Blindness and visual impairment in the Americas and the Caribbean

B Muñoz, S K West

Aim: To summarise available data on the prevalence and causes of visual impairment and blindness in the Americas and the Caribbean.

Methods: The published literature was searched in Medline and LILACS using the following key words: blindness, visual impairment, prevalence. Articles were reviewed, and the references of the articles were also searched for relevant articles, which were also reviewed.

Results: Using the mortality in children under the age of 5 as an indicator, the overall prevalence of childhood blindness (in the under age 15 group) for the region was estimated at 0.45/1000, with the majority (67%) living in countries with mortality of children under age 5 above 30/1000 live births. Corneal opacities were more common in countries where the under 5 year mortality are above 30/1000 live births and retinopathy of prematurity (ROP) was an important cause in countries with intermediate death rates. For adults, overall blindness rates were not estimated because of the social, economic, and ethnic diversity in the region. The primary causes of visual loss in adults in the Americas were age related eye diseases, notably cataract and glaucoma in the African-American and Hispanic populations, and age related macular degeneration in the white population. Uncorrected refractive error was a significant cause of decreased vision across ages, ethnic groups, and countries.

Conclusion: More data are needed on the magnitude and causes of visual loss for the Caribbean and Latin American countries. Rates of blindness and visual loss from available data within these countries are widely disparate. Prevention and control of avoidable blindness needs to be an ongoing focus in this region.

RESULTS
Childhood blindness

Magnitude of blindness

Information on the prevalence of blindness in children is scarce and difficult to obtain because of its relatively low occurrence. Population based studies that could yield results with reasonable precision are very expensive to conduct, so alternative ways to assess the magnitude of the problem have been used. Based on data from blind registers in Europe and the few available population based surveys from Asia and
The prevalence of blindness and visual impairment varied across studies; when available, both the WHO blindness definition (visual acuity 20/400 or worse) and legal blindness in the United States (visual acuity 20/200 or worse) were presented. Only a few studies also incorporated blindness based on visual field loss alone, and we did not include those data. Some studies reported presenting acuity (with habitual correction) in the better eye instead of best corrected acuity. Consequently, the prevalence of blindness and visual impairment for those studies tended to be higher because they included uncorrected refractive error.

Blindness and visual impairment estimates for North America came from studies in the United States, because of the absence of data from Canada, except based on self-report. Within the United States, the etiology and prevalence of blindness varied by ethnic group, location (rural/urban), and year of the survey; with more recent studies reporting lower rates. Temporal trends that affect blindness rates include increasing demand for cataract surgery to correct visual loss, using techniques with much better visual rehabilitation.

Studies carried out before 1990 reported blindness rates (best corrected visual acuity 20/200 or worse) in white people age 40 and older ranging from 0.5% in Beaver Dam to 1.1% in the rural community of Mud Creek Valley. For black people, the Baltimore Eye Survey estimated a blindness rate of 1.5%. In 1994, the Salisbury Eye Evaluation examined black and white people, and the reported prevalence of blindness among ages 65–84 was 1.7% and 0.3% respectively. A recent study of Mexican-Americans age 40 and older estimated blindness rates at 0.3%, although most of the population was less than age 60. Age adjusted comparisons showed rates in Mexican-Americans midway between white and black people.
In Central and South America, the studies from Brazil, Chile, and Peru suggested a higher prevalence of blindness than the prevalence reported among Hispanics in studies in North America.12–23 Comparing two surveys, both carried out in the late 1980s using similar age groups (40 and older), 2.9% of the population had bilateral best corrected acuity 20/200 or worse in Peru23 compared to 0.9% and 1.9% for white and black people in the Baltimore Eye Survey.24–29

The only data on blindness prevalence available for the Caribbean comes from the Barbados Eye Study.24 In this predominantly black population, age adjusted blindness rates were twice as high as the rates reported for black people in the Baltimore Eye Survey (3.0% v 1.5%).

**Causes of visual loss**

As Table 3 shows, the primary causes of visual loss in adults in the Americas were age related eye diseases, notably cataract and glaucoma in the African-American and Hispanic populations, and age related macular degeneration in the white population. In younger age groups, and in high risk populations, diabetic retinopathy was a leading cause of visual loss.

The excess risk of blindness in the Latino-American surveys probably resulted from unoperated cataract. An estimated 72%–74% of the blindness in Chimbote, Peru and Campinas, Brazil23 was cataract related compared to the highest proportion reported for the United States, 27% in black people in the Baltimore Eye Survey. In another two studies in Chile21 and Brazil23 the proportion of blindness due to cataract was 55% and 62% respectively, also much higher than in North America.

In the Caribbean, data from the Barbados Eye Study showed that cataract and glaucoma were responsible for almost 60% of the blindness,24 with each contributing equally. Prevalence of blindness from glaucoma was higher than the proportion reported for black people in the United States. This high proportion of blindness due to glaucoma is consistent with the high prevalence of open angle glaucoma reported in the region.44–45

Uncorrected refractive error is an important cause of visual loss in all ages, and one not captured by studies reporting rates of best corrected acuity loss. Table 4 shows the significance of uncorrected refractive error as a cause of visual impairment in several population groups. A significant number of those who have visual loss would not be classified as impaired with appropriate refractive correction. Studies in children in the United States, Chile, and Colombia suggested that almost half of the children with decreased visual acuity would no longer be impaired with appropriate refractive correction.46–50 Similarly, data from adults showed that close to 20% of the people aged 40 and older with presenting acuity 20/200 or worse improved to better than 20/200 after refraction.51 In Proyecto VER, 73% of the individuals with presenting acuity worse than 20/40 improved after refraction.52

There are populations, particularly in Central and South America, living in extremely impoverished and politically disenchanted circumstances that continue to foster eye diseases long since banished from most of the Americas. Six countries report onchocerciasis in localised areas affecting the poorest of the poor (Brazil, Colombia, Ecuador, Guatemala, Mexico, and Venezuela).48–50 The Onchocerciasis Elimination Program for the Americas (OEPA) has been active in these countries since 1990. According to the last report from the ninth Inter-American Conference on Onchocerciasis, semiannual treatments with ivermectin have been successful, accomplishing good to excellent coverage.53 In fact, Colombia, Ecuador, and Mexico have treatment programmes that reportedly have reached full coverage.54 However, distribution programmes in Guatemala and Brazil are performing below their annual treatment objectives, and in Venezuela the national programme has just completed plans for mass treatment...
<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Study design</th>
<th>Race</th>
<th>Age group</th>
<th>No</th>
<th>Type*</th>
<th>Visual acuity in the better eye</th>
<th>Prevalence</th>
<th>Primary causes</th>
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</thead>
<tbody>
<tr>
<td>Barbados</td>
<td>1987–92</td>
<td>Simple random sample</td>
<td>Black</td>
<td>40–84</td>
<td>4303</td>
<td>B ≤20/200 ≤20/400 ≤20/60–&gt;20/400</td>
<td>3.0% Cataract, cataract, retinal/choroidal diseases</td>
<td></td>
<td></td>
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<tr>
<td>Chile</td>
<td>1988</td>
<td>Community based rural</td>
<td>Hispanic</td>
<td>≥60</td>
<td>664</td>
<td>B ≤20/200</td>
<td>5.9% Cataract, glaucoma, retinal (not AMD)</td>
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<td></td>
</tr>
<tr>
<td>Brazil</td>
<td>1986–7</td>
<td>Stratified random sample</td>
<td>Hispanic</td>
<td>≥65</td>
<td>120</td>
<td>P ≤20/400</td>
<td>6.8% Cataract, myopic degeneration, glaucoma</td>
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<td></td>
</tr>
<tr>
<td>Brazil</td>
<td>1986–7</td>
<td>Community based</td>
<td>Hispanic</td>
<td>≥50</td>
<td>7452</td>
<td>B ≤20/200</td>
<td>2.8% Cataract was involved</td>
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<td></td>
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<tr>
<td>Brazil</td>
<td>1992–4</td>
<td>Community based</td>
<td>Hispanic</td>
<td>All ages</td>
<td>All residents</td>
<td>B ≤20/200</td>
<td>0.1% Cataract, retinal, diabetic retinopathy</td>
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<td></td>
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<tr>
<td>Peru</td>
<td>1986–7</td>
<td>Community based</td>
<td>Hispanic</td>
<td>≥40</td>
<td>12193</td>
<td>B ≤20/200</td>
<td>2.9% Cataract was involved</td>
<td></td>
<td></td>
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<tr>
<td>USA</td>
<td>Framingham, MA</td>
<td>Community based</td>
<td>White</td>
<td>≥55</td>
<td>2631</td>
<td>B ≤20/200</td>
<td>0.6% Cataract, ARMD, glaucoma, diabetic retinopathy</td>
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<td></td>
</tr>
<tr>
<td>USA</td>
<td>National Health and Nutrition Examination</td>
<td>Multistage random sample</td>
<td>Black</td>
<td>75–84</td>
<td>394</td>
<td>P ≤20/200</td>
<td>Not reported</td>
<td></td>
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<tr>
<td>USA</td>
<td>Hispanic Health and Nutrition Examination</td>
<td>Multistage random sample</td>
<td>White</td>
<td>25–74</td>
<td>250</td>
<td>≤20/200</td>
<td>Not reported</td>
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<td>USA</td>
<td>Baltimore, MD</td>
<td>Stratified random sample</td>
<td>White</td>
<td>≥40</td>
<td>2913</td>
<td>B ≤20/400</td>
<td>0.5% ARMD, cataract</td>
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<tr>
<td>USA</td>
<td>Mud Creek Valley, KY</td>
<td>Community based</td>
<td>White</td>
<td>≥40</td>
<td>1136</td>
<td>B ≤20/200</td>
<td>1.1% Cataract, ARMD, diabetic retinopathy, glaucoma</td>
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<td></td>
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<tr>
<td>USA</td>
<td>Beaver Dam, WI</td>
<td>Community based</td>
<td>White</td>
<td>≥43</td>
<td>4897</td>
<td>B ≤20/200</td>
<td>Not reported</td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>3 communities in MA, CT, IO</td>
<td>Community based</td>
<td>White</td>
<td>94%</td>
<td>5335</td>
<td>P ≤20/200</td>
<td>Not reported</td>
<td></td>
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<tr>
<td>USA</td>
<td>Salisbury, MD</td>
<td>Community based random sample</td>
<td>White</td>
<td>65–84</td>
<td>1853</td>
<td>B ≤20/400</td>
<td>Cataract, ARMD, diabetic retinopathy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>Tucson and Nogales, AZ</td>
<td>Community based random sample</td>
<td>Hispanic</td>
<td>≥40</td>
<td>4774</td>
<td>B ≤20/400</td>
<td>Cataract, ARMD, diabetic retinopathy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*P = presenting acuity, B = best corrected.
programmes in all affected communities to be active by the year 2001.\textsuperscript{49} In the past 15 years, there have been studies showing the existence of pockets of endemic trachoma in Brazil, Mexico, and Peru.\textsuperscript{50,51} In South America, the Amazonian region and the bordering states of northwest Brazil seem to be the most affected, with prevalence of active disease ranging from 5% to 42%.\textsuperscript{51,52} While trachoma has been found in urban areas in other states of Brazil,\textsuperscript{53} the low prevalence of active disease (<10%) in children, and no signs of scars and trichiasis in adults were reported, suggested blinding trachoma was not yet a problem.

In Central America, trachoma is endemic in pockets of southern Mexico and Guatemala.\textsuperscript{54-56} Two population based studies reported prevalence of active disease in children around 25%, and in some of the communities almost all examined adults (aged 40 and older) had signs of conjunctival scars. The area affected is mostly rural, inhabited by farmers of Mayan descent with limited access to public services including health care.

Trachoma was endemic until recently in the native Americans in the United States, with trachoma reported in 1982 at 1% among Navaho children.\textsuperscript{57} Trachoma was reported as a cause of blindness in a recent review of the medical records from the Indian Health Services.\textsuperscript{58} There may well be other indigenous populations with trachoma in the Americas, but surveys have not been carried out.

**DISCUSSION**

The region of the Americas encompasses an extremely diverse set of nations. Even within nations, the populations can range from well educated, wealthy members who have access to the most sophisticated eye care available, to very poor minority populations, isolated with little or no access to, or understanding of how to access, reasonable eye care. A simple summary of data on visual loss in the Americas does not do justice to this diversity.

First of all, it is clear that more data are needed on the magnitude and causes of visual loss, particularly in the Caribbean nations and other countries of central and southern America. Some surveys are currently planned, or the data collected but not yet available. Clearly, from the socioeconomic indicators and the estimates of childhood blindness, there will be pronounced differences within different countries. Such data are essential to plan and implement national programmes for blindness prevention. Where there may be populations at high risk for onchocerciasis or trachoma, special surveys to identify these groups and national will to plan targeted interventions are a special priority.

Secondly, attention must be paid to the growing problem ofROP in children. Control of childhood blindness is a high priority set by the Vision 2020 agenda.\textsuperscript{60} Although the total number of blind children is lower than that of adults, the personal and social costs are higher,\textsuperscript{61} because of the life expectancy. In fact, the number of “blind years” due to childhood blindness is estimated to be similar to the number of “cataract blind years” in adults.\textsuperscript{62} The proportion of blindness due to ROP in the developed countries ranges from 6–18%.\textsuperscript{63} However, in middle income countries, there is an epidemic of ROP due to the increased survival of low birthweight infants where there is suboptimal neonatal care.\textsuperscript{64}

The problem of blindness due to cataract will continue to be an issue in the future, as the population ages and risk factors for cataract, such as diabetes, become even more prevalent. The rates of blindness and visual loss are higher in Latin America than in comparable age groups in the United States, due in large part to the proportion blind from cataract. The data from Chimbote and Campinas\textsuperscript{65} suggested that only two thirds of people who were offered cataract surgery were operated. No apparent reasons for refusal were reported, although fear of surgery, acceptance of visual loss as a consequence of old age, and poor outcomes were reasons in other studies.\textsuperscript{66,67} Data from another study in US based Hispanics suggested that economic barriers, such as no insurance, were barriers to having cataract surgery.\textsuperscript{68} The estimated cataract surgery rate per million population per year is fivefold higher in North America compared to the rest of the Americas.\textsuperscript{69} It is clear that the barriers blocking access to cataract surgery need to be identified, and improvements instituted, in order to reduce the burden of blindness in Latin America.

One of the main causes of blindness in younger people is diabetic retinopathy. Prevalence of diabetes in the Hispanic and native American populations is very high; a recent study in a population of Mexican-Americans in the United States reported one in five people over age 40 had diabetes, and almost half had evidence of diabetic retinopathy.\textsuperscript{70} This includes the 15% of people with diabetes who were not aware of their condition. Adequate control and early treatment of diabetes have been shown to be cost effective for controlling diabetic retinopathy, but this will continue to be a significant public health problem in populations where access to treatment is poor.

Finally, the problem of uncorrected refractive error as a cause of visual loss is starting to be recognised. While the
impact on quality of life of people with uncorrected refractive error is not as large as the impact from cataract or other ocular pathology.” It is easily avoidable. The size of the problem is underestimated because many of the studies report visual loss only after best correction. Uncorrected refractive error is not only an issue in children, where visual screening ought to be part of preparation for schooling. Older people have significant uncorrected, or poorly corrected, refractive error as well.

In summary, there are few data on the rates of blindness and visual loss within countries in the Americas, and the data which do exist shows widely disparate rates, as expected. Although many countries have socioeconomic markers that place them as high to middle income countries, there are populations within these countries that do not enjoy the same freedom from visual loss as their compatriots. Prevention and control of avoidable blindness needs to be an ongoing focus in this region.

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Authors’ affiliations
B Muñoz, S K West, Dana Center, Wilmer Eye Institute, Johns Hopkins University, Baltimore, MD, USA

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