Prevalence of Glaucoma in a South Brazilian Population: Projeto Glaucoma

Kenji Sakata,1,2 Lisandro M. Sakata,1,2 Viviane M. Sakata,1 Cintia Santini,1 Luisa M. Hopker,1 Ricardo Bernardes,1 Cristina Yabumoto,1 and Ana T. R. Moreira1

PURPOSE. To assess the prevalence of glaucoma in a South Brazilian population.

METHODS. Subjects older than 40 years underwent a screening examination that included a medical interview, slit lamp examination, tonometry, and fundoscopy. Those with suspected glaucoma (based on optic disc appearance and/or intraocular pressure) underwent a comprehensive ophthalmic evaluation during the definitive examination. Glaucoma was diagnosed based on the International Society of Geographical and Epidemiologic Ophthalmology classification.

RESULTS. A total of 1636 subjects were examined (76.5% participation rate): 71% of the study population self-reported their race as white and 24% as nonwhite (most black and mixed–black/white). Glaucoma was found in 56 subjects (crude prevalence of all glaucoma: 3.4%; 95% CI, 2.5–4.5), primary open-angle glaucoma (POAG) was found in 40 (2.4%; 95% CI, 1.7–3.2), and primary angle-closure glaucoma (PACG) in 12 (0.7%; 95% CI, 0.3–1.1). Six (12%) subjects with primary glaucoma had a previous diagnosis of the disease. Nonwhite persons had a higher prevalence rate of POAG than did white participants, although this difference was not significant (3.8% vs. 2.1%, respectively, P = 0.11). Unilateral blindness due to primary glaucoma was observed in seven subjects (five POAG/2 PACG), and nonwhites had a higher rate of unilateral blindness than did whites (five versus two cases, respectively, P = 0.014).

CONCLUSIONS. Compared to incidence in Hispanic and European populations, PACG was more common among South Brazilians, whereas the POAG rates were similar. The rate of undiagnosed glaucoma was almost 90%. The higher POAG prevalence in the population self-reported as nonwhite may affect the estimation of glaucoma in Brazil, as more than 40% of the population self-report their race as nonwhite. (Invest Ophthalmol Vis Sci. 2007;48:4974–4979) DOI:10.1167/iovs.07-03432

A recent estimate of the number of people affected by glaucoma worldwide suggested that by 2010 there will be approximately 60.5 million people with the disease (45 million with open-angle glaucoma [OAG] and 15 million with angle-closure glaucoma [ACG]). The estimated prevalence of glaucoma is based on previous studies, selected according to specific criteria described elsewhere. Since no study has evaluated glaucoma prevalence in Latin America, the estimated OAG prevalence was derived from studies conducted in Hispanic populations living in the United States, whereas the estimated ACG prevalence was derived from seven studies conducted in European-derived populations.

According to data from the United Nations, the Latin Americans represent 8.6% of the world population. Brazil has 186.4 million people and accounts for approximately one third of Latin America’s 558.3 million people. Brazil is a Portuguese-speaking country where, according to the national census of 2000 conducted by the National Census Agency (Instituto Brasileiro de Geografia e Estatística; IBGE), 54% of the population self-report their race as white, 6% as black, and 38% as mixed black and white.

Previous epidemiologic studies have observed that glaucoma prevalence varies in different races. Thus, it is likely that the variety of ethnicities making up each Latin American nation state, particularly Brazil, would yield different prevalence rates. The purpose of this study was to determine the prevalence and clinical characteristics of glaucoma in adults older than 40 years in a population from the southern region of Brazil.

METHODS

Projeto Glaucoma is a population-based prevalence study conducted from June 2000 to December 2003, in two districts of Piraquara City, located in the south of Brazil, 250 miles south of São Paulo. Piraquara City has 72,886 habitants; 72% of the population is white, and the annual gross domestic product is approximately US$1560.00 per capita (approximately half that in all of Brazil, US$3815.00 per capita). Informed consent was obtained from all participants. The Ethics Committee at the Universidade Federal do Paraná approved all protocols, and the methods described adhered to the tenets of the Declaration of Helsinki.

We conducted the study to determine the prevalence and clinical characteristics of glaucoma in residents 40 years of age or older in two districts in Piraquara City: Vila Macedo and Jardim-Primaívera. These two districts were chosen due to the well-organized records for their respective residents, and the remarkable motivation of the local health care unit employees and local community leaders, who helped motivate residents to participate in the study by explaining the disease process of glaucoma and the importance of screening and early detection. Health care unit employees used the records of residents to identify possible participants who lived in the two districts. In addition, before analyzing the data, we checked each participant’s address against district maps, and we excluded all participants whose addresses were not located in Vila Macedo and Jardim Primavera. Using the records of residents, we identified all subjects older than 40 years who had not attended the screening examination, and we visited their homes to try to encourage their participation.
Screening Examination

The screening examination was performed in health care units located in the two districts. Identification and demographic data were obtained, and racial groups were defined by self-description (based on classification used by the National Census Agency, IBGE).12 The screening examination included an interview on medical history, oblique flash light test, anterior segment evaluation by slit lamp, Goldmann applanation tonometry, and direct fundoscopy (all examinations performed by properly trained ophthalmology residents). The optic disc was examined after each pupil was dilated with 1 drop of tropicamide, unless contraindicated by the oblique flash light test and/or the presence of a shallow anterior chamber depth at the slit lamp examination. The vertical cup-disc ratio (VCDR) was estimated for each eye. The rim border was determined based on the course of the blood vessels and the gradation of color, shadows, and texture.13 A suspect appearance of the optic disc (glaucomatous-appearing optic disc; GAOD) was defined in eyes with VCDR ≥ 0.6, asymmetry of the VCDR between the two eyes ≥ 0.2, focal thinning of the neuroretinal rim, localized or diffuse retinal nerve fiber layer defect, and/or optic disc hemorrhage. A glaucoma specialist (KS) confirmed the presence of a GAOD in the participants. Fundus photography, automated perimetry, and gonioscopy were not part of the screening protocol.

Definitive Examination

Participants with GAOD status and/or intraocular pressure (IOP) measurements > 21 mm Hg at the screening underwent a definitive examination at the Ophthalmologic Clinic of our University, which included at least two more visits. At the first visit, each subject underwent a comprehensive ophthalmic examination, including review of medical history, best corrected visual acuity (using Snellen distance vision chart), retinoscopy and subjective refraction (when visual acuity < 20/20), slit lamp biomicroscopy, IOP measurement (using Goldmann applanation tonometry), standard automated perimetry tests, gonioscopy (using three-mirror Goldmann lens), and fundoscopy examination.

Gonioscopy was performed by one of two glaucoma specialist (KS or LS). Indentation gonioscopy with four-mirror Posner lens was performed in eyes with an anatomically narrow angle. The angle was graded according to the Scheie scheme14 and the peripheral iris contour, degree of pigmentation, presence of peripheral anterior synechiae, and other angle abnormalities were recorded. When the gonioscopy showed no contraindications, dilated direct fundoscopy and slit lamp biomicroscopy of the optic disc (using a 78-D lens) were performed. The VCDR was determined independently in a masked fashion by two glaucoma specialists (KS and LS), and cases of disagreement were resolved by consensus between the two graders during the definite examination visit (18 cases). There was a good agreement between the two graders in determining VCDR (0.7 or more; k = 0.627). The presence of any notch, optic disc hemorrhages, or nerve fiber layer defects was documented. In the first visit, most of the standard automated perimetry tests were performed with the TopCon SHT1000 perimeter (Topcon, Tokyo, Japan). In an attempt to avoid the influence of learning effect in visual field (VF) results, these VF exams were not considered for assessing visual function status.

In the second visit, within 10 months from the first visit, all subjects underwent a second VF examination, this time with a Humphrey visual field perimeter (Humphrey Visual Field Analyzer; Carl Zeiss Meditec, Inc., Dublin, CA), with the 24-2 full-threshold or SITA (Swedish interactive threshold algorithm) standard strategy. The visual function status was determined based on this single VF test, and only reliable VF examinations were considered for analysis. An abnormal VF examination was determined by the presence of one of the following criteria: (1) glaucoma hemifield test (GHT) result outside normal limits; and (2) the presence of a cluster of ≥ 5 contiguous points in the pattern deviation (PD) probability plot with P < 5% or worse (within the same hemifield).15 A reliable visual field test was defined as an examination with less than 33% of fixation losses, false positive and false negative. One glaucoma specialist (KS) verified whether the VF defects were consistent with glaucoma.

Criteria for Glaucoma Diagnosis

Glaucoma was diagnosed according to the International Society of Geographical and Epidemiologic Ophthalmology (ISGEO) classification, which uses three levels of evidence.15 Briefly, the highest level of evidence requires optic disc abnormalities (VCDR > 97.5th percentile in the hypernormal population) and VF defects compatible with glaucoma. In the second level of evidence, if a VF test could not be performed satisfactorily, a severely damage optic disc (VCDR > 99.5th percentile of the hypernormal population) would be sufficient to make the diagnosis. Last, if the optic disc could not be examined because of media opacity (hence, no VF test was possible), then a visual acuity < 20/400, IOP exceeding the 99.5th percentile of the hypernormal population, or evidence of previous glaucoma filtering surgery was taken as sufficient for a diagnosis of glaucoma.

Because our study protocol did not include VF tests in the screening examination, the VCDR and IOP cutoff points described at Table 1 were based on the 97.5th and 99.5th percentiles for hypernormal subjects (those with normal VF results) in surveys described by Foster et al.15 The VCDR 97.5th percentile in hypernormal subjects reported by studies conducted in India, Singapore, South Africa, and The Netherlands19 and in Hispanics living in the United States3 was 0.7, whereas the reported VCDR 99.5th percentile was between 0.8 and 0.9. Table 1 summarizes the criteria for glaucoma diagnosis adopted in our study.

Glaucoma Classification

Participants who fulfilled any of the three categories of evidence mentioned earlier were classified as having primary OAG if they had an open angle, primary ACG if they had an anatomic narrow angle, or secondary glaucoma. An anatomically narrow-angle eye should have pigmented trabecular meshwork not visible in ≥ 270° of the iridocorneal angle (as assessed by nonindentation gonioscopy) and/or the presence of peripheral anterior synchiae not explained by other causes but a primary angle-closure process. Secondary glaucoma diagnosis was determined in eyes with a history or clinical findings of a neovascular process (e.g., diabetes or retinal vein occlusion), iridocyclitis, lens related, ocular trauma, or other ocular abnormalities considered to lead to glaucomatous optic neuropathy. Pseudoxefoliation and pigmentary glaucoma were classified as primary glaucoma. Ocular hypertension was deemed present in participants with an IOP ≥ 23 mm Hg in at least one eye (detected in any visit) associated with normal eye examination results in both eyes (normal optic disc and VF). Blindness was defined as a best corrected visual acuity < 20/400.

Participants with suspected glaucoma included those who met category 1 disc criteria but were not found to have VF defects (disc suspects), and/or those with VF defects who did not meeting category
1 disc criteria (field suspects), and/or those with optic disc margin hemorrhages. Those with suspected primary angle closure or known primary angle closure were defined according to the ISGEO (International Society of Geographical and Epidemiologic Ophthalmology) criteria (normal VF and disc appearance).15

Statistical Analysis
Parametric (Student’s t test) and nonparametric (Mann-Whitney) tests were used to compare continuous variables, according to data distribution. The chi² or Fisher exact test was used to compare categorical data. For analysis purposes, we classified all participants in the white and nonwhite groups. We calculated the crude and age/gender/race-adjusted prevalence rates (using the population of Piraquara City as the standard population, according to the data provided by the National Census 2000) with the respective 95% confidence intervals (CI). The agreement between categorical variables was assessed using the kappa (κ) statistic. P < 0.05 was considered statistically significant. Statistical analyses were performed with commercial software (JMP, ver. 5; SAS Institute, Inc., Cary, NC; and MedCalc for Windows, MedCalc, Mariakerke, Belgium).

RESULTS
The estimated number of subjects 40 years of age or older in the districts of Vila Macedo and Jardim Primavera was 2139 (according to the National Census 2000). Comparing the demographic characteristics of the enumerated sample with the total population of Piraquara City, subjects 70 years of age or older were underrepresented in the sample (9.0% in the total population of Piraquara City, subjects 70 years of age or older). Comparing the demographic characteristics of the enumerated sample with the respective 95% confidence intervals (CI). The difference was not statistically significant (Table 3). The prevalences of primary OAG, primary ACG, secondary glaucoma, ocular hypertension, and primary OAG are described in Table 2.

A total of 275 (17%) participants with suspected glaucoma were screened and were referred for definite examination. Twenty-eight (10%) participants declined or were unable to participate. There were 56 subjects with a definite glaucoma diagnosis yielding a crude overall prevalence of 3.4% (95% CI, 2.5–4.3). The prevalences of primary OAG, primary ACG, secondary glaucoma, ocular hypertension, and primary OAG are described in Table 2.

All 12 subjects with primary ACG were women (overall crude prevalence, 2.4%) and were significantly older than the overall study population (mean age, 59.3 ± 12.5 years vs. 53.7 ± 10.7 years, P = 0.001). The prevalence of primary OAG increased with age (Table 3). Twenty-six of 40 subjects had IOP < 21 mm Hg in at least three different occasions (one was using β-blocker eyedrops). The crude prevalence of primary OAG was higher in nonwhite (3.8%) than white (2.1%) participants, although the difference was not statistically significant (P = 0.11, χ² test; Table 4). The age/gender/race-adjusted prevalence of primary OAG was 2.7%.

All 12 subjects with primary ACG were women (overall crude prevalence, 0.7%), and were significantly older than the overall study population (mean age, 66.6 ± 12.6 years vs. 53.7 ± 10.7 years, P < 0.001; Table 3). Two subjects with primary ACG had history and consistent clinical signs of an acute, symptomatic attack. Peripheral anterior synchiae was detected in nine cases. Two of 12 participants had IOP of < 21 mm Hg on at least three different occasions. The age/gender/

### Table 2. Prevalences, Mechanisms of Glaucoma, and Demographics of Cases

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Cases (n)</th>
<th>Level of Evidence</th>
<th>Crude Prevalence, % (95% CI)</th>
<th>Median Age (Range)</th>
<th>Gender Ratio (%)</th>
<th>Race Ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>POAG</td>
<td>40</td>
<td>3</td>
<td>2.4 (1.7–3.2)</td>
<td>57 (40–91)</td>
<td>58</td>
<td>63</td>
</tr>
<tr>
<td>PACG</td>
<td>12</td>
<td>2</td>
<td>0.7 (0.3–1.1)</td>
<td>66 (41–93)</td>
<td>0</td>
<td>75</td>
</tr>
<tr>
<td>Secondary</td>
<td>4</td>
<td>1</td>
<td>0.2 (0.0–0.5)</td>
<td>74 (67–90)</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>Suspected POAG</td>
<td>43</td>
<td>3</td>
<td>2.6 (1.7–5.4)</td>
<td>52 (40–74)</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>Ocular hypertension</td>
<td>35</td>
<td>3</td>
<td>2.1 (1.4–2.8)</td>
<td>53 (40–77)</td>
<td>49</td>
<td>51</td>
</tr>
</tbody>
</table>

* Three subjects reported undetermined race.
† Five subjects reported undetermined race.

### Table 3. Crude Prevalence of Primary Open-Angle Glaucoma and Primary Angle-Closure Glaucoma by Age and Gender

<table>
<thead>
<tr>
<th>Age Range (y)</th>
<th>Men</th>
<th>Women</th>
<th>All Prevalence, % (95% CI)</th>
<th>Men</th>
<th>Women</th>
<th>All Prevalence, % (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cases</td>
<td>Prevalence (%)</td>
<td>Cases</td>
<td>Prevalence (%)</td>
<td>Cases</td>
<td>Prevalence (%)</td>
</tr>
<tr>
<td>40–49</td>
<td>2/270</td>
<td>0.7</td>
<td>5/417</td>
<td>1.2%</td>
<td>0/270</td>
<td>0%</td>
</tr>
<tr>
<td>50–59</td>
<td>10/224</td>
<td>4.5</td>
<td>5/276</td>
<td>1.8%</td>
<td>0/224</td>
<td>0%</td>
</tr>
<tr>
<td>60–69</td>
<td>4/129</td>
<td>3.1</td>
<td>5/156</td>
<td>3.2%</td>
<td>0/129</td>
<td>0%</td>
</tr>
<tr>
<td>&gt;70</td>
<td>7/73</td>
<td>9.6</td>
<td>2/91</td>
<td>2.2%</td>
<td>0/73</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>23/696</td>
<td>3.3</td>
<td>17/940</td>
<td>1.8%</td>
<td>0/696</td>
<td>0%</td>
</tr>
</tbody>
</table>
race-adjusted prevalence of primary ACG among all subjects was 0.7%.

Four subjects had the following diagnoses (1 each): secondary glaucoma due to a neovascular process secondary to diabetes, ocular trauma- and/or corticoid-induced glaucoma, uveitic glaucoma, or secondary glaucoma due to postsurgical complications of cataract extraction surgery.

Of 275 participants in whom screening detected suspected glaucoma, 43 had a final diagnosis of suspected primary OAG; 32 field suspects, and 10 disc suspects. One subject had disc and field abnormalities, but VF defects could be secondary to retinal abnormalities. There was also one with suspected secondary glaucoma, and four were classified with suspected primary angle closure or definite primary angle closure (normal VF and disc appearance).

A previous diagnosis of glaucoma was reported by six (12%) participants with primary glaucoma (four OAG; two ACG). There were 10 cases of unilateral blindness due to glaucoma (5 OAG, 2 ACG, 3 secondary) yielding a crude prevalence of 0.6% (95% CI, 0.2–1.0), but no subject was bilaterally blind. Advanced glaucomatous optic neuropathy (VCDR ≥ 0.9) was confirmed in all blind eyes, caused by primary glaucoma, with the exception of one primary OAG (juvenile glaucoma) eye, in which the optic disc could not be evaluated, exsiccated due to pain. All blind eyes had high IOPs (median, 30 mm Hg, range 26–54). Unilateral blindness due to primary glaucoma was detected in five (three OAG, two ACG) nonwhite subjects (1.3%; 95% CI, 0.2–2.4), and in two (two OAG) white subjects (0.2%; 95% CI, 0.0–0.4; P = 0.014, Fisher exact test).

**DISCUSSION**

This study, to our knowledge, is the first population-based study to report the prevalence and clinical characteristics of glaucoma in subjects over 40 years of age living in the South region of Brazil. The overall response rate in this study was high (76.5%), and the response rate of confirmatory examination was also high (90%). Based on the ISGEO criteria for glaucoma diagnosis, we observed a crude prevalence of all glaucoma of 3.4% (2.4% primary OAG and 0.7% primary ACG). Glaucoma prevalence increased with age, and self-reported nonwhite participants demonstrated greater rates of primary OAG than did self-reported white participants, although this difference was not significant. Blindness due to primary glaucoma was more common in self-reported nonwhite participants, and nearly 90% of subjects with primary glaucoma had not received a diagnosis before the study.

Previous studies had demonstrated that primary glaucoma prevalence varies among different races.2–4,8–10,20–37 In our study, the prevalence of primary OAG in self-reported white participants (2.1%) was similar those in European-derived3,10,23,24 and Hispanic3 populations in which similar criteria were used for glaucoma diagnosis (Table 5). Self-reported nonwhite participants showed a lower primary OAG prevalence than in previous studies conducted in black populations,10,21,22,36 but it was similar to the rate observed in a mixed group from Barbados (3.3%; no black subjects).21 These comparisons may not be appropriate, however, as our nonwhite group included black and mixed participants in a single

* Sixty-nine subjects were excluded from the analysis due to undetermined self-reported race.

**Table 4. Crude Prevalence of Primary Open-Angle Glaucoma and Primary Angle-Closure Glaucoma by Age and Race**

<table>
<thead>
<tr>
<th>Age Range (y)</th>
<th>White Prevalence (95% CI)</th>
<th>Non-White Prevalence (95% CI)</th>
<th>White Prevalence (95% CI)</th>
<th>Non-White Prevalence (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40–49</td>
<td>2/496 (0.4% 0.0–0.9)</td>
<td>5/163 (3.1% 0.4–5.8)</td>
<td>1/496 (0.2% 0.0–0.6)</td>
<td>0/163 (0.0% 0.0–0.0)</td>
</tr>
<tr>
<td>50–59</td>
<td>10/360 (2.8% 1.1–4.5)</td>
<td>5/125 (4.0% 0.6–7.4)</td>
<td>1/360 (0.3% 0.0–0.9)</td>
<td>1/125 (0.8% 0.0–2.4)</td>
</tr>
<tr>
<td>60–69</td>
<td>6/201 (3.0% 0.6–5.4)</td>
<td>3/68 (4.4% 0.0–9.3)</td>
<td>5/201 (2.5% 0.3–4.7)</td>
<td>1/68 (1.5% 0.0–4.4)</td>
</tr>
<tr>
<td>≥70</td>
<td>7/113 (6.2% 1.7–10.6)</td>
<td>2/41 (4.9% 0.0–11.5)</td>
<td>2/113 (1.8% 0.0–4.2)</td>
<td>1/41 (2.4% 0.0–7.1)</td>
</tr>
<tr>
<td>Total</td>
<td>25/1170 (2.1% 1.3–2.9)</td>
<td>15/397 (3.8% 1.9–5.7)</td>
<td>9/1170 (0.8% 0.3–1.3)</td>
<td>3/597 (0.8% 0.0–1.6)</td>
</tr>
</tbody>
</table>

**Table 5. Crude Prevalence Rates of Primary Glaucomas in the 40 and Over Age Group of Selected Population-Based Studies**

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>Location (Country)</th>
<th>Subjects &gt;40 y of Age (n)</th>
<th>POAG, % (95% CI)</th>
<th>PACG, % (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>Baltimore10 (USA)</td>
<td>2913</td>
<td>1.44% (1.04–1.95)</td>
<td>0.40% (0.17–0.63)*</td>
</tr>
<tr>
<td></td>
<td>Sydney25 (Australia)</td>
<td>3241</td>
<td>2.4% (1.87–2.93)</td>
<td>0.31% (0.12–0.50)</td>
</tr>
<tr>
<td></td>
<td>Arizona† (USA)</td>
<td>4774</td>
<td>1.97% (1.58–2.36)</td>
<td>0.10% (0.05–0.24)</td>
</tr>
<tr>
<td></td>
<td>Piraquara (Brazil)‡</td>
<td>1170</td>
<td>2.14% (1.28–2.92)</td>
<td>0.77% (0.29–1.31)</td>
</tr>
<tr>
<td>Black</td>
<td>Baltimore10 (USA)</td>
<td>2395</td>
<td>4.97% (4.10–5.84)</td>
<td>0.90% (0.52–1.28)*</td>
</tr>
<tr>
<td></td>
<td>Temba18 (South Africa)</td>
<td>859</td>
<td>3.69% (2.41–4.96)</td>
<td>0.59% (0.07–1.12)</td>
</tr>
<tr>
<td>Black and mixed‡</td>
<td>Barbados21 (Barbados)</td>
<td>4498</td>
<td>6.85% (6.11–7.59)</td>
<td>—</td>
</tr>
<tr>
<td>Chinese</td>
<td>Singapore16 (Singapore)</td>
<td>1252</td>
<td>1.78% (1.04–2.52)</td>
<td>1.14% (0.55–1.73)</td>
</tr>
<tr>
<td></td>
<td>Mongolia29 (Mongolia)</td>
<td>942</td>
<td>0.50% (0.07–0.99)</td>
<td>1.49% (0.72–2.26)</td>
</tr>
<tr>
<td>Indian</td>
<td>Tamil Nadu17,22 (India)</td>
<td>3924</td>
<td>1.62% (1.42–1.82)</td>
<td>0.87% (0.58–1.16)</td>
</tr>
</tbody>
</table>

* The prevalence rates are not age standardized.
† Additional unpublished data from Tielsch, 2007.
‡ Majority subjects with Mexican ancestry.
§ Current study.
§§ Each study had different proportion of black and mixed subjects.
group (most self-reported as mixed), and considerable genetic heterogeneity (and admixture) among black populations may preclude direct comparisons. Despite that limitation, we observed that the POAG prevalence in self-reported nonwhite subjects was higher than in self-reported white subjects. Even though this difference did not achieve statistical significance, race may have an impact in estimating glaucoma prevalence in Brazil, as nearly 45% of the Brazilian population describe themselves as black or mixed. In addition, as studies from Africa show wide disparities in glaucoma prevalence across different tribal and regional groups and the black populations that migrated to the North and South region of Brazil came from different regions of Africa (Sudanese and Bantu people, respectively), the glaucoma prevalence rates may vary according to the region of Brazil. Further studies will be valuable to assess the glaucoma prevalence in different regions of Brazil.

We observed that the prevalence of primary ACG in whites was higher than in most European-derived populations41-10.22.23 and similar to that observed in Italy.4 As gonioscopy was not part of the screening examination, the referral criteria of our study were not specifically aimed at those with suspected ACG. Thus, our study protocol does not allow us to provide the prevalence of primary angle closure suspect or primary angle closure, but limits the diagnosis to known primary ACG cases (with structural and/or functional damage). Nevertheless, the adjusted prevalence of primary ACG observed in our study suggests that the prevalence of this disease in non-Asian populations may be greater than has been traditionally believed and also that most cases are asymptomatic.

Of interest, all primary ACG cases diagnosed in our study were in women. Although most prevalence studies have observed a higher prevalence of ACG in women, no one had observed such discrepant rates between genders. Most likely, our results represent a chance finding; as we observe male subjects with ACG in our daily practice.

Similar to some previous studies performed in different parts of the world,17,18,27.28,30 the number of participants with a previous diagnosis of glaucoma was very low. The low socioeconomic status/educational level of our study sample associated with the lack of facilities for ophthalmic examination in the Brazilian public health system may explain, to some extent, the high rate of undiagnosed glaucoma. We did not observe bilateral blindness in any case of glaucoma. Almost all subjects with unilateral blindness had advance glaucomatous optic neuropathy in the fellow eye, but our blindness criterion was based solely in central visual acuity <20/400 (no VF criteria). We observed that in all cases, blindness were restricted to eyes with elevated IOP (>26 mm Hg). Primary glaucoma in nonwhite subjects appears not only to be more common, but also more severe, as self-reported nonwhite subjects had a greater rate of unilateral blindness than did white subjects. Of note, the total number of participants with unilateral blindness due to glaucoma was small; further studies will be helpful for confirmation.

Younger men were underrepresented in our study sample; however, all other age/gender groups had a response rate greater than 80%. In Brazil interracial relationships are common, and we believe an inaccurate determination of self-described race is possible, particularly in the differentiation between black and mixed races. Thus, in an attempt to minimize potential misidentification of race, we classified study participants as white or nonwhite (mostly black and mixed black and white).

To streamline the logistics of examining our study population, our protocol did not include optic disc stereophotographs. The absence of these photographs represents an important limitation of this study, as no objective method of measuring the VCDR was used to aid in reproductibility and minimize interobserver error in the assessment of the optic disc. However, the subjective grading of the two glaucoma specialists performed during the definitive examination demonstrated good agreement in estimating the VCDR. Another limitation was that, although subjects with VCDR > 0.6 were identified by properly trained residents at the screening examination and a suspect optic disc appearance was confirmed by a glaucoma specialist whenever necessary, it is possible that in some subjects subtle structural glaucomatous damage was not detected in the screening examination, leading to an underestimation of the prevalence of glaucoma observed in the present study. Crowston et al.58 have demonstrated that variation in optic disc size may influence the determination of the 97.5th VCDR percentile, potentially affecting the glaucoma prevalence rates in studies in which the ISGEO criteria are used. Unfortunately, until the current time, there is no reference standard approach for avoiding this limitation. Last, the VCDR and IOP cutoff points adopted by the present study were obtained from previous larger prevalence studies; however, it is unlikely that these choices would have affected our results, as groups of different ethnicities demonstrated similar VCDRs in the 97.5th percentile.15 Nevertheless, further studies should assess VCDR and IOP distribution in a hypernormal Brazilian population to evaluate the potential influence of these cutoff points in our results.

In summary, our study results described the glaucoma epidemiologic profile of two districts located in southern Brazil. Primary OAG prevalence was similar to those observed in Hispanic and European populations, whereas primary ACG was more common among south Brazilians than in Hispanic and European populations. Almost 90% of the participants with primary glaucoma had not had the disease diagnosed before the study. Glaucoma appears to be more common and more visually destructive in self-described nonwhite participants than in white participants. These results suggest that race may have an impact in estimating glaucoma prevalence in Brazil, and they should be considered when planning public health measures to prevent blindness caused by glaucoma.

References


