surgical treatment, it is not without risks, including raised IOP, inflammation and possibly cataract formation. These risks are balanced by the benefits when treating patients with definite disease (PAC and PACG cases), but mean that advocating universal treatment of otherwise healthy suspects may not be justified.

So, although good population-based data allow us to obtain a measure of the magnitude of PACG and the resulting blindness in Asia, resources now need be channelled into research focused on obtaining information on the natural history of the disease, the underlying causal mechanisms and the effectiveness of laser iridotomy and other interventions in halting or delaying the disease process. Once we have a greater understanding of these factors, we will be nearer to implementing public health initiatives aimed at reducing blindness due to glaucoma in Asia.

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UNCORRECTED REFRACTIVE ERROR AND PRESBYOPIA

Uncorrected refractive error and presbyopia: accommodating the unmet need

Rupert R A Bourne

Uncorrected refractive error barely features when it comes to reports of global visual impairment.[1] The reason is simple—the World Health Organization (WHO) definition[2] classifies visual impairment and blindness according to visual acuity with "best possible correction". Recent population-based surveys have reported visual acuity in its many guises as uncorrected, presenting with habitual correction and best corrected. This work has exposed the enormous burden of uncorrected refractive error among industrialised[3 4] and developing nations.[5 6]

The survey from Timor-Leste reported by Ramke *et al*[7] ***(see page 860)*** in this issue of the *BJO* represents an important addition to the literature. This population-based survey reports on uncorrected refractive error and presbyopia in adults (aged ⩾40 years) of Timor-Leste. This country is poverty stricken and has recently emerged as an independent democracy from a period of great upheaval. What is it about this survey that is of particular interest?

First, this is one of the few population-based surveys of refractive error that have reported on spectacle coverage for distance vision. We defined this term when reporting on spectacle coverage in the Bangladesh National Low Vision and Blindness Survey[8] as Met refractive error need/(Met refractive error need+Unmet refractive error need)×100. The authors of the Timor-Leste study have used this definition and have explored the assumptions involved with it, for distance and near vision— a useful exercise for further studies that intend to assess coverage. Unsurprisingly, distance spectacle coverage was higher among the urban and literate and those in paid employment, compared with rural, illiterate and those adults involved in subsistence farming.

Second, this survey is unusual in that it looked at the burden of presbyopia. The scale of this problem remains largely unknown in non-European-derived populations, with remarkably few population-based studies having addressed this issue.[9–11] There is a perception that presbyopia is of less importance in locations where reading is uncommon; however, the Timor-Leste study[7] and others[9 11] have demonstrated a considerable unmet presbyopic need in largely rural locations. A recent study by Patel *et al*[12] in rural Tanzania also demonstrated that uncorrected refractive error has a significant impact on vision-related quality of life. There is a pressing need for more studies of presbyopia at a population level, as near vision, particularly the ability to read, is of great importance in socioeconomic development.

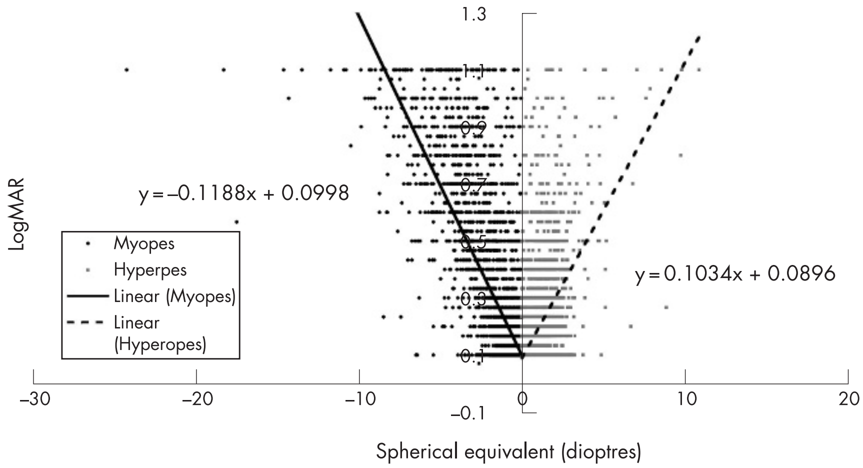

Figure 1 Distance visual acuity logarithmic minimal angle resolution and refractive error (spherical equivalent) for 11 750 right eyes. Linear regression lines are given for myopia (solid line) and hypermetropia (dashed line). Data from the Bangladesh National Low Vision and Blindness Survey.[8]

Third, the method used in this survey may not be familiar to readers. The rapid assessment for cataract surgical services method was used.[13] This was developed to simplify the examination process by limiting the medical examination to cataract, and involves a torch, a visual acuity measuring device, a pinhole and a direct ophthalmoscope. This method has advantages of speed, simplicity, low cost and the involvement of local less experienced staff, but it is likely to underestimate the prevalence of coexistent ocular disease, in particular that of the posterior segment of the eye. Other studies of spectacle coverage[8] have used a much more comprehensive examination method using best-corrected visual acuity rather than pinhole-corrected acuity to judge the effect of the refractive error. The limitations of using a pinhole to judge the presence or absence of refractive error were not discussed in the Timor-Leste paper. A study comparing the results of rapid and more comprehensive methods would be useful, but until then caution should be exercised when comparing results from surveys using the two approaches. It would be interesting to know just how "rapid" the study was or the nature of the logistics involved, both of which would be of use to others planning such surveys. However, despite this, the survey was successful in obtaining a great deal of information that provides an overview of the areas of need, which could be explored later in more detail with a more comprehensive approach.

Fourth, the study used a cut-off of 6/18 on account of the choice of sampling method. As an overview this is fine, but there is also likely to be a need among those with uncorrected refractive error but with better visual acuity. Most of the population-based studies on refractive error so far have classified myopia or hyperopia as ± 0.5 dioptres (D). Just how visually impaired does one become at a given refractive error? We modelled the effect of refractive error on visual acuity in the Bangladesh National Low Vision and Blindness Survey[8] using refractive error data from the right eyes of 11 750 subjects (fig 1). Myopia (spherical equivalent) of –1.68 DS or more, or hyperopia of 2.04 DS or more, equated to a distance visual acuity of 6/12. Although these figures are admittedly pertinent to one particular population, such an analysis gives a more realistic approach to deciding on which cut-off of refractive error to target. It is important for population-based surveys to categorise the severity of refractive errors, rather than simply choose a cut-off of 0.5 D on which to report.

Finally, this study yielded some interesting information on usage, cost and availability of spectacles. Remarkably little information exists on this issue in the literature.[14] Gender differences were evident, with women less likely to have a presbyopic correction than men, yet this gender difference was not found for distance vision. Adults aged >70 years were seven times more likely to be uncorrected for distance than those aged 40–49 years. Clearly, there are important age and gender differences, which may reflect differences in cultural attitudes, perceptions and needs between these groups. It would have been interesting to explore the willingness to wear spectacles among these subgroups and among those who had a need rather than questioning all participants. "Need" is a complex issue—an illiterate farmer may not think that he or she needs a presbyopic correction, whereas an urban literate office worker may have quite a different view. Discontinued use has been shown to be a significant problem in some studies—for example, the Andhra Pradesh Eye Disease Study (APEDS)[14]—in which reasons included loss of spectacles, discomfort and a perception that they were unnecessary. A total of 13% of spectacle wearers in the APEDS Study and 81% in the Bangladesh National Blindness and Low Vision Survey[8] were wearing incorrectly prescribed spectacles at the time of these studies. The prescribing pattern needs to be appropriate to the needs and perceptions of the population involved, so as not to introduce barriers to more widespread uptake or lack of continued uptake if the need persists. It was interesting to read in this Timor-Leste paper that the main reasons underlying unwillingness to wear a correction were cosmesis and embarrassment. Inability to pay was of lesser importance. Distributing spectacles to everyone with a visually significant refractive error would be costly and probably wasteful. Perhaps it would be more appropriate to heighten awareness of uncorrected refractive error and demonstrate the benefits of correction. The individual could then make up his or her mind whether to wear a refractive correction in an environment where spectacles were available and accessible.

Many countries have insufficient numbers of personnel trained in refraction and a general lack of mid-level ophthalmic personnel. Quality of refractive services, as well as quantity, is also critical in ensuring that the barriers to uptake are minimised. The Timor-Leste paper provides an interesting overview of the issues of availability and accessibility for spectacle-dispensing networks in this country, which, like many countries, is currently tipped in favour of the urban population.

If the burden of ocular disease is defined in terms of person-years affected, the refractive error burden may exceed that of cataract.[15] This paper by Ramke *et al*[7] is an impressive attempt to gather a wealth of practical information using a rapid assessment technique. The information gathered provides the basis for action to reduce the impact of uncorrected refractive error in this population. Further research in this area is much needed.

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Subhyaloidal and macular haemorrhage

Subhyaloidal and macular haemorrhage: localisation and treatment strategies

Stefan Mennel

Deterioration of visual acuity as a result of haemorrhage

Haemorrhage at the macula causes deterioration of visual acuity within seconds or minutes. Biomicroscopy reveals a dome-shaped acute bleeding in the macular area, but the precise localisation of the blood—that is, subhyaloidal or macular—is mostly unknown. In this issue of the *British Journal of Ophthalmology*, De Maeyer *et al* (***see page 869***)[1] identify the sub-internal limiting membrane (ILM) cleavage plane as the site of haemorrhage in their patients, and present vitrectomy as an excellent treatment option for this pathology.

Different primary causes of subhyaloidal or macular haemorrhage have been stated, the most common being Valsalva retinopathy and Terson syndrome. In addition, such haemorrhages may occur secondary to vascular diseases such as arteriosclerosis, hypertension, retinal artery or vein occlusion, diabetic retinopathy, retinal macroaneurysm, chorioretinitis, blood disorders as well as shaken baby syndrome, age-related macular degeneration, and can also occur spontaneously or as a result of trauma.[2–9]

In previous studies, the sharply demarcated, dome-shaped haemorrhage has been assumed to be in the subhyaloidal space, anterior to the ILM.[6 10 11] Although some authors identified a sub-ILM haemorrhage by glistening reflexes and surface striae,[12 13] others disputed the reliability of biomicroscopy in locating the plane of haemorrhage.[2 10 14–18] A definitive sub-ILM haemorrhage had been demonstrated in selected cases, where the cleavage plane could be identified by ophthalmoscopy, because of the presence of previously detached vitreous at the area of the sub-ILM haemorrhage,[3 10 12 19–21] by echography,[22] by optical coherence tomography (OCT)[15 16 23] or by histological analyses of the surgically removed anterior wall of the haemorrhage.[2 4 12 14 19 24–28]

Premacular or preretinal haemorrhage and subhyaloidal haemorrhage were the commonly used synonyms for subhyaloidal and sub-ILM haemorrhages, although these terms are anatomically correct only if the haemorrhage is located anterior to the ILM. As the ILM represents the basement membrane of the mueller cells, a haemorrhage beneath the ILM is located within the neuroretina and the anatomically correct description would be macular or sub-ILM haemorrhage. Subhyaloidal haemorrhage has also been described as hyphema posterior,[22] whereas the terms submembranous haemorrhage, haemorrhagic detachment of the ILM[29] or ''haemorrhagic macular cyst''[19] have been used for sub-ILM haemorrhage. However, because ''cyst'' describes a cavity lined by epithelium or endothelium, Schubert recommended the use of an established term, macular haematoma.[30]

The lack of a definitive biomicroscopic characteristic to differentiate subhyaloidal and macular haemorrhages clinically, which may be important for treatment decisions in the future, emphasises the need to develop additional diagnostic techniques. In selected cases, OCT may be helpful. In general, an OCT scan through the centre of a haemorrhage at the macula does not illustrate whether the location is subhyaloidal or sub-ILM. Moreover, it does not allow differentiation between subhyaloidal and subretinal haemorrhage, because the haemorrhage severely attenuates the underlying structures.[31] Shukla *et al*[23] presented a technique to increase the effectivity of OCT by taking OCT scans just above the level of the sedimented blood. In a case of a partial detached vitreous and sub-ILM location of the haemorrhage, these scans displayed two distinct membranes; a single highly reflective band corresponding to the ILM, and an overlying patchy membrane with low optical reflectivity consistent with the posterior hyaloid. Meyer and collegues[15 16] performed a selective A-scan analysis and identified numerous hyper-reflective spikes, of which a highly reflective band representing the anterior wall of the previous haemorrhage corresponded to the ILM.

Although treatment choices must consider the underlying disease, in clinical practice, the primary aim of treatment is removal of the haemorrhage.

Spontaneous reabsorption of the haemorrhage may occur, but this could take 1–2 months,[7 13 21 25 26] during which time the persistence of blood may irreversibly damage the retina and cause permanent visual loss as a result of the formation of preretinal tractional membrane and proliferative vitreoretinopathy.[5 32] The toxic effects of longstanding haemorrhage are even more destructive in macular than in subhyaloidal haemorrhage,[3 26] and haemorrhage beneath the ILM tends to remain longer than subhyaloidal haemorrhage.[3 33] Observation for up to 3 months for spontaneous clearing of haemorrhage is a clinically accepted practice,[4 25] but others advocate early surgery even for