Case Finding for Refractive Errors: Assessment of Refractive Error and Visual Impairment in Children

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The World Health Organization informal planning meeting, in July 2000, clearly indicated that detailed comparisons of refractive error prevalence across study reports are generally not possible because of different measurement methods and definitions.[1] Further, because most studies are carried out using samples of unknown representativeness, interpretation of the findings in a population-based context has problems.

RESC Studies

An exception to this difficulty is a series of population-based surveys of refractive error and associated visual impairment in school-age children conducted in five different geographic regions using a common protocol – the Refractive Error Survey in Children (RESC).[2] These RESC surveys, which began in 1998, were carried out in a rural district in eastern Nepal;[3] a rural county outside of Beijing, China;[4] an urban area of Santiago, Chile;[5] a rural district near Hyderabad in southern India;[6] and an urban area of New Delhi in northern India.[7] A sixth survey is currently being carried out in Durban, South Africa. Others are planned.

In each survey, population-based samples of approximately 5000 children, aged 5 to 15 years, were obtained through cluster sampling. Clusters were defined in rural areas using village boundaries, and in urban areas community blocks or wards were used. The sample size was designed to obtain reasonably accurate prevalence estimates at age- and sex-specific levels.

Clinical Measurements

Enumeration of children within the randomly selected clusters in each study was followed by clinical examination at one or more sites within the community. The examination included measurement of distance visual acuity using an illuminated LogMAR 'E' chart, near and distant, ocular motility evaluation with a cover/uncover test, cycloplegic dilatation with cyclopentolate, streak retinoscopy, autorefraction with a handheld Retinomax K-Plus, subjective refraction for those with unaided visual impairment, and slit - lamp and direct ophthalmoscope examination of the lens, vitreous, and fundus. A principal cause of visual impairment was recorded by the examining ophthalmologist for each eye with visual acuity of 6/12 or worse.

Comparative Findings

Uncorrected visual acuity < 6/18 in the better eye ranged from 0.46% to 3.25% (Figure 1). With presenting vision — aided vision for those wearing glasses — the

Better vision with spectacles for this child in Uganda

Photo: Murray McGavin

prevalence of visual acuity <6/18 in the better eye ranged from 0.42% in Nepal to 1.79% in China. With best corrected visual acuity, visual impairment was substantially reduced, ranging from 0.09% in China to 0.28% in rural India. The difference between presenting and uncorrected vision reflects the amount of refractive error that is already corrected, while the difference between presenting and best corrected vision indicates the extent to which uncorrected refractive error remains as a vision disabling problem. The prevalence of visual impairment with best refractive correction represents the degree of vision loss attributable to causes other than refractive error.

Although some of the refractive error underlying clinically significant visual impairment was found to have been already corrected with spectacles, an essentially equal amount of *correctable* refractive error remained uncorrected (Figure 2). This was the case in all five study areas, which were generally representative of lower and lower middle class populations in each country.

Refractive error in this age group was usually due to myopia with a relatively high prevalence among Chinese children (Figure 3). Although the relationship between uncorrected visual acuity and refractive error was not a precise one, among those with a relatively high prevalence of visual impairment, correspondingly high amounts of refractive error were
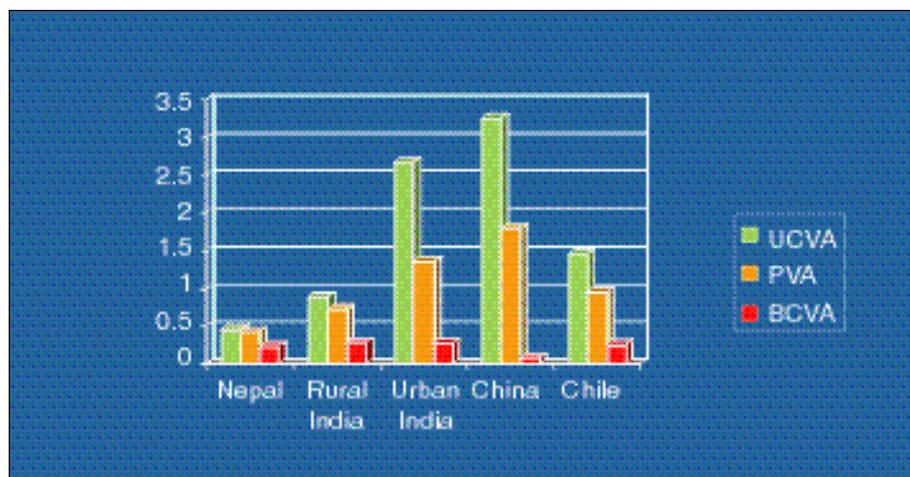

**Fig. 1: Percentage prevalence of visual acuity < 6/18 in the better eye.
UCVA: uncorrected visual acuity. PVA: presenting visual acuity.
BCVA: best corrected visual acuity.**

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Fig. 2: Percentage prevalence of visual impairment < 6/18 in the better eye. Corrected: already corrected visual impairment. Correctable: uncorrected, but correctablevisual impairment.Uncorrectable: uncorrectable visualimpairment.

Fig. 3: Percentage prevalence of myopia: -1.00 spherical equivalent dioptres in either eye (worse eye) and better eye as measured with cycloplegic autorefraction.

found, as expected. The prevalence of hyperopia (hypermetropia: + 3.00 spherical equivalent dioptres or more in either eye) was found to be particularly high in Chile, 5.55%, and was accompanied by comparatively high levels of astigmatism as well (data not shown). Further information regarding the age- and sex-specific prevalence of both myopia and hyperopia is available in the original reports.[2-7]

Recording visual acuity in Zanzibar
Photo: Murray McGavin

Conclusion

These comparative studies illustrate that the prevalence of myopia and hyperopia varies considerably across geographic regions. They also illustrate that visual impairment, which in this age group is almost entirely because of correctable refractive error, will vary in a corresponding fashion. Unfortunately, it appears that approximately half of the visual impairment associated with easily corrected refractive error remains uncorrected – at least among school-age children in lower and lower middle class populations. To the extent that these data represent children across different geographic and ethnic origins, as well as different cultural settings, reduced vision because of uncorrected refractive error is an important public health problem. Cost-effective strategies are needed to eliminate uncorrected refractive error as a cause of disabling visual impairment, particularly during the formative years of children.

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