

## Blindness in children: control priorities and research opportunities

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### Vision 2020

The World Health Organization and the International Agency for the Prevention of Blindness in 1999 jointly launched “Vision 2020—the right to sight.” This ambitious programme, to eliminate unnecessary blindness and promote good vision throughout the world, includes the control of blindness in children as one of its first five priorities.<sup>1</sup> Given that there are estimated to be 45 million blind people, of whom only 3% are children, this may seem to be inappropriate. However, childhood blindness is important because of “years of blindness”: the patient with blindness due to macular degeneration will have a limited number of years of visual loss, but the child who goes blind today is likely to still be with us in 2050. The concept of “blind years saved” is useful when it comes to allocation of resources, as it can be argued that restoring the sight of one child blind from cataract is equivalent to restoring the sight of 10 elderly adults blind from cataract. Children, therefore, deserve special attention.

### Magnitude and causes

The definition of childhood blindness is usually considered as a corrected visual acuity of less than 6/60 in the better eye in an individual aged 0–15 years. Reliable prevalence data are difficult to obtain for a variety of reasons but the available evidence suggests that the prevalence varies from 0.3/1000 children in economically developed communities to over 1.0/1000 children in underprivileged societies.<sup>2</sup> This translates into approximately 80–100 “blind” children per million total population in industrialised societies and over 400 blind children/million population in the poorest areas of the world.

Mortality in blind children, particularly in developing countries, is higher than in their sighted counterparts, as many of the conditions which can lead to visual loss are also causes of child mortality (for example, measles, vitamin A deficiency, prematurity, congenital rubella, inherited syndromes). The prevalence of blindness in children therefore underestimates the magnitude of the problem, as prevalence only takes account of children who survive.

Of the 1.4 million blind children worldwide an estimated 25% are blind from retinal diseases, 20% from corneal pathology, 13%

due to cataract, 6% from glaucoma, and 17% due to anomalies affecting the whole globe. More than 40% of childhood blindness is caused by conditions for which preventive or therapeutic interventions have proved effectiveness.<sup>2</sup> These global figures, although of value in advocacy, are not helpful when it comes to planning and implementing programmes, as wide variations exist in the prevalence and causes of avoidable childhood blindness in, for example, the United Kingdom, Brazil, India, and Ethiopia.

### Control priorities

#### CORNEAL SCARRING

In industrialised countries corneal disease is responsible for less than 2% of blindness in children while in the poorest areas of Africa and Asia corneal scarring accounts for 25–50%. The major cause is vitamin A deficiency often precipitated by measles or gastroenteritis in children aged typically 6 months to 4 years. The prevalence of blindness in children is related to under 5 mortality rates,<sup>3</sup> and under 5 mortality rates are a surrogate indicator of vitamin A deficiency.<sup>4</sup> It has been suggested that countries with under 5 mortality rates over 50/1000 live births are likely to have vitamin A deficiency of public health significance.

Child mortality rates are declining in many developing countries, and other indices of child health, such as malnutrition rates have also improved.<sup>5</sup> This improvement in child health is due to interrelated factors including improved female literacy, reduced fertility, improvements in environmental health, socioeconomic development, as well as specific interventions—for example, measles immunisation and programmes for the control of vitamin A deficiency and diarrhoea. As far as vitamin A deficiency is concerned UNICEF estimates that over one million child deaths have been prevented by supplementation programmes since 1998, and the number of children with clinical and subclinical vitamin A deficiency has declined dramatically over the past decade.<sup>6</sup> Measles deaths have also declined as a result of increased coverage with measles immunisation as part of the expanded programme of immunisation, with an estimated 1.47 million deaths prevented in 1997.<sup>7</sup> The impact of these changes on childhood blindness is that bilateral corneal ulceration is

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becoming less common in poor countries, and the proportion of childhood blindness due to corneal scarring is less now than 20–30 years ago.<sup>8</sup>

The first priority therefore for the control of blindness in children in poorer regions of the world is to develop sustainable, effective interventions for the control of vitamin A deficiency and ensure high coverage with measles immunisation. Of secondary importance are programmes for the control of ophthalmia neonatorum, and the inclusion of traditional healers in primary eye care training which can reduce the rate of corneal damage as a result of harmful traditional practices.<sup>9</sup>

#### CATARACT AND GLAUCOMA

Worldwide, cataract and glaucoma are responsible for about 20% of all cases of childhood blindness. Congenitally acquired rubella is a potentially preventable cause of cataract in some parts of the world—in one study in south India more than 20% of infantile cataract was due to confirmed rubella.<sup>10</sup> However, inadequate coverage with an infantile immunisation strategy can lead to an increased incidence of congenital rubella, and the decision on the best immunisation strategy, if any, needs to be based on seroprevalence and health services research data.<sup>11</sup> Successful treatment of cataract and glaucoma requires a variety of interventions including training of health personnel who deal with newborn babies to recognise these eye diseases; easy and quick referral mechanisms to ensure children with cataract and glaucoma are seen by specialists; training of eye specialists in the assessment, surgery, and long term management of these children; support services including paediatric anaesthesia, orthoptics, optometry, low vision specialists, and educationalists.

In resource-poor regions of the world subspecialty ophthalmology is not generally in place, and children with cataract and glaucoma are managed by general ophthalmologists. Training programmes for ophthalmologists interested in children's eye diseases are being developed in South East Asia, but management will not improve until the culture of subspecialty training and referral of cases by generalists to subspecialists is adopted.

#### RETINOPATHY OF PREMATURITY

A notable achievement in the control of blindness in children is the reduction of blindness due to retinopathy of prematurity (ROP) in industrialised countries since the first epidemic in the 1940s and 1950s. However, in urban settings of Latin America, the former socialist economies, and now Asia, ROP is reaching almost epidemic proportions with between a quarter and a half of all childhood blindness in some countries being due to ROP.<sup>12</sup> It is vitally important that programmes for screening and treating babies are established in all units where preterm babies weighing less than 1500 g survive to 6 weeks and more. There are encouraging developments in Latin America, but much more needs to be done, and this problem is likely to increase in Asia as neonatal

units and survival rates for babies less than 1500 g improve.

#### LOW VISION SERVICES

Many children with minimal residual vision can be greatly helped by full spectacle correction with or without low vision magnification devices. It has been shown that more than half of children in blind schools in Africa can read normal print (and therefore be integrated into normal, non-Braille, education) if provided with spectacles and/or near magnifiers. Regrettably, low vision work does not carry the same kudos as surgery or even public health specialisation; however, the provision of good low vision services is an essential component in any specialist paediatric eye care unit. It is also important that low vision services are made available to visually impaired children in blind schools and special education so they can maximise their available vision and thus improve their quality of life.

#### Research opportunities

Research priorities vary depending on the causes of childhood blindness in any given population and they will also change over time as avoidable conditions are controlled and new problems emerge or assume greater importance.

Research opportunities at present for different situations include:

- clinical trials to determine the optimum management strategy for congenital cataract, particularly where follow up is poor
- identification of screening criteria and evaluation of screening methods for the detection of threshold retinopathy of prematurity in different settings
- development and evaluation of novel community based interventions for the control of vitamin A deficiency in women and children
- evaluation of the impact and best strategies for providing low vision services in different settings
- identification of the causes of conditions where the aetiology is currently not known (for example, congenital glaucoma, and congenital anomalies such as microphthalmos and coloboma).

#### Conclusion

The global prevalence of blindness in children is currently estimated to be 0.8/1000 children, and the total number of children in the world is approximately 1.8 billion. The number of children is expected to peak in the next 20–30 years at two billion, and then start to decline. If the prevalence of blindness in children can be reduced to a global average of 0.4/1000 (that is, similar to that in the established market economies) the number of blind children in 2020 will be approximately half the current number. This can be achieved by:

- elimination of corneal scarring due to vitamin A deficiency and measles
- improved early referral and management of cataract and glaucoma

- control of retinopathy of prematurity by implementation of screening and treatment protocols in all intensive care neonatal units. Further research into genetic conditions, and the role of environmental risk factors operating during fetal development (that is, toxins or nutritional deficiencies) as well as exploration of gene-environment interactions in the aetiology of congenital anomalies also offers potential for further reducing childhood blindness.
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