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A comparative assessment of avoidable blindness and visual impairment in seven Latin American countries: prevalence, coverage, and inequality

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ABSTRACT

Objective. To conduct a comparative analysis of social inequalities in eye health and eye health care and generate baseline evidence for seven Latin American countries as a benchmarking exercise for monitoring progress toward three goals of the regional Plan of Action for the Prevention of Blindness and Visual Impairment: increasing eye health service coverage, minimizing barriers, and reducing eye health-related disease burden.

Methods. Results from cross-sectional eye health surveys conducted in six Latin American countries (Argentina, El Salvador, Honduras, Panama, Peru, and Uruguay) from 2011 to 2013 and recently published national surveys in Paraguay were analyzed. The magnitude of absolute and relative inequalities between countries in five dimensions of eye health across the population gradient defined by three equity stratifiers (educational attainment, literacy, and wealth) were explored using standard exploratory data analysis techniques.

Results. Overall prevalence of blindness in people 50 years old and older varied from 0.7% (95% CI: 0.4–1.0) in Argentina to 3.0% (95% CI: 2.3–3.6) in Panama. Overall prevalence of visual impairment (severe plus moderate) varied from 8.0% (95% CI: 6.5–11.0) in Uruguay to 14.3% (95% CI: 13.9–14.7) in El Salvador. The main reported cause of blindness was unoperated cataract and most cases of visual impairment were caused by uncorrected refractive error. Three countries had cataract surgical coverage of more than 90% for blind persons, and two-thirds of cataract-operated patients had good visual acuity.

Conclusions. Blindness and moderate visual impairment prevalence were concentrated among the most socially disadvantaged, and cataract surgical coverage and cataract surgery optimal outcome were concentrated among the wealthiest. There is a need for policy action to increase services coverage and quality to achieve universality.

Key words

Eye health; blindness; health inequalities; visually impaired persons; prevalence; Argentina; El Salvador; Honduras; Panama; Paraguay; Peru; Uruguay; Latin America.

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To build upon recent achievements in service delivery and reduction of blindness and to address the challenges of universality and equity in the provi-

sion of eye health services, ministers of health from the Americas approved the 2014–2019 Plan of Action for the Prevention of Blindness and Visual Impairment (“the Plan”) at the Pan American Health Organization (PAHO) 53rd Directing Council meeting in October 2014. The Plan outlined concrete steps to continue improving eye health throughout the population and reducing current inequities in eye care systems and services coverage (1). With consistent execution of the Plan at the national level, countries are expected to achieve tangible progress toward these goals, particularly among vulnerable groups, by the year 2020.

The Latin America and Caribbean (LAC) region (“the Region”) is considered one of the most inequitable in the world in terms of distribution of goods and services, social determinants, and health (2). Taking advantage of the wealth of data on eye health generated by the Rapid Assessment of Avoidable Blindness (RAAB) surveys, previously described (3, 4), and the availability of comparable data on socioeconomic attributes at the country level, a comparative assessment was conducted across seven Latin American countries (Argentina, El Salvador, Honduras, Panama, Paraguay, Peru, Uruguay). The assessment included an exploratory analysis of social inequalities in eye health and eye health care to generate baseline evidence as a benchmarking exercise for monitoring progress toward three goals specified in the Plan: increasing eye health service coverage, minimizing barriers, and reducing eye health-related disease burden.

MATERIALS AND METHODS

The *Pan American Journal of Public Health* Series on Eye Health presented eye health population-based data obtained in the Region between 2011 and 2013 (3, 5–10). A standardized methodology used in the RAAB surveys was applied in all national population-based surveys conducted among people aged 50 years old and older to allow for comparison of results between countries.

The results of the cross-sectional eye health survey conducted in six countries in the Region (Argentina, El Salvador, Honduras, Panama, Peru, and Uruguay) (3, 5–10), and the recently published national RAAB surveys in Paraguay (11), were used to make a comparative assessment across the seven countries studies

and with subregional estimates (12) and those from previously published studies (13–25). The study assessed the following variables: 1) prevalence of blindness and severe and moderate visual impairment; 2) leading causes of blindness and severe and moderate visual impairment; 3) cataract surgical coverage (CSC); 4) visual outcome of cataract surgery; 5) reported access barriers to cataract surgery; and 6) various CSC indicators (e.g., location).

The magnitude of absolute and relative inequalities between study countries in the five dimensions of eye health (i.e., blindness prevalence, severe visual impairment prevalence, moderate visual impairment prevalence, CSC, and cataract surgery optimal outcome prevalence) across the population gradient, defined by three equity stratifiers (educational attainment, literacy, and wealth), were assessed using standard exploratory data analysis techniques (26, 27). The slope index of inequality (SII) was calculated as the metric of absolute inequality by regressing the country-level eye health indicators on a relative scale of social position, as defined by the cumulative class interval midpoint of the equity stratifier, logarithmically transformed. A weighted least-squares regression model was used to address the heteroskedasticity of the aggregated data by applying Maddala’s method, described elsewhere (28). The health concentration index (HCI), was also calculated, as the metric of relative inequality, by fitting, by non-linear optimization, a Lorenz concentration curve equation (29) to the observed cumulative relative distributions of population, ranked by the equity stratifiers and eye health indicators across the study countries, and numerically integrating the area under the curve (30). The corresponding SII and HCI 95% confidence intervals (CIs) were also estimated to document statistical uncertainty around the point estimate (31).

The national surveys took place under the auspices of the seven study countries’ ministries of health, with the technical assistance of Hans Limburg, a world expert and developer of the RAAB survey methodology, and the PAHO Regional Eye Health Program.

RESULTS

The seven national surveys were carried out in the Southern Cone (Argentina, Paraguay, Uruguay), Andean

(Peru), and Central American (El Salvador, Honduras, and Panama) countries between 2011 and 2013. The proportion of people ≥ 50 years old varied between countries from as little as 12.3% (in Honduras) to 17.0% (El Salvador); 19.0% (Panama, Paraguay, and Peru); 24.0% (Argentina); and 28.5% or almost one-third of the population (Uruguay). The sample size varied from 2 862 people ≥ 50 years old in Paraguay to 4 849 in Peru (Table 1).

The World Health Organization (WHO) defines blindness as presenting visual acuity (PVA) of less than 20/400 ($< 3/60$) in the better eye and visual impairment (not including blindness) as PVA of less than 20/70 ($< 6/18$) in the better eye. Table 1 shows age- and sex-adjusted prevalence of bilateral blindness and severe and moderate visual impairment, as well as CSC and visual acuity outcomes, in the seven countries studied. Overall prevalence of blindness in people ≥ 50 years old varied from 0.7% (95% CI: 0.4–1.0) in Argentina and 0.9% (95% CI: 0.5–1.3) in Uruguay to 3.0% (95% CI: 2.3–3.6) in Panama. Overall prevalence of visual impairment (severe and moderate) in people in the same age group varied from 8.8% (95% CI: 6.5–11.0) in Uruguay to 14.3% (95% CI: 13.9–14.7) in El Salvador. In the samples that were studied, for all seven countries, prevalence of blindness and visual impairment did not vary significantly between males and females, but did increase with age.

Table 2 shows that unoperated cataract is the main cause of blindness in every country and more than half of the causes in Peru (58.0%), Honduras (59.2%), Panama (66.4%) and El Salvador (68.7%). Glaucoma is the second cause of blindness in Honduras (21.1%), Paraguay (15.6%), Uruguay (14.3%), Peru (13.7%) and Panama (10.2%). Diabetic retinopathy is the second cause in Argentina (16.0%) and corneal opacity is the second cause in El Salvador (7.1%).

The CSC is the estimated proportion of all operable cataracts (of all eyes) that have been operated on. The CSC for people (versus eyes) is the estimated proportion of people with operable cataracts that have been operated (one or both eyes). Table 1 shows CSC for the seven countries studied by level of visual acuity (less than 20/400 ($< 3/60$), less than 20/200 ($< 6/60$), and less than 20/70 ($< 6/18$)). CSC for blindness varied across countries from 62.7% (El Salvador) and

TABLE 1. Rapid Assessment of Avoidable Blindness (RAAB) summary measures of age- and sex-adjusted prevalence of blindness and visual impairment, cataract surgical coverage, and cataract surgery outcome, Latin America, 2011–2013

Country	Subgroup	No.	Blindness (PVA < 3/60)	Visual impairment		Cataract surgery coverage (%)			Cataract surgery outcome	
				Severe (PVA < 6/60–3/60)	Moderate (PVA < 6/18–6/60)	PVA < 3/60	PVA < 6/60	PVA < 6/18	Good (PVA ≥ 6/18)	Poor (PVA ≥ 6/60)
				% (CI)	% (CI)					
Argentina	Total	3 770	0.7 (0.4, 1.0)	2.6 (1.4, 3.9)	9.6 (7.6, 11.6)	97.1	83.7	67.3	82.0	9.2
	Male	1 691	0.8 (0.3, 1.2)	2.4 (1.1, 3.8)	8.7 (6.2, 11.1)	96.4	82.2	64.0	80.5	11.1
	Female	2 079	0.6 (0.3, 0.9)	2.8 (1.5, 4.1)	10.4 (8.4, 12.4)	97.5	84.7	69.6	83.0	7.9
El Salvador	Total	3 399	2.4 (2.2, 2.6)	2.5 (2.3, 2.7)	11.8 (11.6, 12.0)	62.7	48.1	32.2	55.5	22.6
	Male	1 378	2.8 (2.5, 3.1)	2.7 (2.4, 3.0)	10.8 (10.5, 11.1)	63.0	49.0	34.3	58.1	23.6
	Female	2 021	2.2 (1.9, 2.5)	2.4 (2.1, 2.7)	12.6 (12.4, 12.8)	62.3	47.3	30.2	52.8	21.7
Honduras	Total	2 999	1.9 (1.4, 2.4)	1.6 (1.1, 2.1)	9.5 (8.0, 11.0)	75.2	66.5	46.2	62.5	20.0
	Male	1 219	1.7 (0.9, 2.5)	1.6 (0.8, 2.4)	7.7 (5.7, 9.6)	78.3	68.1	46.5	61.4	20.8
	Female	1 780	2.1 (1.5, 2.7)	1.6 (1.0, 2.2)	11.0 (9.1, 12.9)	73.2	65.5	46.0	63.3	19.4
Panama	Total	4 125	3.0 (2.3, 3.6)	3.2, (2.5, 3.8)	9.9 (8.4, 11.3)	76.3	66.8	52.9	58.0	21.8
	Male	1 875	3.4 (2.4, 4.3)	3.0 (2.2, 3.9)	9.3 (7.6, 11.0)	73.0	65.4	49.8	57.6	22.2
	Female	2 250	2.6 (1.8, 3.3)	3.3 (2.2, 4.2)	10.4 (8.7, 12.1)	79.5	67.9	55.8	58.3	21.4
Paraguay	Total	2 862	1.1 (0.6, 1.6)	1.3 (0.9, 1.7)	10.6 (9.2, 12.0)	90.0	78.4	63.2	77.0	7.6
	Male	1 343	1.2 (0.5, 1.9)	1.5 (0.9, 2.1)	10.5 (8.6, 12.4)	86.8	75.0	57.1	74.6	7.5
	Female	1 519	1.1 (0.5, 1.6)	1.1 (0.6, 1.7)	10.7 (8.9, 12.5)	92.9	81.6	68.9	78.8	7.6
Peru	Total	4 849	2.0 (1.5, 2.5)	1.3 (1.0, 1.6)	10.2 (8.7, 11.6)	66.9	57.4	41.5	60.5	18.5
	Male	2 014	1.7 (1.1, 2.2)	1.2 (0.7, 1.7)	10.0 (8.4, 11.8)	64.4	53.8	37.5	62.2	14.5
	Female	2 835	2.3 (1.7, 2.9)	1.4 (1.0, 1.9)	10.3 (8.6, 11.9)	68.3	59.5	44.3	59.4	21.0
Uruguay	Total	3 729	0.9 (0.5, 1.3)	0.9 (0.5, 1.3)	7.9 (6.0, 9.7)	91.3	86.0	54.4	70.0	15.3
	Male	1 571	0.7 (0.3, 1.1)	0.5 (0.1, 0.8)	5.6 (4.3, 6.9)	93.1	89.1	59.5	70.0	16.0
	Female	2 158	1.0 (0.5, 1.6)	1.2 (0.6, 1.8)	9.6 (7.1, 12.2)	90.3	84.3	51.7	70.0	14.9

TABLE 2. Main reported causes of blindness in adults 50 years old and older, Latin America, 2011–2013

Country	Uncorrected refractive error (%)	Unoperated cataract (%)	Non-trachomatous corneal opacity (%)	Glaucoma (%)	Diabetic retinopathy (%)	Age-related macular degeneration (%)
Argentina	8.0	44.0	0.0	8.0	16.0	4.0
El Salvador	4.0	68.7	7.1	5.1	5.1	4.0
Honduras	3.9	59.2	2.6	21.1	0.0	3.9
Panama	0.0	66.4	2.2	10.2	1.5	5.1
Paraguay	3.1	43.8	9.4	15.6	6.3	9.4
Peru	1.5	58.0	5.3	13.7	0.8	11.5
Uruguay	2.9	48.6	0.0	14.3	5.7	8.6

66.9% (Peru) to 90.0% (Paraguay), 91.3% (Uruguay), and 97.1% (Argentina).

In all operated patients, PVA was measured with available correction, and pin-hole (which was used as a proxy for best correction). Overall, two-thirds of operated patients had good visual acuity after surgery (PVA of 20/60 or better) and 16% had a poor visual acuity outcome (PVA < 20/200). The best visual acuity outcomes (PVA of 20/60 or better) were obtained in Argentina (82.0%) and Paraguay (77.0%); these countries also had the lowest proportion of poor visual outcome (PVA < 20/200) (9.2% in Argentina

and 7.6% in Paraguay). Other countries had lower levels of good visual outcome: El Salvador, 55.5%, Honduras, 62.5%, Panama, 58.0%, and Peru, 60.5%. The poorer surgical results (PVA < 20/200) were found in El Salvador (22.6%), Honduras (20.0%), Panama (21.8%), and Peru (18.5%). Correcting postoperative refractive errors with spectacles improved the visual acuity outcomes by 6–13 percentage points.

Table 3 shows the survey year's values for relevant demographic and socioeconomic variables in each of the seven countries studied. The distribu-

tional variability across countries is noticeable, particularly in wealth (purchasing power- and inflation-adjusted gross national income per capita), and in educational attainment (mean years of schooling in male and female adults 51–60 years old). Direction and magnitude of absolute (SII) and relative (HCI) inequalities in each of the five eye health dimensions assessed in the total population ≥ 50 years old, according to the three social determinants (equity stratifiers) that were explored, are presented in Table 4. Analogously, direction and magnitude of educational inequalities in

TABLE 3. Demographic and Socioeconomic variables (equity stratifiers) and base population by sex and survey year, Latin America, 2011–2013

Country ^a	Survey year	Population (adults 50+ years old)			Literacy rate (adults 15+ years old) (%)			Years of schooling (adults 51–60 years)		
		Total	Female	Male	Total	Female	Male	Total	Female	Male
Argentina	2013	10 360 206	5 763 225	4 596 981	97.9	98.0	97.9	10.4	10.5	10.2
El Salvador	2011	1 018 074	579 023	439 051	85.5	83.0	88.4	5.4	4.8	6.1
Honduras	2013	1 018 112	523 245	494 867	85.4	85.1	85.7	5.0	4.9	5.0
Panama	2012	717 816	368 290	349 526	94.1	93.5	94.7	9.8	9.9	9.7
Paraguay	2011	997 437	503 227	494 210	93.9	92.9	94.8	7.0	6.8	7.3
Peru	2011	4 985 509	2 598 222	2 387 287	93.8	90.7	97.0	8.1	7.2	9.1
Uruguay	2011	996 485	563 964	432 521	98.3	98.6	98.0	9.2	9.5	8.9

^a Gross domestic product per capita (in constant 2011 purchasing power parity International dollars (\$)): Argentina, 14 560; El Salvador, 7 352; Honduras, 4 445; Panama, 17 627; Paraguay, 7 186; Peru, 10 429; and Uruguay, 17 645.

TABLE 4. Metrics of intercountry social inequalities in eye health calculated from the results of seven Rapid Assessment of Avoidable Blindness (RAAB) national surveys, Latin America, 2011–2013

Equity stratifier	Health inequality metrics	Blindness prevalence	Severe visual impairment	Moderate visual impairment	Cataract surgery coverage	Good outcome from cataract surgery (PVA ≥ 20/60)
Wealth	SII ^a	−0.90	0.83	−0.87	19.95	14.17
	HCI ^b	−0.19	0.11	−0.03	0.07	0.06
Literacy	SII	−1.33	0.70	−0.93	27.36 ^c	20.38
	HCI	−0.27 ^c	0.14	−0.03	0.10	0.09
Schooling	SII	−1.16	0.89	−0.77	23.77	18.58
	HCI	−0.24 ^c	0.17	−0.02	0.09	0.08

^a SII: slope index of inequality.

^b HCI: health concentration index.

^c Statistically significant ($P < 0.05$).

TABLE 5. Metrics of intercountry inequalities in eye health by education and sex, calculated from the results of seven Rapid Assessment of Avoidable Blindness (RAAB) national surveys, Latin America, 2011–2013

Equity stratifier	Health inequality metrics	Blindness prevalence		Severe visual impairment		Moderate visual impairment		Cataract surgery coverage		Good outcome from cataract surgery (PVA ≥ 20/60)	
		Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Literacy	SII ^a	−1.58 ^b	−1.27	0.76	0.20	−1.11 ^b	−0.89	29.97 ^b	21.85	23.92 ^b	16.84
	HCI ^c	−0.33 ^b	−0.25 ^b	0.15	0.04	−0.02	−0.03	0.10	0.08	0.09	0.07
Schooling	SII	−1.41	−0.86	1.00	0.72	−1.04	−0.15	26.64 ^b	18.74	22.07	15.58
	HCI	−0.29 ^b	−0.18	0.18	0.14	−0.01	−0.02	0.09	0.08	0.09	0.07

^a SII: slope index of inequality.

^b Statistically significant ($P < 0.05$).

^c HCI: health concentration index.

eye health and eye health care, stratified by sex, are presented in Table 5.

Both absolute and relative inequalities in blindness prevalence and moderate visual impairment were systematically negative across the three equity stratifiers and for sex, indicating concentration among the most socially disadvantaged (Supplementary material, Figure 1). Conversely, absolute and relative inequalities in severe visual impairment, CSC, and cataract surgery optimal outcome were systematically positive across all stratifiers and for sex, signaling concentration among the better-off (Supple-

mentary material, Figure 2). Absolute educational inequalities in blindness prevalence, moderate visual impairment, and CSC were statistically significant among women.

Many patients with blindness or visual impairment due to cataract do not come forward for surgery. To explore the reasons for this, patients with best-corrected visual acuity of less than 20/200 in one or both eyes were asked why they had not yet been operated upon. The table presented as Supplementary material shows the most commonly reported barriers; cost of treat-

ment was the most common explanation for failure to come forward for surgery, particularly in Paraguay (45.5%). In El Salvador, Honduras, and Peru, the high costs of the surgery accounted for about one-quarter of the patients not coming for treatment. In Uruguay, cost was not reported as a cause, most likely due to universal health care (UHC) coverage. Lack of awareness that treatment was available was particularly high in El Salvador, Honduras, and Peru. “Fear of surgery or poor result” was the main cause in Argentina, whereas in Panama the main barrier was the feeling that treat-

ment was not needed. Both Honduras and Panama reported geographic and distance barriers to receiving cataract surgery services, and waiting lists due to limited capacity of services was the main barrier to those services in Uruguay (31.6%).

The majority of cataract operations reported in these studies were conducted in public / university and private hospitals in similar proportions, with a smaller proportion taking place in charitable institutions or foundations. Honduras and Paraguay were the only countries that reported community outreach ("eye camp") surgeries. In Panama and Peru, about two-thirds of cataract operations were done in the public sector. In Argentina, the majority of operations took place in the private sector, and in Uruguay, about half were done in private institutions. In El Salvador, about one-third of the surgeries were done in charitable or foundation hospitals.

DISCUSSION

Between 1990 and 2010, age-standardized prevalence of blindness and moderate and severe visual impairment decreased in the LAC region (12). However, evidence reveals that eye health inequalities persist, with blindness and visual impairment highest among poor people, in rural areas and where health systems and services are not reaching all segments of the population (13, 14). In the implementation of the surveys described above, a standardized survey protocol and analysis was applied (3, 4) that allowed for meaningful comparison of the results 1) between the seven countries and 2) with previous studies that used the same methodology.

In this study, the proportion of people ≥ 50 years old ranged from 12.3% in Honduras to 28.5% in Uruguay. The countries with higher proportions of people in this age group may also have a large proportion of individuals at the upper end of the age gradient. These adults are at the highest risk of developing cataract and other ocular diseases and represent a demographic factor that can create wide variation in needs for ocular services.

According to the current results, prevalence of blindness in people ≥ 50 years old was 3.0% in Panama (95% CI: 2.3–3.6%), 2.4% in El Salvador (95% CI: 2.2–2.6), and 1.9% in Honduras (95% CI: 1.4–2.4), proportions higher and similar

respectively than the current overall estimate reported for Central America by Leasher et al. (2.1%; 95% CI: 1.7–2.7) (12). Conversely, the prevalence of blindness found in the current study for Argentina and Uruguay was, respectively, 0.7% (95% CI: 0.4–1.0) and 0.9% (95% CI: 0.5–1.3), lower than the Leasher report's overall estimate for the Southern Cone countries (1.2%; 95% CI: 0.9–1.7) (12). Prevalence in Peru, based on the current study, was 2.0% (95% CI: 1.5–2.5), similar to the overall estimate in the Leasher study for the Andean countries (2.1%; 95% CI: 1.4–2.6) (12). The current study results confirm geographic disparities in prevalence across the Andean, Central American, and Southern Cone countries, and the level of the disparities that were found are higher than previously estimated. Prevalence of blindness in Panama based on the current study was the highest of all seven countries studied and higher than what was previously reported in national surveys (22, 24). The current prevalence of blindness in Argentina found in this study is lower than the levels reported in subnational studies in previous years in urban and semi urban areas (18). There was relatively low prevalence of blindness in Honduras, despite the limited outputs of that country's eye health services, which have one of the lowest cataract surgical rates in the region (32). Only Paraguay had baseline study results comparable to the recent RAAB surveys, with a prevalence of blindness of 1.1% (95% CI: 0.6–1.6) in 2011, significantly less than the 3.1% (95% CI: 2.2–4.4) reported there for 1999 (11). As expected, the national prevalence in Peru (2.0%) was much lower than that reported in semirural areas in 2005 (4.0%) (15).

Most cases of bilateral blindness are avoidable (ranging from 80.0% in Argentina to 92.0% in El Salvador). In all seven countries studied, unoperated cataract remains the most common cause of blindness, and URE is the main cause of visual impairment.

Even though age is the highest risk factor for cataract and has a major effect on the number of cataract surgeries required in various countries (32), prevalence of blindness was lowest in Argentina (0.7%) and Uruguay (0.9%), both of which have large populations of people ≥ 50 years old but with high cataract surgical rates (5 935 cataract operations per million per year in Argentina

and 4 699 cataract operations per million per year in Uruguay) (33). This finding suggests that provision and utilization of services is a very important determinant of prevalence levels in those countries.

CSC for blindness and visual impairment was fairly high in Argentina, Paraguay, and Uruguay, but remained low in Honduras, El Salvador, Panama, and Peru. There is an urgent need to increase cataract surgical output using high volume, good-quality methods (34) at a reasonable cost for patients. This cost includes indirect out-of-pocket expenses, such as transportation, and companion-related expenses appear to be relevant as well (35).

Poor education and low levels of public awareness were reported by study participants as "fear of surgery or poor result," "unaware that treatment is possible," and "do not see a need for the surgery" in about one-third of patients not getting the surgery; problems in services delivery were reported as "cost of surgery," "treatment denied," "no geographic access," and "waiting lists" and remained the most important cause for not getting the surgery in about two-thirds of cases. Demand for cataract surgery must be created in the community; people must be made aware of 1) the condition that they have ("cataract"), 2) the fact that the surgery to correct it has good results, and 3) where they can go to have it. Cataract surgical services should be available in every geographic area (36), and capacity of payment should not be a burden or a barrier to receiving good-quality services.

While the majority of cataract surgeries reported in the studies described here were conducted in public/university or private hospitals (as opposed to charitable institutions or foundations, etc.), there was great variation in the proportions for each type of surgical venue across the seven countries studied. In Peru, 65% of cataract surgeries were done in public hospitals, whereas in Argentina most were provided by private services but with public financial support. In Uruguay and El Salvador, about half of all cataract surgeries were carried out in the public sector.

The percentage of eyes with good visual outcome after surgery (PVA of 20/60 (6/18)) was higher in eyes operated three years or less before the study than those operated seven or more years earlier (67% versus 47% in Panama,

61.6% versus 44.8% in Peru, and 73.4% versus 61.5% in Uruguay, respectively). This may suggest that the quality of cataract surgical services is increasing in those three countries, where most cataract operations are done in the public sector. According to WHO recommendations, the percentage of people presenting good visual outcome after cataract surgery must be improved in all countries in the Region (37). Public eye health services have better visual outcomes in Peru, where 65% of patients operated for cataract in public hospitals had postoperative PVA of 20/60 or better compared to 48% of patients who had the surgery in private hospitals. In the other six countries studied, public hospitals had similar or worse results in visual acuity than private hospitals. This can be explained in part by the fact that private hospitals may select the easy cases, referring complicated cataract surgeries to public or university hospitals. To improve the quality of cataract surgical outcomes, all hospitals should collect data on visual outcomes, have patient safety protocols in place, and develop continuing education programs for professional staff development (38). In addition, public hospitals should establish the systems that are needed to generate demand, support efficient workflow, and provide quality assurance, as well as a transparent fee structure that includes waivers for those who cannot pay (36).

The current study results indicated the systematic and nontrivial presence of intercountry inequalities in eye health and eye health care through social gradients defined by known distal determinants of health such as education, sex, and wealth. In general—and at the ecological (country) level—the exploratory findings suggest that age- and sex-adjusted prevalence of eye ill-health is concentrated among the worst-off segments of the population, while both eye health care coverage and quality disproportionately favor the better-off. While these suggestive findings are consistent with those found in the literature on the overall eye health situation in the Region (2, 39), to the best of the authors' knowledge there were no previously published reports that specifically described social determinants of eye health or ill-health in Latin America other than a few re-

ports on economic and financial barriers to eye health care access (12, 33) and, more recently, educational inequalities in the prevalence of visual impairment in El Salvador (7). The findings reported here concur with the results of a recent meta-analysis that showed that inequalities by sex do not appear to play a role in CSC in Latin America (40). However, the study reported here did find statistically significant differences in CSC between the lower and upper ends of the intercountry educational gradient, and by age, with the least literate women receiving 30% less coverage than those at the better-off end of the spectrum, and women 51–60 years old with the lowest mean years of education receiving 27% less coverage than the most schooled women. These same inequalities and trends existed among men, albeit lower in magnitude and of non-significance statistically.

Limitations

This study had some limitations. First, the RAAB surveys only assess people ≥ 50 years old and thus do not allow for estimation of the prevalence of blindness in people ≥ 50 years old. Second, in the study design, the authors assumed prevalence of blindness was higher than what was found in the study in Argentina, Honduras, and Uruguay, reducing the power to achieve a precision of 25.0% for the estimated prevalence with a 95% probability. Third, as RAAB surveys are conducted door-to-door using portable instruments, the diagnostic capacity is limited and it is not always possible to make an accurate diagnosis of causes of diseases of the posterior segment of the eye (retina). Finally, although it was successful in extracting patterns of systematic social inequalities in eye health and eye health care across countries, due to its ecological design, this exploratory analysis was inherently limited in terms of making causal claims, particularly at the individual level.

Conclusions

Blindness and visual impairment are important health issues in Latin America among people ≥ 50 years old. Prevalence found in this study for both conditions was higher than that found in earlier

estimates for the Central American countries that were studied (El Salvador, Honduras, and Panama) and lower than that found in earlier estimates for the Andean (Peru) and Southern Cone (Argentina, Paraguay, and Uruguay) countries that were studied, demonstrating the disparities in eye health across the Region. The main associated conditions are cataract and refractive error, respectively—two highly treatable conditions.

Systematic social inequalities or at least some patterns of inequality in eye health and eye health care seem to be equally important in the Region. However, in-depth research would be required to determine any causal pathways (e.g., education, income, and sex), due to the ecological design of the current study. The results of future, in-depth research documenting the patterns generating the inequalities identified in this study could be used to better inform policy actions designed to make services more equitable in moving toward universality of coverage.

Based on the results of the current research, there is a need to equitably increase service coverage in each of the seven countries studied. More community work is needed to raise public awareness and demand for services. In addition, the quality of cataract surgery must be improved in every country in the Region by monitoring patients' visual outcomes in public and private hospitals and detecting and correcting the causes of poor results. Public eye care services have the potential to increase good-quality eye care coverage by reaching the poorest segments of the population and people living in unserved geographic areas with more affordable care. Therefore, public sector financing is an important factor in reducing blindness and visual impairment. In addition, with regard to implementation of UHC, eye health services can be used as a useful and easily available marker or indicator for evaluating the reach of health coverage for people ≥ 50 years old.

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Conflicts of interest. None.

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RESUMEN

Una evaluación comparativa de la ceguera y la deficiencia visual evitables en siete países latinoamericanos: prevalencia, cobertura y desigualdades

Objetivo. Realizar un análisis comparativo de las desigualdades sociales en materia de salud ocular y atención oftálmica, y generar datos probatorios de referencia de siete países latinoamericanos como un ejercicio de evaluación comparativa para vigilar el progreso hacia tres metas del Plan de Acción para la Prevención de la Ceguera y la Deficiencia Visual Evitables: el aumento de la cobertura de los servicios de salud ocular, la reducción al mínimo de las barreras y la disminución de la carga de morbilidad relacionada con la salud ocular.

Métodos. Se analizaron los resultados de las encuestas transversales de salud ocular realizadas en seis países latinoamericanos (Argentina, El Salvador, Honduras, Panamá, Perú y Uruguay) desde el 2011 al 2013, y las encuestas nacionales del Paraguay recientemente publicadas. Mediante el empleo de técnicas ordinarias de análisis exploratorio de datos, se investigó la magnitud de las desigualdades absolutas y relativas entre países en cinco dimensiones de la salud ocular a través del gradiente poblacional definido por tres variables de estratificación de equidad (logro educativo, alfabetización y riqueza).

Resultados. La prevalencia general de la ceguera en personas de 50 años de edad o mayores varió de 0,7% (intervalo de confianza (IC) de 95%: 0,4–1,0) en Argentina a 3,0% (IC95%: 2,3–3,6) en Panamá. La prevalencia general de la deficiencia visual (grave y moderada) varió de 8,0% (IC95%: 6,5–11,0) en Uruguay a 14,3% (IC95%: 13,9–14,7) en El Salvador. La principal causa notificada de ceguera fue la catarata no operada, mientras que la mayor parte de los casos de deficiencia visual fueron causados por un error de refracción no corregido. Tres países tenían una cobertura quirúrgica de la catarata de más de 90% para las personas ciegas, mientras que dos terceras partes de los pacientes operados de cataratas mostraban una buena agudeza visual.

Conclusiones. Las prevalencias de la ceguera y la deficiencia visual moderada se concentraban en las personas más desfavorecidas socialmente, mientras que la cobertura quirúrgica de la catarata así como los resultados óptimos de esta intervención se concentraban en los más adinerados. Son necesarias acciones políticas para aumentar la cobertura y la calidad de los servicios con objeto de alcanzar la universalidad.

Palabras clave

Salud ocular; ceguera; desigualdades en la salud; personas con daño visual; prevalencia; Argentina; El Salvador; Honduras; Panamá; Paraguay; Perú; Uruguay; América Latina.