE

Considering those targets listed as important by Vision 2020 and based on institutional experience, activities of those engaged in the fight against childhood blindness can be divided into three action categories: 1) general objectives, 2) institutional goals, and 3) specific training for eye health care providers.

I. General objectives (big picture)

Challenge of Vision 2020:

- Reduce the prevalence of childhood blindness overall
- Specifically eliminate corneal scarring from Vitamin A deficiency, Rubella, measles, and ophthalmia neonatorum
- Eliminate new cases of rubella syndrome
- Establish as a priority the elimination of preventable and treatable childhood blindness while taking the necessary steps to reduced childhood blindness from 1.5 per 1,000 as it is now in the developing world to 0.4 per 1,000 (compared to 0.3 per 1,000 in the most developed economies)

*There should be many more pediatric-oriented comprehensive ophthalmologists, but these numbers are difficult to confirm.
Response:
Programs for childhood blindness prevention should be compatible with the goals of Vision 2020 regarding overall reduction of childhood blindness. This will be manifested by emphasis on programs dedicated to training, screening, and infrastructure development aimed at reducing childhood blinding disease through capacity building combined with sustainability. This could include distribution of Vitamin A and administration of rubella vaccinations; if an organization does not do this, it should encourage other organizations that do, encourage governments to adopt policies to promote these programs, and support training and infrastructure that helps makes these programs effective, holding the elimination of childhood blindness as a high priority.

II. Institutional goals

Challenge of Vision 2020:
- Assume a more effective role in management of low vision
- Establish a communication network of childhood eye care centers linking them for sharing experience and best practice
- Explore ways to provide glasses for children in need
- Develop public awareness and advocacy material and distribute these widely
- Develop effective local eye care facility administration and assist in achieving cost recovery
- Develop tertiary centers with a child friendly approach
- Work toward increasing capacity and establishing sustainability in all programs

III. Specific training aimed at enabling local doctors and/or appropriate health care providers

Challenge of Vision 2020:
- Provide cataract surgery and visual rehabilitation to children with bilateral cataracts
- Examine infants at risk for retinopathy of prematurity and treat those in need
- Provide vision screening and glasses for all school children in need
- Carry out refraction on all who need this service
- Provide low vision services to all in need
- Enable a critical number of specialists to diagnose and treat pediatric eye diseases including those not specifically listed here

Why This Manual?

The specific purpose of this manual is to:
1. Recognize the worldwide impact of childhood blindness with emphasis on those preventable and treatable causes
2. Stress the uniqueness of the child and the relationships with family
3. Describe the physical characteristics, equipment, and staffing of a tertiary care children’s eye care facility
4. List the types of childhood eye diseases that would be encountered in such a facility
5. Create an awareness of the importance of dealing with childhood blindness and offer a strategy to get the job done
6. List the goals of Vision 2020 and develop a strategy to meet them
Generally agreed upon statistics based on Vision 2020 documents:

- There are 1.5 million children blind in the world today.
- A child goes blind in the world every minute.
- A child blind before age 2 years has around a 50% chance of dying before age 5 years.
- The number of “blind years” resulting from childhood blindness is estimated at 75 million based on the number of blind children now. The economic impact of this assumes huge importance as a public health priority with childhood blindness approaching adult cataract blindness in significance.
- In low-income countries childhood blindness is 5X the number found in higher income economies. There would be even greater disparity in these prevalence numbers were it not for the high rate of child mortality in those children blinded early in life in developing countries.
- The WHO defines blindness as best corrected vision of 20/400 in the better eye and severe visual impairment as best corrected vision of 20/200 in the better eye.
- Many blinding eye conditions (estimated at between 50 and 75%) in children in the developing world are either preventable or treatable.
- Because a child’s eye/brain must learn to see during a critical period of development very early in life, including the first weeks and months, the timing of effective treatment of most eye disease in infants is crucial.
- There is a relative shortage of both providers and facilities with a child-centered approach to eye health and blindness prevention available in the developing world.

Causes of childhood blindness (based on Vision 2020 documents with some modification)

**Avoidable** causes of childhood blindness can be divided into **preventable** and **treatable**.

**Preventable**

1. Vitamin A deficiency – causing corneal opacities and ocular inflammation malnutrition and early death
2. Measles – causing corneal opacity and contributing to early death
3. Congenital Rubella syndrome – causing cataract, severe ocular inflammation, deafness, and mental retardation
4. Ophthalmia neonatorum – from infection occurring during the birth process causing conjunctivitis and corneal opacity
5. Harmful traditional medicine and trauma – causing a variety of unintended eye disease
6. Onchocerciasis (river blindness) destructive inflammation and reaction now reasonably well controlled and limited to pockets of Africa

* The chronic conjunctivitis of childhood caused by trachoma leads to early adult corneal blindness and could be considered a type of preventable “childhood” blindness.
**Treatable**

7. Glaucoma – a unique disease when occurring in infants and children requiring early surgery and careful follow up
8. Retinopathy of prematurity – occurring in greatly increasing numbers, especially in emerging economies, as infant mortality is reduced but proper support is lacking for the vulnerable premature infant
9. Cataract – in greatly increased numbers in the developing world (10x more common) especially in sub-Saharan Africa, and India
10. Corneal scarring – from causes other than Vitamin A deficiency
11. Refractive errors – important to find early but only effective if glasses are available; causes visual impairment in up to 140 Million people
12. Retinoblastoma – nearly universally fatal unless diagnosed and treated early (rare, but deadly)
13. Strabismus and amblyopia - vision loss and reduced quality of life result if untreated

**The relationship of preventable and treatable causes of blindness in lower and higher income economies in light of the concept of “baseline” childhood blindness**

Preventable and treatable childhood blindness is found mostly in lower income countries because of environmental factors, limited public awareness of the benefits of early effective treatment, and lack of health care providers and facilities for them to work in. Added to these preventable and treatable causes of blindness so common in the developing countries are the so-called “baseline” blinding childhood diseases that are also found in higher income countries. These blinding diseases are for the most part neither preventable nor treatable. They include central nervous system (brain-related) vision loss such as cortical blindness, and optic nerve hypoplasia, plus a variety of retinal diseases, many of which are hereditary. Also found in developed economies are children afflicted with congenital and childhood glaucoma, corneal disease, retinopathy of prematurity, retinoblastoma, and retinal vascular disease. Consanguinity where it occurs is a significant cause of childhood blindness resulting from recessive inheritance.

**Other childhood eye disease**

A wide variety and large number of non-blinding childhood eye diseases exist that are detrimental to the general health and quality of life of the affected children. Orbis child health initiatives are aimed at diagnosis and treatment of these conditions for the benefit of the children and their families.
OVERVIEW

Care of the child is obviously at the heart of the fight against childhood blindness. But, because the infants and for the most part the young children are unable to care for themselves, they need an advocate. This starts with the family trained to recognize the need for a healthy lifestyle for their child while practicing prevention including providing a healthy diet and the avoidance of harmful traditional medicine practices. If an eye/vision problem occurs with a child, the family should be informed so they recognize the problem and know how and where to seek help. When eye disease occurs in a child, the appropriate level of care should be available reasonably close by, and be affordable, or the service should be provided at no cost if the family has no means of payment. Appropriate eye/vision care for a child should be available at the level of need for the problem at hand. This includes care at the primary, secondary or tertiary level.

PRIMARY CARE

An important component of primary care is to provide education about good health practices. Specific activities of a primary children's eye care facility include: public screening for eye disease, in some cases refraction and providing spectacles, treatment of basic eye disease such as conjunctivitis or simple nasolacrimal duct obstruction, management of minor trauma, etc. While carrying out these activities, appropriate cases are selected for referral to a secondary or tertiary care center to treating more serious eye disease. A primary eye care facility could be free standing and be staffed by a nurse, technician or possibly a part time general physician who has some basic training for the diagnosis and treatment of eye disease in children. Such a primary care facility can be an outreach of a higher-level facility.

A primary eye care facility should include equipment necessary to provide the most basic eye care. This should include, but not be limited to:

- Charts for testing vision at distance and at near
- Small handheld flashlight
- Magnifying glass
- Eye patches, tape, and protective shield
- Dilating drops
- Antibiotic drops and ointment
- Topical anesthetic
- Topical steroid drops and ointment
- Saline solution for irrigation
- Direct ophthalmoscope
- Fluorescein dye
- Lid speculum
• A suitable manual describing the types of eye conditions likely to be seen in an emergency with suggestions for diagnosis and treatment
• A digital camera and a computer to connect to the internet to consult with the nearest tertiary care children’s eye care facility

SECONDARY CARE

A secondary children’s eye care facility will be part of a general health care facility with operating rooms and some inpatient facilities and will provide all of the services listed above but with more sophisticated facilities and skills for refraction, providing glasses, and include treatment of amblyopia. Other activities of a secondary children’s eye care facility include surgical treatment for horizontal strabismus, management of all forms of conjunctivitis, and recognition for referral of retinoblastoma and other serious retinal disease. General anesthesia safe for children should be available for most simple procedures. Cataract, and glaucoma requiring surgery will be referred to a tertiary care facility. The secondary facility working closely with a tertiary care children’s eye care facility should be staffed by a comprehensive ophthalmologist who has interest and skills in the care of children’s eyes. In other words this should be a “child friendly” comprehensive eye care facility. This staff will treat children up to their ability and will refer more complicated cases to a tertiary facility. During the course of treatment, the secondary facility will work closely with the tertiary care staff for guidance and support and will work closely with the tertiary care doctors with the follow up of patients during the course of treatment. This relationship can be supported by use of Cyber-Sight for continuing medical education and patient management.

The main difference between a secondary and tertiary eye care facility regarding equipment and facilities relates to the more specialized equipment required by the more specialized medical staff at the tertiary center. For example; equipment would be needed in a tertiary center for goniometry to treat glaucoma and special equipment to support cataract surgery, and more. In addition more sophisticated imaging equipment and more advanced anesthesia support would be needed.

TERTIARY CARE

The tertiary children’s eye care facility will be part of a comprehensive eye hospital. This level of facility will provide diagnosis and treatment for the most complicated eye diseases in children. Located in a larger eye care facility, the tertiary care children’s eye care facility will have access to operating rooms, laboratories, imaging services, and safe pediatric anesthesia. The team of pediatric ophthalmologists (there would likely be more than one) will be fellowship trained, possessing skills that are described in the training provided by the Cyber-Sight E-Learning course (www.cybersight.org). The pediatric ophthalmologist will also require other practical training for surgery. This tertiary facility and its staff will be able to manage childhood cataracts, all types of childhood glaucoma, retinoblastoma, vertical strabismus, and all of the other significant eye diseases of childhood. The doctors and other staff of this tertiary clinic will work closely with the neonatologists in the intensive care nursery of the hospital to screen and treat infants at risk for retinopathy of prematurity. This facility will support both the secondary and primary children’s eye care facilities in the region and will be advocates on behalf of children’s eye care offering public education for the prevention of childhood eye disease. The
staff of the tertiary care facility will engage in an active training program to produce more children’s eye health care providers at all levels. The tertiary care level staff will engage in continuing education, teach when the opportunity arises, and share information by means of clinical research that may be suitable for publication. This staff can serve as Cyber-Sight E-Consultation mentors for secondary and primary clinic staff and can maintain a collegial relationship with the Orbis International Cyber-Sight mentors.*

At all levels of care, it is expected that the staff will compile and maintain adequate health care records for the patients they treat. This often underrated or overlooked part of health care delivery should be addressed early on with appropriate measures taken to ensure compliance.

PATIENT AND FAMILY EDUCATION

Since so much of childhood blindness is preventable it is necessary for a conscientious pediatric ophthalmology service to participate in programs for prevention! The public must be provided accurate, useful information about safe and healthy eye and vision practices. This education can be carried out with mass communication telling families what to avoid while encouraging positive behavior to ensure a healthier lifestyle for their children. The most effective way to disseminate this information will depend on several factors including: the blinding conditions likely to occur in a given locale, cultural factors, and ease of dissemination of information. A comprehensive selection of material dealing with childhood blindness prevention should be assembled by Orbis, working with partners and local groups and designed to meet the special needs of the population. Methods for disseminating blindness prevention information would include: large scale distribution of informational brochures, mass media announcements, lectures and announcements in school settings, and any other suitable means for reaching the public in a positive way. This type of effort could be initiated at a national, regional, or local level. At the local level, the children’s eye care facility can offer specific advice at gatherings, through word of mouth as the staff deals with members of the local community, and through eye health screening. Eye health screening is an area suitable for operational research to determine what methods are most effective.

PATIENT ASSESSMENT

The child: Remember that the child is not just a "small adult" but is different from the adult in causes of blindness (pathology), visual physiology, psychology, and the examination and treatment techniques required. A suitable environment should be available in the children’s eye care facility to both allay the fears of the child, instill confidence in the family, and provide the most efficient working conditions for the staff. These include having the proper equipment for medical care for the children, and a non-threatening surrounding with pictures and toys for diversion, and furniture of a proper scale for children while they are waiting and areas for conferring with parents.

*For more information, go to www.cybersight.org
Attitude: At the start, every pediatric ophthalmology unit must be designed with the understanding that to be successful the entire effort should be dedicated to establishing and maintaining a “child friendly” atmosphere. Medically speaking it must be remembered that the names of the diseases may be the same, but the glaucoma, cataract, refraction, strabismus, and retinal disease (especially retinopathy of prematurity and retinoblastoma) occurring in a child are different from or nonexistent in the adult and demand a unique set of skills for diagnosis and treatment. Added to this is the sad fact that 50% of children blinded before age 2 years die before age 5 years and 75% of blinding diseases in childhood would not occur if the child had received proper nutrition, appropriate vaccinations, avoided trauma and harmful traditional practices, and had proper screening leading to timely treatment including correction of refractive errors. Since so much of childhood blindness is preventable and therefore unnecessary, the pediatric ophthalmologist and the staff must be aware of the need to promote better health and life style practices for children.

STAFF

A tertiary care children’s eye care facility should be led by a fellowship-trained pediatric ophthalmologist or, in a larger facility, by two or more such staff. This will not be possible in every case. If a formally fellowship trained pediatric ophthalmologist is not available, then an ophthalmologist with skills and interest in children’s eye health will be acceptable. Ophthalmologists in this category should be willing to learn “on the job” and be eager to pursue training, formal or otherwise, when possible. Training in pediatric ophthalmology can be started by pursuing the Orbis, Cyber-Sight E-Learning on-line training program for pediatric ophthalmology and strabismus, including participation in Cyber-Sight E-Consultation.* Other staff of the children’s eye care facility should include: one or more additional ophthalmologists with or without formal fellowship training but with a special interest in caring for children and a willingness to gain further skills, pediatric anesthesia, pediatric nurses, technicians, orthoptist (optional), plus administrative, clerical, maintenance, custodial staff, and access to biomedical engineers.

*For more information, go to www.cybersight.org
A tertiary care children’s eye care facility should be part of a larger facility including both an eye clinic and preferably a general hospital that provides general pediatric care. The facility should have other ophthalmologists who provide comprehensive adult eye care. The entire medical staff should have logistical and administrative support systems suitable for the size and scope of the facility. Simply providing equipment and training in pediatric eye care will not guarantee that pediatric eye care services will be offered properly or that they will develop or improve at an appropriate pace. Therefore it is vital when establishing child’s eye care services to consider the institutional capacity to effectively administer this facility. Once established, the tertiary care children’s eye care facility should function with a degree of autonomy suitable to continue providing the unique services needed by the child while working effectively with the larger unit.

The establishment of a children’s tertiary eye health facility (pediatric ophthalmology clinic), located in almost every case in a comprehensive (adult) eye care facility or larger health care facility, is likely to come about only after some other influence within the larger organization considers this action necessary. Initiation of such a move would depend on people, not necessarily pediatric ophthalmologists, acting on behalf of pediatric ophthalmology. For example, an established eye clinic leader could say, “we need more emphasis on children’s eye care”. This may be what it will take to get a pediatric facility started. In the developing economies there are few if any pediatric ophthalmologists already in place, or if present, they are unlikely to have the influence to champion such a project. For the most part, ophthalmic sub-specialties including pediatric ophthalmology are rare outside of the developed economies. In most cases, leadership and support for pediatric ophthalmology must begin with the comprehensive ophthalmology community. This kind of cooperation will be needed to initiate and later sustain a tertiary children's eye care facility.

To be successful, any venture requires effective governance and leadership. This leadership comes from many sources in an organization, including those in designated leadership positions as well as those who are unofficial leaders, people who understand the direction of the organization and who are trusted by others. Leaders must coordinate and integrate the organization’s various activities to ensure the most efficient use of resources, both human and material. Governing, managing, and leading an organization entails both authority and responsibility. Leaders are responsible for complying with laws and regulations and for meeting the organization’s responsibility to the patient population served.
FACILITIES

The physical plant for a pediatric ophthalmology clinic can be relatively simple and therefore does not require too many special considerations. But, some important features should be included. The facility should have a child friendly waiting area including facilities for other family members, parents and other children. Individual examination rooms should be available and each should contain the basic equipment to carry out an eye examination on a child including data collection forms and equipment to accomplish the following: history taking, vision testing, refraction, motility testing, retina examination, anterior segment examination, and intraocular pressure testing, and examination of the lids, lashes, lacrimal apparatus and adnexa. Each room should have a simple table (drop-down, wall-mounted is ideal) for examination of infants while supine. The number and type of children to be cared for per day should be estimated and calculations completed considering the time per examination to establish the number of examination rooms needed in particular and the size of the facility in general. There should be appropriate equipment to examine infants, toddlers, preschoolers and school age children. The professional staff should each have a modest personal work area but only the size needed to facilitate case management including: evaluating charts, referring to medical literature, connecting online, and communicating with colleagues. Each clinic should have an area for viewing images (CT, X-Ray, MRI) and for conducting A and B ultrasound testing. Equipment and supplies for obtaining cultures should be available as well as equipment for blood drawing and for injection of medications. Basic antibiotic and corticosteroid medications should be available. Capability for small instrument sterilization and disinfection should be available. Each facility should have broadband Internet connection to remain connected to the Internet. A facility for dispensing eyeglasses should be available in the clinic or nearby for the convenience of patients.

FRAMEWORK FOR FACILITY DESIGN

Because the environment has a profound effect on health, productivity, and the natural environment, health care facilities shall be designed within a framework that recognizes the primary mission of health care (including “first, do no harm”) and that considers the larger context of enhanced patient environment, employee effectiveness, and resource stewardship. The health care environment should enhance the dignity of the patient through features that permit privacy and confidentiality.

1. Stress can be a major detriment to the course of a patient’s care. The facility should be designed to reduce child, family, and staff stress wherever possible.
2. Since technology can change, flexible design is in the best interest of enduring quality care.
3. Design should make every effort to enhance the performance, productivity, and satisfaction of the staff in order to promote a safe environment for care.
4. Creativity should be encouraged in the design process to enhance the environment of care.
A MODEL PEDIATRIC OPHTHALMOLOGY CLINIC

The approximate cost for a fully equipped examination room is $35,000 USD. Additional equipment that there needs to be only one of is housed in a “special purposes” room and would cost approximately $40,000.

The sizes of the rooms shown are only to illustrate relative proportions. As a reference, the examination room would ideally allow for a 20 ft (6 M) lane meaning that the room would be a little more than 20 ft or 6M in length. However this is not always possible. In that case mirrors or a chart with reduced optotypes can be used. The other rooms are also shown in more or less relative size proportional to the examination room. This simple suggestion for layout is only to give a general idea or concept, and it is understood that in each case adjustment will be required in both unit size and number of rooms. This room and the furnishings and equipment could be repeated as needed.
The equipment in the examination room would include:

- Examination chair
- Slit lamp
- Indirect ophthalmoscope
- Trial lens set/retinoscope
- Trial frames (child and adult)
- Loose prisms
- Prism bars (horizontal and vertical)
- Direct ophthalmoscope
- Muscle light
- Indirect lenses (2)
- Titmus stereo test
- Color vision test (simple)
- Worth four lights
- Opaque occluder
- Translucent occluder (2)
- Near reading card
- Miscellaneous near fixation targets
- Automated vision tester/fixation with remote control
- Camera

A central coordination and “control” supply area would contain:

- Exophthalmometer
- Computer connected to internet
- Medications (antibiotic and steroids topical and systemic)
- Diagnostic drops
- Work-up form
- Reference library (clinical)
- TONO-PEN®
- Etc.

The supply area would be staffed by a nurse or technician.

**Minor Procedure Room**

1. Table
2. Cabinet
3. Stool
The minor procedure room would have:

- Indirect ophthalmoscope
- Lacrimal intubation set
- Oculinum
- Minor surgery set (for procedures such as chalazion excision, suture removal, etc.)
- IV fluids
- Needles
- Syringes
- Perimeter
- A / B Scan
- Sterilizing and disinfecting equipment
- Portable microscope
- Surgical loupes
- Etc.

This is only a partial list of equipment. More choices will be offered in the following description of tools and equipment useful for the pediatric ophthalmologist.

The patient examination/treatment area is shown below. The number of rooms could be increased or decreased according to patient load.

Also needed, but not shown, is the office area for medical staff, chart storage area, support staff work room, and break area.
The following describes the basic array of equipment that is found in an examining room/clinic for pediatric ophthalmology. This equipment is shown to provide an example of the “class” or type of equipment needed. In nearly every case another brand or design of equipment (in many cases more economical) designed to do the same thing can be substituted.

A chair is required for the patient. It is preferable to have a chair that can be raised and lowered and even flattened to allow the patient to lie flat or nearly so. Also included in this basic examination facility unit are a biomicroscope (slit lamp) and a phoropter, both mounted on an adjustable arm. (The phoropter is optional and is not needed when loose lenses for refraction are available.) This equipment as shown here is expensive and is only an example. Suitable equipment can be obtained at a much lower cost and still be effective. This equipment is shown only to demonstrate the elements of the basic office examination unit. This picture was obtained in a university pediatric ophthalmology clinic in the United States. Very basic and less expensive equipment is sufficient.

Examination rooms should be equipped with a hand-washing sink or access to available alcohol cleanser (e.g., a wall-mounted dispenser that is filled each day) to maintain proper hygiene during examination. This is essential and should be available wherever patients are examined and treated.

This examination room desk, or equivalent, is useful for writing and storing small equipment in drawers. The desktop also holds small instruments. Recharging wells in this desk contain a retinoscope, an illuminator, and a direct ophthalmoscope. In this instance, a sophisticated visual testing/fixation device is shown. While this type of vision testing equipment facilitates the examination by offering an ever-differing array of optotypes (symbols for vision testing), this is not essential and a simple chart can be substituted. The examination room should provide a 20-foot testing distance, if possible. If this size room cannot be obtained, the vision testing chart should be calibrated appropriately with reduced optotypes or mirrors can be used.
A trial lens set is included in the drawer of this console. These lenses along with a suitable trial frame and a retinoscope are all that is needed to carry out an accurate refraction if the examiner is sufficiently skilled. A phoropter can be considered an expensive luxury. In some climates, it is very difficult to keep the lenses of the phoropter clean and the instrument in working order. The loose lens set contains an array of plus and minus lenses usually ranging from 0.5 D to 20.0 D in both plus and minus power lenses. Cylindrical lenses in plus and minus powers are from 0.25 D to 7.0 D and are also included in a full set. These loose lenses are used in conjunction with a retinoscope and trial frame, or they can be hand held when doing refraction in infants.

Although many clinics have an auto refractor available and it is a common practice to delegate refraction to a technician, it is imperative that the ophthalmologists have the skills to carry out both objective and subjective refraction. Moreover, since refraction in an infant or young child is possible only with the use of the retinoscope and loose lenses, this equipment must be included and the skill to use them must be present!

It is imperative that the pediatric ophthalmologist possesses skills to carry out refraction with loose lenses!
EQUIPMENT AND SUPPLIES

The following is a basic equipment list for the tertiary care pediatric ophthalmology clinic to be used for examination and for performing basic procedures:

1. Vision testing equipment - distance and near (this can be automated or a simple chart)
2. Color vision testing
3. Refraction equipment including loose lenses, retinoscope, trial lens frames (child and adult), and skiascopy rack. This could also include an auto refractor, but this equipment can be a detriment if the staff fails to learn this important skill.
4. Slit lamp – both table-mounted and portable machines are needed
5. Ophthalmoscope - direct and indirect
6. Loose prisms
7. Lacrimal probes
8. Ultrasound A/B
9. TONO-PEN®
10. Gonioscopy lenses
11. Indirect lenses
12. Suture sets - needle holder, forceps, scissors
13. Exophthalmometer
14. Translucent occluder
15. Diagnostic eye medicines (dilating drops)
16. Fixation targets
17. Lensometer
18. Schiotz tonometer
19. Eye patches/tape
20. Digital camera
21. Lap top computer
22. Sterilizer
23. Strabismus surgery set
24. Operating loupes
The following demonstrates the various pieces of equipment and provides a brief description of how the equipment is used.

### Trial Frame

The trial frame is a vital part of the refraction process. The trial frame is used to hold loose lenses during the course of refracting a patient. During retinoscopy or with subjective refraction, lenses can be changed rapidly and the axis of the cylinder can be adjusted as needed. The combination of trial frame and loose lenses is used instead of the more expensive phoropter or auto refractor. There are many different models of trial frames. They vary in expense, durability, and ease of use. A children’s size trial frame as well as the adult size should be available. The adult trial frame can be used on all but very small children. When refracting small children and infants too young to respond to a vision chart, refraction can be accomplished with hand held lenses in front of the eye, and prescription determined from the retinoscopy findings. **But, always remember to subtract the working distance.** In most cases the working distance subtraction is +1.50 D. This means that when the retinoscopy findings are +4.50 D the prescription will be +3.00 D. This subtraction does not affect the cylinder. If the retinoscopy findings are -3.00 + 1.50 axis 90, the prescription with average working distance will be -4.50 + 1.50 axis 90.

### Retinoscope

The retinoscope is a key tool for refraction. There are many models of retinoscope. The Copeland model is shown. While it is possible for experts to complete the refraction process by shifting the collar up and down, with minimal or no need to change lenses, it is recommended that the collar of the retinoscope be in the "up" position at all times and that lenses be used. When using a different model retinoscope, the equivalent procedure should be employed. The retinoscope illuminates the retina which sends back the reflected light. Lenses are then placed between the examiner and the patient until the light rays coming from the illuminated retina are parallel as evidenced by no movement of the light reflex when the retinoscope is moved. This is called the "end point" of retinoscopy and is a good estimate of the refractive error of the eye after the working distance is subtracted. In older patients this estimate is refined by subjective response. In infants the prescription is determined by the retinoscopy findings. Retinoscopy leading to the prescription of glasses can be accomplished by a trained technician.
The lensometer is an instrument for measuring the power of the lenses in a pair of spectacles. This instrument can be used by a trained technician. There are several reasons for wanting to know the power of spectacle lenses including confirmation that a prescription has been filled properly, and determining the power of a lens when only a fragment is available.

The biomicroscope (slit lamp) is an essential tool for examining the front of the eye. This includes the cornea, anterior chamber, iris, and lens of the eye. With an additional lens called a gonioprism the slit lamp can be used to examine the anterior chamber angle for the evaluation of cases with glaucoma. Using an additional high plus lens (90 diopter lens or a Hruby lens), the optic nerve and macula can be seen in detail. With the applanation tonometer attachment, the slit lamp can be used to very accurately measure intraocular pressure, a test for glaucoma.

The Schiotz tonometer is an older, indentation method of measuring intraocular pressure (not shown). The results of testing with this instrument can be affected by ocular (scleral) rigidity that has nothing to do with intraocular pressure. For the most reliable intraocular pressure testing the applanation tonometer is used, but the Schiotz instrument continues to have a place because it is relatively inexpensive, requires little maintenance, and is portable.
The TONO-PEN® is a hand held "micro-indentation" tonometer. It is extremely useful for checking pressure in infants and young children. To measure the intraocular pressure it is necessary to only gently "tap" the cornea for a fraction of a second with the tip of the instrument after placing topical anesthesia on the cornea. Results of this test are quite reliable. The instrument is expensive, costing approximately $4,000 USD. A sterile plastic cover must be placed over the tip before each use, but many in developing countries wipe the cover with alcohol and re-use it. The safety of this approach has not been confirmed. This instrument must be handled very carefully and is subject to breakdown even with careful use. For that reason, as well as the expense, this instrument may not be suitable for all applications and if used should be backed up with a Schiotz tonometer. In high-volume settings it is reasonable to have more than one TONO-PEN® available.

**Applanation Tonometer**

The applanation tonometer attachment is used on the slit lamp to measure intraocular pressure. The cornea is stained with fluorescein and anesthetic agent is applied before the measurements are taken.

**Skiascopy Racks**

Skiascopy racks contain plus and minus lenses in a limited but very useful range and are used for doing rapid retinoscopy in place of the complete loose lens set. They can be used in the field and during screening. These portable and inexpensive lens sets are a must for the pediatric ophthalmology clinic and since they are not expensive, both should be available.
Prisms are used to measure the angle of deviation in cases of strabismus. These prisms can be used to center the light reflex in the pupil or can be used to neutralize movement when employing the alternate prism and cover test. Prisms can either be loose (top left), in which case they can be combined to add more power or to combine horizontal and vertical prism, or they can be in a prism bar (bottom left) allowing more rapid change in prism power. Both types of prism are useful for the children's eye clinic, and since they are not expensive both should be available.

Portable Slit Lamp

The portable, hand held, slit lamp can be either battery operated or connected by a cord to a power source. This instrument is especially useful for examining small children or infants and can be used with the patient supine. In this instance, the instrument can be brought to the patient. This is an example of an instrument especially designed for use with infants and children.

Indirect Ophthalmoscope

The indirect ophthalmoscope is a head mounted device that creates a focused light source that is used with a hand held lens enabling a complete view of the retina (back of the eye). To see the more peripheral retina and ora serrata it is necessary to use scleral depression.
Indirect Lenses

Indirect lenses used with the indirect ophthalmoscope are high plus condensing lenses measuring 20 D (above) and 30 D (not shown).

Direct Ophthalmoscope

The direct ophthalmoscope is a hand held device for viewing the posterior of the eye (retina and optic nerve). Magnification with the direct ophthalmoscope is approximately 15 X.

Finhoff Illuminator

This is a Finhoff illuminator. It is used for viewing the anterior segment and it can also be held against the eye to obtain transillumination. A simple penlight is an adequate substitute for this illuminator.
**Auto Refractor**

This is an auto refractor. It is useful for obtaining an estimate of a patient's refractive error. However, measurements of the refractive error are not always sufficiently reliable for prescribing glasses. The auto refractor is used in patients old enough to sit up to the machine and cooperate. The auto refractor should not be used as an excuse to avoid learning the principles of refraction. Every ophthalmologist should know how to refract. This is a basic principle of ophthalmology and should be adhered to.

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**Lacrimal Probes**

Lacrimal probes can be used in the clinic on very young children to carry out probing of the nasolacrimal system in cases of tear duct blockage causing overflow tearing and sometimes infection. The probes come in various sizes usually designated by "0" with 4-0 or 5-0 being the smallest, graduating to the larger 0 probes. The more commonly used probes are 0 and 2-0. Probing is done with anesthesia in the operating room on older children. It is essential during probing with the patient anesthetized that a mechanism be in place for guarding the patient's airway. These instruments are very durable. The ones shown above have been in use for more than 20 years!

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**Gonio Prisms**

Gonio prisms in a variety of shapes can be used with the slit lamp or other light source to view the anterior chamber angle (not shown). These are used primarily for the management of glaucoma.
Ultrasound

Ultrasound equipment capable of demonstrating the internal structures of the eye

This B-Scan ultrasound examination demonstrates an eye that is filled with what appears to be solid tumor.

Ultrasound B-scan and A-scan equipment is very useful in the pediatric clinic. These can be used to evaluate the posterior segment of the eye in cases of suspected retinal pathology such as tumor or detachment, and can also be used to evaluate suspected cysts in the iris. These instruments are costly, approximately $10,000 to $15,000 USD.

Topical Eye Medications

Topical eye medications (drops) used in the diagnostic process are: topical anesthetic - proparacaine 0.5% or tetracaine 0.5%; dilating drops - cyclopentolate 0.5% and 1% (2% cyclopentolate should be avoided because over medication can cause temporary psychosis); atropine 0.5%, 1%, and 2%; homatropine 2% and 5%; and tropicamide 0.5% and 1%. Fluorescein strips to stain the cornea should also be available.
The Titmus stereo test is used to measure the degree of fusion in a patient. The test goes from 4,000 seconds of disparity (peripheral fusion) to 40 seconds of arc disparity (fine fusion). Patients respond positively by noting targets that seem to pop up from the book in "3D". Patients who have normal stereo acuity of 40 seconds are likely to not only have normal binocularity but normal visual acuity and generally healthy eyes. This test requires the book with targets and polarized glasses to view the images in "depth" the images.

The Worth four light test measures peripheral fusion and can be positive for some fusion in the presence of small angles of strabismus. This test can also be used to demonstrate diplopia (double vision).
The Ishihara or equivalent test (not shown) is useful for the diagnosis of specific types of color deficiency such as deuteranopia (requires excess green) and protanopia (requires excess red), macular function, and certain other eye diseases. These very sensitive tests should be used in those patients where this type of information is required. Up to 5% or possibly more males are affected by a type of color deficiency that makes it difficult to differentiate red from green! The eyes in these affected individuals are otherwise normal and this so called "color blindness" is a problem only in special circumstances such as dim illumination and when close comparison of the colors is required. In life situations a simple matching test can be employed such as the one shown above which is very portable and inexpensive.

Visual acuity testing charts can have a wide variety of forms. The important thing is that they are calibrated properly matching the size of the optotype and the testing distance. The usual or standard visual acuity chart is designed to be viewed at 20 feet or 6 meters. The letters are proportioned so that the letters on the 20/20 or 6/6 line subtend 5 minutes of arc with components of 1 minute. The ideal optotype is the English "E" which has 5 components each subtending 1 minute. However a wide variety of charts in various languages and using pictures familiar to children have been employed successfully. An ideal though expensive chart is electronic and provides a random array so that it is impossible to memorize the chart. When a distance vision chart is used at less than 20 feet or 6 meters the optotypes should be appropriately reduced in size. Of all the instruments in pediatric ophthalmology, the vision chart offers the best opportunity to "build it yourself" and do so in a very cost effective way.
The exophthalmometer compares the prominence of the two eyes. This instrument is utilized to quantify proptosis or bulging of the eyes.

This child has bulging of the right eye that would be measured and recorded using an exophthalmometer.

The suture set includes fine scissors and fine-toothed forceps and in some cases a #15 Bard Parker blade or razor blade. These instruments are useful for removing sutures and for other minor surgical tasks in the clinic.

The near vision chart is used to measure near visual acuity. It can be useful to estimate the reading potential in children with reduced vision and it can help diagnose the rare case of hypo-accommodation or premature presbyopia. This test can also be done with newspapers, magazines or any reading material available.

Near Vision Chart

Exophthalmometer

Suture Set
Eye Patches

Eye patches are useful in the clinic to demonstrate patching techniques in patients being treated with occlusion for amblyopia.

Pinhole Device

A pinhole device is a quick way of determining whether reduced vision is due to a refractive error. Since the majority of the light rays coming through the small pin hole do not need to be refracted, vision through the pin hole will be normal or nearly so even in cases of uncorrected high refractive error provided the eye is otherwise normal.

Occluders

Occluders can be opaque or translucent. The opaque occluder covers an eye so that the other eye can be tested independently. The translucent occluder dissociates the eyes as though the eye behind the “occluder” was completely blocked, but the examiner can see the eye quite well. This is a valuable technique for evaluating dissociated vertical deviation and secondary deviations when examining strabismus patients.
A pediatric speculum and Flynn depressor are useful for doing a retinal examination on an infant. These are used mainly in the intensive care nursery to assist in the retinal examination of a premature infant. On some occasions these instruments could also be used in the outpatient clinic setting.

**Sterilizer**

A sterilizer is used in the clinic for sterilizing small instruments.

**Culture Media**

As a minimum culture media should be available in the form of blood and chocolate agar as well as a culture tube with swab. The clinic should work under the guidance of the microbiology laboratory.
A digital camera and computer should be available in the clinic. The camera can record interesting cases, be used for medical documentation, and can provide images for use with E-Consultation. The computer, especially if on-line can provide access to a wealth of information.

**Portable Vitrector**

This portable vitrector unit is being used in Ethiopia for surgery on an infantile cataract.

**RetCam**

The use of a RetCam for obtaining digital images of the retina has been especially useful for helping with management of retinoblastoma and retinopathy of prematurity, the former using Orbis Telemedicine, CyberSight.
Operating Loupes

Operating loupes are worn during surgery and are also useful in the clinic. Magnification can be from 2.5x to 4.3 x.

Operation Microscope

The operation microscope is essential for optimal performance during intraocular surgery.
Strabismus Surgery Instruments

1. Lieberman speculum, child
2. Lieberman speculum, adult
3. Hartmann Mosquito forceps, curved
4. Serrefine
5. "Barbie" retractor, 7 mm
6. "Barbie" retractor, 9 mm (not shown)
7. "Barbie" retractor, 11 mm (not shown)
8. Small teaser hook, 6 mm
9. Finder hook, large
10. Finder hook, small
11. Muscle hook, 8 mm
12. Muscle hook, 10 mm
13. Muscle hook, 12 mm
14. Scleral ruler

15. Castroviejo caliper, straight
16. Westcott tenotomy scissors
17. Westcott stitch scissors
18. Bonn forceps, 0.12 mm
19. Moody fixation forceps, left
20. Moody fixation forceps, right
21. Lester fixation forceps, 2x3
22. Tying forceps
23. Castroviejo needle holder, straight w/ lock
24. Barraquer needle holder, curved w/ lock
25. Bishop-Harmon A/C irrigator
26. Chuck handle
27. Performance miniature blade #69

This instrument set is used for strabismus surgery done in the operating room. With the addition of a few other instruments this set can be used for a variety of surgical procedures carried out on the infant and child. More specialized instruments required for cataract, glaucoma, cornea, and orbital surgery will be discussed in more detail in the online course for Pediatric Ophthalmology and in manuals dealing with these subjects and available on line at www.cybersight.org
General financial and management considerations for owning medical equipment

In addition to its original purchase price, medical equipment costs money to operate and to maintain during its life cycle. Installation of certain equipment such as large sterilizers will involve initial additional costs for dedicated water and electrical supplies. Expensive consumables, which generally are not re-usable, are required for devices such as vitrectomy machines. All medical devices, regardless of their complexity and ruggedness, require periodic maintenance and corrective maintenance at some point. Even a simple device such as an ophthalmoscope requires ongoing costs for replacement of bulbs (which are often very expensive) and batteries, including rechargeable ones.

As a rule, equipment owners should budget anywhere from 5% to 10% of the purchase cost per year for each device for consumables, parts, maintenance, and user training. The life cycle of a medical device can range between 5 and 15 years, depending on the ruggedness of the device and the environment in which it is used.

All eye care departments and institutions should have a medical equipment management program to assure the maximum and most cost effective utilization of its technology. This equipment management program may, depending on the available resources and capacity of the institution, be handled by an in-house biomedical engineering department, by an outside service organization, or by an equipment maintenance service shared by several linked institutions. This program should include equipment inventory, preventive maintenance, corrective maintenance, emergency repair services, technology planning (including selection, procurement and retirement of equipment), training for equipment users and patient safety, among other functions.

General considerations for maintaining ophthalmic equipment

Most ophthalmic diagnostic devices have optical components such as lenses, mirrors, and prisms. Many of these components have a special thin coating for filtering specific wavelengths of light, for reflecting light, or for reducing reflection. Great care must be exercised when removing dust and stains on optical components to avoid scratching or removing the surface coating. Dust and stains become harder to clean when they accumulate and therefore periodic cleaning is recommended. However, excessive cleaning can lead to quick deterioration of the surface coating. Specific manufacturer instructions for frequency and method of cleaning should be followed for each device. All ophthalmic equipment should be kept under dust covers when not in use.

In regions with hot and humid climates, it is very common for fungus to grow on optical components such as lenses and mirrors. In its first stages, fungus would not be perceivable by the clinician. With time the fungus covers the lens surface in a web like manner. Initially there will be a very slight loss of image brightness, followed by decreased contrast due to light reflecting off the fungus. In its final stages, the fungus etches the outer coatings of the lens and image sharpness deteriorates. Removing fungus from lenses is extremely difficult and rarely yields good results. Ultraviolet radiation (sunlight or an ultraviolet lamp) or paraldehyde may be used to kill fungus. Once killed, the fungus may be easier to remove but the outer coatings of the lens will most likely have irreversible damage. Optics should be kept in a dry place with plenty of air circulation to prevent fungus growth. Air conditioners and dehumidifiers are very helpful in preventing fungus growth but if not available, the optics can be kept in a sealed container with packets of desiccant such as silica gel.
Bulbs are common in many ophthalmic devices. When replacing bulbs, care should be taken to not touch them with bare fingers. Oils from the skin create hot spots on the bulb that can shorten the bulb’s life. Additionally, fingerprints can become etched into the bulb’s glass jacket and cause a shadow on the illumination field.

Any maintenance that involves precise alignment of optics, or calibration of potentially dangerous forms of energy such as laser energy, should only be performed by manufacturer representatives or by qualified factory-trained personnel. The level of serviceability in the hospital for any device depends on the equipment design, the technology used, the level of support provided by the manufacturer, the available tools and test equipment, and the skills and training of the institution’s biomedical equipment personnel.

All maintenance personnel must follow protective measures when testing and repairing lasers in order to reduce the possibility of exposure of the eye and skin to hazardous levels of laser radiation. One important measure is the use of proper laser safety glasses designed to filter the specific wavelengths and power of the laser being used. Lasers should not be used or tested in the presence of flammable anesthetics or other volatile substances or materials because of the serious risk of explosion or fire.

Special consideration shall be given to protecting computerized equipment such as A/B scans, as well as computers, from power surges and spikes that might damage the equipment or programs. Consideration shall also be given to the addition of a constant power source where loss of data input might compromise patient care.

**PEDIATRIC INPATIENT FACILITY**

Sufficient operating rooms, anesthesia equipment (and, of course, anesthesiologists), a post anesthesia recovery room, and in-patient rooms for pre and post-operative care should be available as part of the general patient care facilities provided by the eye hospital. For retinopathy of prematurity (ROP) management, an intensive care nursery with adequate medical and nursing staff should include the necessary oxygen monitoring system as well as eye examination equipment: indirect ophthalmoscope, condensing lenses, speculums, and depressors as listed above. In addition the nursery should have access to a diode laser and cryotherapy machine with suitable tips for treatment of ROP.

**IMAGING**

Imaging equipment for computed tomography (CT) and magnet resonance imaging (MRI) is very useful for the pediatric clinic and can be a part of the larger eye or general medical facility. A retinal camera, especially one capable of capturing digital images can be useful for the pediatric clinic and such an instrument has been used in programs dedicated to diagnosis and management of childhood eye cancer, retinoblastoma. This instrument can be shared with an adult eye clinic.

**MANAGEMENT AND ADMINISTRATION**

In order to function effectively a health care facility needs competent management and administration. Who carries out this responsibility and how the necessary tasks are
accomplished can vary with local needs, but there are likely to be more similarities than
differences among institutions. One way to arrive at a good plan might be to collect the best
practices of successful institutions, and then use this information to synthesize a formula that
can be used for the institution at hand.

Insight into the likelihood of the success of a project can be gained by looking carefully at the
management and administration of other pediatric ophthalmology facilities. Are there people in
place who are dedicated and also competent to provide leadership that promises success? If
yes, how can they best be supported; and if no, how can this capacity be developed?

HUMAN RESOURCES

The human resource requirements for a pediatric ophthalmology facility start with the
ophthalmologist. This can be a pediatric ophthalmologist who has had fellowship training or an
ophthalmologist who lacks formal fellowship training, but who is fully qualified as a
comprehensive ophthalmologist but is willing and able to deal with diseases of children's eyes,
at least at the basic level. Since the difference is only a matter of degree, any fully qualified
ophthalmologist can be trained for children's eye care. The standard duration of fellowship
training for a pediatric ophthalmologist is one year, however, many fine pediatric
ophthalmologists can learn "on the job" with training supplemented by means of short term
fellowship training, study with books, and on the internet, and through tutoring and mentoring*. The number of ophthalmologists skilled in the care of children needed by a given children's eye care facility is dictated mostly by the number and type of patients seen. However, in more
sophisticated institutions, there can be several pediatric ophthalmologists each of whom further specializes in a particular condition or disease such as glaucoma, cataract, retinoblastoma,
strabismus, etc.

Other human resource requirements include technicians who are able to do many of the
routine tasks in the clinic ordinarily done by the ophthalmologist. These include: history taking,
measurement of visual acuity, checking intraocular pressure, initial evaluation of alignment and
motility, retinoscopy and preliminary refraction, moving and positioning patients, charting, and
more. An orthoptist can be a valuable asset in the management of strabismus and amblyopia,
for teaching, and also functioning as an ophthalmic technician.

Pediatric nurses are important components of the clinic dealing with the management of
drugs, drawing blood, counseling patients and families, supervising sterilization, managing the
operating room, and acting as a surgical scrub nurse. A well-trained nurse is a significant asset
to a pediatric clinic. In some cases a well-trained and motivated technician can carry out most
of the duties of a nurse both in the outpatient clinic and in the operating room.

Optical shop - A tertiary pediatric eye care facility should have a mechanism for fitting and
dispensing glasses at a reasonable cost. The actual manufacture of the spectacles would take
place in most cases off site.

*See:  www.cybersight.org
Low vision assistance should be available for those patients who have low vision and who would benefit from special training. This low vision facility should be staffed by trained personnel and contain a variety of lens and magnifying devices suitable for the population served.

Counseling for families is an important service that is extremely useful in a tertiary pediatric eye care facility. This counseling is important for families dealing with the complexities of childhood blindness and the diseases such as cataract, glaucoma, retinoblastoma, etc. that require follow up and family support.

Other human resources needed in a pediatric ophthalmology facility include: 1) clerical/administrative personnel to manage patient flow and keep track of charts; 2) financial managers to oversee charging and collecting from patients, and the paying of bills for supplies, etc. The financial person(s) could also deal with the parent institution, as well as any granting agencies; 3) personnel to maintain equipment including access to biomedical engineers with appropriate skills for repairs and routine upkeep; 4) custodial care to keep the facility clean.

FINANCIAL MANAGEMENT

In order to keep a facility functioning there must be sufficient income to pay salaries for staff, purchase supplies, and provide for the maintenance of the facility. This assumes that the major equipment, the rooms and building, and the remainder of the infrastructure are in place. Of course, if a pediatric ophthalmology facility is to be established de novo the money to establish the total infrastructure or that part needed must be obtained.

A problem with children's eye care is that cost recovery can be difficult. Of course, the children cannot pay themselves and often, perhaps most of the time, the families themselves are unable to pay. This means the financial support frequently must be generated from sources outside the actual clinic activity. This may come from the government, from "financial shifting" within an institution, or from outside sources such as granting agencies or from an NGO, at least to get the program started or to "prime the pump". It has been a tradition in ophthalmology that even in developed economies the care of children's eyes is that part of the practice of ophthalmology with the poorest reimbursement. This can also have a negative impact on the recruiting of ophthalmologists to become pediatric ophthalmologists. It is a good strategy to link the establishment of pediatric eye care services to other eye care services such as cataract surgery that could in part subsidize costs of caring for children.

MANAGEMENT OF INFORMATION

As with any medical facility, a pediatric ophthalmology clinic will create a number of documents and records containing important information. This information will include the following:

- Patient charts - These documents must be complete, legible, accurate and readily available for use during a patient's visit. They should also be used to compile reports and statistics, and to recognize best practices. To do this, a system for creating and maintaining records must be developed. In addition there must be a provision for maintaining confidentiality of a patient's information.
Billing, or at least charging, information should be maintained regardless of whether payment has been made. This will provide a target for establishing a self-sustaining facility.

- **Appointments** - should be established when possible to promote the most efficient use of the facility and the staff time and create the most efficient patient flow as well as responsibility on the part of the patient.

- **Reporting** - Results of the work completed should be available to demonstrate what has been accomplished both in quantity and quality. This would include both good results and complications.

**CREATING A SAFE ENVIRONMENT**

When dealing with children it is especially important to take extra measures for safety of the patient. These young patients may not always be accompanied by an adult who is familiar with the child and who can communicate on their behalf and be an advocate in general. Some important points to consider are the following:

1. Identify the patient properly so that any care giver can “connect” the patient accurately with charted material pertaining to past history as well as what is occurring during the course of providing the proper treatment. This can include provisions for identifying the surgical site and intended procedure. However, no single method such as painting a mark or depending on a note in the chart should be relied upon as the sole safety measure. There is no substitute for the actual care giver knowing the patient and the intended treatment and then using any marks or “safety net” types of measures as a back up and reminder. When in doubt, any delay is more than made up for by doing the right thing.

2. Treat the child like a child but in those special ways that speed the diagnosis and healing process while reducing fear and anxiety for a patient. Deal with children honestly, openly, and in a manner appropriate for their age and level of understanding. Much has been said about creating a child-friendly waiting room and this is good. This child friendliness should not end at the waiting room but should persist throughout the care giving process and include all aspects of care giving including personnel, environment, and equipment.

3. Encourage family support for the child by making it possible for family members to be with the child as much as possible and when appropriate.

4. Other recommendations of the Joint Commission International (JCI) for hospital accreditation include:
   - Promote effective communication
   - Be aware of the dangers of concentrated medications suitable for adults and not for children and take measures to ensure that these substances will not be used improperly
Reduce the risk of infections by using accepted hygiene measures, especially hand washing
Take measures to reduce the risk of falling

These guidelines sound like common sense and all health care workers should be aware of their importance ahead of time, but they bear repeating because they are important.

**INTEGRATION OF PEDIATRIC CARE WITH “VERTICAL” SUB-SPECIALISTS**

In most, if not all cases, a pediatric ophthalmology facility will function as part of a larger, comprehensive eye clinic or even general hospital. It is important for children to be cared for by an ophthalmologist who has a special ability to deal with children and their parents and who understands how to diagnose and treat the unique eye diseases found in infants and children. But, there are diseases in children that are best treated, at least in part, by a specialist who deals with a particular disease regardless of age these are called “vertical” sub-specialists. These include: selected surgical diseases of the cornea and retina, oculoplastic problems, some neuro-ophthalmologic cases, and cases where an ophthalmic oncologist would be needed for treatment of eye cancer. The ability to share equipment and operating rooms, and have access to general anesthesia can play an important role in the success of a pediatric ophthalmology clinic. Combining adult and pediatric eye care in close proximity allows for the sharing of resources to save money and provide better care. Ideally, any tertiary level eye care facility should have both pediatric and adult eye care available. In addition, the pediatric ophthalmologist should be part of the team that participates in the intensive care nursery, examining and treating infants at risk for retinopathy of prematurity.
THE INTERNET AND THE UNIQUE CONTRIBUTION OF Orbis

The advent of the Internet has made it possible to establish a low cost effective connection between facilities and people anywhere in the world. This technology has been embraced by Orbis using the intranet for internal communication and the Internet for communication with the public and the donor base by means of the Orbis web site. The Cyber-Sight web site connects the Orbis program staff, and volunteer faculty with our partners and with any other eye health care provider in the lesser-developed economies who can benefit from access to patient care consultation and other eye health care information. The Orbis telemedicine program, Cyber-Sight is available online through E-Resources, E-Learning, and E-Consultation.

E-RESOURCES

This is a section of the Cyber-Sight web site that contains material for study that is in the form of lectures, demonstration videos, on-line books, frequently asked questions, Question of the Week, and Clinical Challenges. This material can be viewed by clicking on: www.cybersight.org and selecting E-Resources. The content of this section deals extensively with strabismus and pediatric ophthalmology, but it is becoming more comprehensive with the inclusion of additional material dealing with broader aspects of ophthalmology and eye health.

E-CONSULTATION

This section of the Cyber-Sight web site is reserved for doctors who have applied for and have received an E-Consultation username and password. When enrollment is completed these Cyber-Sight partners are assigned to a Cyber-Sight mentor team made up of 10 to 13 international experts in the various ophthalmic sub-specialties. After enrollment, partners can send patient consultation requests to a specific mentor using the E-Consultation on-line forms. Mentors then respond, with advice and teaching provided free to the partner.

All of the steps necessary to become a Cyber-Sight E-consultation partner can be completed on-line at www.cybersight.org after selecting "How to Become a Partner". This free consultation/teaching service connecting partner doctors with expert ophthalmologists, all of whom are Orbis volunteer faculty, provides advice about diagnosis, treatment plan, and when appropriate makes suggestions for further study related to the problem presented.

By the fall of 2010 the E-Consultation program had completed 7,200 consultations and handled more than 32,000 messages related to patient care. Recognizing the value of this technique, E-Consultation is now being used as a pre-screening and post training follow-up tool for Orbis Hospital based programs and Flying Eye Hospital (FEH) programs. In addition the connection made possible between the student and teacher using E-Consultation is being used during Orbis fellowship training to enhance learning by students as they work in their home.
institutions. To learn more about this program click on: www.cybersight.org Then go to "General Information" and click on "How to Become a Partner".

**E-LEARNING**

The Cyber-Sight E-Learning program provides study material and follows students’ progress online. The curriculum starts with Strabismus and Pediatric Ophthalmology and is continuing with development of the other sub-specialties in ophthalmology. The material for strabismus is also available on a CD enabling study offline. CME credit is granted for successful completion of this material.
OVERVIEW

This section provides a description of the clinical conditions that are managed in a tertiary care children's eye care facility. Treatment of these conditions is carried out by the pediatric ophthalmologist supported by a clinical staff; with care provided through a team effort. Moreover, to attain the best level of care it is necessary from time to time to obtain assistance from other ophthalmologic sub-specialists as well as other medical specialists including the anesthesiologist, radiologist, and neonatologist, dermatologists and others. This can be accomplished readily if the children's eye care facility is ideally part of a larger, comprehensive eye care facility.

The medical conditions treated by the pediatric ophthalmologist are in many cases unique to children because they occur in a developing eye, and especially one that is developing vision. To successfully treat the child's eye, diagnosis and the necessary treatment must be started early and must be accomplished in time! This is one of the reasons for encouraging screening for childhood eye disease. This activity meets the criteria for better eye health for children because it leads to earlier diagnosis, which is essential to early treatment. The eye in a child must grow and develop in a proper way and in a timely fashion in order to provide normal vision and binocular function. A special set of skills is needed by those trusted with the care of a child's eye. This care can be provided by a general ophthalmologist, (or in some respects any caring person) provided he/she prepares for this job, acquires the necessary skills and treats a child as a child. In many cases this is the best that can be accomplished. Such an ophthalmologist could be said to have an "interest" in pediatric ophthalmology. The fellowship trained pediatric ophthalmologist is an ophthalmologist who has received extra training in the care of children, usually for one year or equivalent, and who devotes at least 75% of his/her practice to children.

PEDIATRIC OPHTHALMOLOGY

This section describes some of the clinical activities that would occur under the broad heading of Pediatric Ophthalmology. These include the following:

- Amblyopia
- Refraction
- Spectacle correction
- Strabismus
- Cataract
- Lacrimal disorders
- Uveitis
- Medical genetics and congenital disease
- Retinoblastoma and other orbital and adnexal tumors
- Retina diseases, congenital and related to childhood
- Cornea and external disease (medical)
- Corneal transplantation (done by only a few pediatric ophthalmologists)
- Oculoplastic surgery
- Retinopathy of prematurity
- Glaucoma
- Eye health screening
- Phacomatoses
- Trauma
- Conjunctivitis and infectious disease
- Low vision
- Anesthesia
- Orthoptics

This list describes the range of activities that would take place in a tertiary care children's eye care facility.

**Amblyopia**

Amblyopia is a leading cause, possibly the leading cause, of vision loss at least in one eye occurring in children. Since there are no obvious physical signs of amblyopia, except when it occurs in the presence of strabismus (also called “squint” or misalignment of the eyes), amblyopia is usually discovered only after a child fails vision screening or during a general physical examination that includes vision testing. Once a child presents for a vision check, such as during a vision screening program, amblyopia is easily diagnosed and the treatment for the most part is cheap and uncomplicated but does require supervision. The time honored approach to the diagnosis and treatment of amblyopia starts by finding reduced vision, usually in one eye, in the absence of any other physical abnormality of the eye to account for this reduction in vision. Treatment usually begins with prescribing glasses, if needed, especially if there is a difference in refraction between the two eyes (anisometropia). Treatment of amblyopia traditionally begins with occlusion of the good eye for as many hours of the day as possible. This treatment is continued until vision in the two eyes is equal or there has been no improvement in vision for several months of faithful patching. In recent years a variety of newer amblyopia treatment programs have been demonstrated to be effective. These protocols include less patching time for the better eye and eye drops to defocus the better eye. These new amblyopia treatment programs have been reported by the U.S. based Pediatric Eye Disease Investigator Group. Success in these programs, which is comparable to prescribed "full time occlusion", may be due to better compliance. The pediatric ophthalmology staff should be familiar with these new methods as well as with traditional amblyopia treatment programs. Armed with this information about amblyopia, as well as with programs for screening, diagnosis, and treatment, of amblyopia and

This child is wearing a patch over the “good” eye to help stimulate vision in the amblyopic, poorer seeing eye, and she also is wearing corrective glasses for farsightedness.
other common eye conditions occurring in the child, the staff of a children's eye care facility should function in a way that best meets the needs of the local population. An inducement for more aggressive treatment for amblyopia is the fact that the child who has poor vision from amblyopia in one eye is more likely to have injury or harm to the one remaining good eye than the child with two good eyes. In the larger scheme of childhood blindness, the reduced vision occurring in just one eye of the amblyopic child may seem insignificant. However, in order to promote a higher quality of life and a more promising outlook for children of any society, inexpensive and effective amblyopia treatment should be a part of the plan for any pediatric ophthalmology facility.

Refraction*

The pediatric ophthalmologist must be an expert at refraction. One of the first teaching responsibilities for Orbis and the duty of the partner is to teach/learn the art of refraction. Teaching should start with use of a retinoscope and loose lenses (a phoropter can be used if available, but an automatic refractor is not recommended for the beginning student).

Before moving ahead with the more advanced pediatric ophthalmology training process in a given facility, refraction should be mastered. While most ophthalmologists will readily claim to be fully qualified to carry out refraction, they may say that their time is better spent in other more demanding activities in pediatric ophthalmology. This may be valid, but it is still necessary for these ophthalmologists to demonstrate proficiency at refraction so that they can properly train and supervise technicians and other staff who may be required to carry out this task. The pediatric ophthalmologist should also be able to say who will be doing the refractions in the clinic and should be responsible for their actions. As many as 15% of children require spectacle correction by the teen years to obtain normal vision in some populations (China, for example). This important public health issue should not be overlooked. There is no activity in pediatric ophthalmology that can restore a child to normal vision faster or cheaper than refraction followed by providing suitable spectacles.

This demonstrates the simple technique and limited equipment needed to complete a refraction. The examiner uses a light with a special focusing device and the patient wears a spectacle frame that accepts interchangeable lenses.

*A manual, “Vision and Refraction” is available online at: www.cybersight.org
Spectacle correction

It has been shown that the need for glasses to correct reduced vision from untreated refractive error in childhood can be as high as 15% by teenage. These statistics from China are slightly higher than in other parts of the developing world. Measure of this refractive error determining the strength of glasses to give must be done by carrying out an accurate refraction. But, as important as it is to obtain an accurate refraction on a child of any age, the pediatric ophthalmologist must not stop there. Refraction should be followed up by providing sturdy and attractive spectacle correction. These should be glasses that children will wear faithfully, and without ridicule from peers! This may require public education to change negative attitudes that are associated with the wearing of glasses in many communities. The spectacle frames should be non-flammable and the lenses shatterproof.

This child is wearing glasses that fit properly and are acceptable in appearance.

Strabismus

The pediatric ophthalmologist should have a thorough understanding of strabismus diagnosis and management. Strabismus includes eyes that are crossed in (esotropia), deviate outward (exotropia) or that are misaligned vertically (hyper/hypotropia). Strabismus can be congenital or acquired from uncorrected hyperopia (farsightedness), injury, or systemic disease. Adults who suffer from acute strabismus often have diplopia (double vision). The treatment of strabismus involves surgery, optical correction, prism, patching in some cases, and rarely exercises. As with refraction, those skills for diagnosis and measurement of strabismus must be fully understood by the ophtalmologist and not be a solely delegated responsibility. In addition to work-up and non-medical treatment, the surgical treatment of strabismus must be thoroughly understood. Partners should be instructed in the use of this technique and encouraged to continue its use. There are several good books dealing with strabismus available on the Cyber-Sight web site; partners have ample opportunity to study and learn skills for dealing with strabismus and can pursue an online course at www.cybersight.org.

These children with strabismus can be helped with a simple surgical procedure that will have a beneficial effect on their vision and quality of life.
An orthoptist is a professional who is trained in the diagnosis and measurement of strabismus and for carrying out non-surgical treatment of strabismus. The orthoptist can be an asset in a busy strabismus clinic and can be an important component for teaching strabismus skills to partners.

It has often been pointed out that strabismus does not threaten sight except in those cases where crossing of an eye (usually crossed in) causes amblyopia or a functional loss of vision in one eye from disuse or suppression. However, children and adults with strabismus often suffer significant psychological harm when dealing with peers and society in general, and may be handicapped in the workplace because they may not be selected for employment even though the job they seek could be done adequately in spite of the strabismus. Surgery to align the eyes of a person with strabismus can have important benefits for both economic and social reasons.

**Cataract**

Congenital and childhood cataracts are said to be one of the most treatable causes of visual impairment during infancy. This is important because these childhood cataracts are more common in the developing countries. The incidence of congenital and/or infantile cataracts has been reported to be as high as 60 or as low as 12 cases per 100,000 births.

Dealing with this blinding condition of childhood cataract in developing countries is mostly the responsibility of doctors tertiary pediatric eye care facilities in developing countries and of those organizations that support them. The process begins with making good decisions. This could start by asking the question, ”Should resources be dedicated to the treatment of childhood cataracts or should they be used solely for prevention of other blinding diseases?” “Should unilateral cataracts be treated or should surgical treatment of childhood cataract be limited to bilateral, blinding, cataracts?” The questions are legitimate because challenges to successful treatment of congenital and childhood cataracts are many. Even in those areas with the best-developed children's eye care system, many questions about best treatment remain unanswered and results of treatment even with the best of care often falls short. Some unanswered questions regarding treatment of childhood cataracts include: the best time to treat, the best technique to use, at what age should an intraocular lens (IOL) be used in a child, what is the spectrum of complications, and how are they best treated? Added to this quandary is the fact that the infant or young child treated for congenital cataract must “learn to see” and avoid amblyopia during this period of challenging and often uncertain treatment! This means that, to be effective, surgery must not only be done competently, and optical correction be accurate, but close medical follow up must be carried out. Appropriate treatment must be done in a timely manner for those post operative complications that can arise only in children. Having said all of this, it is appropriate for a tertiary care facility dealing with pediatric ophthalmology to have the capability to treat cataracts in infancy and childhood especially those that are bilateral and blinding.
The above could be interpreted as a "mixed message". Should programs for treatment of congenital and childhood cataract be supported? The answer is a definite YES! But, it is important to have a realistic attitude and to prepare properly to deal with the problem that is more challenging than is presented by the adult cataract.

Lacrimal disorders

The infant's lacrimal system is especially prone to malfunction. Most infantile lacrimal disease is caused by spontaneous obstruction of the tear drainage system causing tearing and frequently leading to infection in the tear sac. This can be dealt with effectively in most cases with infants by simply performing probing in the outpatient clinic with use of topical anesthesia. Chronic obstruction of the lacrimal system in toddlers and in older children is best treated in the operating room with general anesthesia and with the use of a temporary stent. More serious disease including acquired and congenital permanent obstruction of the system and trauma can require more complicated surgical repair. The anatomy and physiology of the lacrimal drainage system should be thoroughly understood as well as the appropriate treatment techniques. Disorders of the lacrimal gland including infection and neoplasia occur rarely.

Uveitis

Uveitis is an inflammation of the middle, mostly pigmented layers of the anterior and/or posterior parts of the eye. Uveitis can affect the eyes of children anywhere. It is caused by a variety of autoimmune disorders, and also is related to bacterial, viral, and parasitic disease. These conditions will be managed almost exclusively by tertiary care centers. Because of the rarity of the disease and the highly specialized nature of the diagnosis and treatment, E-Consultation provided on Cyber-Sight can be very useful.

Medical genetics

In areas of the developing world, medical genetics plays an important role. In many societies consanguineous union is common. This results in a concentration of diseases that are called recessive. These recessive diseases occur only when both parents (neither of whom is clinically affected) of an offspring carry the same gene for a given abnormality. Because they come from a similar gene or genetic pool, blood relatives are more likely to carry the same recessive gene. If these blood relatives have an offspring, their children are much more likely to have the congenital abnormality than if either parent had a child with someone not related and from an entirely different genetic pool. There are many complex issues in the area of medical genetics. Recessive traits can occur even without consanguineous mating and other congenital disease can occur when only one parent has the affected gene, and this is called dominant inheritance. Competent basic genetic counseling at least as it is related to eye disease should be available at a tertiary care children's eye care facility.
Retinoblastoma

In many parts of the developing world retinoblastoma (childhood eye cancer) is first diagnosed as a fungating mass protruding form the orbit. When this stage of retinoblastoma is reached, it is universally fatal! Between one and two thousand new cases of retinoblastoma affect children in the world each year. While the death rate is less than 3% in the developed world, it approaches 60% in some developing countries. If retinoblastoma is present in only one eye, successful treatment may require nothing more than timely diagnosis followed by removal of the affected eye. In bilateral disease, the treatment is more complicated requiring in some cases, extensive chemotherapy, radio-therapy, brachytherapy, laser, cryosurgery, and more. Treatment of both unilateral and bilateral retinoblastoma has been undertaken successfully by special Orbis partners who have benefited from a “networking” program connecting with St. Jude Hospital and the University of Tennessee, both in Memphis Tennessee. This program has been an ideal use of Cyber-Sight which has been employed successfully for retinoblastoma treatment programs carried out in Central America and Jordan.
**Cornea/external disease**

Cornea and external eye disease, causing an opaque cornea, is one of the leading causes of blindness in children in the developing world. This corneal disease tends to be chronic and is usually related to constitutional disease related to an inadequate diet, lifestyle issues, and the lack of proper immunization. These corneal diseases are commonly related to Vitamin A deficiency and lack of maternal and child immunization for rubella and measles. Half of those children blind before age 2 years will die before age 5 or 6 years. Compounding the problem of childhood corneal disease is that once the opacity occurs and is in a moderately advanced state, treatment, including attempts at corneal transplantation, is unsuccessful in the long term. Another example of chronic external disease is trachoma. This starts in childhood as chronic conjunctivitis, and persists into adulthood where it is a leading cause of corneal blindness in young adult females.

Prevention is key to dealing with cornea and external diseases in children. Pediatric ophthalmologists should promote healthful practices and should be advocates for children and their families through public education and in dealing with governments and other NGOs.

**Corneal transplantation**

This is a very great challenge to a local pediatric ophthalmology facility. While these techniques have been successful in some selected cases they will not likely be widespread in the foreseeable future. Complications after corneal transplantation in children include glaucoma, amblyopia, and graft opacification, all of which are very difficult to manage successfully. However, the tertiary care facility faculty and staff could explore the possibility of offering this service. Corneal transplantation programs for children should be considered carefully and attempted only after consultation.

**Oculoplastic surgery**

A variety of surgical procedures for ptosis, other lid abnormalities, enucleation, lacrimal surgery, trauma surgery, and more must be performed in a pediatric ophthalmology clinic. The sub-specialty area of oculoplastic surgery for either adults or children is neither well established nor common in many areas of the developing world. More awareness and better training should be sought.
Glaucoma

Pediatric glaucoma, especially primary congenital glaucoma, is an entirely different entity from glaucoma in the adult. Congenital glaucoma is a condition resulting from abnormality of the eye's internal drainage system that impedes the free exchange of fluid through the anterior chamber angle to the systemic circulation. The treatment of primary congenital glaucoma is surgical. It is done by dividing the abnormal membranes that deny access of the internal eye fluids to the systemic drainage system. This surgery is extremely delicate and requires special though not particularly expensive instruments. The technique can be learned by a competent pediatric eye surgeon with training or can be performed by glaucoma specialists. This surgery must be repeated in many cases and to be successful must be done early, before damage had been sustained by the optic nerve and other eye structures. Other surgery can be done to create new outflow channels and with placement of a stent. Other types of glaucoma in childhood require a variety of diagnostic and therapeutic procedures that in turn require a thorough understanding on the part of the pediatric ophthalmology staff (or glaucoma staff depending on how the subspecialty services allocate this responsibility). As with many eye diseases in children, early diagnosis is key. Late diagnosis, usually eliminating the chance for successful treatment, is all too often the case in childhood glaucoma. As with many childhood eye diseases, the pediatric ophthalmologist should be at the forefront in promoting early diagnosis leading to early treatment.

Retinopathy of prematurity

Retinopathy of prematurity is a complex blinding disease that is on the increase. The reason for this is that as health care improves for premature infants in developing countries more low birth weight children will survive. This survival is brought about through the efforts of pediatricians specializing in neonatology supported by competent nurses working in suitably equipped neonatal nurseries. These nurseries admit very small "sick" infants as they mature in a hostile environment when compared to the uterus. This sets the stage for the pediatric ophthalmologist who examines the retina of all premature infants under a given birth weight which is approximately two pounds (one kilogram). These infants must be followed with serial retinal examinations until retinal growth is complete or until retinopathy of prematurity develops to a stage and grade that is dangerous for the infant's eye. While only approximately 14% of children have retinopathy requiring treatment, all at-risk low birthweight infants must be evaluated until retinal development is complete. Treatment for retinopathy of prematurity is time consuming, delicate and requires the use of expensive equipment including a laser and in some cases cryotherapy machine.
Medical retinal diseases in children can occur from a variety of causes including hereditary abnormalities, vascular defects, systemic disease, and neural defects, infection and inflammation. The tertiary children's eye care facility staff should have the ability to deal with the diagnosis and treatment of these conditions. Most of the more complicated surgical treatment of retinal disease in childhood is done by the adult retinal surgeon with the pediatric ophthalmologist remaining as the primary care giver for the child's other needs related to the eye.

**Eye health screening as a policy**

Eye health screening can be carried out to detect various eye conditions. This screening done for children is intended primarily for: 1) visual acuity testing leading to providing glasses for those who need them, 2) determination of general eye health. All of these can be accomplished at the same screening carried out by trained technical or lay personnel. Some controversy exists regarding the true value of eye health screening for children. This is voiced particularly by those who say that vision screening as currently practiced does not meet the criteria for evidence-based medicine. Many others who do not share this opinion believe that the unique nature of eye health screening and the obvious benefits produced are unassailable. It is expected that the tertiary eye care facilities will both undertake and support vision and eye health screening for children.

Eye health screening has been done in many ways in all parts of the world and for many years; eye health screening includes:

1) A general inspection of the child to evaluate for ptosis, crossed eyes, red eyes, tearing, abnormal head posture, dancing eyes, white pupil reflex, enlarged cornea, and cloudy cornea.
2) Distance visual acuity is measured with criteria for pass/fail established locally or according to published standards. For example: vision less than 20/40 in the better eye can be criterion for failure.

3) Children who fail either inspection or vision testingshould have this information sent to parents and should be referred to an appropriate eye health care facility for diagnosis and treatment.

4) Children who will benefit from spectacles to improve vision should have safe and attractive spectacles provided.

5) Complete records of the results of screening should be compiled and retained locally.

Low vision

Millions of children in the developing world who may be severely visually impaired or legally blind with best corrected vision from 20/200 to 20/400 or less can be helped to lead a more productive and satisfying life with low vision aids and appropriate training. These vision aids come in a variety of forms including magnifying glasses, telescopes, and projection devices that magnify print. In addition a variety of devices like tactile timepieces and other adaptive equipment, as well as life training including mobility skills can be provided to improve the lot of the severely visually impaired. Low vision training is in its infancy in the developing world, but should be included in the activities of the Orbis sponsored tertiary care children's eye care facility.

Anesthesia

In adult ophthalmology, the majority of surgical procedures are done using local anesthesia. In some cases this type of anesthesia can be administered by the ophthalmologist. In contrast with pediatric ophthalmology, surgical treatment and even in some cases examination, requires safe, available pediatric general anesthesia. This signals the need for an anesthesiologist skilled in managing general anesthesia for children as well as being able to use the specialized anesthesia equipment needed for children. For this to be accomplished, in nearly every case, it is necessary for the children's eye care facility to be associated with a larger institution that has operating rooms and anesthesia staff available for the needs of children.

Protocols

Protocol: an official account of a proceeding; the notes or records relating to an activity.

Activities should be planned in advance to ensure that procedures are uniform, repeatable, effective, and accountable; that is, develop a plan, stick to it, and make changes when needed in an orderly manner.

Data: Plan in advance what data is to be recorded, and how this is to be done. This allows accurate reporting with a minimum of time and effort.
COMMUNITY-CENTERED ELEMENTS

THE COMMUNITY

The community has a significant effect on the life and well being of the child. This effect would include a community spirit that promotes good health practices by making information available about the value of hand and face washing, avoiding harmful practices and dangerous play, providing clean water, and proper disposal of waste. The community through the schools or through volunteer organizations can initiate vision and eye health screening for children of preschool and school age. Through community effort, effective children's eye health care facilities can be established and sustained. Depending on the size of the community this may be only at the primary or secondary level, but working in conjunction with a tertiary care center. These relationships are both important. Community efforts supporting better prenatal health care, vaccinating children and young women of child bearing age for rubella, and working toward the establishment of a diet sufficient in vitamin A can be supported by the community. People have power! The community of people has more power and potential to get good things accomplished.

NETWORKING

Networking can in all aspects of its work, and will encourage and support partners to network locally, regionally, and globally in an effort to best support organizational goals and objectives, as well as policy. Networking is a process of building and strengthening relationships between and among parties, and can lead to long term and highly beneficial institutional relationships or partnerships.

Networking allows organizations and other stakeholders to both lend and receive expertise and share best practices. It can boost an organization’s ability to share information, resources and experiences with strategic allies and other partners, enhance its knowledge base and avoid duplication of efforts. Networking can also allow organizations to broaden their support base and mobilize stakeholders from all areas to get involved and take action. All of these aspects to networking should ultimately enable institutions to make better informed program and policy decisions.

Networking is also important in facilitating access to and from services, as can be seen through community outreach and referral systems that rely heavily on information exchange and inter-institutional relationships to promote and ensure greater access to services. Effective networking can lead to collective discussion and pointed actions that can have measurable impacts on a community or population.
Networking Strategies

- Identify twinning relationships across regional, national and international borders to share expertise and enhance learning.

- Initiate electronic networking (Modern Information Technology) via list-serves, Cyber-Sight, etc. to allow for great volumes of information/expertise to be exchanged on a daily or regular basis. Electronic networking can also help to bring institutions/people together to build and formulate partnerships or joint action plans. It should be convenient (depending on internet accessibility), and an inexpensive forum for bringing together people to share experiences and information with one another.

- Develop referral networks and establish linkages between tertiary and secondary and community level eye care centers, schools, other community-based organizations, to promote awareness of and accessibility to services.

Networking/Advocacy Standards

- Work collaboratively with community, local government, private organizations and related associations

- Knowledge of the work/strategies of others in pediatric eye care, and local and international standards

- Establish relationships with stakeholders (community, government, other institutions) at community, local, national and global level

- Electronic or e-networking systems are appropriate to …

- Referral systems in place and functioning

ADVOCACY

Eye care does not take place in a vacuum. There are many "players". One of these very important players is the government, at all levels, that has an obligation to serve the population. NGOs can deal with these governments on behalf of the people, explaining needs, offering solutions, and demonstrating how we are enabling the local health care providers to better serve their patients for prevention as well as remediation. Advocacy efforts require the cooperation of many participants, each of whom may feel like a small part of the process. Development of an effective advocacy plan is an obligation of Orbis as a whole and each of us should do our part.