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Prevalence of visual impairment in El Salvador: inequalities in educational level and occupational status

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ABSTRACT

Objective. *To examine the prevalence of blindness, visual impairment, and related eye diseases and conditions among adults in El Salvador, and to explore socioeconomic inequalities in their prevalence by education level and occupational status, stratified by sex.*

Methods. *Based upon the Rapid Assessment of Avoidable Blindness (RAAB) methodology, this nationwide sample comprised 3 800 participants (3 399 examined) ≥ 50 years old from 76 randomly selected clusters of 50 persons each. The prevalence of blindness, visual impairment and related eye diseases and conditions, including uncorrected refractive error (URE), was calculated for categories of education level and occupational status. Multiple logistic regression models were fitted to calculate odds ratios (ORs) and 95% confidence intervals (CIs) and stratified by sex.*

Results. *Age-adjusted prevalence was 2.4% (95% CI: 2.2–2.6) for blindness (men: 2.8% (95% CI: 2.5–3.1); women: 2.2% (95% CI: 1.9–2.5)) and 11.8% (95% CI: 11.6–12.0) for moderate visual impairment (men: 10.8% (95% CI: 10.5–11.1); women: 12.6% (95% CI: 12.4–12.8)). The proportion of visual impairment due to cataract was 43.8% in men and 33.5% in women. Inverse gradients of socioeconomic inequalities were observed in the prevalence of visual impairment. For example, the age-adjusted OR (AOR) was 3.4 (95% CI: 2.0–6.4) for visual impairment and 4.3 (95% CI: 2.1–10.4) for related URE in illiterate women compared to those with secondary education, and 1.9 (95% CI: 1.1–3.1) in cataract in unemployed men.*

Conclusions. *Blindness and visual impairment prevalence is high in the El Salvador adult population. The main associated conditions are cataract and URE, two treatable conditions. As socioeconomic and gender inequalities in ocular health may herald discrimination and important barriers to accessing affordable, good-quality, and timely health care services, prioritization of public eye health care and disability policies should be put in place, particularly among women, the unemployed, and uneducated people.*

Key words Eye health; ophthalmology; health inequalities; blindness; refractive errors; cataract; El Salvador.

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It is estimated that worldwide 32.4 million people are blind and 191 million people have moderate and severe visual impairment (1). Several population-based studies report women have a higher age-adjusted prevalence of blindness, visual impairment, and related eye diseases and conditions (1, 2). Up to 80% of blindness and 85% of visual impairment worldwide is avoidable (3). Treatment of the two main proximal causes, cataract and uncorrected refractive error (URE), is considered to be one of the most cost-effective interventions (4, 5).

Socioeconomic status is recognized as a distal determinant of the prevalence of blindness and visual impairment (6). Illiteracy and lower levels of education have been associated with higher prevalence of blindness and visual impairment (7–15) and the main eye-related diseases and conditions, such as cataract (10) and URE (16), particularly among women (17). In Europe, visual impairment has been associated with not having a paid job, having a permanent disability (18), and manual social class (17), and in India, it is associated with unemployment (19). This trend was not found in the United States, however, based on one study that found similar levels of low vision and blindness prevalence in both workers and the unemployed (20).

In the Latin America and Caribbean region, in 2010, it was estimated that in all age groups there were 2.3 million blind people (presenting visual acuity (PVA) < 3/60) and 14.1 million people with severe visual impairment (SVI) (PVA < 6/60–3/60) or moderate visual impairment (MVI) (PVA < 6/18–6/60) (21). This same study reported that among those 50 years old and older, the Central America subregional age-standardized prevalence of blindness is estimated to be 1.8% (95% confidence interval (CI): 1.4–2.4) in men and 2.0% (95% CI: 2.0–3.1) in women, and SVI and MVI is estimated to be 9.8% (95% CI: 7.6–12.6) among men and 11.4% (95% CI: 8.7–14.7) among women. However, to the best of the authors' knowledge, no national prevalence data has been published previously for Central American countries. In 2009, the governments of Central America signed a Pan American Health Organization (PAHO) Directing Council Resolution to develop an Action Plan for the Prevention of Blindness that required assessing the prevalence and distribution of visual impairment and eye diseases in the population (22).

In line with the scenario described above, this study aimed to estimate the national prevalence of blindness, visual impairment, and related eye diseases and conditions, including URE, among adults in El Salvador. In addition, by adding measures of individual socioeconomic status to the standardized Rapid Assessment of Avoidable Blindness (RAAB) protocol (23), the updated and modified version of the Rapid Assessment of Cataract Surgical Services (RACSS) methodology developed by the World Health Organization (WHO) (24), this study aimed to determine any differences related to education level and occupational status independent of age, and whether these patterns differ as a function of sex. The authors' hypothesis is that blindness, visual impairment, and related eye diseases and conditions are more frequent among individuals who are unemployed or have a lower level of education, especially women, even after adjusting for age.

MATERIALS AND METHODS

This study used the standard RAAB methodology (23) for collecting baseline data on blindness and visual impairment in adults ≥ 50 years old in El Salvador. Two new questions were included in the RAAB methodology to evaluate educational and occupational status. All clinicians and interviewers were trained by certified personnel according to RAAB methodology protocols and a pilot study was conducted to ensure compliance with the methodology.

Data acquisition

The 2007 census indicated that there were an estimated 941 000 people ≥ 50 years old in 10 771 districts in El Salvador (25). The reference population stratified by educational level and occupation status was obtained from El Salvador's Bureau of Statistics and Census (*Dirección General de Estadística y Censos*, DIGESTYC) (25, 26). The required sample size for an estimated prevalence of blindness of 4.0% (27) was calculated using the RAAB software package, assuming a variation of 20% around the estimate, with a probability of 95%, a design effect of 1.5, and a noncompliance of 10%. Using standardized RAAB multi-stage cluster sampling, 76 randomly selected clusters of 50 persons were identified, resulting in a total of 3 800 eligible participants representing the entire country. In each cluster, 50 people 1) were interviewed in their homes by five teams that included certified ophthalmologists and medical residents and 2) received an eye examination that included a visual acuity (VA) measurement using a Snellen "E" chart. If visual impairment or blindness was detected, ophthalmologists diagnosed the primary cause using portable instruments and recorded the data using the standard RAAB survey record, a modified version of the form used in the RACSS methodology. Self-reported socio-demographic data on age, sex, educational level, and occupation status were also collected.

Measures

Visual acuity measurement. Presenting monocular VA was measured and the results for the better eye were categorized as blindness (PVA < 3/60) or visual impairment (VA < 6/18 and ≥ 3/60), and subcategorized as MVI (PVA < 6/18–6/60) or SVI (VA < 6/60–3/60), according to the International Classification of Diseases, 10th Revision (ICD-10) (28).

Eye diseases and conditions. Among visually impaired and blind individuals, related eye diseases and conditions were classified as URE; cataract; posterior segment (including primary glaucoma, diabetic retinopathy, age-related macular degeneration (AMD), and other disorders of the posterior segment); complications; corneal opacities; aphakia; and trachoma. The lens status of all participants was assessed with a flashlight to calculate cataract surgical coverage (CSC). An additional measure of VA with a pinhole was performed to the visually impaired or blind individuals who have undergone cataract surgery (23).

Age groups. Age was categorized into four groups: 50–59 years; 60–69 years; 70–79 years; and ≥ 80 years.

Educational level. Educational level was obtained using the question "What is the highest level of education you have completed?" Possible answers followed

the classification used in El Salvador's national census (24) and were classified as one of three levels: 1) illiterate (can not read or write); 2) primary education or less (primary education or equivalent, or incomplete primary education grade 1–6); or 3) secondary education or more (first- or second-stage secondary school (years 7, 8, or 9), technical careers, or university degree or equivalent).

Occupational status. To assess occupational status, all eligible individuals were asked, "In relation to economic activity, what was your situation last week?" In accordance with El Salvador's Multipurpose Household Survey (25), answers were categorized into six groups: working; unemployed; receiving pension; disabled or unable to work; homemaker; or other situation (unpaid job, volunteer work, student, or other). The last five categories were also classified as nonworking status.

Statistical analysis

Prevalence estimation. Distribution and prevalence and 95% binomial CIs for blindness, visual impairment, and related eye diseases and conditions (including URE) of those who also had visual impairment or blindness were calculated by age group, education level, and occupational status. The distribution in the reference population and the study sample of blindness, visual impairment, and related eye diseases and conditions were compared using the chi-square test. Multiple logistic regression models were used to calculate socioeconomic inequalities through crude odds ratios (ORs) and age-adjusted ORs (AORs) and their 95% CIs. All analyses were stratified by sex. Data were processed using the R software (version 3.0.0) (Wirtschaftsuniversität Wien, Vienna, Austria) (29).

Health inequities. Secondary education and "employed" status were normatively defined as equity standard categories. Relative measures of social (i.e., education and occupational) inequalities in eye diseases were assessed by ORs and AORs. Absolute inequalities (expressed in percentage points) were computed as the arithmetic difference between point prevalence in the social categories other than the equity standard and the equity standard.

RESULTS

Study sample

A total of 3 399 subjects were examined (response rate 89.4%). Of those who were not examined, 262 (6.9%) were not available after two attempts, 123 (3.3%) refused to participate, and 16 (0.4%) had communication problems. More men than women were absent (8.0% men versus 6.1% women; $P = 0.02$) or refused to participate (4.2% men versus 2.6% women; $P = 0.005$). The nonresponse rates for questions on occupational status (3.5%) and education level (3.2%) were similar to those for other variables and nonsignificant differences were observed between sexes. Sample characteristics and descriptive statistics for those who were blind and visually impaired, stratified by sex, are shown in Table 1; significant differences were observed between the reference population and the study sample in the distribution of age, education level, and occupational status, stratified by sex. A total of 34% of blind and 50% of visually impaired men were working. Among women, no one with blindness was employed, but 10% of those visually impaired were working.

Prevalence of blindness, visual impairment, and related eye diseases and conditions

The age-adjusted prevalence of blindness was 2.4% (95% CI: 2.2–2.6) (men, 2.8% (95% CI: 2.5–3.1); women, 2.2% (95% CI: 1.9–2.5)); severe visual impairment, 2.5% (95% CI: 2.3–2.7) (men, 2.7% (95% CI: 2.4–3.0); women, 2.4% (95% CI: 2.1–2.7)); and moderate visual impairment, 11.8% (95% CI: 11.6–12.0) (men, 10.8% (95% CI: 10.5–11.1); women, 12.6% (95% CI: 12.4–12.8)) (Table 2). Cataract was the most common cause among blind individuals (men, 66.7%; women, 70.6%) and URE was the most common cause among visually impaired individuals (men, 49.1%; women, 57.6%). The distribution of each related eye disease or condition differed between blind and visually impaired individuals ($P < 0.001$) (Table 1). Prevalence of blinding cataract was 2.0% (95% CI: 1.5–2.5) (men, 2.3% (95% CI: 1.5–3.1); women, 1.8% (95% CI: 1.2–2.4)) and prevalence of blinding posterior segment pathologies was 0.5% (95% CI: 0.3–0.7) (0.2% (95% CI: 0.0–0.5) in men and 0.1% (95% CI: 0.0–0.2) in women for primary glaucoma; 0.1% (95% CI: 0.0–0.2) in men and 0.2% (95% CI: 0.0–0.4) in women for diabetic retinopathy; and 0.2% (95% CI: 0.0–0.5) in men and 0.0% (95% CI: 0.0–0.1) in women for AMD). Prevalence of visual impairment resulting from URE was 8.8% (95% CI: 7.8–9.8) (8.0% (95% CI: 6.6–9.5) in men and 9.4% (95% CI: 8.1–10.6) in women) (Table 2).

Global coverage of cataract surgery was 34.2% (36.6% in men and 32.2% in women) and was lower in illiterates (31.3% in men and 28.4% women) than in individuals with secondary education or higher (37.9% in men and 41.7% in women) (not shown).

Of all eyes that had cataract surgery, 55.6% could see 20/60 or better and 22.7% could not see 20/200 with the available correction. Using a pinhole, the results improved in 65.7% of cases (not shown).

Education and occupational inequalities

The overall prevalence of visual impairment and related cataract or URE differed significantly according to education level and occupational status (Table 3). Illiterate individuals had higher odds (and therefore a higher prevalence) of visual impairment (OR = 3.9 ($P < 0.001$)), cataract (OR = 3.1 ($P < 0.001$)), and URE (OR = 4.0 ($P < 0.001$)) compared to those with secondary education or higher. Compared to those working, there was a higher prevalence of visual impairment, cataract, and URE among both disabled nonworking individuals (OR = 4.5 ($P < 0.001$), 5.5 ($P < 0.001$), and 2.8 ($P < 0.001$) respectively) and the unemployed (OR = 3.1 ($P < 0.001$), 5.1 ($P < 0.001$), and 1.4 ($P = 0.91$) respectively). The increased prevalence among the unemployed versus the employed was statistically significant for cataract and visual impairment but not for URE.

Socioeconomic inequalities partly explained by age

After adjusting for age, illiterate individuals still had significantly higher odds (and therefore a higher prevalence) of visual impairment (AOR = 2.3 ($P < 0.001$)), and of URE (AOR = 3.0 ($P < 0.001$)) than those with at least secondary education

TABLE 1. Characteristics of reference population, study sample, and study sample participants diagnosed with visual impairment (VI), blindness, and related eye diseases and conditions using the Rapid Assessment of Avoidable Blindness (RAAB) methodology, by sex, age, education level, and occupational status, El Salvador, 2011

	Men									Women								
	Reference population		Study Sample			VI		Blindness		Reference population		Study Sample			VI		Blindness	
Characteristic	No.	%	No.	%	*P*	No.	%	No.	%	No.	%	No.	%	*P*	No.	%	No.	%
Total	416 989	44.3	1 378	40.5	< 0.001	228	16.4	48	3.5	524 011	55.7	2 021	59.5	< 0.001	328	16.2	51	2.5
Age group (years)																		
50–59	176 993	42.4	501	36.4	< 0.001	22	9.7	9	18.8	22 1816	42.3	824	40.8	0.03	60	18.3	4	7.8
60–69	123 988	29.7	410	29.8		53	23.5	9	18.8	153 033	29.2	564	27.9		91	27.7	6	11.8
70–79	77 107	18.5	280	20.3		76	33.6	7	14.6	96 334	18.4	419	20.7		85	25.9	18	35.3
≥ 80	38 901	9.3	187	13.6		75	33.2	23	47.9	52 828	10.1	214	10.6		92	28.0	23	45.1
Education level																		
Illiterate	127 513	30.6	445	32.3	< 0.001	107	47.8	26	54.2	221 533	42.3	870	43.0	0.005	201	61.5	40	78.4
Primary or less	210 459	50.5	637	46.2		91	40.6	17	35.4	233 223	44.5	864	42.8		112	34.3	9	17.6
Secondary or more	61 345	14.7	286	20.8		26	11.6	5	10.4	56 113	10.7	262	13.0		14	4.3	2	3.9
Occupational status																		
Unemployed	25 104	17.2	190	14.3	< 0.001	54	24.9	14	31.8	2 749	3.2	51	2.6	< 0.001	14	4.3	2	3.9
Receiving pension	45 119	30.9	114	8.6		28	12.9	1	2.3	37 557	44.0	47	2.4		6	1.8	0	0.0
Disabled or unable to work	30 044	20.6	53	4.0		19	8.8	9	20.5	25 927	30.4	19	1.0		7	2.1	4	7.8
Homemaker	1 543	1.1	50	3.8		8	3.7	5	11.4	1 550	1.8	1 540	77.8		268	82.0	45	88.2
Working	44 174	30.3	923	69.4		108	49.8	15	34.1	17 501	20.5	322	16.3		32	9.8	0	0.0
Related eye disease/condition[a]																		
Uncorrected refractive error	—[b]		—			111	49.1	1	2.1	—		—			189	57.6	3	5.9
Cataract	—		—			99	43.8	32	66.7	—		—			110	33.5	36	70.6
Posterior segment[c]	—		—			13	5.8	9	18.8	—		—			18	5.5	8	15.7
Complication	—		—			3	1.3	1	2.1	—		—			7	2.1	1	2.0
Corneal opacities	—		—			0	0.0	5	10.4	—		—			1	0.3	2	3.9
Aphakia	—		—			0	0.0	0	0.0	—		—			2	0.6	0	0.0
Trachoma corneal opacity	—		—			0	0.0	0	0.0	—		—			1	0.3	1	2.0

[a] Among the visually impaired and blind population.
[b] Not applicable.
[c] Primary glaucoma, diabetic retinopathy, age-related macular degeneration, and other disorders of the posterior segment.

TABLE 2. Age-adjusted prevalence of blindness and visual impairment and crude prevalence of related eye diseases and conditions in adults ≥ 50 years old, based on the Rapid Assessment of Avoidable Blindness (RAAB) methodology, El Salvador, 2011

Blindness, visual impairment, related eye disease or condition	Visual impairment (PVA[a] < 6/18 to ≥ 3/60)			Blindness (PVA < 3/60)		
	Men % (CI[b])	Women % (CI)	Total % (CI)	Men % (CI)	Women % (CI)	Total % (CI)
Blindness (age-adjusted prevalence)	—[c]	—	—	2.8 (2.5–3.1)	2.2 (1.9–2.5)	2.4 (2.2–2.6)
Visual impairment (age-adjusted prevalence)	18.8 (18.5–19.1)	19.2 (19.0–19.4)	19.9 (19.6–20.2)	—	—	—
Moderate (PVA < 6/18–6/60)	10.8 (10.5–11.1)	12.6 (12.4–12.8)	11.8 (11.6–12.0)	—	—	—
Severe (PVA < 6/60–3/60)	2.7 (2.4–3.0)	2.4 (2.1–2.7)	2.5 (2.3–2.7)	—	—	—
Eye disease/condition[d] causing visual impairment or blindness (crude prevalence)						
Uncorrected refractive error	8.0 (6.6–9.5)	9.4 (8.1–10.6)	8.8 (7.8–9.8)	0.1 (0.0–0.2)	0.2 (0.0–0.3)	0.1 (0.0–0.2)
Cataract	7.2 (5.8–8.5)	5.4 (4.5–6.4)	6.1 (5.3–6.9)	2.3 (1.5–3.1)	1.8 (1.2–2.4)	2.0 (1.5–2.5)
Posterior segment[e]	0.9 (0.4–1.5)	0.9 (0.3–1.4)	0.9 (0.6–1.2)	0.7 (0.0–0.7)	0.4 (0.0–0.6)	0.5 (0.3–0.7)
Complication	0.2 (0.0–0.5)	0.4 (0.1–0.6)	0.3 (0.1–0.5)	0.1 (0.0–0.3)	0.1 (0.5–0.2)	0.06 (0.0–0.1)
Corneal opacities	...[f]	0.1 (0.0–0.1)	0.03 (0.0–0.09)	…	0.1 (0.0–0.2)	0.03 (0.0–0.09)
Aphakia	...	0.1 (0.0–0.2)	0.06 (0.0–0.1)	…	…	…
Trachoma corneal opacity	…	0.1 (0.0–0.1)	0.03 (0.0–0.09)	0.4 (0.1–0.7)	0.1 (0.0–0.2)	0.2 (0.05–0.4)

[a] Presenting visual acuity.
[b] 95% confidence interval.
[c] Not applicable.
[d] Prevalence of eye disease or condition as well as visual impairment or blindness (or causing visual impairment or blindness) among general population.
[e] Primary glaucoma, diabetic retinopathy, age-related macular degeneration, and other disorders of the posterior segment.
[f] No observations.

(Table 3). Indeed, an education inverse gradient was observed. Compared to those working, the higher odds of visual impairment among the disabled (AOR = 1.8 ($P < 0.001$)) and the unemployed (AOR = 1.4 ($P < 0.001$)) remained significant after adjusting by age. Compared to those working, significantly higher odds of cataract persisted after adjusting for age among those who were unemployed (AOR = 1.8 ($P < 0.001$)).

Inequality patterns differed by sex

No significant differences in the overall prevalence of blindness, visual impairment, or related eye diseases and conditions were observed between men and women (Table 2), even though women showed higher socioeconomic disparities. Different patterns between sexes were observed after stratifying the data by education level and occupational status (Table 4). While a higher prevalence of visual impairment, related cataract, and URE was observed among both men and women with a lower level of education, the differences between illiterate individuals and those with a high level of education were greater among women (visual impairment: $OR_{men} = 3.2$ ($P < 0.001$), $OR_{women} = 5.3$ ($P < 0.001$); cataract: $OR_{men} = 2.7$ ($P < 0.001$), $OR_{women} = 4.8$ ($P < 0.001$); URE: $OR_{men} = 3.0$ ($P < 0.002$), $OR_{women} = 5.3$ ($P < 0.001$)). Differences between men and women were also observed after stratifying the data according to occupational status. The prevalence of visual impairment and cataract was lower among women with a job or receiving a pension compared to men. Inequalities after adjusting for age in the prevalence of visual impairment and URE in low-education–level individuals compared to those who were highly educated only remained significant among women (visual impairment: $OR_{men} = 1.5$ ($P < 0.08$), $OR_{women} = 3.4$ ($P < 0.001$); URE: $OR_{men} = 1.8$ ($P < 0.09$), $OR_{women} = 4.3$ ($P < 0.001$)) (Table 4).

DISCUSSION

This study produced four main findings: 1) cataract and URE were the two most prevalent eye conditions in blind and visually impaired populations respectively; 2) lower education level and unemployment were associated with higher prevalence of visual impairment, related cataract, and URE; 3) socioeconomic inequalities in the overall prevalence of visual impairment remained after adjusting for age; and 4) the socioeconomic inequalities observed were higher among women.

This study was based on a randomized sample from El Salvador and to the best of the authors' knowledge is the first nationally representative population-based study of visual impairment and blindness in Central America. Moreover, the inclusion of variables for education level and occupational status allowed the research team to improve the precision of previous research by stratifying the analysis by socioeconomic status and sex, thus incorporating an equity analysis into the RAAB methodology. The study results placed El Salvador fifth highest in the ranking of prevalence of blindness and fourth highest in visual impairment among those ≥ 50 years old compared to other countries in Latin America (21).

These results confirm the authors' hypotheses that visual impairment is more common in less educated and unemployed individuals, particularly among poorly educated women and unemployed men.

This study shows that both cataract and URE are highly prevalent among the blind and visually impaired, as expected (30). Both conditions can be effectively treated (through an outpatient surgical procedure, for cataract, and optical correction for URE). Only 15% of the patients diagnosed with cataract who were examined in this study had already been treated, and only 45% of patients who needed compensation for an URE causing a visual impairment were wearing it at the time of the examination (results not shown). The low coverage of cataract surgical services and spectacle correction suggests there is a need to strengthen eye care services. Adequately treating

TABLE 3. Crude prevalence, ORs,[a] AORs,[b] and 95% CIs[c] of visual impairment (PVA[d] < 6/18 and ≥ 3/60), related cataract, and uncorrected refractive error by age group, education level, and occupational status in adults ≥ 50 years old, based on the Rapid Assessment of Avoidable Blindness (RAAB) methodology, El Salvador, 2011

	Visual impairment (moderate and severe) (*n* = 556)						Cataract						Uncorrected refractive error					
Characteristic	No.	% (CI)	OR	CI	AOR	CI	No.	% (CI)	OR	CI	AOR	CI	No.	% (CI)	OR	CI	AOR	CI
Age group (years)																		
50–59	82	6.2 (4.9–7.5)	1		1		25	1.9 (1.2, 2.6)	1		1		61	4.6 (3.5, 5.7)	1		1	
60–69	144	14.8 (12.6–17)	2.6	1.98–3.51[e]	2.4	1.82–3.24[e]	45	4.6 (3.3, 5.9)	2.5	1.55–4.19[e]	2.4	1.46–3.98[e]	97	10.0 (8.1, 11.8)	2.3	1.65–3.21[e]	2.1	1.51–2.95[e]
70–79	161	23 (19.9–26.2)	4.5	3.42–6.05[e]	3.9	2.95–5.28[e]	76	10.9 (8.6, 13.2)	6.3	4.06–10.26[e]	5.8	3.66–9.43[e]	89	12.7 (10.3, 15.2)	3.0	2.16–4.26[e]	2.6	1.84–3.68[e]
≥ 80	167	41.6 (36.8–46.5)	10.8	8.05–14.64[e]	8.7	6.42–11.92[e]	131	32.7 (28.1, 37.3)	22.2	16.41–40.30[e]	21.3	13.65–34.57[e]	57	14.2 (10.8, 17.6)	3.4	2.34–5.02[e]	2.8	1.90–4.17[e]
Education level																		
Illiterate	308	23.4 (21.1–25.7)	3.9	2.78–5.57[e]	2.3	1.60–3.29[e]	169	12.8 (11, 14.7)	3.1	2.04–4.86[e]	1.3	0.85–2.15	158	12.0 (10.3, 13.8)	4.0	2.51–6.84[e]	3.0	1.84–5.13[e]
Primary or less	203	13.5 (11.8–15.3)	2.0	1.41–2.87[e]	1.6	1.12–2.31[e]	80	5.3 (4.2, 6.5)	1.2	0.75–1.90	0.8	0.50–1.31	128	8.5 (7.1, 9.9)	2.8	1.70–4.69[e]	2.4	1.49–4.14[e]
Secondary or more	40	7.3 (5.1–9.5)	1.0		1		25	4.6 (2.8, 6.3)	1		1		18	3.3 (1.8, 4.8)	1		1	
Occupational status																		
Unemployed	68	28.2 (22.5–33.9)	3.1	2.22–4.31[e]	1.4	1.00–2.06[e]	51	21.2 (16, 26.3)	5.1	3.42–7.64[e]	1.8	1.16–2.83[e]	22	9.1 (5.5, 12.8)	1.4	0.81–2.23	0.9	0.53–1.47
Receiving pension	34	21.1 (14.8–27.4)	2.1	1.38–3.18[e]	1.5	0.95–2.38	14	8.7 (4.3, 13)	1.8	0.96–3.23	0.9	0.44–1.64	19	11.8 (6.8, 16.8)	1.9	1.06–3.07[e]	1.8	0.99–3.07
Disabled or unable to work	26	36.1 (25 –47.2)	4.5	2.64–7.39[e]	1.8	1.04–3.15[e]	16	22.2 (12.6, 31.8)	5.5	2.88–9.86[e]	1.6	0.80–3.05	12	16.7 (8.1, 25.3)	2.8	1.37–5.17[e]	1.7	0.81–3.20
Homemaker	276	17.4 (15.5–19.2)	1.7	1.33–2.07[e]	1.2	0.93–1.48	127	8.0 (6.7, 9.3)	1.7	1.22–2.28[e]	1.0	0.74–1.46	162	10.2 (8.7, 11.7)	1.6	1.19–2.07[e]	1.2	0.93–1.63
Working	140	11.2 (9.5–13)	1.0		1		62	5.0 (3.8, 6.2)	1		1		84	6.7 (5.4, 8.1)	1		1	

[a] Odds ratios.
[b] Age-adjusted ORs.
[c] Confidence intervals.
[d] Presenting visual acuity.
[e] $P < 0.05$.

patients who suffer from cataract or URE could reduce 72.7% of the blindness and 94.0% of the visual impairment encountered in El Salvador, assuming that the cataract was not obscuring posterior segment disease.

Socioeconomic inequalities were observed among individuals visually impaired by cataract, with a higher prevalence among those with a low education level and the nonworking population. This inequality could be due to the quality of public services, differences in coverage in public hospitals among individuals with low socioeconomic status, or an unequal ability to pay substitutive services. Approximately 1 in 3 women and 1 in 5 men who were blind due to cataract indicated that they had not been treated because of economic constraints (results not shown). The results also indicated cataract surgery coverage was higher among highly educated individuals (men, 37.9%; women, 41.7%) than among the illiterate (men, 31.3%; women, 28.4%) (not shown) and, as expected based on previous studies (31), there were no crude differences by gender. El Salvador is characterized by significant inequalities; the average annual salary of illiterate individuals (35% of the population ≥ 50 years) is US$ 145.31 compared to US$ 601.35 for highly educated individuals (26). Cataract surgery is provided free of charge by public hospitals in El Salvador, but in the current results (not shown) only 48% individuals operated for cataract had had the surgery conducted in a public hospital. Given that the average cost of the procedure in the private sector in 2008 was between US$ 750 in a private eye care center and US$ 175 (32) in a nonprofit eye care center, and that the average monthly income in El Salvador is US$ 498.09 per household (26), this procedure is not affordable for a significant portion of the Salvadoran population. In addition, prevention and treatment of blindness has not been a priority for the government, as per the current five-year national health strategic plan (2009–2014) (33). The country is underserved by ophthalmology services, with a catchment area of only 6 out of 30 public hospitals covered by those services (32). Those persons who are excluded from access are those with the least income and lowest education levels. Lower therapeutic effort by health personnel could also be related to longer waiting lists and variance in therapeutic

TABLE 4. Sex stratified crude prevalence, ORs,[a] AORs,[b] and 95% CIs[c] of visual impairment (PVA[d] < 6/18 and ≥ 3/60), related cataract, and uncorrected refractive error (URE) by age group, education level, and occupational status in adults ≥ 50 years old, based on the Rapid Assessment of Avoidable Blindness (RAAB) methodology, El Salvador, 2011

Characteristic	Men (*n* = 228)						Women (*n* = 328)					
	No.	% (CI)	OR	CI	AOR	CI	No.	% (CI)	OR	CI	AOR	CI
Visual impairment (moderate and severe)												
Age group (years)												
50–59	22	4.4 (2.6–6.2)	1				60	7.3 (5.5–9.1)	1			
60–69	53	12.9 (9.7–16.2)	3.2	1.96–5.51[e]	—[f]		91	16.1 (13.1–19.2)	2.5	1.74–3.47[e]	—	
70–79	76	27.1 (21.9–32.3)	8.1	4.99–13.68[e]	—		85	20.3 (16.4–24.1)	3.2	2.28–4.64[e]	—	
≥ 80	75	40.1 (33.2–47.3)	14.6	8.83–24.97[e]	—		92	43.0 (36.4–49.6)	9.6	6.61–14.06[e]	—	
Education level												
Illiterate	107	24.0 (20.1–28.0)	3.2	2.03–5.10[e]	1.5	0.95–2.56	201	23.1 (20.3–25.9)	5.3	3.15–9.7[e]	3.4	2.00–6.36[e]
Primary or less	91	14.3 (11.6–17.0)	1.7	1.07–2.69[e]	1.1	0.69–1.83	112	12.9 (10.7–15.2)	2.6	1.54–4.88[e]	2.4	1.35–4.38[e]
Secondary or more	26	9.1 (5.6–12.4)	1		1		14	5.3 (2.6–8.1)	1		1	
Occupational status												
Unemployed	54	28.4 (22.0–34.8)	3.0	2.05–4.34[e]	1.4	0.91–2.10	14	27.5 (15.2–39.7)	3.4	1.68–7.01[e]	1.6	0.76–3.48
Receiving pension	28	24.6 (16.7–32.5)	2.5	1.51–3.90[e]	1.3	0.79–2.13	6	12.8 (3.2–22.3)	1.3	0.52–3.37[e]	0.6	0.22–1.58
Disabled or unable to work	19	35.9 (22.9–48.8)	4.2	2.29–7.58[e]	1.9	0.97–3.57	7	36.8 (15.2–58.5)	5.3	1.94–14.39[e]	2.2	0.73–6.24
Homemaker	8	16.0 (5.8–26.2)	1.4	0.61–2.99	0.9	0.36–1.91	268	17.4 (15.5–19.3)	1.9	1.30–2.81[e]	1.3	0.88–1.99
Working	108	11.7 (9.6–13.8)	1		1		32	9.9 (6.7–13.2)	1		1	
Cataract												
Age group (years)												
50–59	15	2.9 (1.5, 4.5)	1		1		10	1.2 (0.5, 2)	1		1	
60–69	21	5.1 (3, 7.3)	1.8	0.90–3.50	1.7	0.88–3.46	24	4.3 (2.6, 5.9)	3.6	1.77–7.98[e]	3.3	1.60–7.28[e]
70–79	34	12.1 (8.3, 16)	4.5	2.44–8.61[e]	4.3	2.32–8.50[e]	42	10.0 (7.1, 12.9)	9.1	4.69–19.31[e]	7.7	3.93–16.53[e]
≥ 80	61	32.6 (25.9, 39.3)	15.7	8.85–29.49[e]	13.8	7.54–26.79[e]	70	32.7 (26.4, 39)	39.6	20.85–83.35[e]	31.4	16.25–67.12[e]
Education level												
Illiterate	68	15.3 (11.9, 18.6)	2.7	1.59–4.75[e]	1.2	0.66–2.17	101	11.6 (9.5, 13.7)	4.8	2.36–11.47[e]	2.0	0.95–5.01
Primary or less	43	6.7 (4.8, 8.7)	1.1	0.62–1.95	0.7	0.38–1.27	37	4.3 (2.9, 5.6)	1.6	0.76–4.03	1.2	0.55–3.09
Secondary or more	18	6.3 (3.5, 9.1)	1		1		7	2.7 (0.7, 4.6)	1		1	
Occupational status												
Unemployed	42	22.1 (16.2, 28)	4.5	2.88–6.93[e]	1.9	1.12–3.05[e]	9	17.6 (7.2, 28.1)	9.6	3.42–28.30[e]	3.1	1.02–9.71[e]
Receiving pension	11	9.6 (4.2, 15.1)	1.7	0.81–3.21	0.9	0.43–1.92	3	6.4 (0.0, 13.4)	3.1	0.64–11.49	1.2	0.23–4.84
Disabled or unable to work	13	24.5 (12.9, 36.1)	5.1	2.51–9.93[e]	1.9	0.85–3.89	3	15.8 (0.0, 32.2)	8.4	1.70–33.63[e]	1.7	0.32–7.62
Homemaker	4	8.0 (0.5, 15.5)	1.4	0.40–3.53	0.7	0.20–1.99	123	8.0 (6.6, 9.3)	3.9	1.94–9.31[e]	2.0	0.90–4.68
Working	55	6.0 (4.4, 7.5)	1		1		7	2.2 (0.6, 3.8)	1		1	
URE												
Age group (years)												
50–59	15	3.0 (1.5, 4.5)	1		1		46	5.6 (4, 7.2)	1		1	
60–69	31	7.6 (5, 10.1)	2.7	1.43–5.11[e]	2.5	1.34–4.81[e]	66	11.7 (9, 14.4)	2.2	1.52–3.34[e]	2.0	1.37–3.04[e]
70–79	41	14.6 (10.5, 18.8)	5.5	3.08–10.56[e]	5.0	2.76–9.65[e]	48	11.5 (8.4, 14.5)	2.2	1.43–3.35[e]	1.8	1.18–2.82[e]
≥ 80	25	13.4 (8.5, 18.2)	5.0	2.60–9.93[e]	4.4	2.23–8.87[e]	32	14.9 (10.2, 19.7)	3.0	1.83–4.79[e]	2.4	1.43–3.88[e]
Education level												
Illiterate	47	10.6 (7.7, 13.4)	3.0	1.56–6.09[e]	1.8	0.94–3.85	111	12.7 (10.5, 15)	5.3	2.63–12.75[e]	4.3	2.11–10.42[e]
Primary or less	54	8.5 (6.3, 10.6)	2.3	1.24–4.73[e]	1.8	0.93–3.64	74	8.6 (6.7, 10.4)	3.4	1.66–8.24[e]	3.2	1.56–7.74[e]
Secondary or more	11	3.8 (1.6, 6.1)	1		1		7	2.7 (0.7, 4.6)	1		1	
Occupational status												
Unemployed	17	8.9 (4.9, 13)	1.4	0.77–2.38	0.8	0.45–1.51	5	9.8 (1.6, 18)	1.4	0.46–3.63	0.8	0.27–2.22
Receiving pension	16	14.0 (7.7, 20.4)	2.3	1.24–4.07[e]	1.8	0.93–3.41	3	6.4 (0.0, 13.4)	0.9	0.20–2.68	1.0	0.21–3.07
Disabled or unable to work	10	18.9 (8.3, 29.4)	3.3	1.50–6.62[e]	2.0	0.86–4.21	2	10.5 (0.0, 24.3)	1.5	0.23–5.79	0.7	0.11–2.86
Homemaker	3	6.0 (0.0, 12.6)	0.9	0.21–2.56	0.7	0.15–1.88	159	10.3 (8.8, 11.8)	1.5	0.97–2.42	1.0	0.64–1.66
Working	61	6.6 (5, 8.2)	1		1		23	7.1 (4.3, 10)	1		1	

[a] Odds ratios.
[b] Age-adjusted ORs.
[c] Confidence intervals.
[d] Presenting visual acuity.
[e] $P < 0.05$.
[f] Not applicable.

strategies as well as a lower level of prescription of medication and treatments among individuals with lower socioeconomic position population, as has been observed for other health procedures (34, 35).

The higher prevalence of URE causing visual impairment among the socioeconomically disadvantaged and nonworking individuals may reflect a significant barrier to accessing affordable, good-quality, and timely health care services, and could be related to these individuals' lower capacity to pay for treatment, as well as the weakness of public policies in overcoming this gap. The public health system does not provide optical correction for URE and the average cost for a prescription and a pair of glasses is about US$ 75 (36), which is not affordable for a significant portion of the Salvadoran population. While 61.1% of highly educated men and 70.0% of highly educated women who needed glasses to compensate for a visual impairment were wearing them at the time of this study's examination, only 22.0% and 31.4% of illiterate men and women were wearing them, respectively (not shown). Although 19 nongovernmental organizations (NGOs) in El Salvador were providing eye care services to compensate for the lack of public services in 2009 (37), there are no national policies for prevention or detection of URE. Consequently, URE still causes a significant proportion of visual impairment (men, 49.1%; women, 57.6%) despite the fact that it is relatively inexpensive to treat.

Differences in the prevalence of visual impairment, cataract, and URE between illiterate and highly educated individuals were higher among women. The authors suggest these results may be due, at least partially, to differences in the impact of socioeconomic status among women, which, in turn, may conceal deeper gender inequities rooted in the Salvadoran society. Gender differences in the prevalence of visual impairment and cataract between educational levels in this study appear to be related to lower prevalence for both conditions among highly educated women (Table 4). Considering the lower prevalence of visual impairment and cataract among women with their own income (having a job or receiving a pension) compared to men, the capacity of highly educated and working women to pay private services seems to be more important than for men (2). In addition, a reverse effect could also occur wherein women with a visual impairment or blindness could suffer greater discrimination than men (facing both disability and gender discrimination) to find or keep a job.

Limitations

This study had several limitations, including significant differences in the distribution of age, education level, occupational status, and sex in the study sample versus the reference population. Sample over-representation was observed for the following groups: women; men and women older than 70; men and women with more than secondary education; illiterate men; working men; and women who were homemakers (housewives). Visual impairment was found to be more common among illiterate individuals (men, 47.8%; women, 61.5%), and those with visual impairment or blindness may be more likely to stay home and be interviewed. These potential biases may have affected the prevalence calculations provided by the RAAB methodology. For this reason, sex-stratified socioeconomic and occupational status should be considered in future studies, especially when selecting the study sample for national blindness and visual impairment surveys.

Conclusions

Blindness and visual impairment are important public health issues in El Salvador. The main associated conditions are cataract and URE, respectively—two highly treatable conditions. Socioeconomic inequalities and different patterns among men and women were observed in the prevalence of visual impairment, cataract, and URE. Low education level was associated with visual impairment, especially among women. Unemployment was associated with visual impairment in men. Employment among visually impaired and blind women was rare. These socioeconomic and gender inequalities in eye conditions may herald discrimination and important barriers to accessing affordable, good-quality, and timely health care services. Prioritization of public eye health care and disability policies removing barriers and increasing access and affordability of services is recommended, particularly among women, the unemployed, and uneducated people.

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Conflicts of interest. None.

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Prevalencia de deficiencia visual en El Salvador: desigualdades según el nivel educativo y la situación laboral

RESUMEN

Objetivo. Analizar la prevalencia de la ceguera, la deficiencia visual, y las enfermedades y afecciones oculares relacionadas en adultos de El Salvador, y explorar las desigualdades socioeconómicas en cuanto a su prevalencia según el nivel educativo y la situación laboral, estratificados por sexos.

Métodos. Se adoptó el método de Evaluación Rápida de la Ceguera Evitable, y se escogió una muestra a escala nacional de 3 800 participantes (de ellos se examinaron 3 399) de 50 años de edad o mayores, pertenecientes a 76 agrupamientos seleccionados aleatoriamente y constituidos por 50 personas cada uno. Se calculó la prevalencia de la ceguera, la deficiencia visual y las enfermedades y afecciones oculares relacionadas, incluido el error de refracción no corregido, según las diferentes categorías de nivel educativo y situación laboral. Se emplearon modelos de regresión logística múltiple para calcular las razones de posibilidades (OR) y los intervalos de confianza (IC) de 95%, y se estratificaron por sexos.

Resultados. La prevalencia ajustada por edad fue de 2,4% (IC de 95%: 2,2–2,6) para la ceguera (hombres: 2,8% [IC de 95%: 2,5–3,1]; mujeres: 2,2% [IC de 95%: 1,9–2,5]) y de 11,8% (IC de 95%: 11,6–12,0) para la deficiencia visual moderada (hombres: 10,8% [IC de 95%: 10,5–11,1]; mujeres: 12,6% [IC de 95%: 12,4–12,8]). La proporción de deficiencias visuales debidas a catarata fue de 43,8% en los hombres y de 33,5% en las mujeres. En la prevalencia de la deficiencia visual se observaron gradientes inversos de desigualdades socioeconómicas. Por ejemplo, la OR ajustada por edad fue de 3,4 (IC de 95%: 2,0–6,4) para la deficiencia visual y de 4,3 (IC de 95%: 2,1–10,4) para el error de refracción no corregido relacionado en las mujeres analfabetas, en comparación con las que tenían un nivel de educación secundaria, y fue de 1,9 (IC de 95%: 1,1–3,1) para la catarata en los hombres desempleados.

Conclusiones. La prevalencia de ceguera y deficiencia visual es alta en la población adulta de El Salvador. Las principales afecciones asociadas son la catarata y el error de refracción no corregido, ambas tratables. Puesto que las desigualdades socioeconómicas y de género en materia de salud ocular pueden ser indicativas de discriminación y de la existencia de barreras importantes para obtener acceso a servicios de atención de salud asequibles, de buena calidad y oportunos, es preciso dar prioridad a la atención oftalmológica pública y a las políticas dirigidas a corregir la discapacidad, en particular en las mujeres y en las personas desempleadas y sin formación.

Palabras clave Salud ocular; oftalmología; desigualdades en la salud; ceguera; errores de refracción; catarata; El Salvador.