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Ocular Findings in a Brazilian Rural Slave-Descendant Community: Eye Health in *Quilombos*

ORIGINAL

Vladimir Fontes de Oliveira[1,2,3], Kleper Carvalho de Figueiredo Leitão[2], Luiz Augusto Pereira da Costa Carvalho[2], Ana Carolina Vieira Peixoto e Lucena[1], Luiz Carlos de Abreu[1], Ricardo Peres do Souto[1]

1 Faculdade de Medicina do ABC (FMABC), Santo André, SP. Brasil.
2 Fundação Altino Ventura (FAV), Recife, PE. Brasil.
3 Universidade de Pernambuco (UPE), Serra Talhada, PE. Brasil.

Contact information:

Vladimir Fontes de Oliveira.

Address: Universidade de Pernambuco. Campus Serra Talhada. Avenida Agamenon Magalhães, S/N - Santo Amaro. Recife, PE, Brazil CEP 50100-010.

vladimirfontes@gmail.com

Abstract

Purpose: To report ophthalmological findings from one *quilombo* remnant population, a Brazilian marginalized rural and slave-descendant community.

Methods: Descriptive study of eye health from one of the largest *quilombo* communities in Brazil, located in Conceição das Crioulas, Pernambuco. Ophthalmic exam including visual acuity, refractive examination, biomicroscopy, fundus examination, tonometry and pachymetry was performed in a convenience sample of 255 residents over 40 years-old, representing approximately one third of the population in this age range.

Results: Half of the subjects had never been examined by an ophthalmologist in their lives. Blindness was identified in 6.7% of participants and low vision in 8.6%. Visual impairment was caused mainly by cataract and uncorrected refractive errors. Cataract was found in 27.3% of subjects. Ametropia was documented in 71% of participants and the most prevalent refraction error was hyperopia. Prevalence of glaucoma and age-related macular degeneration were respectively 5.4% and 1.9%. Pterygium was detected in 26.7% of participants. Correcting lenses were prescribed to 57.4% of individuals, 5.5% were referred for surgery, 2.7% to specialized clinics and 1.2% to additional tests.

Conclusions: Blindness, cataract and pterygium were highly frequent in *quilombo* residents, and distribution of other ocular diseases were close to average published rates. Data collected may help planning preventive and promotive actions for eye health of socioeconomic disadvantaged *quilombo* populations.

Keywords
Eye Care; Visually Impaired Persons; Minority Health; Healthcare Disparities; Vulnerable Populations; Pterygium.

Introduction

In 2010 there were in the world 285 million people visually impaired of which 39 million were blind. [1] In response to this challenging public health problem, World Health Organization (WHO) launched a global program for eye health. [2] Based on data revealing that most of the people affected by blindness or low vision belong to low income families in developing countries, one essential principle of the plan was to provide access for the poorest and one strategic action was the integration of eye care into the national health system. [2]

In Brazil, ophthalmologic attention is available to the population in the public health care system *Sistema Unico de Saude* (SUS). Some programs such as cataract surgery campaigns are overloaded [3] but primary eye care attention is poorly used [4]. Underutilization of free public primary eye care in the latter study was associated to education and economic status of users (among other reasons), raising the concern about vision health from minorities and vulnerable groups in the country.

A distinctive Brazilian marginalized group is constituted by slave descendent *quilombo* remnant communities. [5] Slavery was practiced in Brazil for almost four centuries, when millions of Africans were brought to the country. Before the abolition of slavery in 1888, fugitive slaves founded populations known as *quilombos*. For protection, the original settlements were established in isolated rural areas. Even today some degree of geographical, social and cultural isolation persists in *quilombo*-derived communities. Segregation has been reinforced by discrimination based on race and socioeconomic status, and resulted in various forms of inequity affecting *quilombolas*, people residing in *quilombo* remnant communities. Regarding access to general health care, the proportion of *quilombo* remnant residents using services offered by the public system is lower than general Brazilian population. [6]

Besides the inequity issue, eye health from *quilombolas* present additional interest for their particular genetic background. Studies of DNA polymorphisms in those populations show high degree of miscegenation and large contribution of African genes. [7] In ophthalmology, some diseases with stronger genetic factor as primary open angle glaucoma and hypertensive retinopathy are more prevalent in people of African ancestry [8-10] and therefore may have high prevalence in *quilombo* remnant residents. Nevertheless, apparently only one study describing ophthalmologic examination of *quilombolas* has been published so far. [11]

Eye health of socioeconomic disadvantaged groups have been studied in different contexts around the world. [12-17] Interestingly, there is no common simple pattern to describe vision conditions found in these different populations. Visual impairment, for instance, may be among highest rates in the world - as in rural villages from Myanmar [12] or close to the lower rates from middle-income countries - as in Rwanda [13] and Burundi [16]. Therefore, minorities and unprivileged populations should not be considered a homogeneous group and the comprehensive evaluation of each case may be a key step toward fulfilling the goals of universal eye care.

In order to provide information on eye health of an isolated and vulnerable group, this study aimed to describe ophthalmological findings in individuals living in one of the largest *quilombo* remnant community in Brazil.

Methods

The population from *quilombo* remnant Conceição das Crioulas, belonging to the municipality of Salgueiro in the countryside of Northeastern Brazil **(Figure 1)**, was evaluated. Conceição das Crioulas (latitude 8o19´S, longitude 38o56´W, 445 m above sea level) is the largest *quilombo* remant area of Pernambuco State, with an estimated population of 4,000 inhabitants [18]. The study population is composed by a cohort of 255 individuals over 40

Figure 1: Location of Conceição das Crioulas Quilombo remant in Salgueiro, Pernambuco State, Brazil. (Latitude 08° 04' 27" S).

years, representing approximately one third of the community residents in this age range.

The study is compliant with the Declaration of Helsinki for Studies involving Humans. All patients signed a written informed consent form. The research proposal was reviewed and approved by the Ethics Committee in Human Research from Fundação Altino Ventura (FAV).

Subjects were initially evaluated regarding weight, height, waist circumference, blood pressure and blood glucose. The eye examination occurred in a mobile ophthalmic unit from FAV and was performed by ophthalmologists covering measurement of visual acuity, refractive examinations, biomicroscopy, fundus examination, tonometry and pachymetry.

Visual Acuity was measured for each eye with E Snellen adapted chart at 3 meters and results were classified according to WHO definition [19], considering blindness as presenting visual acuity < 20/400 (0.05) in the better eye and low vision as presenting visual acuity < 20/60 (0.33) but ≥ 20/400 (0.05) in the better eye.

Objective refraction exam was performed with retinoscope (Model 18335, Welch Allyn, USA) and subjective refraction with Greens refractor (Bausch & Lomb, USA). Myopia was defined as spherical equivalent (SE) ≤ -0.5D, hyperopia as SE ≥ +0.5D, and astigmatism ≤ -0.5 D (cylinder).

Slit lamp biomicroscopy was performed (SL-3, Topcon, Japan), followed by dilatation with 1 drop of tropicamide 1% applied three times with 5 min intervals. Participants were submitted to fundus examination utilizing the slit lamp microscope with a 78D Volk lens. Intraocular pressure (IOP) was assessed after instillation of a single drop of 0.5% proximetacayne and 1% fluorescein using a Goldmann applanation tonometer (AT900, Haag-Streit AG, Switzerland). Cup-to-disc ratio (CDR) was the ratio between the vertical diameter of the optic cup and optic disc measured through the center of the optic disc. Pachymetry analysis (5000, DGH, USA) was performed after instillation of 0.5% proximetacaine.

Glaucoma was evaluated in participants with evidences for optical neuropathy and low vision. Visual field exams were not performed because of local infrastructure deficiency as well as limiting time and human resources. Besides IOP measurement and CDR calculation, patients were submitted to water-drinking test (WDT). After obtaining a baseline IOP, subject drank one litre of water in 10 minutes and IOP was obtained three times at 15 minutes intervals. Subjects were classified as non-glaucomatous when IOP < 21 mmHg and typical changes of optic disc were absent and as glaucomatous when presented typical changes of optic disc or CDR ≥ 0,7 with irregular rim or asymmetry of cupping between eyes ≥ 0.2. Glaucoma suspects had CDR ≥ 0.6 or asymmetry of cupping between eyes ≤ 0.2 despite of suggestive lesions or IOP increase above 3 mmHg during WDT. Individuals with IOP > 21 mmHg without typical changes of optic disc were considered ocular hypertensive.

The quantitative variables were expressed as mean ± standard deviation (SD), whereas the qualitative variables were expressed as frequencies.

Results

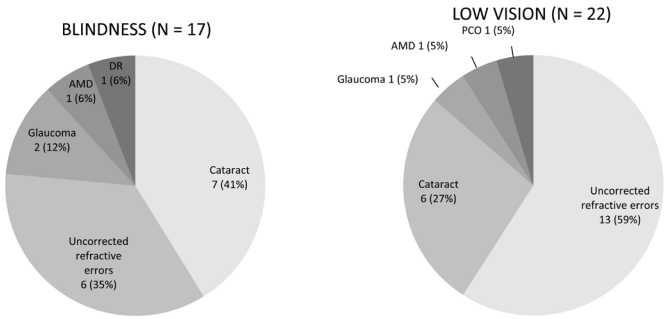
From the total of 255 individuals evaluated in this study, the majority reported the race as black (63.9%) and most were females (59.2%). Regarding systemic diseases and related risk factors for ophthalmological conditions, 36.3% were hypertensive and 4.3% had diabetes mellitus **(Table 1)**.

Table 1. Characteristics of the evaluated subjects from Conceição das Crioulas, Brazil.

	N (%)	
Total	255 (100)	
Sex		
Female	151 (59.2)	
Male	104 (40.8)	
Race/Ethnicity		
Black	163 (63.9)	
Mixed white-black (Mulatto)	74 (29.0)	
Indian	15 (5.9)	
White	3 (1.2)	
Tabagism	55 (20.7)	
Hypertension	93 (36.3)	
Diabetes mellitus	11 (4.3)	
Chagas disease (American trypanosomiasis)	25 (9.8)	
	Average ± SD*	**Minimum–Maximum**
Age (years)	56.0 ± 12.0	40-92
Weight (kg)	61.7 ± 13.7	36-161
Height (cm)	157 ± 11.56	62-187
Waist circumference (cm)	83.7 ± 10.18	52-118
Capillary blood glucose (mg/dl)	103.5 ± 39.1	51-400

* SD: standard deviation.

Figure 2: Most frequent causes of visual impairment (blindness and low vision) in a sample of residents from Conceição das Crioulas, Brazil. AMD: Age-Related Macular Disease; DR: Diabetic Retinopathy; PCO: Posterior Capsule Opacity.



One hundred twenty seven subjects (49.8%) had never been examined by an ophthalmologist in their lives. After eye examination, the average visual acuity was 0.86 ± 0.29 in the right eye and 0.84 ± 0.31 in the left eye. Seventeen subjects (6.7%) were diagnosed blind and low vision was found in 22 subjects (8.6%). The main causes for these 39 cases of visual impairment were uncorrected refractive errors and cataract **(Figure 2)**.

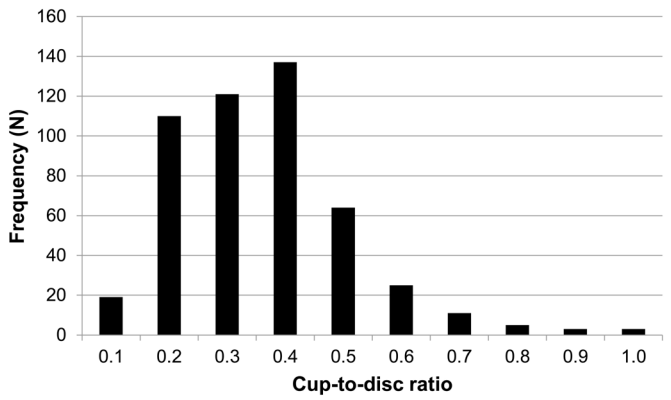
Refraction examination identified hyperopia being the most prevalent refractive error (43.1%) followed by astigmatism (21.6%) and myopia (6.7%). Presbyopia was observed in 211 (82.7%) subjects.

Outcomes from biomicroscopic analysis and fundus examination are presented in in **Table 2**. Cataract (27%) and pterygium (26.2%) were the most common conditions. Most significant findings in fundus evaluation were atrophy of the retinal pigment epithelium (5.1%), age-related macular degeneration (1.9%), diabetic retinopathy (1.2%), hypertensive retinopathy (0.8%) and chorioretinal scar (0.8%). The average cup-to-disc ratio was 0.36 ± 0.15 in the right eye and 0.35 ± 0.14 in the left. In 12 eyes the fundus exam was not possible due to the opacity of the refractive media. The frequency

Table 2. Frequencies of biomicroscopic and fundus findings in residents from Conceição das Crioulas, Brazil.

Number of cases	n (%)
Biomicroscopic Findings	
Cataract	70 (27.3)
Pterigyum	67 (26.2)
Conjuntival melanosis	37 (14.4)
Halo senile	26 (10.1)
Pinguecula	20 (7.8)
Pseudophakia	9 (3.5)
Eyelid Papiloma, Leucoma (each)	7 (2.7)
Posterior Capsule Opacity	5 (1.9)
Shagreen, Conjunctival nevus (each)	3 (1.2)
Keratitis, Hialitis asteroidis, Band keratopaty, Bullous keratopathy, Ptosis, Rubeosis iridis, Iris atrophy, Iron depositis, Vitreous syneresis, Strabismus, Hordeolum (each)	1 (0.4)
Fundus Findings	
Retinal pigment epithelium atrophy	13 (5.1)
Age-Related Macular Degeneration	5 (1.9)
Diabetic retinopathy	3 (1.2)
Hipertensive retinopathy, Chorioretinal scar, Vitreous detachment (each)	2 (0.8)
Epiretinal membrane, Optic disc notch, Myelined retinal fiber layer, Tigroid fundus, Nerve optic atrophy, Pigmentary dispersion (each)	1 (0.4)

Figure 3: Distribution of frequencies of cup-to-disc ratio in 498 eyes studied.



distribution of the cup-to-disc ratio in studied eyes is shown in **Figure 3**.

The mean intraocular pressure (IOP) was 14.3 ± 3.3 mmHg for the right eye and 14.2 ± 3.5 mmHg for the left. IOP was high (> 21 mmHg) for 14 subjects (5.5%). The mean central corneal thickness (CCT) was 527.6 ± 32.6 µm in the right eye and 529.9 ± 33.6 µm on the left. The minimum and the maximum values for CCT (both eyes) were 450 and 625 µm, respectively. Pachymetric analysis was not possible in two eyes.

Glaucoma was detected in 14 individuals (5.5%), half of the cases were simple chronic glaucoma and the other half were normal-pressure glaucoma. Fifteen patients were glaucoma suspects and six presented non-glaucomatous hypertensive eyes.

Regarding therapy and monitoring of subjects engaged in this study, correcting lenses were prescribed to 147 individuals (57.6%); 11 (4.3%) were referred for cataract surgery and three (1.2%) to pterygium surgery; three (1.2%) were referred to other procedures and specialized tests (YAG laser and optical coherence tomography); and seven (2.7%) were referred to specialized clinics. Two from thirteen individuals requiring cataract surgery refused treatment.

Discussion

Official Brazilian statistics from 2015 notify 2,474 certified *quilombo* communities scattered over the country, most of them in the Northeastern region of the country, where Conceição das Crioulas is located. [20] Health concern with these neglected populations is rising, and several recent papers describe various clinical evaluations of *quilombolas*. [11, 21-23] In this study, we have found high prevalence of preventable and treatable eye diseases in *quilombolas*.

Despite the elevated average age of subjects studied (56 years), half of them have never had an eye examination in their lives. Similar absence of ophthalmological care were described recently

only in low income countries from South Asia and Africa [24], and particularly in very isolated locations or in critical conditions. [25, 26] When marginalized groups located in urban areas from developed countries are studied, access to eye care is substantially higher. [27] The majority of *quilombolas* evaluated by ophthalmologists (67%) needed some sort of ophthalmologic intervention, from prescription of refractive lenses to specialized clinic or surgery.

Prevalence of blind people among *quilombolas* was very elevated (6.7%), higher than the global and Latin American indexes (respectively 1.9% and 1.8%). [28] In Americas, the highest published rates were observed in rural areas from Peru (4.0%) and provinces from Guatemala (3.6%). [29] On the other hand, low vision (8.6%) was below average for the continent and the world (10.4%) [28] but higher than observed in urban areas from Brazil (5.2-6.3%). [29, 30] Discrepancies between the rates calculated in this study and literature data may be associated with differences in age range (≥40 years for *quilombolas versus* ≥50 years for the most compatible published global/continental estimates). The very high prevalence of blindness among *quilombolas*, however, should be in part a consequence of: (1) insufficient care provided; (2) misinformation of the population; and (3) influence of African genetic background to some diseases causing vision impairment.

The high frequency of vision loss found in Conceição das Crioulas is not easily and directly comparable to other marginalized populations around the world. Considering studies published in the last 10 years, blindness prevalence in vulnerable groups vary from 1.1% in rural provinces from Burundi (Central Africa) to 8.1% in rural villages from Myanmar (South Asia). [12-17] Reasons for this wide variation may include sampling variations, age groups evaluated, availability of eye care services, genetic background of populations, and other specific environmental or regional causes.

Over 90% of visual impairment diagnosed in this population is consequence of avoidable conditions: cataract, uncorrected refractive errors, glaucoma and diabetic retinopathy **(Figure 2)**. The leading causes for blindness and low vision were cataract (respectively 41 and 27%) and refractive errors (35 and 59%). The proportion of vision impairment because of cataract were substantially higher than published global estimates (blindness: 33.4%; low vision: 18.4%) and for the tropical region of Latin America (23.9% and 13.9%) in a large and recent systematic review. [31] Considering data from the same study, the frequency of vision loss caused by cataract and refractive errors in Conceição das Crioulas was similar only to average rates observed in South Asia (India and neighbour countries), where cataract and refractive errors were responsible for 41.7% and 21.4% of blindness and for 36.0% and 65.4% of low vision. South Asia is an area of notable apprehension about eye health, as vision loss is three times higher than worldwide and adjacent Central Asia. [32] High prevalence of blindness and low vision associated to cataract in Conceição das Crioulas is not unexpected as *quilombolas* are not benefitting from cataract surgery programs that are responsible for its decline in most of the world [31, 33] as well as in urban centers in Brazil. [34] Surgery was offered for all subjects with cataract resulting in visual impairment, however two refused this treatment.

The distribution of refractive errors was different from the most recent data available for Brazilian population (São Paulo state). [35] Compared to published rates, there was more hyperopia and less astigmatism and myopia in residents from Conceição das Crioulas. Nevertheless, increased hyperopia and decreased myopia in *quilombolas* are consistent with the trends observed for similar age groups in the cross-sectional survey. From 182 residents identified with refractive errors, 147 were prescribed corrective lenses. Reasons for not receiving a prescription included: previous use of recently prescribed correc-

tive glasses, patient declination and low to moderate ametropias.

Despite of the African ancestry there was no evidence for high hypertensive retinopathy in *quilombolas*. It was observed in only 0.8% of participants, below prevalence found in other studies.36 On the other hand, glaucoma was diagnosed in 5.4% of the studied population, higher than the calculated worldwide prevalence (3.54%) for 40-80 years old populations. [37] Other features of the eye that may indicate asymptomatic evolution of glaucoma (intraocular pressure, cup-to-disc ratio, central corneal thickness) were within normality range.

The age related macular degeneration in *quilombolas* (1.9%) was inferior to the global pooled rate (8.69%) recently estimated. [38] In the same meta-analysis, prevalence in populations with African ancestry was lower than populations with European ancestry and closer to observed in Conceição das Crioulas. There was a greater number of subjects (5.1%) presenting atrophy of the retinal pigment epithelium, as a possible early sign of the disease.

Pterygium was the second most common eye condition found in biomicroscopic analysis of *quilombolas*, after cataract **(Table 2)**. Prevalence of this connective tissue growth over cornea in this population (26.2%) was much higher than the worldwide rate (10.2%). [39] Very few published studies reported greater prevalence of pterygium: 33.01% in Doumen County, China [40]; 30.8% in Kumejima Island, Japan [41]; and 36.6% in Arawak and Tukano indian communities from Amazon forest [42]. Rural environment, low geographical latitude of Conceição das Crioulas and preponderance of black ethnicity among *quilombolas* may contribute to the high prevalence. [39, 43] Other probable contributing factors to numerous cases of pterygium, not evaluated in this study, are: outdoor work, few years of education, low use of protection to UV exposure (hat, sunglasses or prescription glasses). Three *quilombolas* were referred to pterygium surgery.

This study was conducted as an opportunity to describe the eye health from the isolated population of Conceição das Crioulas during a primary care initiative and therefore has some limitations. Participants were not selected following best practices for sampling, all residents seeking eye care who agreed to participate were included. Sophisticated exams were not available because of deficiencies in local infrastructure and limiting time and human resources. On the other hand, subjects with eye conditions were treated or referred to specialized services.

Characterization of health conditions from marginalized groups is very important for understanding their actual necessities. In this study, eye health from a very specific vulnerable population, Brazilian slave-descendant *quilombo* remnant community, was evaluated. Blindness, cataract and pterygium were highly frequent. Data collected may help planning preventive and promotive actions for eye health of socioeconomic disadvantaged *quilombo* populations.

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Conflicts of interest

None of the authors have any proprietary interests or conflicts of interest related to this submission.

The authors declare that this manuscript has not been published nor submitted simultaneously for publication elsewhere.

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