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ORIGINAL ARTICLE

Rapid Assessment of Visual Impairment Due to Cataract and Cataract Surgical Services in Urban Argentina

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ABSTRACT *Aim*: To present results of a rapid assessment on visual impairment due to cataract and on cataract surgical services in the Northwestern districts of Buenos Aires, Argentina. These results will enable health managers to plan effective interventions in this area in line with VISION 2020. *Methods*: One hundred fifteen clusters of 40 persons of 50 years and older in each cluster (4600 eligible persons) were selected by systematic sampling from the Northwestern districts of Buenos Aires, Argentina. This area consists of 10 districts with a total population of 2,716,573 (2001 census), from whom 4302 persons were examined (coverage 93.5%). The visual acuity was measured with a tumbling E-chart and the lens status with distant direct ophthalmoscopy. *Results*: Cataract is the major cause of bilateral blindness (54.2%). The age and sex adjusted prevalence of bilateral cataract blindness (presenting VA < 20/400) in people of 50 years and older was 0.5% (95% CI: 0.4–0.8%), an estimated number of 2,985 persons. The cataract surgical coverage at this level was 70% for males and 78% for females. The prevalence of bilateral cataract and VA < 20/200 in persons of 50 years and older was 0.8% (95% CI: 0.6–1.1), an estimated 4,705 persons. In this last group, the surgical coverage was 66% (persons) and 57% (eyes). Of all operated eyes, 10% could not see 20/200. 'Cannot afford' (32%), 'unaware of cataract' (21%) and 'contraindication for surgery' (18%) were mentioned most as reason why surgery had not been done. *Conclusion*: The cataract problem is getting under control in this area. Coverage indicators are fairly high, and the outcome data better than in other studies. The cataract surgical rate could be raised further by awareness campaigns and by making cataract surgery more affordable.

KEYWORDS Cataract; blindness; survey; Argentina; Buenos Aires

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INTRODUCTION

Age-related cataract is the major cause of visual impairment and blindness in most countries. A declining birth rate and increased life expectancy has resulted in a sharp increase in the number of people of 50 years and older.

In many countries, this has caused an increase in the prevalence of cataract blindness and a greater demand for adequate cataract surgical services. Periodic assessment of magnitude and cataract services status is crucial for countries aiming to reach the goals of VISION 2020.

This survey was conducted in ten districts in the Northwestern part of Great Buenos Aires, the capital of Argentina. The 10 districts are Merlo, Moreno, Hurlingham, San Fernando, Tigre, Malvinas Argentinas, Jose C. Paz, Morón, Ituzaingo and San Miguel, covering a population of 2,716,573.[1] This area was selected because it is covered by ophthalmic services from the Hugo D. Nano Ophthalmology Foundation. Also, the demographic and social composition of population in these ten districts is similar to that of all districts in Great Buenos Aires.

The total population of Argentina is estimated at 36.3 million in 2001, of which 22.7% is 50 years or older. Nearly 90% of the population of Argentina live in urban areas, and 38% live in Buenos Aires alone.[2] The average annual population growth between 1991 and 2001 was 1.0% for Argentina and 0.89% for Buenos Aires. The Province Buenos Aires consists of 135 districts: 24 districts in the inner city, Great Buenos Aires (8.7 million people) and 111 districts in its surrounding residential and rural areas (5.1 million).

In Buenos Aires 15.8% of the population, 2,161,064 people, live under the poverty line. In the districts covered by the survey, the proportion under the poverty line ranges between 8 and 27%. About half of the population has some kind of medical insurance that will pay for the cataract operation. Without insurance, the patient will have to pay for the surgery. Those who cannot afford to pay can go to public hospitals where they are operated free of charge or against payment for the consumables only.

A recent report provides data on the cataract surgical rate and the number of ophthalmologists for each province in entire Argentina in the year 2001.[3] In that year, the total number of ophthalmologists was estimated at 3,417, on average 95 per million population, with a variation between 122 per million (Buenos Aires Province) and 31 per million (Misiones Province). In 2001, 62,739 cataract operations were performed in Argentina, giving an average cataract surgery rate (CSR) of 1,744, with a variation between 0 (Formosa Province) and 2,500 (Cordoba Province). The average number of cataract operations per ophthalmologist was 18. Of all operations, 91% were performed by the private sector and 9% by the state public health services.

In the survey area, 151 ophthalmologists are working, of whom 48 are performing cataract surgery. There are 13 public hospitals in the survey area, and 7 of them provide cataract surgical services. The CSR in this area is around 1600 for the year 2004. This is lower than the average of 2,110 for Buenos Aires because this is a poor area of the province.

No earlier population-based surveys were conducted in this area and no information is available on prevalence of cataract blindness. These results of this study provide an insight in the magnitude of blindness and cataract and will enable health managers to plan effective interventions in this area in line with VISION 2020.

METHODS AND MATERIALS

According to the latest census from 2001, the total population of the 10 districts of the survey area was 2,716,573 people, of which 572,243 people (21.1%) were 50 years or older. Local ophthalmologists estimated the overall prevalence of blindness (VA < 20/400 with best correction) at 6% in the population of 50 years and older, of which 50% was attributed to cataract. Allowing a variation of 20% around the estimated prevalence (2.4–3.6%), a 95% confidence interval and an estimated design effect of 1.5 for using a cluster size of 40, a sample size of 4577 would be required.[4]

The sampling frame consisted of all enumeration areas of the National Census of 2001 and their population in the 10 districts of northwest Buenos Aires.[1] After adding a cumulative column for the population, the clusters were selected by systematic sampling through a specially designed spreadsheet. This selection process ensures probability proportional to the size of the population. Each enumeration area has an average population of 1,468 of all ages (range: 46–7,379) and is clearly demarcated by roads or other landmarks. Detailed digital maps were available for each selected enumeration area. The route to be taken by each survey team was determined in the office. The starting point is a landmark in the centre of the enumeration area. From there, the direction was determined by spinning a pencil on the map and moving in the direction in which the tip of the pencil is pointing. At every crossing, the pencil was turned again to determine the new direction. The route thus obtained was drawn on the map and the survey

teams were instructed to follow this route in the field. This will avoid any bias by the survey team in the selection of houses to be examined.

For the rapid assessment a standardized protocol was used, which has also been applied in other countries in Asia, Africa and South America.[5] A standardized survey record, translated in Spanish, was completed for each eligible person. This form has seven different sections: general information; vision and pinhole examination; lens examination; principle cause of vision less than 20/60; history, if not examined; why cataract operation has not been done; and details of cataract operation.

Visual acuity was measured with a tumbling 'E' chart with a Snellens optotype size 60 on one and size 200 on the other side at 20 or 10 feet distance with available correction. The vision was measured in full daylight, in the courtyard or on the street. If the VA was less than 20/60 in either eye, pinhole vision was also taken for each eye.

The WHO defines blindness as visual acuity (VA) less than 20/400 in the better eye with the best possible correction or pinhole. Besides this, the analysis reports also calculate VA < 20/400 with available correction, the optical correction that the patient actually uses. A VA less than 20/200, but equal to or better than 20/400 in the better eye is classified as severe visual impairment and a VA less than 20/60, but equal to or better than 20/200 in the better eye is classified as visual impairment. Some patients may have more than one eye disorder causing visual impairment. The accepted WHO convention is to assign the major cause to the disorder that is easiest to treat or can be prevented.[6]

After measuring visual acuity, the examinee is taken inside the house, into a shaded or dark area. There, the lens status is assessed by torch, binocular loupe and by distant direct ophthalmoscopy at 20–30 cm distance under semi-dark condition, without dilatation of the pupil. The lens in each eye was examined and graded as 'normal lens,' 'obvious lens opacity present,' 'lens absent (aphakia),' 'Intra-ocular lens (IOL) implanted without posterior capsule opacification' or 'IOL implanted and posterior capsule opacification present.' If the lens could not be seen because of corneal scarring, phthysis bulbi or other causes, 'No view of lens' is marked.

The survey coordinator informed the selected communities, local health authorities and local police a few days before the actual examinations. Each selected cluster was examined by two teams, each consisting of one resident ophthalmologist and one assistant. A total of five survey teams were available for all the field work. The teams followed the route that was drawn on the map of the cluster. Persons with minor ophthalmic ailments were treated. In case of disorders that were more serious, patients were referred to the Foundation Oftalmológica Hugo D. Nano.

A special software program (RACSS version 2.02a)[5] for data entry and automatic standardized data analysis has been developed in EpiInfo version 6.[7] After data entry is completed, the user first selects the required level of vision (VA < 20/400, VA < 20/200 or VA < 20/60) and then the required analysis report, using the menu system. The selected report appears on screen and can be saved on disk or sent to a printer. Further customized analysis is possible using the analysis facilities of EpiInfo. The sampling error and design effect for the different indicators are calculated by using the CSample module of the EpiInfo 6.04 software, which is specially developed to calculate these parameters.

RESULTS

A total of 4,600 persons aged 50 years were eligible for examination, out of which 4,302 persons (93.5%) were physically examined: 1,896 males and 2,406 females. One hundred fourteen eligible persons were not available, and 185 refused examination. Information about the visual status of these 299 persons was obtained from relatives or neighbours. These data are not included in the analysis. Of those that could not be examined, 59% were males and 41% females. The age and sex composition of the sample population differed only slightly from the actual population of the survey area.

Out of the total 4,302 examined persons of 50 years and older, 37 (0.9%) were bilaterally blind (VA < 20/400 with pinhole correction) due to all causes. From these, 20 persons (54%) were bilateral blind due to cataract, a prevalence of 0.5% in the population aged 50 years and older. Detailed results are shown in Table 1.

The prevalence of blindness (due to cataract as well as other causes) increases by age and is usually higher in females.[8] When the age and sex composition of the sample differs from the actual population composition in the survey area, the prevalence rates calculated from the sample data do not reflect the true prevalence in the population. As can be seen in Figure 1, males of 50 to 60 and females of 75 years and older are underrepresented, while males of 60 years and older and females younger than 75 are over-represented in the

TABLE 1 Sample Prevalence for Bilateral Blindness and Cataract Blindness in 10 Districts in Northwest Buenos Aires, Argentina

	Males (*n* = 1,896)		Females (*n* = 2,406)		Total (*n* = 4,302)	
People in sample age 50+ years	Cases	Prev.	Cases	Prev.	Cases	Prev. (CI: 95%)
VA < 20/400 (with pinhole)						
All bilateral blindness	16	0.8%	21	0.9%	37	0.9% (0.6–1.2)
VA < 20/400 (available correction)						
All bilateral blindness	19	1.0%	30	1.2%	49	1.1% (0.8–1.5)
Bilateral cataract blindness	8	0.4%	12	0.5%	20	0.5% (0.3–0.7)
Cataract blind eyes	39	1.0%	49	1.0%	88	1.0% (0.8–1.3)
VA < 20/200 (available correction)						
All bilateral blindness	40	2.1%	57	2.4%	97	2.3% (1.8–2.7)
Bilateral cataract blindness	12	0.6%	20	0.8%	32	0.7% (0.5–1.0)
Cataract blind eyes	58	1.5%	73	1.5%	131	1.5% (1.3–1.8)
VA < 20/60 (available correction)						
All bilateral blindness	129	6.8%	165	6.9%	294	6.8% (6.1–7.6)
Bilateral cataract blindness	20	1.1%	33	1.4%	53	1.2% (0.9–1.6)
Cataract blind eyes	83	2.2%	108	2.2%	191	2.2% (1.9–2.6)
Bilateral pseudo aphakia	14	0.7%	40	1.7%	54	1.3% (0.9–1.6)
Unilateral pseudo aphakia	38	2.0%	30	1.2%	68	1.6% (1.2–1.9)
pseudo aphakic eyes	66	1.7%	110	2.3%	176	2.0% (1.8–2.4)

CI: 95% = 95% Confidence Interval.

sample compared to the actual population of the survey area.

Hence, the age and sex adjusted prevalence rates (Table 2) may differ from those calculated from the sample.

The age and sex adjusted prevalence of all bilateral blindness (VA < 20/400 with best correction or pinhole) in people of 50 years and older is 1.0% (95% CI: 0.7–1.3%), an estimated 5,508 people. With available correction, the prevalence is 1.3% (95% CI: 0.9–1.6%), an estimated 7,190 people. The adjusted prevalence of bilateral cataract blindness in people of 50 years and older is 0.5% (95% CI: 0.4–0.8%), an estimated 2,985 patients. In total, 12,406 eyes are estimated to be blind due to cataract, more than 20,000 per million population. Cataract is the major cause of bilateral blindness (VA < 20/400) with 54.2%.

Assuming that cataract blindness under the age of 50 is negligible, the prevalence of bilateral cataract blindness in the entire population of 2.7 million would be 0.11% or 1,100 cases per million people.

For VA < 20/200 with available correction, the age and sex adjusted prevalence rates in people of 50 years and older are higher: 2.5% (95% CI: 2.0–2.9%) for

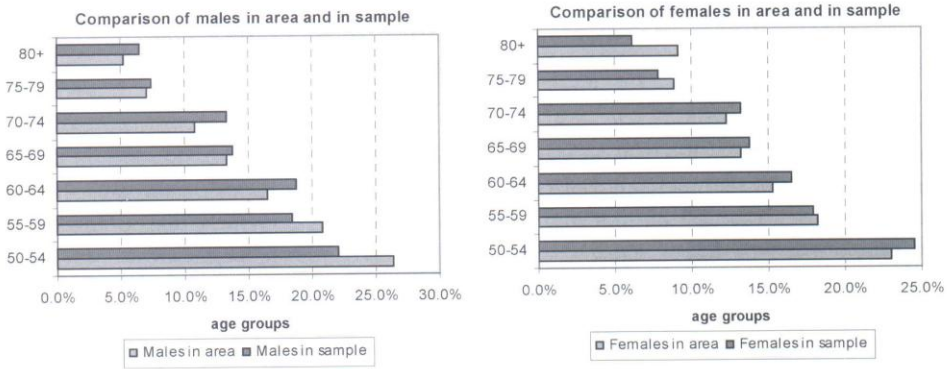

FIGURE 1 Age and sex composition of population 50+ in survey area and in sample.

TABLE 2 Age and Sex Adjusted Prevalence Rates and Estimated Total Cases for Bilateral Blindness and Cataract Blindness in 10 Districts in the North-West of Buenos Aires, Argentina

	Males (*n = 257,660*)		Females (*n = 314,583*)		Total (*n = 572,243*)	
Total people 50+	Cases	Prev.	Cases	Prev.	Cases	Prev. (CI: 95%)
VA < 20/400 (with pinhole)						
All bilateral blindness	2,063	0.8%	3,446	1.1%	5,508	1.0% (0.7–1.3)
VA < 20/400 (available correction)						
All bilateral blindness	2,453	1.0%	4,737	1.5%	7,190	1.3% (0.9–1.6)
Bilateral cataract blindness	1,032	0.4%	1,953	0.6%	2,985	0.5% (0.4–0.8)
Cataract blind eyes	4,833	0.9%	7,573	1.2%	12,406	1.1% (0.9–1.4)
VA < 20/200 (available correction)						
All bilateral blindness	5,108	2.0%	8,940	2.8%	14,048	2.5% (2.0–2.9)
Bilateral cataract blindness	1,478	0.6%	3,227	1.0%	4,705	0.8% (0.6–1.1)
Cataract blind eyes	7,094	1.4%	11,292	1.8%	18,386	1.6% (1.4–1.9)
VA < 20/60 (available correction)						
All bilateral blindness	16,641	6.5%	24,096	7.7%	40,737	7.1% (6.4–7.9)
Bilateral cataract blindness	2,442	0.9%	5,410	1.7%	7,851	1.4% (1.0–1.7)
Cataract blind eyes	10,189	2.0%	17,020	2.7%	27,209	2.4% (2.1–2.8)
Bilateral pseudo aphakia	1,690	0.7%	6,040	1.9%	7,730	1.4% (1.0–1.7)
Unilateral pseudo aphakia	4,631	1.8%	4,325	1.4%	8,956	1.6% (1.2–1.9)
pseudo aphakic eyes	8,010	1.6%	16,405	2.6%	24,415	2.1% (1.9–2.5)

CI: 95% = 95% Confidence Interval.

all causes and 0.8% (95% CI: 0.6–1.1) for bilateral cataract.

People, bilaterally blind (VA < 20/400) due to cataract, were asked why they had not been operated so far. "Cannot afford" is the major barrier to cataract surgery (32%), followed by "Unaware of cataract" (21%), "Contra-indication" (18%) and "Destiny" (11%). There was no significant difference in barriers between men and women. Barriers for people with bilateral cataract and best corrected VA < 20/200 showed a similar distribution of barriers.

By comparing the number of aphakic and pseudophakic persons, or eyes, with the number of cataract blind persons, or eyes, the Cataract Surgical Coverage can be calculated, the proportion of the all cataract blind people, or eyes, that have been provided surgical services, independent on the visual outcome.[9] It indicates which part of the cataract problem has been covered by surgery and gives an idea of the availability and accessibility of the cataract surgical services to the population of the survey area (Table 3).

Coverage rates for women seem to be higher than for men but the differences are not significant. Over the past 10 years, the proportion of females operated for cataract in the Hugo D. Nano Ophthalmology Foundation was 59%, against 41% for men.

Visual acuity was measured in all aphakic and pseudophakic eyes in the sample (Table 4). This gives an impression of the visual outcome after cataract surgery. It is important to realize that these cases include patients operated recently as well as decades earlier by skilled and less skilled surgeons under optimal and less optimal conditions. Good results from recent surgeries may be overshadowed by less good results of operations conducted decades earlier.

TABLE 3 Cataract Surgical Coverage (CSC) in Persons age 50+ years (Adjusted)

	CSC-persons	CSC-eyes
VA < 20/400		
Male	70%	62%
Female	78%	68%
Total	74%	66%
VA < 20/200		
Male	64%	53%
Female	69%	59%
Total	66%	57%
VA < 20/60		
Male	41%	44%
Female	53%	49%
Total	47%	47%

TABLE 4 Post-Operative Visual Acuity with Available and with Best Correction

Category of visual acuity	IOL's		Non-IOL's		Total eyes	
	Eyes	%	Eyes	%	Eyes	%
With available correction						
Can see 20/60	131	*78.9%*	3	*30.0%*	134	*76.1%*
Cannot see 20/60, can see 20/200	21	*12.7%*	3	*30.0%*	24	*13.6%*
Cannot see 20/200	14	*8.4%*	4	*40.0%*	18	*10.2%*
Totals	166	*100.0%*	10	*100.0%*	176	*100.0%*
With best correction or pinhole						
Can see 20/60	149	*89.8%*	6	*60.0%*	155	*88.1%*
Cannot see 20/60, can see 20/200	5	*3.0%*	0	*0.0%*	5	*2.8%*
Cannot see 20/200	12	*7.2%*	4	*40.0%*	16	*9.1%*
Totals	166	*100.0%*	10	*100.0%*	176	*100.0%*

With pinhole, the proportion of eyes with VA < 20/200 could only be reduced from 10.2% to 9.1%. However, significant improvement was made in the borderline ($Z = 3.49$; two-sided $p = 0.00048$) and good vision ($Z = 2.78$; two-sided $p = 0.0054$) group. IOL implantation surgery has significantly better results than operations without IOL implantation ($Z = 2.32$; two-sided $p = 0.02$). Visual outcome in patients operated less than five years ago is better than in patients operated more than five years ago. Of all operations, 68% are conducted in private hospitals and 32% in government hospitals. Of all operated patients, 15% stated that they paid all costs of the operation, 36% paid part of the costs and 49% had a free operation.

The design effect varied between 1.00 for bilateral severe visual impairment (VA < 20/200) with available correction due to all causes to 1.40 for bilateral cataract blindness (VA < 20/400) and bilateral visual impairment due to cataract VA < 20/60).

DISCUSSION

In this rapid assessment only persons of 50 years and older were examined. Data from surveys in India and Nepal, where cataract tends to develop at a younger age, showed that approximately 5% of all cataract blindness (VA < 20/200) occurred in the age group 40–50.[10,11] However, a survey of persons of 40 years and older would require nearly twice the sample size to achieve the same accuracy on the estimated prevalence of cataract blindness. In this rapid assessment method, feasibility is given priority over a marginal gain in accuracy. The prevalence of congenital and traumatic cataract is so low that it can be ignored.

The prevalence of bilateral cataract blindness in persons of 50 years and older was found to be 0.5% (95% CI: 0.4–0.8%), far less than the expected 3% on which the calculation of the sample size was based. As a result, the 95% confidence interval is 0.5% plus or minus 32%, rather than the expected 20% variation.

With 21% of the population being 50 years or older and assuming that 15% of all blindness occurs in people younger than 50, the age and sex adjusted prevalence for all bilateral blindness (VA < 20/400 with pinhole correction) in the entire population of all age groups in the 10 districts of northwest Buenos Aires is estimated at 0.25%.

Three out of every four persons with bilateral cataract blindness (VA < 20/400) have been operated in one or both eyes, and two out of every three cataract blind eyes have been operated upon. The cataract surgical coverage for persons and eyes at VA < 20/200 and VA < 20/60 are fairly high, suggesting that patients are regularly operated before they are actually blind due to cataract.

More women are operated than men. The prevalence of bilateral pseudo aphakia in women is significantly higher than in men ($Z = 1.7$; two-sided $p = 0.0103$) in the sample. The coverage rates for women are consistently higher than for men at all levels, but the differences are not significant. However, the prevalence of bilateral blindness, cataract blindness and cataract blind eyes is consistently higher in females, although the sample sizes are too small to demonstrate significance. Apparently the surplus in cataract surgery is not enough to compensate for the increased risk in women to develop cataract.

Outcome data in population-based studies like this reflect results by all surgeons over many years. Of all operated cases, 94% received an intra-ocular lens (IOL),

against 82% in Peru and 60% in Paraguay. The visual outcome of cataract surgery compared favourably with Paraguay and Peru, with 76% of the operated eyes able to see 20/60 or better and 10% unable to see 20/200.[12,13] However, this survey was conducted in an urban setting with well-equipped ophthalmic services, while Paraguay was a national survey and Peru was a survey in two remote districts with limited eye care services.

Adequate refraction could significantly improve the proportion of borderline and good outcome, but only marginally the proportion of eyes with poor outcome.

Sixty-eight percent of the cataract operations were conducted in private hospitals and 32% in government hospitals. Significantly more females (76%) than males (55%) are operated in private hospitals. The major barrier to cataract surgery is "Cannot afford," although 49% of the operations were reportedly done free of charge, 36% were partially paid and 15% were paid totally. These costs were about the same in private and in government hospitals. The other barriers, like "unaware of cataract," "destiny" and "contra-indication" could be reduced by awareness campaigns.

The current CSR of 1,600 is below the national average of 1,744 and needs to be increased to well over 2,000 to be in line with the WHO recommendations for Latin America.[14] With the current CSR, one would expect lower cataract surgical coverage and a higher prevalence. Patients may be operated outside the survey area or the reporting of the number of cataract operations may not be complete. With an average output of 33 cataract operations per eye surgeon, there should be enough capacity to increase the CSR in this area. If there is public demand in Argentina for cataract surgery at earlier stages, the CSR needs to be increased well above 3000.

The major recommendations to further reduce avoidable blindness and visual impairment due to cataract in the survey area are:

1. provide adequate optical correction after cataract surgery;
2. routine monitoring of visual outcome after cataract surgery may help to identify causes of poor outcome and improve future results;[15]
3. make cataract operations more affordable by using cheaper intraocular lenses and consumables, or by using small incision cataract surgery instead of phaco emulsification; and
4. start awareness campaigns to reduce barriers like "unaware of cataract" or "destiny."

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