

PUBLIC HEALTH AND THE EYE

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Eye Disease and Care in Latin America and the Caribbean

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Abstract. In the last decade, health indicators in Latin America and the Caribbean reflect advances. The per capita public expenditure on health care has increased in many countries. Despite these improvements, it is estimated that for every million population in Latin America and the Caribbean, 5,000 are blind and 20,000 are visually impaired; at least 66% of the blindness is attributable to treatable conditions such as cataract. The cataract surgery rate in the region remains low as compared to the industrialized countries, although it is higher than many other regions of the world. The availability of eye care services varies from country to country within the region, and the number of ophthalmologists per million population in the richest countries may be nine times more than in the poorest. Access, defined as the distance between the consumer and the services, is problematic in countries with isolated areas in the rainforest or high mountains, poor road systems, or lack of public transportation. Affordability is an important issue that limits utilization of services by the poorest segments of the population in nearly all countries in Latin America and the Caribbean. (*Surv Ophthalmol* 47:267–274. © 2002 by Elsevier Science Inc. All rights reserved.)

Key words. blindness • Caribbean • cataract • diabetic retinopathy • glaucoma • Latin America • onchocercosis • public health • vitamin A deficiency • trachoma

Estimating the prevalence of visual impairment and assessing the access, affordability, and effectiveness of eye care delivery systems in Latin America and the Caribbean are difficult tasks because of the lack of comprehensive data. Some studies are not well designed, data are not standardized, or the publications are inaccessible.

This review summarizes the available data to give a general overview of the eye care situation in the region, acknowledging the enormous economic, ethnic, and cultural differences among the countries. For that reason, the cataract surgery rate and number of ophthalmologist per million population are

treated separately for Latin America and the Caribbean. The prevalence of disease is reported according to the study of ethnic composition and such data cannot be extrapolated to other populations in the region. Unfortunately, there are not enough epidemiological and services data to accurately review for each sub-region (Mexico, Caribbean, Central America, Andean Countries, South Cone, and Brazil).

Population and Health Situation

Data from national census and estimates for the year 1999 reveal that the combined population of Latin America and the Caribbean is about 514 mil-

lion people, with an average annual growth of 1.4%.³⁹ Of the total population, Brazil represents 33%, Andean countries 22%, Mexico 19%, Central America and the Caribbean 14%, and the Southern Cone 12%.³⁹

General health indicators in Latin America and the Caribbean have steadily improved in the past decade reflecting improved social, environmental, economic, and cultural factors, as well as greater accessibility and higher quality of services. In the decade between the mid 1980s to the mid 1990s, life expectancy rose in the region from 68.7 to 71.1 years, and infant mortality rates fell to 35 per 1,000 live births;⁴⁰ in the United States and Canada, infant mortality has remained at 7.3 and 5.5 per 1,000 live births, respectively.³⁹

Blindness and Visual Loss

Since 1997, national ministries of health, in conjunction with the Pan American Health Organization, have collected data on blindness and the development of the eye care services.^{44,45,51} In Latin America and the Caribbean, there are 5,000 blind (visual acuity of less than 20/400 in the best eye) and 20,000 visually impaired (visual acuity of less than 20/70 in the best eye) per million population, according to the WHO data and some population-based surveys done in the region.³⁸ In Latin America, it is estimated that 6 million people suffer low vision,⁴² defined as visual acuity of less than 6/18 (20/50) after treatment or standard refractive correction.⁶⁶ Close to 60% of blindness and visual impairment is due to unoperated cataract;³⁸ other important causes are glaucoma, diabetic retinopathy, and childhood blindness. Uncorrected refractive errors are an important cause of visual impairment. Trachoma, onchocerciasis, and xerophthalmia are limited to small regions and do not pose an important public health problem.³⁸

CATARACT

The World Health Organization estimates that cataract represents 41.8% of global blindness; in Latin America, it represents 57.6%.⁶⁴ The incidence of blinding cataract in the world is estimated to be 1–2 cases per 1,000 population per year.⁷¹ Most of the studies of Latin America and the Caribbean confirm the importance of cataract as a cause of blindness and visual impairment. The Barbados Eye Study found the prevalence of lens changes (in at least one eye) among the 45–84-year-old group to be 42% in blacks, 38% in mixed races, and 36% in caucasians.²⁴ In the same population, a longitudinal study found a high incidence of 1 in 4–5 participants over 45 years of age for the development cortical opacities after 4 years of follow-up.²⁷ In the Dominican Republic, a

blindness survey done of all age groups ($n = 17,490$) found visual acuity under 20/200 in 0.45% of the population; 49% was due to cataract.³³ An eye study done in the elderly of Sao Paulo, Brazil, in the last decade also found cataract as a cause of preventable blindness.³⁰ In 1983, a study in people of all ages in the Puno region of Peru, 1,500 km from Lima, found a 2% prevalence of blindness, of which 34% was due to cataract.¹

By the mid 1980s, a methodology for organizing the cataract projects was established and several countries decentralized eye care delivery and increased eye care services in rural areas.⁷ By 1987, “cataract free zones” or cataract eradication projects were initiated in Campinas, Brazil, and Chimbote, Peru, to reduce the prevalence of blinding cataract.^{20,21} The organization of permanent services in remote regions has been established through primary eye care by training health personnel in the early detection of eye diseases, provision of simple treatments, and referrals.^{4,70}

The number of cataract operations performed per year, per million (cataract surgical rate) in developed countries is usually between 4,000 and 6,000;¹⁰ in Latin America, this rate varies according to the social and economic development of the countries and ranges from 500 to 2,000 (Table 1), with the lowest rates in the poorest regions.³⁸

GLAUCOMA

Glaucoma remains a common cause of blindness, both in developing and industrialized countries; the WHO estimates that it accounts for approximately 15% of all blindness and is responsible for about 5.2 million blind worldwide.⁵⁸ Among the population between 40 and 84 years of age in the Barbados Eye Study, the prevalence of open-angle glaucoma (OAG) has been found to be 0.8% in caucasians, 3.3% in mixed-race, and 7% in blacks.²⁵ A population-based survey in Peru^{62,63} found that glaucoma was responsible for 10.6% of blindness; 85% of the cases had OAG and approximately 50% of the patients were undiagnosed.⁶³

Due to the lack of low-cost sensitive and specific methods for screening, there are no public health efforts in Latin America to detect glaucoma in the general population.

DIABETIC RETINOPATHY

Diabetic retinopathy in Latin America is one of the main causes of blindness after cataract and glaucoma.⁵⁹ In the 30–64-year-old Latin American population, the prevalence of diabetes ranges from less than 1% in the Mapuche Indians of Chile to almost 20% among low-income Hispanics living in the U.S.A.; in Brazil, the prevalence is 7%.²² A recent

TABLE 1
*Annual Cataract Surgical Rate*³⁸

Annual Cataract Operations per Million	Latin America	Caribbean
<500	Nicaragua, Honduras	Haiti
500–750	Bolivia, Dominican Republic, El Salvador, Paraguay, Peru	Belize, Guyana, Jamaica
751–1,000	Ecuador	St. Lucia
1,001–1,500	Brazil, Chile, Costa Rica, Cuba	Antigua, St. Vincent
1,501–2,000		Dominica, Grenada
>2,000		Barbados, Trinidad

study in the Dominican Republic found that 5% of the population was diabetic and approximately half was undiagnosed,³³ which is similar to other internationally accepted figures.¹⁸ Battle and colleagues³³ found that 5% of blindness was due to diabetic retinopathy. The Barbados Eye Study targeted the population of African origin living in the Caribbean and found that among people between 40 and 84 years of age, 1 in 17 persons had diabetic retinopathy; among diabetics, 29% had retinopathy.²⁶

In the past decade, the Pan American Health Organization (PAHO-WHO), together with the Pan American Association of Ophthalmology (PAAO), developed guidelines for the organization of programs to prevent blindness due to diabetes in Latin America.⁵⁰

REFRACTIVE ERRORS

In some regions of the world, uncorrected refractive error is the most common cause of bilateral visual impairment,⁶¹ accounting for 33% of those with vision under 6/18.⁵⁷ PAHO-WHO estimates that in Latin America, 13% of the school children have refractive errors that may cause a decreased visual acuity.⁴⁶ In the Caribbean population between 40 and 84 years of age, myopia occurs in 22% and hyperopia in 47%.⁷² In a study of Colombian children ($n = 6,277$), only 36% of children with reduced visual acuity in either eye utilize spectacles.⁴¹ A study in the suburban area of Santiago, Chile assessed the prevalence of refractive errors and vision impairment in school age children ($n = 6,998$) and found that more than 7% could benefit from the provision of proper spectacles.²⁹ During the past decade, limited visual acuity screening programs have been organized to detect amblyopia in children under the age of 6 years, and myopia between ages 6 and 11 years.^{19,34}

ONCHOCERCOSIS

In 1991, the WHO estimated that there were 17 million individuals infected with onchocercosis in 32 countries.⁶⁹ In Latin America, onchocercosis is re-

gionally clustered in six countries (Mexico, Guatemala, Colombia, Venezuela, Ecuador, and Brazil), but it is not a major cause of blindness or visual impairment.³⁵ The disease was first described in the American region of Guatemala in 1915,⁸ and currently it is present in the central portion of the country, where almost 300,000 are at risk. In Mexico, the disease is located in the southern state of Chiapas and Oaxaca with 25,000 confirmed cases and 261,000 people at risk.³⁵ In Brazil, a focus was identified in 1967 along the Venezuelan border in the Yanomami Indians.³⁵ In Venezuela, there are two other regions, the center-north and the northeast.³⁵ In 1965, a cluster was identified in Colombia in the Micay River region in the southwest of the country and recently, a focus in the south was found. In northern Ecuador, the disease is located in the Esmeraldas province affecting the Chachis Indians and those of African descent living along the Santiago river.³⁵

In 1991, a partnership consisting of the PAHO, the governments in endemic countries (Brazil, Colombia, Ecuador, Guatemala, Mexico, and Venezuela), non-governmental development organizations (NGDOs), and the Center for Disease Control (CDC) in Atlanta, developed the political, financial, and technical support needed for the elimination of morbidity by onchocerciasis from the hemisphere by the year 2007.² It is estimated that the overall population at risk for onchocerciasis in the Americas has decreased by 86% since 1995 as a result of this program.⁵⁴

VITAMIN A DEFICIENCY

At the global level, vitamin A deficiency remains the leading cause of preventable visual impairment and blindness among children.⁶⁰ Vitamin A deficiency in Latin America and the Caribbean is usually subclinical but remains as a public health problem in El Salvador, Nicaragua, Honduras, Guatemala, Dominican Republic, Ecuador, Colombia, and Bolivia, as well as in some regions of Brazil, Mexico, Peru, and Panama.³² Clinical manifestations—such as night blindness, Bitot spots, xerosis, and xe-

ropththalmia-related corneal scars were reported during the 1980s in Bolivia, Brazil (Paraiba), Guatemala, and Peru and in the early 1990s in the Dominican Republic.³¹ A national survey conducted in Haiti in 1996–1997 by UNICEF identified a prevalence of 9.7 per 1,000 for xerosis and 2.5 per 1,000 ulceration of the cornea.²³

To reduce vitamin A deficiency, some Latin American countries include universal target supplementation of vitamin A, adequate immunization, sugar fortification (El Salvador, Guatemala, Honduras), and programs to promote dietary diversification.³² In Haiti, some international organizations have initiated programs.²³

TRACHOMA

Trachoma is caused by *clamydia trachomatis* infection and is the second leading cause of blindness at the global level. In Latin America, trachoma is not a major cause of blindness. However, some foci have been identified in Brazil, Guatemala, and Mexico; it is suspected that the disease is also present in Bolivia and Peru.³⁷ Brazil has monitored trachoma in the last decade and the disease is endemic in the northeast, with the highest prevalence in the state of Pernambuco.⁶⁸ Some foci were found in the states of Bahia Ceara and Sao Paulo and, recently, the Brazilian Ministry of Health established a Trachoma Control Program.⁶⁸ Trachoma occurs in Mexico in the highlands of the southern state of Chiapas.⁵⁵ An association between trachoma and poor personal hygiene has been confirmed in Mexico in the poorest states.⁵⁶ The WHO Alliance for the Global Elimination of Trachoma through the SAFE program (surgery, antibiotics, facial hygiene, and environmental change) is improving infection control.^{5,67}

CHILDHOOD BLINDNESS

There is an estimated 1.5 million blind children worldwide.⁹ The availability of reliable data on prevalence and causes is limited in most regions, including Latin America. Since the WHO developed a form for recording causes of pediatric visual loss in the early 1990s, the collection of data has been standardized, which facilitates analysis.¹⁴ The estimated prevalence of childhood blindness in Latin America is 4 to 6 for every 10,000 and in the poorest countries of Africa and Asia, it is 9–11 for every 10,000; the prevalence correlates with socioeconomic status.¹³ Data collected from schools for the blind in Latin America revealed that between 34% and 44% of cases of childhood blindness are preventable or treatable.⁴⁷ The most common treatable diseases are congenital cataract, congenital glaucoma, and retinopathy of prematurity (ROP), and the most common preventable causes include rubella, toxoplas-

mosis, and ophthalmia neonatorum.⁴⁷ Between 1991 and 1996, studies in the schools of the blind in six Latin American countries identified ROP as the most common etiology, occurring in 4% to 39% of blind children.¹⁵ Data suggest that ROP is becoming a major cause of preventable blindness among children in those Latin American countries that have introduced neonatal intensive care services for low-birth weight infants.¹⁵ In Chile, the major anatomical cause of severe visual impairment and blindness is retinal disease including ROP (47%); cataract accounted for 9.2%, and glaucoma and corneal pathology accounted for 8.3% and 6.9%, respectively.¹² Genetic diseases were responsible for a higher proportion of childhood visual loss in countries with higher socio-economic levels, with retinal dystrophies being the most common.¹⁶

The barriers that prevent the implementation of effective intervention include the lack of data concerning the causes as well as awareness and knowledge among health care providers. Technical and infrastructure resources are also scarce in many countries. In Latin America, regional efforts to increase public awareness, improve knowledge of the providers and, in some cases, develop prevention policies have been instituted.⁴⁶

Health Services and Systems

Health care reform is an ongoing process in most Latin American and Caribbean countries. Current trends include decentralization, new forms of financing, cost control, cost recovery, and the creation of basic packages for health services.³⁶ Ministries of health are reducing their roles as direct service providers and emphasizing public policy as well as the management, coordination, articulation, and regulation of public and private health resources. Practically every country in Latin America has a public/private mix of health services and financing.³⁶ Public expenditures for health care in the countries of the region grew the most between 1990 and 1995, with the average growth of public expenditures per capita at almost 50%.⁴⁰

Eye Care Services

A potential patient is one with the motivation to seek services for an examination or for treatment of an eye disease. This motivation is related to both the educational level and the public awareness. Limited availability and access, as well as affordability of the services, are important causes of the high prevalence of blinding cataract.⁴⁹ In the Dominican Republic, the two most important barriers to cataract surgery were lack of money (38%) and lack of knowledge and awareness (25%).³³

AVAILABILITY

To calculate the professional effort necessary to meet the needs of a defined population, demographic characteristics, utilization of services, and the productivity of eye care providers are assessed. It is estimated that 10 eye surgeons per million population with a well-developed technical and administrative infrastructure are able to treat all blinding cataracts.⁴³ Therefore, the number of ophthalmologists (19,000)³⁸ in Latin America is sufficient to meet the needs of the population. Of the 19 Spanish and Portuguese speaking countries, just five (Bolivia, El Salvador, Guatemala, Honduras, Nicaragua) have less than 15 ophthalmologists per million population. In the Caribbean, half of the countries have at least 15 ophthalmologists per million population (Table 2).^{38,44} Even if 30% of the ophthalmologists do not perform surgery, 10 eye surgeons per million are functioning in most countries. Unfortunately, many constraints limit access to eye care professionals in Latin America. Most ophthalmologists work in private practice, limit their services to patients who can afford it, and are located in the wealthier neighborhoods of urban centers, reducing availability and accessibility of services to a large proportion of the population. As a result, the surgical productivity per ophthalmologist is relatively low as compared to other regions.⁴⁸

The shortage of ophthalmic assistants limits the productivity of ophthalmologists. In Latin America, there are only two schools for training of ophthalmic assistants. In addition, this career is not highly regarded by ophthalmologists in most countries. Optometrists are not licensed in many Latin American and Caribbean countries.⁴⁸ Other limitations include shortages of modern ophthalmic diagnostic and therapeutic equipment in some countries. In places with sophisticated equipment, the costs to operate, maintain, and repair the equipment are high.

ACCESS

Access can be measured by the travel time required by public transportation to reach the nearest

eye care provider. Some access studies done in the Caribbean and Central America countries^{6,3} have used the following definition: less than 1.5 hours of travel is "accessible," from 1.5 to 3 hours is "marginally accessible," and greater than 3 hours is "not accessible." In most Caribbean Islands (Trinidad, Antigua, St. Lucia, St. Kitts, Dominica, Jamaica, St. Vincent), access is not a problem due to the short distances, good roads, and public transportation.³ In the continental countries, access is variable depending on the size of the country, geographical characteristics, roads, and public transportation. In El Salvador eye care is accessible, 75% of the population is within 1.5 hours of an eye care professional. In Honduras, a larger country, 25% of patients travel more than 3 hours to reach services. In Guyana, a rainforest country approximately the size of the United Kingdom, eye care services are located only on the coast and only 50% of the population can reach the coast within 1.5 hours.⁶ One of the strategies used to reduce the distance barrier is the inclusion of basic eye care as a component of the primary health care system.⁴

AFFORDABILITY

Affordability of eye care delivery is based on income levels, costs, efficiency, and prices.¹⁷ In the U.S.A., a median-income worker may spend 3 days of salary for an eye examination and a simple pair of prescribed reading glasses. In El Salvador, Trinidad and St. Vincent, the cost may be 15 days of salary; in Honduras it is 30 days of salary; and, in Jamaica, even more.⁶

The utilization of low-cost intraocular lenses and sutures in the community-oriented eye care programs has increased affordability for eye care services. Local production of eye drops in the Caribbean has reduced costs by nearly 33% and increased availability, especially for glaucoma medication.⁵²

In the early 1990s, two self-sustainable primary eye care programs were organized in Colombia and Belize to increase access and affordability of eye services.¹⁹ The cost of the spectacles was reduced by

TABLE 2
*Eye Care Providers*³⁸

Ophthalmologists per Million Population	Latin America	Caribbean
<5	—	Haiti
5–15	Bolivia, El Salvador, Guatemala, Honduras, Nicaragua	Dominica, Grenada, Guyana, Jamaica, St Lucia
16–25	Ecuador, Paraguay, Peru, Dominican Republic	Belize, St. Vincent, Trinidad
26–35	Colombia, Costa Rica, Chile, Mexico, Panama	Antigua
36–45	Brazil, Uruguay, Venezuela	Barbados
>45	Argentina, Cuba	

buying frames and lenses at low cost on the international market with local assembly. Recently, similar projects were organized in Bolivia, Honduras and Jamaica.

QUALITY

The most important issue in the reduction of blindness is the quality of the cataract surgery. Regrettably, no well-documented studies have been published in Latin America and the Caribbean. Paraguay started a rapid assessment of cataract outcomes utilizing methodology developed by Limburg;²⁸ results are not available yet.

PUBLIC AWARENESS

The motivation to obtain eye care depends on both the educational level of the individual and on the public awareness of eye diseases. A national survey in Colombia showed that 55% of people over 49 years of age ($n = 6,028$) with lens opacities were unaware they had a treatable eye condition.⁴¹ There are no well-documented studies of the effectiveness in public awareness of the eye care programs in Latin America and the Caribbean.

Non-Governmental Development Organizations

The PAHO and the WHO have prepared a document with detailed information on international non-governmental development organizations (INGDOs) activities in the region (personal communication). Sight Savers International from the UK and the Christoffel-Blindenmission from Germany have made major contributions in most Latin American and Caribbean countries for many years. United States-based organizations include the Lions Clubs International Foundation, ORBIS International, Helen Keller International, and the International Eye Foundation. The Pan American Association of Ophthalmology and the American Academy of Ophthalmology also contribute to the development of the services in the region by promoting community eye care services. ONCE from Spain, Light House International from the U.S.A., Perkins School for the Blind from the U.S.A., and Operation Eye Sight Universal from Canada have made important contributions in programs for the blind, low vision, and refractive errors services.

Global Initiative for the Elimination of Avoidable Blindness Vision 2020

Globally, the number of blind people during the last 20 years has increased from approximately 30 million in 1980 to an estimate of 50 million in the year 2000. With this trend and the aging of the population, the projection for the year 2020 is 75 million

blind people. The aim of the Global Initiative for the Elimination of Avoidable Blindness Vision 2020¹¹ (a partnership of the WHO, the International Agency for the Prevention of Blindness, and several international organizations and NGOs) is to change current projections through the provision of affordable, quality eye care to the poor and unserved populations. The WHO has developed guidelines for this global initiative.⁶⁵ The PAHO has adapted the strategies for Latin America^{38,46,53} and the Caribbean.⁴⁷

Methods of Literature Search

We reviewed pertinent information on the status of eye disease and care from international journals and publications (including the WHO and the PAHO) and regional journals. The search included Medline, LILACS (Latin American and Caribbean database in health sciences containing publications since 1982), COLOPS (PAHO-WHO Colombian Office database containing most of the documentation of the eye care regional program) and other PAHO-WHO documents. The search for references (English, Spanish, and Portuguese languages) used the following key words: Latin America, Caribbean, eye care services, blindness, visual impairment, cataract, glaucoma, diabetic retinopathy, refractive errors, onchocercosis, vitamin A deficiency, trachoma, childhood blindness, services availability, services access, services affordability. The searches included years 1990 to 2001 except for trachoma and diabetes that included the 1980s.

References containing rigorous epidemiological information or data regarding the eye care delivery systems in Latin America and the Caribbean were included in the review. Some countries, such as Brazil, have several publications on prevention of blindness. On the contrary, some small countries do not have published data and the data are from reports of the Ministry of Health or local authorities. Informal data or topics not relevant to the general overview were excluded from the review.

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