Education has the potential to change individuals’ lives and fuel social transformation. There is a strong link between children’s health, including their visual health, and the quality of their learning and achievement at school. This, in turn, affects children’s future quality of life and economic productivity. School eye health programmes provide a unique opportunity to deliver comprehensive eye health services to school-going children.

The World Health Organization (WHO) reports that 43% of all visual impairment is due to uncorrected refractive errors. This amounts to 122.5 million people, 12 million of whom are children.1

A recent study demonstrates that programmes for the detection and treatment of uncorrected refractive error (URE) among school children are highly cost effective.2

Comprehensive school eye health programmes are not just about URE, but can also have a positive impact on locally endemic diseases such as vitamin A deficiency or trachoma. School eye health programmes should also include identifying and referring children with other eye conditions such as strabismus or lens opacities. Health promotion and education in schools can reduce the spread of epidemic diseases.

What is comprehensive school eye health?
About this issue

School eye health programmes have the potential to change the lives of school children and their teachers by detecting eye conditions and ensuring access to quality eye care. Health education delivered at schools also has the potential to reduce eye disease and visual impairment in the future. Comprehensive programmes should be undertaken in collaboration with ministries of health and ministries of education, and need to be monitored and evaluated to ensure they are a good use of resources and bring about positive change. Guidelines have recently been produced to help plan, implement, monitor and evaluate school eye health programmes.

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such as viral conjunctivitis and reduce the risk of eye injuries. The eye health of teachers can also be addressed by detecting and managing any refractive errors, including presbyopia. The steps involved in developing a plan are shown in Figure 1.

Children’s rights, the WHO and the UN Sustainable Development Goals

The United Nations Convention on the Rights of the Child (UNCRC) recognises that children have rights of their own: the right to health, including treatment of illness and rehabilitation, a right to education and a right to an adequate standard of living. Poor eye health affects the realisation of these rights. UNCRC provides a mandate for communities, civil society and governments to come together to address child eye health.

The WHO calls for activities in prevention, treatment and rehabilitation to promote eye health in children. These activities are also enshrined in several of the United Nation’s Sustainable Development Goals:

- Goal 1: Ending poverty
- Goal 3: Providing good health
- Goal 4: Providing quality education
- Goal 5: Gender equality
- Goal 8: Ensuring economic growth through the provision of good jobs.

Challenges of current school eye health initiatives

Many school eye health initiatives are narrow in focus, do not involve ministries of health or education and are not integrated into other school health initiatives. Often, they do not provide periodic vision screening to identify new cases, nor follow up children previously identified with myopia (which can progress with age). These factors can lead to poor co-ordination, lack of ownership and affect the sustainability of programmes.
There has also been a lack of standard approaches to screening, referral, prescribing, dispensing and follow-up, and most programmes do not address the eye health needs of teachers. Many of these topics are addressed in the new Standard Guidelines for Comprehensive School Eye Health Programmes. 3

Another challenge is the inadequate monitoring and evaluation of school eye health initiatives. This can lead to inefficiencies, with poor assessment of outcomes and impact. There is evidence that a high proportion of children given spectacles do not wear them for a range of reasons, many of which could be minimised or overcome by educating parents, teachers, the children affected and their peers. Spectacle wear can be increased by dispensing spectacles only to children who really need them (see article on p. 31) and by ensuring that comfortable, cosmetically acceptable spectacles are provided free or at a minimal cost. Several of these topics are addressed in this issue.

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**Figure 1** Steps in developing a comprehensive school eye health programme

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Components of a comprehensive school eye health programme
An ideal school eye health programme should be integrated into the broader school health programme and encompass the following:

Screening, referral and treatment
- Correction of refractive error and provision of affordable, durable spectacles that are comfortable and look good.
- Identification and referral of children with other causes of visual impairment
- Identification, referral and treatment of common eye complaints in children, e.g. conjunctivitis
- Identification and referral of teachers with visual impairment
- Provision of reading spectacles for presbyopia in teachers, if required.

Health promotion and education
- Health education to prevent locally endemic diseases in children, e.g. face washing to promote a clean face to prevent trachoma and/or good nutrition to prevent vitamin A deficiency.
- Promoting a clean, safe and healthy school environment, e.g. growing vitamin A-rich foods in a school garden, collecting water for face washing and avoiding games with sharp objects.
- Encourage children to take eye health messages home. They can act as ‘case detectors,’ identifying people in their community who need eye services. See www.childtochild.org.uk for more information.

The health education component of school eye health should be delivered by qualified eye care professionals, such as nurses or clinical officers, at a level that children can understand. The purpose of health education is to increase children's knowledge about the eye, how it works and what can go wrong (in simple language), and to tell them how they can keep their own eyes healthy. Ideally, this should be an integral component of the school curriculum.

Figure 2: Different approaches to screening and service provision in school eye health programmes

<table>
<thead>
<tr>
<th>Activities</th>
<th>Who can do this and where? Advantages (+) and Disadvantages (–)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHECK: Screen vision using one row of optotypes (p. 30, Fig. 1) AND CHECK: Simple eye examination to detect abnormalities FAIL? DO: Refraction of children who fail vision screening FAIL? CHECK: Can the vision problem be corrected using spectacles? NO? Detailed eye examination to diagnose (and treat) the condition</td>
<td>Teachers trained to screen visual acuity and to screen for abnormalities OR Community health worker or school nurse trained to screen OR Optometrist or other trained eye worker to screen</td>
</tr>
<tr>
<td>+ All children can be screened</td>
<td>+ Can provide high quality</td>
</tr>
<tr>
<td>+ New intake can be screened</td>
<td>+ Fewer to be trained</td>
</tr>
<tr>
<td>– Large number to be trained</td>
<td>– May not be available</td>
</tr>
<tr>
<td>– Variable quality</td>
<td></td>
</tr>
<tr>
<td>Child referred to nearest eye clinic for refraction OR Refraction by optometrist in the school</td>
<td>+ Uptake can be low</td>
</tr>
<tr>
<td>– Uptake can be low</td>
<td>+ Uptake higher</td>
</tr>
<tr>
<td>– May still need referral for management</td>
<td>– May still need referral for management</td>
</tr>
<tr>
<td>Ready-made spectacles dispensed immediately in school OR Spectacles made up by dispensing optometrist and then delivered to school</td>
<td>+ High proportion receive spectacles</td>
</tr>
<tr>
<td>– High proportion receive spectacles</td>
<td>+ High proportion receive spectacles</td>
</tr>
<tr>
<td>– Larger inventory needed in schools</td>
<td>– Lower proportion receive spectacles</td>
</tr>
<tr>
<td>Child referred to nearest eye clinic for examination and management OR Examination and treatment by an eye health professional in the school</td>
<td>+ Uptake can be low</td>
</tr>
<tr>
<td>– Uptake can be low</td>
<td>+ Uptake higher</td>
</tr>
<tr>
<td>– May still need referral to an ophthalmologist for management</td>
<td>– May still need referral for management</td>
</tr>
</tbody>
</table>
Service delivery
It is desirable that the ministry of health provides financial support for programmes, including the provision of spectacles. If this is not possible, the average cost of refraction and spectacles should be kept affordable for parents.

Lack of trained eye care professionals is a major challenge in many low-income settings. The key to a successful programme is well trained and dedicated eye care personnel with clearly defined roles and responsibilities. There are several different approaches to delivering school eye health programmes; which approach is adopted largely depends on the personnel available (see Figure 2).

Ideally, refraction, prescribing and dispensing should be done in schools, as this improves children’s access. If this is not possible, the next best approach is for refraction and prescribing to be done in the school, with dispensing outside: each child selects the frame they prefer in the school, and the local eye unit makes up the spectacles which are then taken back to the school.

Low power spectacles should not be provided, as they are unnecessary and will not be worn. This is a waste of resources and the programme is open to exploitation through unscrupulous prescribing. The article on p. 31 recommends prescribing based on improvement in visual acuity rather than the refractive error.

Young children do not have a well-developed bridge to their nose, and spectacle frames for children must be selected and fitted carefully. They must be cosmetically appealing, comfortable and robust enough to withstand normal wear and tear. The lenses must be able to withstand impact. Glass lenses should not be used. Plastic lenses are light, but can become scratched and should be replaced if badly scratched.

Follow-up
The success of any programme depends on follow-up. Resources should be allocated to this and systems put in place to follow up all children who fail vision screening or who are found to have an eye condition. Follow-up may be needed after referral for refraction, to obtain spectacles, or for an eye examination at the local hospital or vision centre. Accurate and efficient record-keeping is essential, both by those who are screening and referring and those who are receiving referrals.

New guidelines
The document Standard Guidelines for Comprehensive School Eye Health Programmes has recently been released. It provides details on how to plan, implement and monitor school eye health programmes. It is hoped that the guidelines will help to standardise school eye health programmes globally.

References

Resources
Online course based on the Standard Guidelines for Comprehensive School Eye Health Programmes (free). https://academy.brienholdenvision.org/courses/school-eye-health
Ready to screen? Start with the goal in mind

School eye health programmes must be planned properly. Before any work begins, everyone needs to be clear on what the objectives are and how the team will monitor their progress. Only then will programmes achieve their maximum impact.

As with any planning, it is important to decide what is to be achieved by school eye health initiatives. Before acting, it is important to ask the question “What is the benefit we hope to achieve, and for whom?” This positive change is the goal or impact of the programme. It is important to ask this question early on when planning school eye health programmes. Depending on the goal, several different activities are possible, each of which would benefit different groups of people.

Activities to benefit school children
• Detect and treat refractive errors in school children
• Detect and refer children identified with other eye conditions
• Train school nurses to detect and treat simple eye conditions in children in schools
• Health education on how children can keep their eyes healthy

Activities to benefit teachers
• Detecting and treating refractive errors, including presbyopia, in teachers
• Detecting and referring teachers who have poor vision or a history of cataract, glaucoma or diabetic retinopathy.

Activities to benefit communities
• Teaching children how to be agents of change for healthy eyes in their families and communities (see www.childtochild.org.uk).

Having decided which components to include, the activities needed to achieve the goal can then be planned, working backwards from the goal/impact. It is important to describe the objectives, which, if implemented, would bring about the goal/impact intended. The objectives need to be clear, precise and measurable. The term SMART is often used: Specific, Measurable, Achievable, Relevant and Time-bound.

Example
Imagine a school eye health programme with the following goal: “Less visual impairment from uncorrected refractive errors and other eye conditions in children, better near visual functioning among teachers and a lower risk of visual loss from diabetic retinopathy among teachers with diabetes.”

Figure 1 Overview of planning school eye health programmes
To achieve this goal, the objectives might be as follows:

1. To train (xx) teachers in (xx) schools to screen visual acuity in children
2. To screen (xx) children aged 10–18 years between (date) and (date)
3. To dispense spectacles for distance correction to (xx) (y%) children, (xx) (y%) pairs of which will be ready-made spectacles
4. To refer (xx) (y%) children to the base hospital for assessment and treatment
5. To refer (xx) teachers (y% of those aged 40 and above who have diabetes) for diabetic retinopathy screening, and treatment if required

The numbers (xx’s) will vary from place to place and should be based on information from publications and/or reports of previous school eye health programmes in the same or a similar location.

The activities to implement the objectives are shown in the panel (right). Once the activities have been planned, the inputs needed to deliver them can be identified and budgeted for. The objectives are also important as they generate the indicators needed to monitor progress and assess the quality of the programme.

In this example, the activities include the following:

- Training teachers in screening vision at the 6/9 or 6/12 level in each eye
- Vision screening and simple eye examination of children
- Recording the visual acuity measurement, refraction and best corrected visual acuity of those who fail screening
- Prescribing and dispensing spectacles (custom-made or ready-made) to children who fulfil the prescribing guidelines
- Referring children whose vision does not improve with refraction, who have eye abnormalities, or who need cycloplegic refraction
- Assessing near acuity in teachers using standard methods and dispensing near reading spectacles if needed
- Counselling and referring all teachers known to have diabetes for a retinal examination.

The objectives guide the data that need to be collected (the indicators) to continuously monitor progress and assess the quality of the programme. Examples are:

- The number of teachers trained
- The number of children screened
- The number of children prescribed spectacles
- The number of children referred.

Activities based on objectives 1–5, and monitoring data to be collected

In this example, the activities include the following.

- Test visual acuity (VA)
- Refraction
- Spectacle provision
- Assess outcomes/impact

Figure 2 Data to be collected (for children and teachers) to monitor and evaluate a school eye health programme at each stage.
Delivering spectacles to children in schools is recommended.

INDIA

progress in implementing the programme (see panel, p. 27).

Most school eye health programmes do not collect any data beyond the number of pairs of spectacles dispensed/given. This means that it is not possible to assess whether the programme has had any impact, i.e. whether it has made any difference to the lives of children or teachers (see the line “Do not stop here!” in Figure 2, p. 27).

Without knowing the number and proportion of teachers referred who attend the base hospital and then undergo treatment, we have no idea whether they have benefited – we assume they do. Similarly, without recording the number of children who obtain spectacles and the number and proportion who subsequently wear them, we cannot assess the impact of the programme.

We often make assumptions that children will obtain and then wear their spectacles when, in fact, they may not do so in large enough numbers to make the activity worthwhile. We also often make assumptions that children and teachers function better and are satisfied with the treatment they have received as a result of the programme. However, we cannot know this without gathering the appropriate evidence.

Additional information can readily be collected to assess the coverage of the programme and the quality of screening (Figure 2, p 27).

How to use information collected during school eye health programmes

So why do we need to do all this? The answer is that measuring what we are doing allows us to see how we can improve. For example, if none of the teachers identified as having diabetes attend the base hospital for retinal examination, we need to know this. We must either find out why this has happened so that corrective action can be taken, or stop doing it. If the programme includes children aged 5–9 years, it is important to know what proportion of them need and subsequently wear their spectacles. If this is very low then a decision needs to be made whether including this age group is a good use of resources.

Suppose we plan to screen 10,000 children aged 10–15 years, and we estimate that 4% have significant uncorrected errors (Table 1). This means that there are around 400 children needing spectacles in this population of children. As a result of careful monitoring we find out that 4 schools did not participate, and only 8,000 children were screened. 8% of the 8,000 children screened failed screening, but only 60% of these attended for refraction. Among the children refracted, some had normal vision on retesting and the others were dispensed spectacles. Among the latter, only 50% obtained their spectacles, and only 30% of the children who obtained spectacles were actually wearing them 4 months later. Not all (80%) were satisfied with their spectacles. As can be seen from Table 1, this means that although the intention had been that 400 children would benefit, only 35 were wearing their spectacles, and only 28 were satisfied with them: this is only 7% of the 400 we anticipated would benefit. A similar set of information should be collected for children referred with other eye conditions to eye care providers. If uptake is low, then the reasons need to be explored so that corrective action can be taken.

The data in Table 1 raise a lot of questions which, if addressed, could improve the programme. Improving coverage may require better explanation of the programme to headteachers, or flexibility as to when the programme might take place. In this example, approximately twice the proportion of children (8%) failed screening than anticipated. A high proportion of those who failed screening and came for refraction (40%) did not need spectacles. This suggests that vision screening could be improved (see article on p. 31), and where and/or when refraction is done may need to be rethought. Only half of the children prescribed spectacles actually obtained them, which is a common finding. Ways to improve immediate access to affordable, high quality spectacles need to be explored (see article on p. 33).

In summary, school eye health programmes need to be carefully planned and monitored so that the maximum benefit can be achieved for the resources available.

Table 1 Using data (see Figure 2) to identify problems. Only 28 of the estimated 400 children in this example benefited from improved vision.

<table>
<thead>
<tr>
<th>Actual need</th>
<th>Monitoring data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of children</td>
<td>Total number of children</td>
</tr>
<tr>
<td>An estimated 4% have significant RE</td>
<td>10,000</td>
</tr>
<tr>
<td>Need spectacles</td>
<td>80% (of 10,000) screened</td>
</tr>
<tr>
<td></td>
<td>8% (of 8,000) failed screening</td>
</tr>
<tr>
<td></td>
<td>60% (of 640) attended for refraction</td>
</tr>
<tr>
<td></td>
<td>60% (of 384) were prescribed spectacles</td>
</tr>
<tr>
<td></td>
<td>40% (of 384) had normal vision on retesting</td>
</tr>
<tr>
<td></td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>8,000</td>
</tr>
<tr>
<td></td>
<td>640</td>
</tr>
<tr>
<td></td>
<td>384</td>
</tr>
<tr>
<td></td>
<td>230</td>
</tr>
<tr>
<td></td>
<td>154</td>
</tr>
<tr>
<td></td>
<td>[False positives]</td>
</tr>
<tr>
<td>Outcome data</td>
<td></td>
</tr>
<tr>
<td>50% (of 230) received their spectacles</td>
<td>115</td>
</tr>
<tr>
<td>30% (of 115) wear their spectacles</td>
<td>35 Wear spectacles</td>
</tr>
<tr>
<td>Impact data</td>
<td></td>
</tr>
<tr>
<td>80% (of 35) report better vision</td>
<td>28 Satisfied</td>
</tr>
</tbody>
</table>

COMMUNITY EYE HEALTH JOURNAL | VOLUME 30 | NUMBER 98 | 2017
Good visual acuity (VA) is important for educational and behavioural development. Many countries have promoted VA screening to detect refractive errors and other ocular disorders as part of school health programmes.1

There is limited evidence about which strategies are cost-effective for screening visual acuity in school age children.2 The optimum age, number of occasions for screening, and VA screening threshold in different contexts have not been established in controlled studies.

School-based screening

There is evidence that a school-based VA screening programme is both more effective and less costly than other primary eye care models when it comes to delivering eye care to school-going children.3 Due to a scarcity of ophthalmic professionals in most settings, school screening programmes have used non-eye care personnel, most commonly school teachers, who are trained to conduct the VA testing.4 It has been shown that teachers can be trained in VA testing with good results.5

Components

Visual acuity screening includes several components:

• Examiner competence
• Awareness of students
• Examination tools
• Referral system

Each factor can influence the results of the screening test, but so far these factors have not been standardised and therefore comparison across programmes is limited. A few studies have evaluated methods within a single programme.

Comparing selected and all-class teachers

Two studies which compared the training and use of a few selected teachers (STs) and use of ‘all class teachers’ (ACTs) or ‘more class teachers’ (MCTs) found that school screening with more teachers (i.e. fewer children screened per teacher) identified more ocular conditions requiring intervention, including refractive error. In both instances, improved accuracy was achieved without increasing the proportion of referred children.6,7

The ACT study6 found more true positive children with a significantly lower proportion of false positive referrals (9.7% versus 16.7%). The same study showed that the all-class teacher (ACT) model significantly increased the number of children attending follow-up within 3 months compared to the select-teacher (ST) model. This study showed that a small change in the role of teachers improved the eye care of children while reducing programme costs. Another advantage seen with ACT screening compared with STs is a shorter time between screening and follow-up examination by eye care personnel.

A major cost of school screening programmes is the time spent examining children who are referred for refraction after vision screening (the screen positives). The number of referrals is higher if vision screening is not done well (i.e., if there are many false positives) and if the screening cut-off is a relatively good level of VA, as the proportion of children in schools with this level of vision or worse will be higher.

One study examined visual acuity testing at two different VA cut-offs/thresholds.8 At the 6/12 cut-off (poorer VA), the number of children correctly identified as needing help (the sensitivity) was the same as at the 6/9 level (better VA). However, there were fewer false positives (i.e. unnecessary referrals), which led the authors to conclude that it is preferable to screen each eye separately at 6/12. This reduced the number of referrals by about 50% compared with a 6/9 cut-off. However, further studies are needed to determine the optimal VA cut-off in each context.

Continues overleaf ➤
Table 1 Proposed school visual acuity screening preferred practices (in the Indian context)

<table>
<thead>
<tr>
<th>Component</th>
<th>Preferred practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual acuity (VA) testers</td>
<td>All class teachers</td>
</tr>
<tr>
<td>Training of VA testers</td>
<td>At school by ophthalmic professional. Give teachers a VA testing kit</td>
</tr>
<tr>
<td>Setting for screening</td>
<td>School: Find a quiet, private place with normal classroom lighting. Measure the distance using a 6 metre line</td>
</tr>
<tr>
<td>Process of screening</td>
<td>• Test children one at a time; other children remain outside the room</td>
</tr>
<tr>
<td></td>
<td>• Test one eye at a time; cover the other eye with an occluder</td>
</tr>
<tr>
<td></td>
<td>• Use one row of optotypes, preferably Es, rotating it between eyes (to minimise memorisation)</td>
</tr>
<tr>
<td>Age of first examination</td>
<td>5 to 6 years (first year of the primary school)</td>
</tr>
<tr>
<td>Thresholds for VA testing</td>
<td>Cannot see 6/12 (or 6/9) Snellen line in one or both eyes</td>
</tr>
<tr>
<td>Referrals for failed VA testing</td>
<td>Refer children who cannot correctly identify at least 4 or 5 letters of the 6/12 (or 6/9) line with one or both eyes</td>
</tr>
<tr>
<td></td>
<td>Refer to ophthalmic personnel, preferably seen at school within 1 month</td>
</tr>
<tr>
<td>Provision of spectacles</td>
<td>Provided at school within a week of refraction; usually free</td>
</tr>
<tr>
<td>Referrals to hospital</td>
<td>Refer all children with eye problems, regardless of their vision</td>
</tr>
<tr>
<td></td>
<td>Refer children whose vision does not improve to normal in both eyes with refraction</td>
</tr>
<tr>
<td></td>
<td>Give children referral cards to take to their parents. Teachers can assist with counselling/information</td>
</tr>
<tr>
<td>Compliance (spectacles + referral)</td>
<td>After 3 months, visit schools to find out: Do the children have their spectacles? Are they wearing them?</td>
</tr>
<tr>
<td>Frequency of VA testing</td>
<td>Return every 2 years if VA is normal; return every year if VA is not normal</td>
</tr>
</tbody>
</table>

For example, if most teaching uses blackboards, which are often of poor quality, or if classrooms are poorly lit, a better level of vision would be required for distance viewing.

Training teachers to measure VA

In the Indian context, training teachers is typically carried out in two sessions. In the first session, ophthalmologists train teachers to recognise eye conditions in children such as squint, nystagmus, corneal opacities, ptosis, conjunctivitis and eyelid swellings. The teachers are also given posters and pictures. In the second session, optometrists instruct teachers in vision screening using eye charts. The teachers are equipped with Snellen screener charts (both number and tumbling E), 6 metre tape and data forms to record whether the child can or cannot see the optotypes with each eye. They practise on one another to standardise methods and to test reliability.

Visual acuity is measured at 6 metres using a Snellen (or E) chart, asking students to occlude one eye at a time with an occluder. To limit memorisation, and to improve reliability, a tumbling E chart can also be used.

**Tip: Rotate the chart between eyes and between children.** Only one student should be examined at a time; keep others outside the examination room. During screening, students should read the cut-off/threshold line only (6/12 or 6/9). High-contrast black on white should be used, with a dark surround, as this improves reliability when only using one row of optotypes (Figure 1).

A line is considered a pass if at least four out of five letters are read accurately. Children with spectacles should have their vision tested first without, and then with, their spectacles. An eye with visual acuity of less than 6/12 (or 6/9) is noted as ‘screening failure’ and the child is referred.6

In summary, the limited evidence supports school screening methods using ‘all class teachers' and failure to see the 6/12 (or 6/9) Snellen line in one or both eyes as the referral threshold for refraction. All children suspected of having other eye problems, regardless of their vision, should also be referred for examination.

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3. Lester BA. Comparing the cost-effectiveness of school eye screening versus a primary eye care model to provide refractive error services for children in India. Community Eye Health 2007; 20:15.
Improving spectacle wear in school children

Spectacle compliance is low in many school eye health programmes. There are various reasons for this, including that children do not perceive a beneficial improvement in their vision. Accurate visual acuity (VA) measurement, refraction and prescribing based on the degree of improvement in VA can also help.

Measurement of visual acuity

Children who fail visual acuity screening must undergo thorough and detailed visual acuity measurement. This is the first step in identifying those who may benefit from spectacle correction.

Ideally, visual acuity measurement is done in the school immediately or very soon after vision screening. This should be done by an optometrist or a trained refractionist experienced in measuring visual acuity in children. Visual acuity measurements carried out in schools should be of the same standard as at an eye unit.

The distance between the screener and the student (usually 6 metres) should be measured and marked appropriately. The student's chair may move around, so make a mark on the floor where the front legs of the chair should be. Check that the chair is in the right place before assessing each child. If using a standard, unlit visual acuity chart, the room should be well lit, taking care to avoid reflections off the chart. Backlit charts can be used in a darkened room. Students should not be distracted by strong external sources of light.

Before starting to measure visual acuity, the optometrist/refractionist should check that the environment is correctly set up by sitting where the student will sit.

The following equipment is required:

- Tape measure
- Full tumbling E chart (or multi-letter Snellen). Ideally, this should be the logMAR version
- Eye occluder or a piece of card to place over one eye
- Student record sheet.

Procedure

- Explain the test to the child. If an E chart is being used, ensure that they understand what they are being asked to do before starting to measure their visual acuity.
- Measure the acuity one eye at a time, usually the right eye first, then the left.
- If a child already wears spectacles, measure their acuity without spectacles first.
- Ensure that the chart is at the student's eye level.
- Cover the left eye with the eye occluder or a piece of card. It is advisable that they do not use their hand as they may be able to see between their fingers.
- If using a tumbling E chart, point first to the 6/60 size E and ask the student to indicate which way the bars of the E point. Proceed down the chart, pointing out each E in turn, taking care not to cover any part of the E with the pointer.
- Follow the same procedure if using a standard letter Snellen chart.
- To see any particular line of the chart, the child must be able to see at least three of the five Es or letters.
- The smallest line accurately read is expressed as a fraction, e.g. 6/18. The upper number refers to the distance between the chart and the person being tested (6 metres), and the lower number is the line on the E or Snellen chart that the child can see.
- Record the VA for each eye immediately after measuring the acuity, stating whether this was tested with or without spectacle correction.
- If the child cannot read the 6/60 E or letter this is recorded as <6/60.

Refraction

Refraction should be undertaken by a competent practitioner experienced in refracting children.

NOTE: Children whose visual acuity does not improve to normal with refraction must be referred for examination to determine the cause so that appropriate action can be taken.

Retinoscopy, or preliminary assessment using an autorefractor appropriate for children, should be followed by comprehensive subjective refraction. Children should be referred for cycloplegic refraction if they are uncooperative, if there is a variable or inconsistent end-point to refraction, in the presence of strabismus or suspected amblyopia and if they are difficult to refract because of media opacities or irregular corneas.

Continues overleaf →
Before describing how to prescribe spectacles for children, it is important to understand why children may not wear their spectacles.

**Why children do not wear their spectacles**

A key issue in school eye health programmes is that children do not always wear the spectacles provided, which means they do not benefit when they have the potential to. Studies in all income settings show that spectacle wear is often less than 50%. Reasons include:

1. Parents do not buy the spectacles
2. Parents are concerned about their child's appearance
3. Parents are concerned that spectacles will weaken their child's eyes
4. Teachers do not encourage children to wear their spectacles
5. The child is teased or bullied for wearing spectacles
6. The child does not like the spectacles or they are uncomfortable
7. The child does not notice any improvement in vision

There are simple solutions for many of these reasons.

- Reasons 1–5 can be addressed by health education which should include teachers, parents and all children whether they need spectacles or not.
- Reason 6 can be addressed by ensuring that children select the frames they prefer from a range of colours and designs which school children in the programme area say they like, and by checking that the frames are a good fit.
- Reason 7 relates to prescribing.

A recent randomised clinical trial compared rates of spectacle wear in children based on the type of spectacles used. In the trial, children received spectacles only if doing so improved their visual acuity by two or more lines. When followed up after 3–4 months, 75% of all the children were still wearing their spectacles or had them at school.1

This is much higher than in other studies, conducted among children of similar ages, in which prescribing was based on the degree of refractive error found at retinoscopy. This meant that spectacles were prescribed even when some children already had good VA in one eye. These children would not notice an improvement in their vision and would be less likely to wear their spectacles.

**Prescribing guidance**

The prescribing guidelines given here are based on those followed in the clinical trial, in modified form. We hope that the guidelines will help to avoid unnecessary prescribing of spectacles – which will not be worn – in settings with limited resources. However, this must not override the needs of an individual child.

**Note:** The guidelines apply to children with VA <6/9.

Correction for myopia is indicated if:
- Minus powered lenses improve the VA by 2 or more logMAR (or Snellen) VA lines in the better eye or with both eyes tested together.

Correction for hypermetropia is indicated if:
- Plus powered lenses improve the acuity by 2 or more logMAR (or Snellen) VA lines in the better eye or with both eyes tested together, and/or noticeably improve eye comfort when reading

Correction for anisometropia is indicated if:
- There is amblyopia (and the child's age suggests that the amblyopia is potentially treatable)
- There is esotropia or a large esophoria (and the child has some potential for normal binocular vision)

Correction of astigmatism is indicated if:
- Cylindrical lenses improve the acuity by 2 or more logMAR (or Snellen) VA lines in the better eye or with both eyes tested together; and/or noticeably improve eye comfort
- There is amblyopia (and the child's age suggests that the amblyopia is potentially treatable)

Correction for anisometropia is indicated if:
- There is significant anisometropia (i.e. 1D or more), and one or more of the following apply:
  - correctly balanced lenses improve the acuity of the most affected eye by 2 or more logMAR VA lines
  - eye comfort is notably improved
- There is amblyopia (and the child's age suggests that the amblyopia is potentially treatable)

**Conclusion**

There is increasing evidence that, if most children see better with spectacles than without, a higher proportion will wear them. Ideally, a sample of children who do not wear spectacles should be interviewed to find out why they are not wearing them so that corrective measures can be put in place. An important measure of success for any school eye health programme is the proportion of children given spectacles who subsequently wear them – it is not enough just to measure and report the number of spectacles that are dispensed.
Use of ready-made spectacles in school eye health programmes

Ready-made spectacles are suitable for a high proportion of children with refractive errors – but not everyone can benefit.

The most common means of correcting refractive errors is with spectacles. Spectacles are prescribed and dispensed with corrective lenses that give the best visual acuity and are comfortable. Custom-made spectacles (i.e., made up for each individual) are more expensive, but they are essential in some cases, i.e., when a person requires astigmatic correction or needs different power lenses in each eye (anisometropia).

A standard way to report refractive error is to use the ‘spherical equivalent’, which is calculated as the sphere plus half the cylinder, in dioptres (for example, the spherical equivalent for a refractive error of +2.00 with a -1.00 cylinder is $2 + (-1/2) = 1.50$). In children who have no or low astigmatism, and only a small difference between the left and right eyes, their refractive error can be corrected using a pair of ready-made spectacles: low cost, high quality spectacles that have been pre-fitted with pairs of lenses of the same spherical equivalent.

Advantages and disadvantages

The advantage of ready-made spectacles is that they are less expensive, can be dispensed immediately in schools or clinics, and require less time to dispense.

The drawback to ready-made spectacles is that it requires a large inventory of frames in different sizes, colours and shapes, each with a range of power lenses. They are only suitable if the prescription in both eyes is the same and lenses are seldom available in powers of over ±3.5 D. That said, evidence from studies in Cambodia, China and India indicate that 70–90% of children with uncorrected refractive errors could benefit from ready-made spectacles.1,2

2.5 New Vision Generation, an Essilor Group initiative, has produced a range of spectacles called ‘Ready-to-Clip’ that allows on-the-spot delivery. The lenses, which are interchangeable between right and left, are clipped into the person’s chosen frame according to their individual prescription. Lenses of different powers can be used in each eye, which means that some children with anisometropia can also benefit. Inventory is also reduced.

Conclusion

Despite the many advantages of ready-made spectacles, it is important to identify which children have refractive error needs that cannot be met by ready-made spectacles; these children need custom-made spectacles made up by a dispensing optician (Table 1). Those who prescribe and dispense spectacles must be trained to be able to distinguish which type of spectacles would be suitable for each child.

Custom-made spectacles and ready-made spectacles should only be dispensed by a trained person, based on appropriate refractive technique, e.g., retinoscopy undertaken by a competent practitioner. All children who require spectacles must have their inter-pupillary distance measured to ensure the correct size spectacles are fitted (Figure 2).

Table 1 Indications for ready-made and custom-made spectacles

<table>
<thead>
<tr>
<th></th>
<th>Ready-made spectacles</th>
<th>Custom-made spectacles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improvement in vision</td>
<td>The same or only one line less than with full correction</td>
<td>Visual acuity with full correction is more than one line better than with the spherical equivalent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>More than 1.00D</td>
</tr>
<tr>
<td>Difference in the</td>
<td>Not more than 1.00D</td>
<td>More than 0.75D cylinder in one or both eyes</td>
</tr>
<tr>
<td>spherical equivalent</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maximum of 0.75D cylinder in both eyes</td>
<td>No limit</td>
</tr>
<tr>
<td>Astigmatism</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum spherical</td>
<td>+ or -3.50D</td>
<td></td>
</tr>
<tr>
<td>equivalent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inter-pupillary distance</td>
<td>Not more than +/- 2 mm</td>
<td>This may be more than +/- 2 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comfort of spectacle</td>
<td>As comfortable as custom made spectacles</td>
<td></td>
</tr>
<tr>
<td>frames available</td>
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</table>
Helpful developments and technologies for school eye health programmes

School eye health programmes provide a unique opportunity to positively influence the health of 700 million children globally. The impact of school eye health (SEH) goes far beyond good vision—it encompasses education, social development and economic productivity.

In all school eye health programmes, there are usually a number of factors which limit implementation, which can include a lack of trained personnel for screening, accurate diagnosis and acceptable treatment. The availability of appropriate and affordable spectacle frames and lenses for children with refractive error, and access to specialist treatment for diagnosis and management of other eye conditions, are important resources that need to be accessible. New technology and innovative medical devices and software can be used at many stages in school eye health programmes. These innovations can make the programme more efficient and effective and can offer benefits to those running the programme as well as the children receiving care.

The following are essential to ensure that all children receive appropriate care:

- Visual acuity screening
- Simple eye examination
- Refractive error assessment
- Spectacle dispensing
- Identification of other eye conditions and referral
- Health education for children, parents and teachers.

Each task in a school eye health programme can affect the quality of care provided. Below, and in Table 1, we summarise some of the challenges and outline new developments that could assist in improving the quality and delivery of comprehensive school eye health. The list is not exhaustive and only gives a few examples of what is currently available.

Screening

During screening, there are several challenges from the provider’s perspective. The screening needs to be standardised in terms of the type of vision chart used, the training of the personnel who will screen, and the criteria for referral. We recommend using a single line optotype (see Figure 1, p. 30). Peek Acuity is a smartphone-based application which helps to standardise testing and referral and reduce the time taken to screen. It can be used to screen at a test distance of 2 m or 3 m, and the definition of pass or fail visual acuity screening (i.e. less than 6/9 or less than 6/12) is automated and can be adapted to the local programme (Figure 1). See more here: https://www.youtube.com/watch?v=2l8RD-xsT30

Eye examination and refractive error assessment

These are crucial elements of a school eye health programme. Depending on the skills and qualifications of personnel available, these can be either two separate stages or be combined. To assist in an eye examination, low cost ophthalmoscopes are now available, including Optype and ArcLight. These can also be used as torches to examine the anterior segment. ArcLight (Figure 2) has a solar panel to recharge the battery. Read more: http://arclightscope.com/features/. Initial assessment of the refractive error using an autorefractor (such as SmartVision or EyeNetra) can help to speed up refraction, but it is essential that this is followed by comprehensive refraction by a skilled practitioner.

Spectacle dispensing

Dispensing and delivering spectacles pose further challenges, particularly when it comes to the availability of high-quality spectacle frames that are affordable,
acceptable and appropriate for children (see article on page 33 for innovations in spectacles for children).

**Treatment of other eye conditions and specialist referral**
The following children need to have a detailed eye examination, including examination of the posterior segment: those with strabismus, corneal opacities, or high degrees of refractive error, and those for whom visual acuity does not improve to normal with refraction. Low-cost ophthalmoscopes, such as ArcLight or Optyse, can also be used for this purpose. After identification, these children need to be referred for further examination as appropriate, e.g., for routine/urgent ophthalmologist review or cycloplegic refraction.

**Health education**
The final stage in the process is health education of parents/carers, as it is vital that they know about the results of the screening and eye examination of their child, and the action required. This is usually done by giving the child an information sheet or pamphlet to take home for their parents, but this can be challenging where many adults are not literate or where multiple languages are used. Software, such as the Peek School Screening System, can address this by sending SMS or pre-recorded voice messages to parents/carers. Peek can also generate photographs which show how the world appears to a child with uncorrected refractive error (simulation images), which can also be sent to parents.
Management information system (MIS) software

Management information system (MIS) software, such as Orbis’ REACHSoft, capture data for planning, implementation, and monitoring of field activities. The data generated can then be analysed and used to better understand local service delivery challenges.

Another example of a MIS system is the Peek School Screening System (Figure 3), which works in tandem with the Peek Acuity App. It is integrated with software that tracks children as they move through each stage in the comprehensive school eye health programme (Figure 3). It can, for example, automatically create a referral for children who have failed screening or have been identified as needing more specialist care, and communicate this to staff at the base hospital or vision centre. The system is also able to capture parents’ mobile numbers so they can be kept informed and also receive reminders of follow-up appointments, etc. The software allows children to be tracked at each stage in the process, and generates data that can be used to monitor the programme in real-time, identifying bottlenecks early in the process.

Table 2 summarises how management information system software can be of benefit to programme managers as well as children and their families.

Table 2 The benefits of management information software to programme managers, children and parents

<table>
<thead>
<tr>
<th>Who benefits</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programme managers</td>
<td>Visual acuity screening is quicker and easier with standardised optotypes or Peek Visual Acuity App</td>
</tr>
<tr>
<td></td>
<td>Potential to reduce the burden on specialist eye services</td>
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<td></td>
<td>Better accountability as bottlenecks in the system can be detected early and resolved in a timely manner</td>
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<tr>
<td></td>
<td>Provides a system that enables continuous improvement</td>
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<td></td>
<td>Alignment of different partners around standardised outcomes</td>
</tr>
<tr>
<td></td>
<td>Easier reporting systems and greater accountability</td>
</tr>
<tr>
<td>Children and their parents</td>
<td>Reduced waiting for screening, eye examination/refraction and spectacle dispensing</td>
</tr>
<tr>
<td></td>
<td>Empathy from teachers, parents and peers with increased awareness and knowledge about ocular conditions</td>
</tr>
<tr>
<td></td>
<td>Better communication with decision makers with an opportunity to have concerns addressed</td>
</tr>
<tr>
<td></td>
<td>Less travel for further review/treatment</td>
</tr>
<tr>
<td></td>
<td>Less stigma about the use of spectacles or eye treatments</td>
</tr>
<tr>
<td></td>
<td>Better vision</td>
</tr>
</tbody>
</table>

Figure 3 The Peek School Screening System and how it can be used to track children through the system and for health education of parents/carers
Children’s myopia: prevention and the role of school programmes

There are 12.8 million children worldwide who are visually impaired due to uncorrected refractive error (URE), the leading cause of visual impairment among children wherever the problem has been studied. Half of these children live in China, where the total number with URE may reach 100 million by 2020. The prevalence of myopia, the most common refractive error, is growing rapidly in children around the world, reaching 80–90% among East Asian secondary school students.

Why we care
Spectacles are crucial to achieving the United Nation’s Sustainable Development Goals on access to essential health care services and equitable, high-quality education. They provide an inexpensive, safe and effective means of addressing URE. Giving a child spectacles significantly improves educational outcomes, unlocking a lifetime of opportunities.

Challenges
Unfortunately, in areas of limited resources, as few as 15–25% of children who need spectacles actually have them. Reasons for this lost opportunity include the cost of spectacles (provision of free spectacles have been shown to double rates of use); fear that spectacles harm children’s vision, even though this has been proven to be incorrect; parents’ lack of knowledge about their children’s myopia; low rates of use when spectacles are given (which can be improved by various methods, including teacher incentives); the idea that wearing spectacles is unappealing or inconvenient; and the poor quality of available refractive services.

Solutions: reducing myopia in children
Exciting developments have recently occurred in the prevention of myopia through increased time spent outdoors, multi- or dual-focal lenses, overnight hard contact lenses (Ortho-K), and use of very low concentration atropine eye drops. It appears that an additional 40 minutes per day spent outdoors can reduce new cases of myopia by a quarter, and some studies suggest that more time outdoors might lead to even greater reductions, perhaps as much as a 50% decrease. In some countries, such as China, where myopia rates are very high, pressures for children to study more have made it difficult to increase the time spent outdoors. However, a full-scale, island-wide programme in Taiwan called ‘Daily 120’ has added two hours (120 minutes) of outdoor time to every school day for all children, and there are indications that myopia rates may be falling as a consequence. Increased outdoor time for children can also reduce...
the risk of diabetes and childhood obesity, two growing problems in children worldwide, and may also be helpful in combating vitamin D deficiency.

Regarding atropine, higher concentrations can cause blurred vision for reading and discomfort in bright lights due to dilatation of the pupils. However, recent studies in Singapore suggest that using very low concentrations (0.01%) offer several advantages: this dose has nearly as strong an effect in slowing myopia progression as higher concentrations, does not affect near vision, causes no problems with discomfort from bright lights, and – most importantly – does not appear to have a strong ‘rebound’ effect (an increase in myopia after cessation of the drops). Due to this latter reason, the overall effect of 0.01% atropine in reducing myopia may actually be greater than that of higher concentrations.

Solutions: school screening programmes

Until these strategies are ready for wider use, schools provide an appealing location for carrying out traditional vision screening for children. As attendance rates continue to climb throughout the world, schools offer a convenient setting where the majority of children in a community may be found and regular follow-up can be provided, often with the assistance of teachers who are familiar with children’s needs. Children attending school are more likely to develop myopia requiring the use of spectacles, and the educational benefits of spectacle wear are most likely to be realised if teachers help to support their use in school. Treatment for the full range of vision problems affecting children in a particular setting can be arranged by collaborating with nearby vision care facilities. School-based vision care programmes work best in settings with a larger burden of refractive error, a greater proportion of children attending school, a higher population density and better transport infrastructure. Below are two examples.

The Rural Education Action Programme (REAP)’s Seeing for Learning social enterprise programme is a successful collaboration between the private and public sectors. It provides vision screening services and spectacles to children living in rural areas in China. Teachers are trained to provide initial vision screening of students, and children who need additional care are referred to affiliated vision centres at nearby hospitals. After additional examinations and refraction by a medical professional at the vision centre, rural school children receive their first pair of spectacles free. The vision centre is able to access a new consumer market, children receive the services and spectacles they need, schools see improved test scores and the county government is credited with addressing a public health concern.

Orbis’ new REACH (Refractive Error Among Children) programme is working with local partners to address the problem of URE among three million school-going children in fifteen districts across India. REACH Guidelines help standardise the screening process for all partners. The programme includes the use of LED pocket screeners, hand-held autorefractors and REACHSoft, a comprehensive software solution developed to capture data for planning, implementation, and monitoring of field activities in real time. The data generated are analysed and used to better understand local service delivery challenges, thereby aiding future programmes.

These and many more school vision programmes around the world bring health care and education providers together to improve children’s vision in the setting where it matters most: the schools in which they must see to learn.

References
How schools can help to build healthy, productive lives, free of trachoma

Children can be effective behaviour-change ambassadors and schools can act as key sites for health interventions to combat trachoma, especially when awareness forms part of the curriculum. These examples from Morocco and Ethiopia illustrate the important role that schools can play in efforts to end trachoma.

Children are particularly vulnerable to ocular *C. trachomatis* infection, which causes trachoma. The bacteria can spread easily to siblings and playmates via flies, towels and dirty hands. Good hygiene and facial cleanliness form part of the World Health Organization (WHO) SAFE strategy: Surgery to correct trichiasis, Antibiotics to reduce active infection, and Facial cleanliness and Environmental improvements to reduce transmission. School-based trachoma interventions provide an opportunity to raise children’s awareness of the importance of hygiene. Typically, these interventions involve students learning about the causes and consequences of trachoma and the behaviours they can adopt to avoid contracting the disease. They then, in turn, disseminate these messages further amongst their families and community members.

Morocco was one of the first countries to implement the comprehensive SAFE strategy at scale. Progress was rapid, thanks in large part to strong partnerships and government buy-in at all levels, including the Ministry of Education. The effectiveness of school outreach strategies is dependent on the proportion of school-aged children who attend school. When the national programme to eliminate trachoma was rolled out in the late 1990s, Morocco benefited from school attendance rates exceeding 99%, which made schools excellent sites for tackling trachoma and the behaviours they can adopt to avoid contracting the disease. They then, in turn, disseminate these messages further amongst their families and community members.

Key to the success in South Gondar was the development of school hygiene and sanitation clubs. These clubs appoint student ambassadors to promote hand/face washing, environmental sanitation and the proper use of latrines among their peers. In addition, a 25 litre can of water fitted with a tap in a ‘school hygiene corner’ ensures students are able to wash their faces when needed. Health extension workers are also using schools to raise awareness of good hygiene and sanitation practices within the school and the wider community through displays illustrating model health practices.

The elimination of trachoma both depends upon and supports progress in education. When integrated into the school curriculum, more children accessing education increases the chance that they will be exposed to eye health messages about trachoma prevention. At the same time, improvement in child health increases the likelihood that children will access education.

These examples from Morocco and Ethiopia illustrate the important role that schools can play in efforts to end trachoma and save future generations from contracting this potentially debilitating disease, thereby improving their chances of leading healthy, productive lives.
Retinoscopy is the use of a retinoscope to measure a patient's refractive error. Retinoscopy is an objective method of refraction in which the patient does not need to tell the practitioner how they see. If instead they ask the patient questions about how she/he sees, that is called subjective refraction.

When the practitioner shines the light of a retinoscope into an eye, they see the light reflected from the retina. This reflected light is called the retinoscopic reflex, or 'ret reflex'; it looks like a red light inside the pupil. Depending on the person's refractive error, when the practitioner moves the retinoscope, the ret reflex will move in a certain way inside the pupil. Trial lenses can be used to measure the amount of movement that a ret reflex has, so that the refractive error can be estimated accurately.

There are two types of retinoscopes:

1. **Streak retinoscopes** have a light source that produces a line or streak of light. The streak of light can be changed by moving the slide knob or sleeve (Figure 1). It can be:
   - rotated to any axis position (by rotating the sleeve)
   - made wider or narrower in width (by moving sleeve up or down)
   - changed from convergent to divergent light (by moving the sleeve up or down).
   It is normally used in the 'down' position.

2. **Spot retinoscopes** have a light source that produces a spot of light. The spot of light can be changed by moving its slide knob. It can be:
   - made larger or smaller in diameter (by moving the sleeve up or down)
   - changed from convergent to divergent light (by moving the sleeve up or down).

The spot light of a spot retinoscope does not need to be rotated (like the streak retinoscope) to examine different axis directions.

The ret reflex can be neutralised with plus and minus trial lenses:
- Plus lenses neutralise a 'with' movement.
- Minus lenses neutralise an 'against' movement.

A trial lens set can include up to 266 lenses:
- Spherical lenses, with a wide range of powers, both positive and negative, generally 0.12 D, 0.25 D, and then in steps of 0.25 D up to a certain point, then in steps of 0.50 D, and then finally in steps of 1.00 D. At least two of each power are included.
- Cylindrical lenses in a variety of powers, often both positive and negative, mostly in steps of 0.25 D.
- Accessory lenses used for special tests: prisms, filters, occluders, pinhole, and others.

---

**Figure 1** Retinoscope components: streak retinoscope

- **Head**
  - Forehead rest
  - Viewing hole/adjustable aperture
  - Adjustable vergence sleeve
  - Streak rotator

- **Neck**
  - Light brightness adjustment

- **Handle/battery compartment**

- **Peephole**
  - Concave effect
  - Mirror
  - Condensing lens
  - Bulb

- **Plane effect**
  - Sleeve (bulb) down
  - Sleeve (bulb) up
Figure 2 shows some typical trial lenses.

A trial lens set also includes a trial frame which is needed to hold the lenses over each eye. A typical frame can be seen in Figure 3.

The positions of the two side assemblies can be adjusted laterally by two small knobs. The positions can be read on scales. The sum of the two readings is the interpupillary distance (PD).

The nosepiece assembly can be adjusted in two ways. It can be moved fore-and-aft, to adjust the distance of the trial lenses from the eye to meet the standard distance or the measured distance chosen for the patient. It can be adjusted up-and-down, to place the centres of the lenses vertically in line with the patient's pupils.

The temple pieces have adjusting knobs that adjust their angle with respect to the frame. The lengths of the temple pieces can also be adjusted to the location of the patient's ears after the eye distance has been set.

On each side, there is a ring with two bars, each having three cells to receive trial lenses, plus a set of three spring clips for holding them in place.

Each ring can be separately rotated by means of a small, knurled knob. A scale gives the orientation of the axis of a cylinder lens, indicated by a dot or straight line marking on the lens.

**General care**

**Retinoscope**

Wipe the external surface of the retinoscope with a cloth dampened with a mild detergent and water solution, or a 70% isopropyl alcohol solution, or a 10% bleach solution (by volume); however, always consult the manufacturer's user manual.

When wiping, avoid the optical surfaces.

**NOTE:** solution entering the assembly could damage internal components. Use caution to ensure cloth is not saturated with solution.

Wipe the lenses with a dry lens-cleaning cloth.

Periodically check the following – the answer for all the below should be yes:

- Do you get a streak of uniform brightness when the instrument is turned on?
- Does the brightness of the streak vary when the brightness control is turned?
- Does the sleeve in the instrument slide up and down freely and vary the length when it is moved?
- Does the patch of light or the streak rotate when the bulb is turned using the sleeve?

**Trial lens set**

- Wipe lenses with a lens cleaning cloth if stained or smudged.
- Keep the lenses in the case after use.
- Wipe the trial frame's nose rest with an alcohol wipe after each patient.
Test your knowledge and understanding

This page is designed to help you to test your own understanding of the concepts covered in this issue, and to reflect on what you have learnt.

We hope that you will also discuss the questions with your colleagues and other members of the eye care team, perhaps in a journal club. To complete the activities online – and get instant feedback – please visit www.cehjournal.org

Tick ALL that are TRUE

**Question 1**
The following children, seen by a school teacher, need referral to an eye trained health worker:

- a. Child with a red eye
- b. Child with convergent squint
- c. Child with 6/18 vision in both eyes
- d. Child with a white pupil in one eye
- e. Child with 6/6 and 6/9 vision

**Question 2**
The following are reasons why children may not wear prescribed spectacles:

- a. Too expensive
- b. Do not fit properly
- c. Teased by other children
- d. Parents do not think they are important
- e. Cannot see any better

**Question 3**
The following are important indicators to monitor a school screening programme for refractive error:

- a. Total number of children in the school and the number who had their vision screened
- b. Number of children who failed the visual acuity test
- c. Number of children who were refracted
- d. Number of children who had spectacles prescribed
- e. Number of children who are using spectacles 3–6 months after the spectacles were prescribed

**Question 4**
School eye health programmes need to:

- a. Have the approval of the ministry of education
- b. Be funded through the sale of children’s spectacles
- c. Be done once for all schools in a district every 5–10 years
- d. Be part of a broader school health programme
- e. Include eye health for teachers

**ANSWERS**

1. a, b, c and d are correct. A white pupil (leukocoria) may be due to a cataract or other serious eye condition. It is unlikely that the child in (e) will need (or wear) spectacles.

2. All are correct.

3. All are correct.

4. a, d and e are correct. The programme should ideally be funded by the Ministry of Education or other institutional donors, not from sales of spectacles to children.
Picture quiz

At school screening, an 8-year-old child is found to have presenting visual acuities of 6/6 in the right eye and 6/60 in the left.

**Question 1** Which of the following conditions may be responsible?
- [ ] a. Myopia
- [ ] b. Amblyopia
- [ ] c. Congenital cataract
- [ ] d. Toxoplasmosis
- [ ] e. Optic atrophy

**Question 2** What further tests are appropriate in this case?
- [ ] a. Refraction
- [ ] b. Dilated fundus examination
- [ ] c. Corneal topography
- [ ] d. Cover test
- [ ] e. Ishihara test for colour blindness

**Question 3** Which of the following can be associated with visual impairment in a child?
- [ ] a. Prematurity
- [ ] b. Family history of squint
- [ ] c. Maternal history of rubella infection
- [ ] d. Prolonged close work from an early age
- [ ] e. Maternal history of diabetes

**Question 4** Amblyopia. Which statements are true?
- [ ] a. Amblyopia may occur in a child with straight eyes
- [ ] b. Amblyopia is more commonly associated with short sight than long sight
- [ ] c. Unilateral cataract may cause amblyopia
- [ ] d. Severe astigmatism can cause bilateral amblyopia
- [ ] e. Unilateral congenital ptosis will not cause amblyopia

**Answers**

**Question 1**
- [ ] a. Myopia
- [ ] b. Amblyopia
- [ ] c. Congenital cataract
- [ ] e. Optic atrophy

**Question 2**
- [ ] a. Refraction
- [ ] b. Dilated fundus examination
- [ ] d. Cover test

**Question 3**
- [ ] a. Prematurity
- [ ] b. Family history of squint
- [ ] d. Prolonged close work from an early age

**Question 4**
- [ ] a. Amblyopia may occur in a child with straight eyes
- [ ] b. Amblyopia is more commonly associated with short sight than long sight
- [ ] c. Unilateral cataract may cause amblyopia
- [ ] e. Unilateral congenital ptosis will not cause amblyopia
A comprehensive school eye health programme:
• Should be integrated into a broader school health programme
• Requires a goal that will result in positive change
• Must have the engagement of the ministries of health and education
• Needs ‘SMART’ objectives for each component of the programme

A key issue in a school eye health programme is that children may not wear their spectacles.
• Parents should understand why a child needs spectacles
• The child’s vision must improve with correction
• The child must feel comfortable wearing spectacles and like the frames
• The spectacles should be affordable
• Teachers should encourage children to wear their glasses

A school eye health programme requires careful planning, with a goal and specific objectives which address:
• School children with refractive errors and other eye conditions
• Teachers who may themselves have refractive errors or other eye conditions
• Broader eye health education: children can act as ‘agents of change’ in their families and communities
Lessons from the USAID Child Blindness Programme

Helping all children who need spectacles means doing more than visiting schools and offering good refractive services. Partnerships with local government, hospitals and community groups are needed, alongside a thorough awareness of gender disparities and disability.

The United States Agency for International Development (USAID)’s Child Blindness Program (CBP) focuses on ending avoidable blindness in children. CBP’s work includes the provision of sight-restoring surgery, screening children for eye diseases and conditions, and delivering spectacles to school children. Children who are irreversibly blind receive specialised education to learn Braille, use a cane, and improve their daily living skills.

The CBP has identified uncorrected refractive error in children as one of its priorities and has recently funded twelve school eye health projects. In these projects, children were screened at school to identify vision problems; they were then referred for refraction and spectacles, clinical treatment, and/or low vision care, as needed.

At the first CBP regional partners’ meeting, held last year, partners from around the world had an opportunity to share field experiences, good practices and lessons learned. The uncorrected refractive error round-table discussion included managers from six of the twelve projects involved in school eye health; their projects were based in Ethiopia, Vietnam, China, Bangladesh and India (two projects). The managers identified the following key issues as having the greatest impact on project success:

- Availability and cost of spectacles
- Income generation
- The quality and availability of eye care professionals
- Case finding, gender disparities and disability
- Follow-up and compliance.

Each of these are discussed in more detail here.

Availability and cost of spectacles
Since India and many other countries in Asia produce their own spectacles, the projects outside of Africa had the easiest access to spectacles. The project in Ethiopia, however, had ongoing issues with importation, taxation and so on, leading to higher costs and longer lag times between order and delivery. The managers agreed that, ideally, children should not have to wait for more than two weeks before receiving their spectacles. This is because children’s visual acuity changes more rapidly than adults’ and delays in delivery could result in children receiving spectacles that no longer correct their refractive error.

The cost of plastic lenses was also an issue. For safety reasons, plastic lenses, not glass lenses, should always be used in children’s spectacles. However, plastic lenses are more expensive. Two of the six projects represented in the working group were consistently providing plastic lenses. Before receiving funding from the CBP, four projects had used glass lenses when they had insufficient funds to purchase plastic ones.

Income generation
Income generation through the sale of spectacles was a point of much discussion. The aim is to make a profit on the sale of more expensive spectacle frames in order to cross-subsidise free spectacles for poorer families.

In China, Vietnam and Bangladesh, government hospitals were not always permitted to sell spectacles. To get around this, the project in Vietnam had convinced the government to allow them to sell spectacles in three vision centres (clinics) instead. However, there were doubts about long-term
sustainability because there was no certainty that the
government would continue to allow the clinics to
generate income in this way.

The CBP-funded project in China used a combined
model. In this model, the government provided
spectacles at no cost, whereas the private sector
sold spectacles of varying styles and prices. People
could decide which service to use, depending on their
available funds.

The quality and availability of eye care
professionals
There was a general concern about the lack of skilled
refraction personnel. The managers from China,
Vietnam, and Bangladesh were also concerned about
the quality of existing services.

"India has an education system that promotes
the development of eye care professionals
(including optometrists) in an efficient and
cost-effective manner, supported by strong supervision."

The project in Vietnam found that
the quality of refraction provided by
optometrists was lower than expected.
This could be due to inadequate training
or perhaps reduced motivation in areas
where the profits from spectacle sales
were smaller. Vietnam reported a lack of
equipment such as Snellen charts, trial
lens sets and retinoscopes in district-level
government hospitals.

Only the projects in India felt that their
refraction services were of acceptable
quality. India has an education system that
promotes the development of eye care
professionals (including optometrists) in an efficient
and cost-effective manner, supported by strong supervision.

Case finding, gender disparities and
disability
Most projects in the working group used teachers
to conduct vision screening among children aged
five years and older. Pathologies such as paediatric
cataract, conjunctivitis, strabismus and trauma were
also detected. Some projects screened patients with
multiple disabilities, who were often identified in
specialised schools.

Gender disparities existed in case finding and other
activities across all settings. Project staff expressed a
desire to address this proactively, but methods such
as counselling demanded additional resources and
were often not accepted by decision makers, including
government officials (who did not always believe the
data regarding gender disparity in health outcomes).

To counter this, teachers and other health workers
involved in CBP projects were taught how gender
determines the likelihood that a child will receive
services, and how the lack of attention given to girls
can lead to poor outcomes later on. CBP projects were
also required to disaggregate their data by gender. As
a result, project personnel were especially motivated to
find, examine and ensure spectacle distribution to girls.
This led to greater efforts and resources being applied
to gender equity.

Identification of children in blind schools has unique
barriers. Families of children in blind schools often do
not want to learn that their child has the ability to see,
because these schools may have superior facilities
in comparison to non-specialised schools. Many are
boarding schools where food and clothing are provided.
Additionally, parents may receive government stipends
if they are caring for a disabled child; they would be reluctant to lose those benefits. Organisations need to make a greater effort to identify children in these schools and to give families incentives to accept care when the child’s vision can be recovered.

Follow-up and compliance
The increased use of cell phones (mobile phones) in the global population is having a positive impact on follow-up and compliance, as project staff are able to reach parents more easily. The Bangladesh project reported using cell phones in 20–25% of their case follow-up work.

Project staff also reported that their organisations are emphasising patient counselling and support, such as transportation costs, in addition to referring children who failed vision screening.

In some instances, teachers were trained to educate families and children regarding the importance of attending follow-up visits and wearing their spectacles. Teachers reinforced this in their classrooms by asking the child if they had received their spectacles and by monitoring whether children wore them. This training, and the fact that teachers are seen as role models, helped to improve acceptance of spectacles.

The managers all agreed that follow-up visits to teachers, after school screening, is best when done more than once after the initial activity. All the partners maintained records of patient follow-up after school screening.

Discussion
The topics above highlight the challenges of getting spectacles to the millions of children who need them. Screening is relatively easy and many groups show success finding children who need spectacles. Getting the spectacles to them is far more difficult, however. In some parts of the world, particularly in Asia, frames and blank lenses are increasingly being manufactured in the region at a low cost and with timely shipping. However, in the majority of low- and middle-income countries, frames and lenses are not readily available and must be imported, requiring import tariffs, intermediary companies and high shipping costs. These barriers increase the cost of providing spectacles, leading to high retail prices for parents.

Human resources are a common problem, mentioned across most of the working group participants. Low- and middle-income countries lack sufficient, qualified optometrists and/or refractionists. Ophthalmologists prioritise clinical and surgical care and have little time to perform refraction. Even when there are more personnel available to refract children, the majority are concentrated in urban areas – which means that children in rural areas may not receive the services they need. The quality of training is often poor, leading to incorrect refraction; this can result in non-compliance with spectacle wear or worsening of the child’s vision.

Whereas screening is relatively easy, there are barriers to achieving good results. Finding all children who need vision correction can be difficult. Schools are an easy target for screening, but very young children, and children with extremely poor vision, do not go to school. A lot of time and resources are needed in order to develop relationships with community leaders and health professionals in order to find and help all families whose children need eye care.

Follow-up is always challenging, given that many children and their families live in remote areas and some do not have access to a telephone (although that is changing due to the proliferation of cell phones/mobile phones). Therefore, projects should carefully consider how they will ensure that children are properly followed up and also carry on wearing their spectacles.

Cultural prohibitions, bullying in school, incorrect refraction, and financial constraints are among the challenges in getting children to wear their spectacles. Promoting and celebrating spectacle wear can help to improve matters.

In summary, a successful, sustainable URE programme, which ensures that children who need spectacles receive them, must include screening, qualified human resources, training, quality improvement, procurement, monitoring, and financing.

The challenges of getting government support: an example from India
Representatives from Aravind Eye Hospitals in India discussed the impact of government involvement (or the lack thereof) on their projects. An example was shared regarding two school screening projects in two adjoining districts (these projects were not funded by USAID’s Child Blindness Project, but were given to illustrate an important field reality).

In each case, the local health ministry was asked to commit funds to match the non-governmental organisation’s (NGO) contribution of human resources. In one of the districts, the local health ministry was receptive; it provided funds and advertised the screening programme in all local schools. This led to almost 100% of all children being screened, and further government support for annual screening. However, the health ministry in the nearby district declined to work with the same NGO to set up a screening programme. Despite similar geographic conditions and government structures, and the same level of effort from the NGO, the outcome was negative.

These cases show that unique factors such as motivated government staff and representatives can dictate success or failure, despite the efforts of the same NGO in both instances.

“Schools are an easy target for screening, but very young children, and children with extremely poor vision, do not go to school.”