

Visual acuity and academic performance of students in a Brazilian Amazon municipality

Acuidade visual e desempenho escolar de estudantes em um município na Amazônia Brasileira
La agudeza visual y el rendimiento escolar de estudiantes en una ciudad de la Amazonia Brasileña

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ABSTRACT

Objective: To evaluate visual acuity deficiency and its association with academic performance in schoolchildren. **Methods:** A cross-sectional study was carried out with 1,050 students between 05 and 17 years of age from the public school system of Barcelos, Amazonas. The examination was performed at the school itself and with the aid of Snellen's Optometric Scale. **Results:** Of the 1,050 students submitted to the examination, 526 (50.1%) were female. The frequency for low acuity was 6.3% (66/1050). Among the students evaluated, there was no statistically significant difference at a 5% level for visual acuity and academic performance ($p = 0.223$). **Conclusion:** The study indicated a low frequency for visual deficit in the public school students of Barcelos - AM. In spite of this, it is advisable to carry out actions directed to eye health throughout the educational public network, aiming at prevention and early treatment of these students.

Keywords: Visual Acuity; School Health; Health Education; Epidemiology; Eye Health.

RESUMO

Objetivo: Avaliar a deficiência na acuidade visual e sua associação com o desempenho escolar em escolares. **Métodos:** Estudo transversal realizado com 1.050 estudantes entre 05 e 17 anos de idade, da rede pública de ensino de Barcelos, Amazonas. O exame foi realizado na própria escola e com o auxílio da Escala optométrica de Snellen. **Resultados:** Dos 1.050 estudantes submetidos ao exame, 526 (50,1%) pertenciam ao sexo feminino. A frequência para baixa acuidade foi de 6,3% (66/1050). Entre os alunos avaliados, não houve diferença estatisticamente significativa em nível de 5% para acuidade visual e desempenho escolar ($p = 0,223$). **Conclusão:** O estudo indicou baixa frequência para déficit visual nos estudantes da rede pública de ensino de Barcelos - AM. Apesar disso, aconselha-se a realização de ações voltadas à saúde ocular em toda rede pública de ensino, visando à prevenção e o tratamento precoce desses estudantes.

Palavras-chave: Acuidade Visual; Saúde Escolar; Educação em Saúde; Epidemiologia; Saúde Ocular.

RESUMEN

Objetivo: Evaluar la deficiencia en la agudeza visual y su relación con el rendimiento escolar en alumnos. **Métodos:** Estudio transversal, realizado con 1.050 estudiantes entre 5 y 17 años, de la red pública de enseñanza de Barcelos, Amazonas. El examen fue realizado en la propia escuela, con la ayuda de la Escala Optométrica de Snellen. **Resultados:** De los 1.050 estudiantes sometidos al examen, 526 (50,1%) eran mujeres. La frecuencia de baja agudeza fue del 6,3% (66/1050). Entre los estudiantes evaluados, no hubo diferencia estadísticamente significativa en el nivel 5% de la agudeza visual y el rendimiento escolar ($p = 0,223$). **Conclusión:** El estudio indicó baja frecuencia para estudiantes con discapacidad visual en Barcelos. Sin embargo, se recomiendan acciones dirigidas a la salud ocular en todas las escuelas públicas, visando la prevención y el tratamiento precoz de estos estudiantes.

Palabras clave: Agudeza Visual; Salud Escolar; Educación para la Salud; Epidemiología; Salud Ocular.

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INTRODUCTION

Vision is responsible for most of the sensory information received from the environment.^{1,2} The integrity of this sense is indispensable for the child's learning.¹ Visual problems, once unidentified and without proper treatment, can jeopardize the efficiency of the teaching/learning process, leading to disinterest and poor academic performance, triggering dropouts from school.^{1,3,4}

The World Health Organization estimates that the number of children and adolescents with visual impairment for uncorrected refractive error is 153 million, of which eight million are blind (this estimate does not consider presbyopia sufferers). In the global context, uncorrected refractive errors are the main causes of visual impairment in children and adolescents.⁵

Based on the latest census of the Brazilian Institute of Geography and Statistics (IBGE), conducted in 2010, 23.9% of the Brazilian population has some kind of visual, auditory or motor deficiency. It also found that 5.3% of children between 0 and 14 years of age are visually impaired.⁶

The Ministry of Education, in conjunction with the Ministry of Health, is carrying out actions to prevent and promote the visual health of public school network students. The "Olhar Brasil" [Brazil Vision] Project, launched in 2007, provides for the participation of teachers, literacy teachers and Community Health Agents in identifying and correcting vision problems in students enrolled in Elementary Education, in young people aged 15 years or older and in adults of the Literate Brazil Program.⁴ The Health in School Program (PSE) directs the Family Health teams to evaluate the health conditions of children, adolescents and young people who are members of the schools enrolled in their assigned territories, and Ophthalmological Assessment is one of the health actions envisaged under the PSE.⁷

There is unanimity among the experts regarding the relevance of the early detection of visual problems, since they prevent serious future problems and contribute to the prevention of permanent damage to vision.^{4,8,9} In Brazil, studies point to visual problems as the precursors of headaches, dizziness, visual fatigue and red eyes among Basic Education students.⁴

From a public health point of view, the investigation of eye problems by ophthalmologists through mass examination in children is very expensive.⁸ The Snellen Optometric Scale visual acuity test is one of the best indicators of visual function, given that the examiner doesn't need to have a high level of specialization, or extensive training, nor does it require great effort on behalf of the patient or even sophisticated equipment for comprehension.^{8,10,11} Indeed, once there is suspicion of eye problems, the test should be provided as soon as possible,¹² in order to avoid higher expenses, since the cost of Ophthalmology by SUS [Brazil's Unified Health System] represents the third largest budget per specialty, being surpassed only by the cost of cardiology and oncology.¹³

The range of studies on low visual acuity in the Amazon Region is limited, which is why this study's importance arises, aiming to verify the deficiency in visual acuity in elementary education students of the public school system in the urban area of Barcelos - Amazonas, as well as to evaluate its association with their academic performance. This study will help in the construction of an epidemiological reference, and also to generate strategic definition tools, allowing actions of prevention, promotion and recovery of these students' eye health.

METHODS

A cross-sectional study was carried out in the city of Barcelos, in the state of Amazonas, to which access is only by air or river transportation. The municipality is located 405 km from the capital, with a population of 25,718 inhabitants, 43.4% of which are urban residents.¹⁴ The health care network has a general hospital and four Basic Health Units. Only 62.88% of this population is serviced by Primary Care and, as recommended by the Health in School Program (2009), the Family Health teams are responsible for monitoring the health of children, adolescents and young students from schools in their assigned territories.¹⁵

This project is part of the Rural Internship in Collective Health course at the Amazonas State University. This subject is mandatory and also involves the Medicine course final year students, and comprises activities performed in basic health care services in some municipalities located in the interior of the state of Amazonas.

This study was approved by the Research Ethics Committee of the Amazonas State University through Opinion No. 197/2012. It began in November 2012 and ended in December 2013, involving students aged between 5 and 17, enrolled in elementary education (1st to 9th year) of the public school system, living in the urban area of that city.

Students aged 17 years and over, those who did not present their guardians' authorization (students \leq 17 years), and those who did not allow the examination (students \leq 17 years) were excluded from this study.

Through a mapping of the city of Barcelos-AM, and as the municipality does not have private schools, research was limited to the number of schools in the municipal and state education network, as well as the number of students enrolled in elementary education, in a total of seven schools (four municipal and three state schools) and 2,439 schoolchildren (674 and 1,765 schoolchildren in the municipal and state education network, respectively).

1,050 (498 from municipal and 552 from state schools) students agreed to participate in the study from a total of 2,439 students enrolled in elementary education in the public school system of the Barcelos urban area, representing a response rate of 43.1%.

Initially, through a conversation circle, all study participants received an explanation about human eye anatomy, refractive

disorders and guidance on the importance of early diagnosis of visual disturbances. The visual acuity test was then carried out by a group of seniors from the Medical School of the Amazonas State University, trained by a teacher with expertise in the area, who participated in the research. The training process comprised a total workload of 16 hours (theory - practice) in order to standardize the technique among the 11 examiners.⁴

The entire examination was carried out in the school itself, in a well-lit classroom and with the aid of Snellen's Optometric Scale, at a distance of five metres, which has as measurement unit values of 0.1 to 1.0. Students of all ages who presented visual acuity (VA) values greater than or equal to 0.8 for both eyes were classified as having normal VA, and those with VA values lower than or equal to 0.7 for one or both eyes were classified as having VA deficit, following the Ministry of Health standardization.^{4,7}

In this study, academic performance was measured through the grade average of the last school year, and was considered satisfactory when the general average obtained was greater than or equal to 70 points; regular when between 60 points and 70 points; and unsatisfactory when less than 60 points.¹⁶ Because it is a municipality with no private schools, and having a low Human Development Index (HDI) of 0.500, it was decided not to collect socioeconomic information.¹⁷

In this study, we detected the students who presented low visual acuity in the Municipality of Barcelos, with aspects of early detection, and the Municipal Health Department was informed about these students so they could be evaluated by a specialist and, if necessary, receive appropriate treatment.

All data was recorded in an Excel table and statistically evaluated in the SPSS program version 20.0. Data was presented using tables. The frequencies were calculated in SPSS and Confidence Interval at the 95% level (95% CI). The chi-square, Pearson and Fisher test was used to analyse the categorical data, and the significance level set in the tests was 5%.

RESULTS

Of the 1,050 students who underwent screening, 526 (50.1%) were female. The frequency of low acuity was 6.3% (66/1050), with 95% CI (4.9% - 7.9%), who were referred for medical examination.

Table 1 shows the relationship between low visual acuity and the variables gender ($p = 0.662$), school type ($p = 0.665$) and average age ($p = 0.893$).

Analysing the two eyes separately, 46 students (4.4%) had altered VA in the right eye and 49 students (4.7%) in the left eye. According to the Fisher Test result ($p = 0.89$), there was no statistically significant difference. There is no relation on visual acuity between the right and left eyes (Table 2). Over the course of the examination, it was observed that 136 (13%) schoolchildren had signs and symptoms such as: burning, tearing, squinting, frowning, head tilting, blinking, blurred vision, glasses, strabismus and hyperaemia.

Table 3 shows the relationship between visual acuity and the academic performance variable ($p = 0.223$).

DISCUSSION

The relevance of this work is due to the inexistence of studies related to reduced visual acuity in the city of Barcelos, Amazonas, providing an awareness of problems that, once diagnosed and resolved, can contribute to the improvement of the quality of life, academic performance and means to avoid compromising the effectiveness of the teaching-learning process.^{3,4,8,18} The evaluation and detection of possible eye diseases should be performed as early as possible, since the longer the delay in the determination of visual problems, the lower are the chances of recovery and correction of the problem.¹⁶

Because it is a simple method of measuring visual acuity, the Snellen Optometric Scale can be used as an instrument for the early screening of ophthalmological problems, mainly in municipalities with few financial or social-technical resources.^{1,19} According to the Brazilian Council of Ophthalmology (CBO), such assessment may be performed by Community Health Agents, Nurses, Nursing Assistants, Teachers, Literacy Teachers or by any other person, provided that they are adequately qualified.⁷

A visual deficit was observed in only 6.3% of the students examined. However, it is worth noting that the study was performed only with 43.1% of the city's public school system students.

The prevalence of altered visual acuity was higher in females (6.6%), being in agreement with the study in Curitiba (PR)¹⁸ and with the 2010 Demographic Census.⁶ Differing from the findings of Pouso Alegre (MG), where the prevalence was higher for males.¹⁹ Most studies indicate that women of all ages in all regions of the world have a considerably higher risk of being visually impaired in relation to men, especially in the case of higher life expectancy, and in those societies with considerable reduction of purchasing power, due to the limited access to health services.⁵

The low frequency of reduced visual acuity found in the present study corroborates the results of similar studies, such as those performed in Londrina (PR) with 17.1%,³ in Pelotas (RS) with 15.1%,¹ in Sorocaba (SP) with 13.1%,²⁰ in Manaus (AM) with 7%,²¹ in Passo Fundo (RS) with 10.9%,⁸ in Pouso Alegre (MG) with 11.4%,¹⁹ in Curitiba (PR) with 7.03%,¹⁸ and in Belo Horizonte (MG) with 10.3%.⁹ In any case, it is suggested that joint prevention programs of the Health and Education Departments be strengthened, in order to guarantee continuous decline of the visual deficit and consequent improvement of the students eye health. According to the Ministry of Health, the school is an environment conducive to the initiation and continuity of programs aimed at health education directed at children and adolescents, and it should be emphasized that it is the responsibility of the Family Health teams to assess the health conditions of children and adolescents enrolled in the schools in their assigned territories.⁷

Table 1. Distribution of school attendance in relation to gender and type of school according to Visual Acuity in Barcelos, Amazonas, 2013

Variables	n	Acuity				p*
		Low (< 0.8)		Normal (≥ 0.8)		
		fi	(%)	fi	(%)	
Gender						0.662
Male	524	31	5.9	493	94.1	
Female	526	35	6.6	491	93.4	
Total	1050	66	6.3	984	93.7	
Schools						0.665
State Schools	552	33	6.0	519	94.0	
Municipal Schools	498	33	6.6	465	93.4	
Total	1050	66	6.3	984	93.7	
Age (Average ± SD)	1050	11.2 ± 3.2		11.0 ± 2.9		0.893**

* Statistical chi-square test; ** t-student test; fi: absolute frequency; SD: standard deviation.

Table 2. Distribution of schoolchildren by age according to Visual Acuity in Barcelos, Amazonas, 2013

Age	n	Right eye		Left eye	
		Low (< 0.8)	Low (< 0.8)	Low (< 0.8)	Low (< 0.8)
		fi	(%)	fi	(%)
5 years	04	0	0	0	0
6 years	56	3	5.4	3	5.4
7 years	93	3	3.2	8	8.6
8 years	100	5	5	6	6
9 years	100	8	8	4	4
10 years	81	1	1.2	2	2.5
11 years	94	3	3.2	3	3.2
12 years	147	6	4.1	8	5.4
13 years	134	5	3.7	4	3
14 years	113	5	4.4	3	2.7
15 years	63	4	6.4	2	3.2
16 years	33	1	3	4	12.1
17 years	32	2	6.3	2	6.3
Total	1050	46	4.4	49	4.7

p = 0.89 (Fisher Statistical Test); fi = absolute frequency.

In this study, no association was found between visual acuity and academic performance, corroborating the study carried out in Curitiba (PR), in 242 schoolchildren from first to third grade of an elementary school, in which a low visual acuity was observed in 7.03% of the students examined, of which only one had below-average scores (considered C).¹⁸ Although no association was found, it is essential to maintain good eye health in the school environment, and State action is essential in this regard.

In another study carried out with 201 schoolchildren between 8 and 10 years of age in a public school in the city of Pouso Alegre (MG), 11.4% of the students presented altered visual acuity, and it was observed that these students had lower grades in mathematics than those without visual deficiencies (p = 0.032).¹⁹ Another study, conducted with 161 students in the third year of elementary school in the state and municipal public network of the city of Juiz de Fora (MG), presented low VA in 34.8% of the students examined. Of these students, 25% presented regular or unsatisfactory academic performance, resulting in an association between low visual acuity and low academic performance (p = 0.015).¹⁶ In another study carried out with 338 schoolchildren from 4 to 15 years of age at the Ophthalmology Department of the Health is Citizenship/Community Action Project of the Northeast of Rio Grande do Sul, a low VA was observed in 20.1% of the students examined, and school failure was found in 28.1% of the children, showing that low visual acuity is associated with school failure (p < 0.001) and that its presence increases the chance of a child failing in school in at least one grade by approximately three times (odds ratio 2.9, with 95% CI from 1.6 to 5.0).²² Thus, several studies suggest that schoolchildren with reduced visual acuity are more subject to poor academic performance and, if untreated, it can in the future lead to limitations in their professional and social life.^{16,18,19,23}

The National School Health Survey, conducted by the Ministry of Health in 2015, shows that Amazonas has the greatest difference between the students' average grades in relation to the socioeconomic condition, both in Portuguese and in mathematics. Barcelos, being a city in the interior of the state, has peculiar characteristics, being far from the capital and offering only public schools for students. Preventive health care is limited to Family Health teams, requiring greater attention in health promotion and access to students in need

Table 3. Distribution of the visual acuity frequency of schoolchildren according to academic performance, in Barcelos, Amazonas, 2013

Academic performance	Acuity				Total
	Low (< 0.8)		Normal (≥ 0.8)		
	fi	(%)	fi	(%)	
Dropped out/Transferred	4	5.4	70	94.6	74
Regular/Unsatisfactory	43	7.4	534	92.6	577
Satisfactory	19	4.8	380	95.2	399
Total	66	6.3	984	93.7	1050

$p = 0.223$ (Fisher Statistical Test); fi: absolute frequency.

of specialized consultations. The sequelae of visual impairment can be mitigated or even avoided if they are detected as early as possible.^{14,24}

CONCLUSIONS

The study showed a visual deficit in 6.3% of the students evaluated and there was no significant association between low visual acuity and academic performance among students enrolled in elementary education in the Barcelos public school system, in the state of Amazonas. It is worth noting that this result evaluated 43.1% of the students in the public school system of the aforementioned municipality.

In spite of this, it is advisable to carry out actions directed to eye health in all the public education network, aiming at the prevention and the early treatment of these students.

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