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EVALUATION OF VISUAL ACUITY IN SCHOOLCHILDREN

Avaliação da acuidade visual de crianças escolares

Evaluación de la agudeza visual em escolares

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RESUMO

Objetivo: avaliar a acuidade visual de estudantes do ensino fundamental matriculados em uma escola pública no município de Macaé, Rio de Janeiro. **Método:** estudo transversal, de abordagem quantitativa. Participaram da pesquisa 221 estudantes com idades entre seis e 14 anos. O Teste de Exato de Fisher e o coeficiente de correlação de Pearson foram usados. **Resultado:** as maiores proporções de estudantes com baixa acuidade visual foram identificadas no primeiro ano do turno vespertino (31,58%), seguido do terceiro ano do mesmo turno (27,27%). Evidenciou-se que se identificado algum sinal sugestivo para problemas visuais, maior é a possibilidade de o estudante possuir baixa acuidade visual. A proporção de estudantes que se submeteram ao reteste no turno matutino e vespertino é igual**. Conclusão:** apesar de a maior parte de estudantes apresentar acuidade visual normal, identificou-se uma parcela com valores alterados, o que reforça a importância da saúde ocular no contexto escolar.

DESCRITORES: Criança; Serviços de saúde escolar; Saúde ocular; Acuidade visual.

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ABSTRACT

Objective: to evaluate the visual acuity of students enrolled in a public school in the city of Macaé, Rio de Janeiro, Brazil. **Method:** cross-sectional study with an analytical approach. A total of 221 students between the ages of six and 14 participated in the study. Fisher's exact test and Pearson's test were performed. **Results:** the highest proportion of students with low visual acuity was identified in the first year, in the afternoon shift (31.58%), followed by the third year in the same shift (27.27%). It was evident that, if any signs suggestive of visual problems were identified, the greater the possibility that the student had low visual acuity. The proportion of students who underwent testing in the morning and afternoon shifts was equal. **Conclusion:** Although most students had normal visual acuity, some were identified as having abnormal results. This emphasizes the importance of eye health in a school setting.

DESCRIPTORS: Child; School health service; Eye health; Visual acuity.

RESUMEN

Objetivo: evaluar la agudeza visual de estudiantes matriculados en una escuela pública en la ciudad de Macaé, Rio de Janeiro, Brazil. **Método:** estudio transversal. Un total de 221 estudiantes con edades comprendidas entre los seis y los 14 años participaron en la investigación. Se probaron la Teste Exacto de Fisher y la de Pearson. **Resultado:** las mayores proporciones de estudiantes con resultados de agudeza visual se identificaron en el primer año del mismo turno (31,58%), seguido del tercer año del mismo turno (27,27%). Se evidenció que si se identifica un signo sugestivo de un problema visual, mayor es la posibilidad de que el niño presente baja agudeza visual. La proporción de estudaintes sometidos a reevaluación en los turnos de la mañana y la tarde es la misma. **Conclusión:** Aunque la mayoría de los estudiantes tenían agudeza visual normal, una porción tenía valores alterados, lo que refuerza la importancia de la salud ocular en los escolares.

DESCRIPTORES: Niño; Servicios de salud escolar; Salud ocular; Agudeza visual.

INTRODUCTION

During childhood, school is an essential setting for an individual's social and intellectual development. Through cultural activities that stimulate the affective, psychological, and social dimensions, students develop skills that transcend the motor and cognitive spheres.

Thus, schools are an important setting for health promotion involving students and their families. To enhance prevention, promotion, and healthcare actions, the Health at School Program (PSE) was established in 2007. It is a relevant strategy that coordinates education and health actions and policies through the involvement of the school community, the health team, and basic education.[1]

The PSE recommends promoting eye health and identifying students with possible vision impairments.[1] Vision plays an essential role in all aspects of life by contributing to the performance of daily activities and is the most dominant of the five senses.[2]

Learning to read, write, and participate in school activities becomes challenging when vision is impaired. Worldwide, at least 2.2 million people have visual impairment or are blind, and at least one million of these individuals have some type of visual impairment that could have been prevented or has not yet been treated.[2]

Therefore, promoting eye health and identifying students with possible signs of impairment within the PSE is essential to promoting learning and the integral development of students. These initiatives also improve student access to health services by allowing for referral to specialized services when symptoms are identified.

Promoting eye health and assessing visual acuity in schools are important steps in preventing and detecting visual problems, including blindness and low vision in children. In the Report on Eye Health Conditions in Brazil, the Brazilian Council of Ophthalmology (CBO) warns that more than half of blind children worldwide are blind due to preventable causes, 15% of which are treatable and 28% of which are preventable.

In view of the above, the PSE proves to be a privileged opportunity for detecting visual problems in childhood and adolescence. Consequently, it is imperative to fortify and enhance access to eye health services in educational institutions, particularly in economically disadvantaged and emerging nations.

One available tool for assessing children's and adolescents' eye health in schools is the Snellen Test, which uses the Snellen Optometric Scale. It should be administered to schoolchildren aged five years and one month and older at least once a year. The Snellen Optometric Scale is a widely used, simple, quick, and economical tool.[4]

In Brazil, the number of students with visual impairments who received eye healthcare in the context of the PSE has increased. The number of students with visual impairments who received care increased from 12,524 in 2014 to 15,325 in 2019.[5]

Following this logic, a cross-sectional study was conducted with 1,407 students, aged 6-17, from the public school system in a municipality in the state of Amazonas, northern Brazil. The study identified that 86 (6.1%) of the students evaluated had impaired visual acuity in the right eye, and 94 (6.7%) had impaired vision in the left eye. Additionally, 451 students (32.1%) showed signs and/or symptoms of visual impairment.[6]

Another study conducted at a school in Araçatuba, São Paulo, revealed that of the 439 students evaluated, 75 (15%) had low visual acuity and were referred for an ophthalmological consultation. The causes of low visual acuity among students included refractive errors (56; 90.4%), strabismus (2; 3.2%), congenital cataracts (2; 3.2%), retinochoroiditis (1; 1.6%), and keratoconus (1; 1.6%).

In Santa Catarina, southern Brazil, it was found that 359 (75%) of the 465 children and adolescents evaluated had never undergone an ophthalmological assessment. Only 26 (5.6%) wore glasses, and 49 (10.5%) had abnormalities in the Snellen test in one or both eyes. Half-closed eyes and frowning were the most frequently observed signs during the test.[8]

Given this issue, this study aimed to evaluate the visual acuity of elementary school students enrolled in a public school in Macaé, Rio de Janeiro. This study aims to contribute scientific data on elementary school students' eye health, which is fundamental for developing programs and strategies that improve health professionals' performance in preventing and detecting visual problems in the school setting.

METHOD

This cross-sectional, descriptive study employed a quantitative approach, adhering to the guidelines recommended by the EQUATOR Network. The participants were 221 students enrolled in a public elementary school in Macaé, a municipality in the state of Rio de Janeiro. The inclusion criteria were: students with at least 6 years old, enrolled in the school where the research was conducted, and present in the classroom at the time of data collection. The exclusion criterion was students with special health needs.

Data was collected between February and June of 2022, and sampling was done by convenience. The researchers used a self-developed form to assess the students' visual acuity, which they administered in a reserved room at the school. The team consisted of two nurses and two nursing students who were trained by the researcher in charge to administer the test according to the Ministry of Health's guidelines.[4]

The form included student identification data: name, date of birth, age, gender, year, and class. It also included data related to visual acuity: decimal optometry in the right eye, decimal optometry in the left eye, need for retesting, signs and symptoms of visual impairment, and referral for a medical evaluation.

The Snellen optometric scale was used, following the Ministry of Health's guidelines regarding site preparation and technique application. This scale uses values ranging from 0.1 to 1.0. Students with a VA greater than or equal to 0.8 in both eyes at all ages were classified as having normal visual acuity (VA). A VA deficit is established when the value is less than or equal to 0.7 in one or both eyes. In case of VA deficit, a retest was performed seven days after the initial test.[4]

The collected data were recorded on a form and organized in an Excel file. Then, they were submitted to statistical analysis using Fisher's Exact Test and Pearson's Correlation. For Fisher's Exact Test, a 5% significance level (95% confidence level) was used, and the P-value was observed. When the P-value is less than or equal to 0.05, it reveals a statistically significant difference between the compared proportions. Pearson's correlation coefficient (r) was used to measure the degree of linear correlation between visual acuity in the right eye and visual acuity in the left eye. Data analysis was performed using RStudio software.

In compliance with Resolution 466/2012 of the Ministry of Health, data collection began after the Research Ethics Committee of the proposing institution approved the research project. Parents or the student's legal representative received a letter clarifying the objectives and methodology of the research, as well as the potential risks of student participation. Next, each student with a signed ICF received an explanation of the research and was asked if they wanted to participate. Those who agreed were given a Free and Informed Consent Form to sign.

RESULTS

Of the 123 students enrolled in the morning shift, 114 met the inclusion criteria. Of the 114 students enrolled in the afternoon shift, 107 met the inclusion criteria. Thus, 221 students, aged six to 14 years, participated in the research.

Table 1 shows the proportion of students with normal and low visual acuity considering the variables year, shift, right eye (RE), and left eye (LE).

Table 1 – Proportion of students with normal VA and with low VA considering Year/Shift/RE/LE. Macaé, RJ, Brazil, 2022

Year/Shift	**Low Visual Acuity RE**	**Normal Visual Acuity RE**
1st morning	25,00%	75,00%
2nd morning	9,52%	90,48%
3rd morning	19,23%	80,77%
4th morning	11,54%	88,46%
5th morning	14,29%	85,71%
Year/Shift	**Low Visual Acuity LE**	**Normal Visual Acuity LE**
1st morning	25,00%	75,00%
2nd morning	23,81%	76,19%
3rd morning	19,23%	80,77%
4th morning	23,08%	76,92%
5th morning	14,29%	85,71%
Year/Shift	Low Visual Acuity **RE**	Normal Visual Acuity **RE**
1st afternoon	31,58%	68,42%
2nd afternoon	22,73%	77,27%
3rd afternoon	27,27%	72,73%
4th afternoon	17,39%	82,61%
5th afternoon	19,05%	80,95%
Year/Shift	**Low Visual Acuity LE**	**Normal Visual Acuity LE**
1st afternoon	26,32%	73,68%
2nd afternoon	13,64%	86,36%
3rd afternoon	18,18%	81,82%
4th afternoon	13,04%	86,96%
5th afternoon	14,29%	85,71%

Table 1 shows that the proportion of students with normal visual acuity is higher than the proportion of students with low visual acuity in both eyes in all classes and shifts.

However, considering the variables Year/Shift and RE, the highest proportion of students with low visual acuity was identified in the first year of the afternoon shift (31.58%), followed by the third year of the same shift (27.27%). Considering the variables Year/Shift and LE, the highest proportion of students with low visual acuity was found in the first year of the afternoon shift (26.32%), followed by the first year of the morning shift (25%).

The highest proportion of students with normal visual acuity in the right eye was in the second year of the morning shift (90.48%), while the highest proportion of students with normal visual acuity in the left eye was in the fourth year of the afternoon shift (86.96%). Table 2 presents the visual acuity profile of the evaluated students.

Table 2 – VA profile of students. Macaé, RJ, Brazil, 2022

Low VA O1/O2	**Absolute Frequency**	**CI (95%)**
Low VA O1	44	0,1498 - 0,2591
Low VA O2	29	0,0910 - 0,1846
Total Students	221	-
Have any signs/symptoms	**Low VA**	**Normal VA**
Yes	40%	60%
No	7%	93%
Fisher's exact test	**P-Value**	**CI (95%)**
Yes x No	0,0000	3,7829 – 20,8095
Shift	Did retest	Didn't retest
Morning	24,56%	75,44%
Afternoon	26,17%	73,83%
Fisher's exact test	**P-Value**	**CI (95%)**
Morning X Afternoon	0,7593	0,46399 - 1,69479
Statistic/Parameter	Value	
t	14,55	
Df	219	
P-Value	0,0000	
CI (95%)	0,6773 - 0,7626	
Correlation	0,7012	

Low AV O1 – At least one of the eyes has low ACV.
Low AV O2 – Both eyes have low LCA.

Table 2 shows that of the 221 students evaluated, 44 had low visual acuity in one eye and 29 had low visual acuity in both eyes. Among students presenting signs or symptoms suggestive of visual problems, 40% had low visual acuity and 60% had normal visual acuity. Among students without signs or symptoms of visual impairment, 7% had low visual acuity and 93% had normal visual acuity.

According to the p-value (0.0000) obtained from the statistical analysis of the proportions of students with or without signs suggesting visual impairment, one can infer that the greater the number of signs or symptoms identified, the greater the likelihood that a child has low visual acuity.

Table 2 also shows that 24.56% of morning shift students and 26.17% of afternoon shift students took the retest, while 75.44% of morning shift students and 73.83% of afternoon shift students did not need a retest. Considering the p-value of 0.7593, one can state with 95% confidence that the proportion of morning students who took the retest is equal to the proportion of afternoon students who took the retest.

Additionally, Table 2 presents a significant correlation between the right and left eye variables due to the correlation coefficient value (0.7012). Data reveals that, on average, as visual acuity values in the right eye increase, visual acuity values in the left eye also increase. Therefore, it can be inferred that the likelihood of having low visual acuity in both eyes is greater than the likelihood of having low visual acuity in only one eye. Table 3 presents the visual acuity profile of students who underwent retesting.

Table 3 – VA profile of students who underwent retesting. Macaé, RJ, Brazil, 2022

Variable	Absolute Frequency	Relative Frequency (Total)	Relative Frequency (Retest)
Total Retest	56	25,34%	100,00%
Retest (RE Origin)	15	6,79%	26,79%
Retest (LE Origin)	13	5,88%	23,21%
Retest (RE and LE Origin)	28	12,67%	50,00%
Normal VA in Retest (RE)	4	1,81%	7,14%
Normal VA in Retest (LE)	6	2,71%	10,71%
Normal VA in Retest (RE and LE)	9	4,07%	16,07%

According to Table 3, of the 221 total students, 56 (25.34%) were given a retest. Of those students, 15 (6.79%) took the retest due to low visual acuity in their right eye, and 13 (5.88%) took the retest due to low visual acuity in their left eye. Therefore, 28 students (12.67%) were retested due to low visual acuity in both eyes. Of the 56 students who took the retest, four (7.14%) had normal visual acuity in only the right eye, six (10.71%) had normal visual acuity in only the left eye, and 9 (16.7%) had normal visual acuity in both eyes.

DISCUSSION

Vision plays a fundamental role in the development of children and adolescents by enabling their integration with the environment. Consequently, it is acknowledged that the evaluation of visual acuity is imperative within the educational setting, as visual impairments can impede learning processes in children and adolescents.[9-11]

In this study, the proportion of students with low visual acuity was lower than the proportion of those with normal visual acuity, both in the right eye and/or in the left eye. Most of the students evaluated exhibited normal visual acuity, a finding that is consistent with the findings of a study conducted in five municipal public schools in Feira de Santana, Bahia. In this study, 367 children were evaluated, and it was determined that 29.7% of them demonstrated low visual acuity. Conversely, a study conducted in a public school within the Federal District revealed that among the 166 children evaluated, 111 (66.87%) exhibited low visual acuity, and of these, 126 (75.9%) had never received any form of eye health care.

In the present study, the highest proportion of students with low visual acuity in the right eye was identified in the first year of the afternoon shift (31.58%), where a higher proportion of students with low visual acuity in the left eye was also identified (26.32%). Conversely, the highest proportion of students with normal visual acuity in both eyes was identified, respectively, in the second year of the morning shift (90.48%) and in the fourth year of the afternoon shift (86.96%).

The Snellen test is a standard procedure that should be performed continuously to identify changes in visual acuity as they occur. However, extant literature emphasizes that the implementation of this in school setting faces operational and local challenges, such as the lack of time, training, and commitment of the professionals involved.

During the administration of the Snellen test, it is advisable to meticulously observe any indications or symptoms that might be indicative of alterations. The findings of this study indicated that among the total number of students who exhibited signs or symptoms indicative of visual impairment, 40% demonstrated low visual acuity, while 60% exhibited normal visual acuity. The P-Value (0.0000) indicated that when identifying any suggestive sign or symptom, the greater the possibility of the child having low visual acuity.

The recognition of potential alterations, including the proximity of objects to the eyes, squinting, or widening of the eyes to enhance visual acuity, as well as tearing, can be discerned by parents, as these behaviors may indicate

the presence of refractive errors, which are prevalent. In Baltimore, Maryland, a study of 4,972 students revealed that 65% of students exhibited nearsightedness, 24% exhibited farsightedness, 60% exhibited astigmatism, and 46% exhibited clinically significant refractive error.[14]

In the present study, the retest was administered to 24.56% of the students in the morning shift and to 26.17% of the students in the afternoon shift. The analysis yielded a correlation coefficient of 0.7012, which indicated a higher probability of low visual acuity in both eyes compared to the occurrence of low visual acuity in only one eye.

A study was conducted in southeastern China with a sample of school children. The study identified that of the total 8,000 children examined, 938 had reduced visual acuity in one eye, while 453 children had low visual acuity in both eyes. The identification of low visual acuity in any of the eyes necessitates the effective referral of children and adolescents to specialized services for subsequent follow-up.

In view of the aforementioned literature, it is evident that a myriad of challenges is associated with the referral and follow-up of children and adolescents in ophthalmological services. In southeastern India, several factors have been identified as impediments to the follow-up of children in specialized services. These factors include a low level of education, low parental income, and distance from health services.[16]

In Brazil, it has been acknowledged that the school-based healthcare model can be advantageous in cases necessitating the prescription of corrective lenses. However, in the United States, approximately 15% of children who undergo eye screenings are identified as having or being at risk of developing a visual impairment, typically amblyopia, strabismus, or glaucoma. These conditions necessitate referral to a specialized professional for further evaluation and management.[17]

To ensure the efficacy of the eye care scenario, it is recommended that health programs employ a multifaceted strategy that includes the dissemination of correspondence, the issuance of reminders, and the utilization of telephonic communication to parents. This strategy should be complemented by the facilitation of transportation and the provision of complimentary ophthalmological consultations; measures designed to enhance adherence and ensure the delivery of optimal care for children and adolescents.[17]

However, it is noteworthy that enhancing the population's awareness of the significance of assessing children's visual acuity within the educational environment is paramount. This can be achieved through health education initiatives, as evidenced by the extant literature pointing to a correlation between academic performance, visual acuity, and refractive error. This association warrants further investigation by the scientific community.

Vision is conceptualized as a medullary sense that plays a pivotal role in the developmental trajectory of children and adolescents. For this reason, the resolution ratified by the United Nations on Vision for All reaffirms that improved vision and optimized functional capacity are fundamental for achieving the goals defined in the Sustainable Development Goals.[19]

CONCLUSION

The results of this study indicate that the proportion of students with normal visual acuity exceeds the proportion of students with low visual acuity. The proportion of students who submitted to the retest was equivalent when considering the morning and afternoon shifts. Moreover, the presence of any sign or symptom that suggests the potential for visual problems increases the likelihood of the student having low visual acuity.

Furthermore, the study indicates that the probability of exhibiting low visual acuity in both eyes simultaneously is higher than the probability of having low visual acuity in a single eye.

While it is acknowledged that the issue under discussion does not represent the totality of elementary school students in the municipality of Macaé, it is nevertheless recognized that the issue in question should be addressed in schools with parents, given its impact on learning processes, quality of life, and effective development.

The study's reliance on non-probabilistic sampling is acknowledged as a limitation, precluding the possibility of extending the findings to a broader population. However, the data revealed were fundamental for the proposition of health education activities on the subject with the students evaluated, as well as for referrals to ophthalmological consultations. For this reason, the intervention was only implemented after a diagnosis that was supported by the results. This demonstrates the practical scope of the research and indicates the possibility of planning an intervention for other contexts and establishing a foundation for new research.

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