




Towards the development of a uniform screening guideline: Current status of paediatric vision screening in Abia State, Nigeria



Authors:

Uchenna C. Atowa¹ 
Samuel O. Wajuihian¹ 
Rekha Hansraj¹ 

Affiliations:

¹Department of Optometry,
College of Health Sciences,
University of KwaZulu-Natal,
Durban, South Africa

Corresponding author:

Uchenna Atowa,
atowauc@gmail.com

Dates:

Received: 28 Feb. 2021
Accepted: 07 Mar. 2022
Published: 29 Apr. 2022

How to cite this article:

Atowa UC, Wajuihian SO,
Hansraj R. Towards the
development of a uniform
screening guideline: Current
status of paediatric vision
screening in Abia State,
Nigeria. Afr Vision Eye
Health. 2022;81(1), a661.
[https://doi.org/10.4102/
aveh.v81i1.661](https://doi.org/10.4102/aveh.v81i1.661)

Copyright:

© 2022. The Author(s).
Licensee: AOSIS. This work
is licensed under the
Creative Commons
Attribution License.

Background: Vision screening is an important component of any child eye health system. Availability of standardised and broad screening guidelines is important to its success because it will allow for uniform and full utilisation of services through the system.

Aim: This study aimed to evaluate the coverage, components, and referral criteria of the paediatric vision screening services in Abia State, Nigeria, towards the development of a uniform vision screening guideline.

Methods: Eighty-three registered optometrists practising in Abia State for at least one year prior to the commencement of the study were invited to participate. Self-administered questionnaires were distributed directly or via email to the optometrists. The questionnaire covered areas such as the participation of optometrists in paediatric vision screening, coverage of the screening programmes, screening tools and referral criteria.

Results: A response rate of 77.1% (64 participants) was recorded for the survey. Twenty-eight (43.8%) respondents offered more than one paediatric vision screening outside their practice in the last year before the survey. Among those respondents, 20 were from the private sector and 20 were based in urban cities. Only 10 respondents undertook more than four paediatric screening services within this period. Visual acuity measurement and ocular health assessment were the main components of the screening batteries of optometrists. While a child with any disease abnormality was referred for evaluation, the referral criteria for a full examination were inconsistent.

Conclusion: The existing paediatric screening programmes in Abia State are inadequate. Of the few conditions that are screened for, varied referral criteria for further examination are applied. It therefore appears that the current screening programmes are not meeting the visual needs of the paediatric population and suggests the need for a new strategy to improve vision screening provisions to children in Abia State.

Keywords: paediatrics; vision screening; screening coverage; test batteries; referral criteria; screening guidelines.

Introduction

Vision screening is an important component of the child eye health system as it helps to identify children who are already affected by, or prone to have, ocular conditions that requires referral for further evaluation and treatment.¹ Over the past few decades screening services and test batteries have evolved to detect several remediable visual conditions in children. Traditionally, paediatric vision screening involved only the Snellen visual acuity test and was focused on detecting children with reduced distance visual acuity thereby having the possibility of missing several other important basic visual skills.^{2,3,4} Consequently, test batteries including the modified clinical technique,⁵ the New York State Optometric Association test battery⁶ and the computerised vision efficiency rating (known as VERA) screening battery⁷ were designed to detect a wider range of vision problems. Vision problems encountered in the paediatric population can include reduced visual acuity at distance and near, refractive errors, strabismus and significant heterophoria, insufficient accommodative facility, fusional reserves, receded near point of convergence, colour vision anomalies, reduced stereopsis, and pathological problems. Furthermore, the need to address the inequalities in eye care delivery and enhance the effectiveness of paediatric vision screening services prompted countries such as the United States,⁴ Australia,⁸ Sweden,⁹ United Kingdom¹⁰ and Canada¹¹ to develop strategies that

Read online:



Scan this QR
code with your
smart phone or
mobile device
to read online.

have improved the provision and participation of vision screening in their domains. A significant increase in the number of children who are receiving vision screenings, as well as significant reduction in the prevalence of paediatric vision conditions have been reported for these countries.^{8,9,10,11}

Nigeria is the most populous country in sub-Saharan Africa with almost half (46%) of its 180 million population consisting of children under the age of 15.¹² Eye care services are provided at public and private health facilities. However, there exists geographical disparity in the delivery of eye care services in Nigeria.^{13,14,15,16,17} A review of paediatric eye care in Nigeria found that of the 400 ophthalmologists (including those in training), only 12 specialised in paediatric ophthalmology and 95% – 99% of them were practising in urban areas.¹⁴ A situational analysis of optometry in Africa has reported a similar trend. Of the approximately 4000 optometrists in Nigeria, 60% are working in Federal capital territory and in private settings.¹⁵ Specifically, in Abia State, the few eye care (primary, secondary, and tertiary) facilities are in the cosmopolitan cities of Aba and Umuahia. In addition, school eye health has not received adequate attention from the government.^{13,14,15,16,17,18} Unavailability and inaccessibility of eye care services to many children warrants the need for regular screening programmes especially in the under-served and under-resourced rural areas of Abia State and Nigeria as a whole.

Currently, vision screening programmes in Abia State and Nigeria are mainly organised by individual eye care practitioners including optometrists. Such screening programmes lack strategic coordination and are mainly for the economic benefit of the eye care practitioner, rarely focusing on the needs of the paediatric population. Consequently, some visual conditions such as near vision anomalies, which may affect school performance,^{19,20,21,22,23} may be overlooked. Thus, it is important to have uniform and broad screening guidelines with a valid, reliable, age-appropriate test battery and an adequate referral system. This study will assess the extent of paediatric vision screening provision to school children from ages 5 to 16 years in Abia State and identify the vision screening test battery and referral criteria used. The findings are expected to direct the development of a uniform and broad paediatric vision screening guidelines.

Methods

Participants

All optometrists who are registered with the Optometrists and Dispensing Opticians Registration Board of Nigeria (ODORBN) and currently practising for at least one year, in public and private eye care facilities in Abia State were invited to participate in this study, that is, saturated opportunistic sampling was used. Optometrists were contacted via email, telephonically or

visitation during the bimonthly meeting of the Nigerian Optometric Association Abia State chapter and at their individual offices.

Procedures

A self-administered questionnaire, comprising of mainly closed-ended questions was the data collection tool. Questionnaires were distributed to all registered optometrists in Abia State either as a hard copy or via email. The principal investigator was available or contactable to provide further clarification on any of the questions if required. Participants returned the questionnaires at their convenience with there being no obligation to participate in the survey. Returned questionnaires were included in the analysis if they were completed by registered optometrists currently practising in Abia State for at least one year prior to the commencement of the study. Participants of the initial pilot exercise were excluded from the main study. The questionnaire covered areas such as the participation of the optometrist on paediatric vision screening, location of the screenings, the ages of children being screened, tests performed and referral criteria. Information on the number of children referred to the optometrist from a screening programme, and the reason for referral, were also included in the questionnaire. The questionnaire could be completed in approximately 25 min.

Statistical analysis

The data were entered onto a Microsoft Excel spreadsheet with data cleaning and consistency checks conducted by the principal investigator. Data analysis was performed using Microsoft Excel and the results were presented in frequency tables and figures.

Results

Location of the respondents

Of the 83 registered optometrists contacted to participate in the survey, 64 responded, giving a response rate of 77.1%. The distribution of participants, organised by practice location and sector (public or private), is presented in Table 1. Approximately 87.5% were working in the two cosmopolitan cities of Aba and Umuahia and 71.9% were working in private eye care facilities across the state.

TABLE 1: Respondents demographics by practice location and setting as well as optometrists that have participated in at least one vision screening in the last 1 year.

Practice location/sector	Number of responses		Optometrists involved in screening	
	<i>n</i>	%	<i>n</i>	%
Location				
Aba	20	31.3	8	40.0
Umuahia	36	56.3	12	33.3
Other	8	12.5	8	100.0
Sector				
Public	14	21.9	7	50.0
Private	46	71.9	20	43.5
Both	4	6.3	1	25.0

Vision screening delivery and coverage

Twenty-eight (43.8%) participants reported to have provided at least one vision screening outside their practice that included children as participants in the last one year before the survey. Among this number, 20 (71.4%) are from the private sector and either based in Umuahia or Aba (Table 1). Table 2 shows the various centres where the screening exercises were conducted. Over half (57.1%) of the optometrists involved in screening exercises have provided vision screening in a school setting. The frequency of the vision screening service delivery was low. In the last one year prior to the study, 10 (35.7%) of these optometrists have each undertaken not more than two paediatric vision screening exercises, another 10 (35.7%) have provided vision screening service more than four times, while 6 (21.4%) have been involved in three screening exercises.

Among those respondents who participated in a vision screening of schoolchildren, four (14.3%) were involved in screening organised by themselves, three (10.7%) were involved in screening organised by schools, nine (32.1%) were involved in screening organised by non-governmental organisations and one optometrist participated in a screening exercise organised by government. With respect to services provided to school-age children, vision screenings are offered by private sector optometrists within their practice locations primarily to create awareness and for business economic reasons. In instances of vision screening conducted outside of their practice locations, it often involved optometrists or ophthalmologists who were collecting data for research purposes.

As a way of improving the coverage of paediatric vision screening, some respondents suggested that vision screening should be legislated and become a policy, just like the National Program on Immunization. Others suggested that teachers and parents should be given basic knowledge in eye care to help in the early detection of children with ocular-visual problems. There is also a call for improvement in the delivery of primary healthcare by getting more optometrists and other eye care practitioners involved.

Components (test batteries) of vision screening programmes

The test batteries of the optometrists that have provided at least one vision screening programme in the last one year prior to the study are presented in Table 3. The analysis of the responses showed that visual acuity and ocular health assessment (using either the penlight and/or ophthalmoscope)

TABLE 2: Number of optometrists who performed vision screening in various screening centres.

Screening centres	Number of optometrists	Percentage (%) (n = 28)
School	16	57.1
Community	8	28.6
Religious places	6	21.4
Others	2	7.1

Note: The total number of responses by optometrists for the screening centres (n = 32) is more than the number of optometrists who have participated in at least one vision screening (n = 28) in the last one year before the study because some optometrists have undertaken screenings at more than one site.

procedures were the major components of the screening battery of optometrists. Further information indicates that most optometrists prefer the problem-oriented approach. They tend to focus strictly on significant eye problems, those either mentioned by the patient or obvious to the doctor; therefore tests like retinoscopy, stereopsis, and colour vision are excluded from the screening battery. Children who need such examinations are usually referred to a clinic where such examinations are carried out.

Referral criteria

The referral criteria adopted by individual optometrists for each of the tests included in a screening battery are presented in Table 4. Only screening tests (visual acuity, cover test, ocular motility and ocular health) which are reported in Table 3 are presented here. The result shows no definitive criteria for the test batteries.

Other responses

Furthermore, we analysed responses of those optometrists who had consulted children (6–18 years) in their various practices who were referred for comprehensive evaluation and treatment from a vision screening programme in the last

TABLE 3: Number of optometrists that performed specific vision tests in paediatric vision screenings.

Test batteries	Optometrists	
	n	%
Visual acuity/refractive status		
Monocular distance visual acuity	28	100.0
Near visual acuity	20	71.4
Hyperopia (plus lens test)	0	0.0
Refraction (retinoscopy/autorefraction)	4	14.2
Binocular vision test		
Strabismus (cover test/Hirschberg test)	10	35.7
Ocular motility	4	14.3
Near point of convergence	0	0.0
Phoria measurement	0	0.0
Stereoacuity	0	0.0
Accommodative amplitude	0	0.0
Colour vision test	0	0.0
Ocular health		
External (Penlight) examination	28	100.0
Ophthalmoscopy	20	71.4
Other	0	0.0

N = 28.

TABLE 4: Referral criteria applied by optometrists for various test protocols.

Test batteries	Criteria	Optometrists	
		n	%
Visual acuity/refractive status			
Distance visual acuity	< 6/6	21	75.0
	< 6/9	7	25.0
Near visual acuity	< N ₆	20	71.4
Binocular vision test			
Strabismus (cover test/Hirschberg test)	Not reported	0	0.0
Ocular motility	Not reported	0	0.0
Ocular health			
External (Penlight) examination	Any abnormality	28	100.0
Ophthalmoscopy	Any abnormality	20	71.4

N = 28.

one month. Of the respondents, 18 (29.5%) had seen at least one child in their clinic who was referred from a vision screening programme. Among these optometrists, 16 (88.9%) reported that the children were referred from vision screening conducted by optometrists while two (11.1%) respondents did not know who had referred the children. None of the respondents reported to having seen children referred by ophthalmologists or nurses. Forty percent of the optometrists reported that the children who presented to their clinic from a vision screening programme were mostly from primary school. The reasons for the referrals of the children seen by optometrists in their clinics are presented in Table 5.

Discussion

In this study, the coverage, components, and referral criteria of paediatric vision screening services in Abia State by optometrists are evaluated. The findings indicate that the provision of paediatric vision screening is irregular and only a small number of children may be receiving vision screening services from the current system. Visual acuity measurement and ocular health assessment (penlight and ophthalmoscopy) were the main components of the screening batteries of optometrists. While a child with any ocular disease was referred for further evaluation, the referral criteria for a full examination were inconsistent.

Current situation of child eye care in Abia State

Approximately, 87.5% of the respondents in the present study are practising in the metropolitan cities of Umuahia and Aba and 71.9% of the respondents are working in private eye care facilities. An earlier study in Aba, Abia State had reported that eye care services are mainly provided by private sector practitioners and are restricted to cosmopolitan cities centres.¹³ Given the disparity in the geographical spread of registered optometrists¹⁵ in Abia State, it is highly unlikely that the recommendation of the World Health Organization of at least one optometrist per 50 000 people²⁴ is achievable. The consequences of this scenario are that eye care services are unavailable and unaffordable to many children, especially those living in rural communities. Therefore, there is need to provide more eye care services including vision screenings to the residents.

Provision and coverage of vision screening programmes

Regarding the provision of vision screening, a smaller proportion of the respondents (43.8%) had participated in

TABLE 5: Reasons for referral of children seen in optometric clinics from vision screening programmes.

Reasons for referral	Number of optometrists
Distance visual acuity	17
Near visual acuity	8
Tropia/phoria	5
Pathology	8
Others	0

Note: The total number of responses by optometrists for reasons for referral ($n = 38$) is greater than the number of optometrists who have attended to children referred for comprehensive evaluation from a vision screening programme ($n = 18$) in the last one year before the study, because some optometrists reported for more than one reason.

one or more vision screening that included the paediatric population in the last one year before this study. Although the vision screening programmes were conducted in both rural and urban areas, considering the number of optometrists involved (Table 1), the frequency of participation and the population of children in Abia State, it is possible that not all school-age children are screened by optometrists in Abia State. In addition, the focus of some of the screening programmes was not on the paediatric population.

As suggested by some respondents, more eye care practitioners need to be involved in vision screening and screening should be delivered in several locations across the state, especially in rural areas. Interestingly, adequately trained non-ophthalmic practitioners in Sweden have shown competence in screening children and making necessary referrals for professional eye examination.⁹ Integrating adequately trained community health nurses in paediatric vision screenings, in addition to implementing policies that will coordinate, and guide service provision will increase the number of screeners and improve coverage of vision screening in Abia State.^{16,25} In Sweden, it is recommended that children receive numerous vision screenings before school entry. According to this policy, children are expected to have undergone six vision screenings before the age of four years and subsequently two more screenings during primary school. With the series of vision screenings, 99.0% of 4-year-old children have received one or more vision screening services which resulted in a significant decrease in the prevalence of amblyopia from 2.0% in 1970 to 0.2% in 1992.^{9,26} In British Columbia, Canada, a province-wide vision screening was established to detect vision problems in children, not more than six years of age using uniform guidelines and criteria. An appraisal of the screening programme over a 4-year period revealed that the programme reached over 35 000 kindergarten children annually, which is equivalent to roughly 9 out of 10 enrolled students.¹¹ In Australia, Queensland health authorities recommend that all children be screened for reduced visual acuity and strabismus at age 4–5 years, as well as receive up to seven vision screenings between the ages of 0.0–3.5 years by the child health nurse.⁸ A law was also passed in the state of Kentucky in the United States (US) in the year 2000 which required every child between 3 and 6 years to have a vision assessment by an eye care practitioner prior to entering public school. Overall, paediatric vision screening is part of the regular assessment of every child health visit and school health programmes in the US,⁴ because it affords the opportunity of wider vision screening coverage.

Vision screening protocols

The findings of this study indicate that distance visual acuity, penlight assessment and ophthalmoscopy were the main test batteries included in the paediatric vision screening programmes conducted by individual optometrists in Abia State. Only a few optometrists performed retinoscopy (14.2%) ocular motility evaluation (14.3%) and a cover test (35.7%)

examination with test batteries such as the plus lens test (for latent hyperopia), convergence point at near, accommodation amplitude, heterophoria measurements and colour vision test not included in their screening protocols (Table 3). The use of a problem-oriented approach in vision screening as reported by some respondents contradicts the purpose of paediatric vision screening, which is to identify and refer children affected by, or who are prone to develop, specific visual disorders, for further evaluation and treatment.^{1,23} Many children with critical vision problems who are not aware of their condition are likely to be missed.

Previous studies in Nigeria^{13,18,27,28} and elsewhere^{19,20,21,22,23} have shown that low amounts of hyperopia and astigmatism, vergence and accommodative anomalies were common visual conditions in children and such vision disorders can affect reading efficiency,^{23,29} school performance^{19,20,21,22} and the overall development of a child.^{16,23} In view of these findings, it is highly possible that the tests included in paediatric vision screenings programmes by optometrists are not meeting the most important visual needs of children in Abia State.

Referral criteria and follow-up

Although, a child with any ocular disease was referred for a further evaluation, the referral criteria for a full examination were inconsistent. Among the 28 optometrists who performed distance visual acuity testing during vision screening, 75% considered visual acuity worse than 6/6 as the criterion for referral, whereas 25% considered visual acuity worse than 6/9 as the criterion for referral (Table 4). The difference in referral criteria is expected considering that there are no vision screening guidelines in Abia State and Nigeria.

Regarding the follow-up of those referred for complete examination, it would be difficult to establish the rate of referral of screening initiatives where there are no proper documents and uniform guidelines. However, the findings of the present study show that the main reason for referral for those children who presented for complete evaluation at an optometric clinic was reduced distance visual acuity (Table 3). This may not necessarily imply that reduced visual acuity was the main problem among the children screened but that the visual acuity test was the major component of the screening batteries of optometrists in Abia.

The findings of the present study demonstrate strict adherence to research protocol and eligibility criteria. Respondents were recruited from both public and private eye care facilities as well as from rural and urban areas. In addition, data were collected using a questionnaire that was adapted from a previous children's vision screening survey in Australia²³ and respondents had the freedom to provide additional information. However, there may be errors of memory recall bias in the estimation of the frequency of respondent's participation in vision screening, number of children being screened including the components of screening batteries over a 1-year period, especially for vision screening programmes

where the respondents are not directly involved in the organisation of the event. Considering that there are no uniform guidelines, these factors may vary depending on the focus of the vision screening and the screening centres. An on-going evaluation through the development of uniform guidelines and proper documentation of vision screening data may provide a better assessment of paediatric vision screening in Abia State in the future.

Conclusion

Existing vision screening programmes, particularly for children, in Abia State are irregular and unevenly distributed and are mainly focused on the detection of reduced distance visual acuity and pathological problems. The implication is that many children with common paediatric eye conditions including those linked to reduced academic achievement are not routinely screened. For the few conditions that are screened, dissimilar referral criteria were applied in classifying participants as having vision problems and no systematic follow-up process was in place, to ensure that those identified as having problems received the recommended comprehensive evaluation. Exploration is also required in determining the value of referring refractive problems to optometrists and ocular pathology to ophthalmologists to ensure that the child receives a timely referral. Overall, it appears the current screening programmes are not meeting the visual needs of the paediatric population, thereby indicating that a new strategy is required to increase the coverage and effectiveness of paediatric vision screening in Abia State. Thus, a coordinated and broad screening guideline with the goal of improving service provision as well as to detect a wide range of vision problems is recommended.

Acknowledgements

The authors are grateful to the members of the Nigerian Optometric Association, Abia State Chapter for their participation in this study.

Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Authors' contributions

U.C.A., S.O.W. and R.H. contributed to the design and implementation of the research, to the analysis of the results and to the writing of the article.

Ethical considerations

Approval to conduct the research study was obtained from the College of Medicine Health Research and Ethics Committee, University of Nigeria, Enugu Campus (023/01/2017) and the Biomedical Research Ethics Committee of the University of KwaZulu-Natal, Durban, South Africa (BE619/16).

Funding information

This research received no specific grant from any funding agency in the public, commercial or non-for-profit sectors.

Data availability

The authors confirm that the data supporting the findings of this study are available within the article.

Disclaimer

The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors.

References

- Carlton J, Czoski-Murray C. The value of screening for amblyopia revisited. In: Lorenz B, Brodsky M, editors. *Pediatric ophthalmology, neuro-ophthalmology, genetics: Strabismus – New concepts in pathophysiology, diagnosis, and treatment*. Berlin Heidelberg: Springer; 2010; p. 95–111.
- Appelboom TM. A history of vision screening. *J School Health*. 1985;55(4):138–141. <https://doi.org/10.1111/j.1746-1561.1985.tb04102.x>
- Bodach MI, Chung I, Krumholtz I. An analysis of vision screening data from New York City public schools. *J Am Optom Assoc*. 2010;81(9):476–484. <https://doi.org/10.1016/j.optm.2010.05.006>
- Marshall EC, Meetz RE, Harmon LL. Through our children's eyes – The public health impact of the vision screening requirements for Indiana School children. *Optometry*. 2010;81(2):71–82. <https://doi.org/10.1016/j.optm.2009.04.099>
- Peters HB, Blum BL, Betman JW, Johnson F, Fellows V. The Orinda vision study. *Am J Optom Arch Am Acad Optom*. 1959;36(9):455–469. <https://doi.org/10.1097/00006324-195909000-00001>
- Lieberman S, Cohen AH, Stolzberg M, Ritty JM. Validation study of the New York State Optometric Association (NYSOA) vision screening battery. *Am J Optom Physiol Opt*. 1985;62(3):165–168. <https://doi.org/10.1097/00006324-198503000-00003>
- Galloway M, Mitchell GL. Validity of the VERA visual skills screening. *Optometry*. 2010;81(11):571–579. <https://doi.org/10.1016/j.optm.2010.07.024>
- Centre for Community and Child Health. National children's vision project: Final report [homepage on the Internet]. Murdoch Children Research Institute; 2009 [cited 2021 Nov 2]. Available from: <https://www.iapb.org/wp-content/uploads/Final-Report-Vision-Screening-May-2009.pdf>
- Kvarnström G, Jakobson P, Lennerstrand G. Visual screening of Swedish children: An ophthalmological evaluation. *Acta Ophthalmol Scand*. 2001;79(3):240–244. <https://doi.org/10.1034/j.1600-0420.2001.790306.x>
- Logan NS, Gilmartin B. School vision screening, ages 5 – 16 years: The evidence-base for content, provision and efficacy. *Ophthal Physiol Opt*. 2004;24(6):481–492. <https://doi.org/10.1111/j.1475-1313.2004.00247.x>
- Poon B, Hertzman C, Holley P, et al. BC Early childhood vision screening program final evaluation report [homepage on the Internet]. Human Early Learning Partnership. University of British Columbia; 2012 [cited 2018 Mar 21]. Available from: <https://www2.gov.bc.ca/assets/gov/health/managing-your-health/women-children-maternal-health/bc-early-childhood-vision-screening-program.pdf>
- United Nation Children and Educational Fund. Situation of women and children in Nigeria: Challenges faced by women and children in Nigeria [homepage on the Internet]. [cited 2021 Nov 2]. Available from: <https://www.unicef.org/nigeria/situation-women-and-children-nigeria>
- Atowa UC, Munsamy AJ, Wajuihian SO. Prevalence and risk factors for Myopia among school children in Aba, Nigeria. *Afr Vision Eye Health*. 2017;76(1):a369. <https://doi.org/10.4102/aveh.v76i1.369>
- Adio AO, Komolafe RD. The state of paediatric eye care in Nigeria: A situational review and call for action. *Niger Health J [serial online]*. 2013 [cited 2016 Jun 20];13:1–6. Available from: <https://www.ajol.info/index.php/nhj/article/download/90354/79769>
- International Agency for Prevention of Blindness. Situation analysis of optometry in Africa [homepage on the Internet]; 2016 [cited 2018 Apr 30]. Available from: https://www.iapb.org/wp-content/uploads/Situation-Analysis-of-Optometry-in-Africa_June-2016.pdf
- Atowa UC, Wajuihian SO, Hansraj R. A review of paediatric vision screening protocols and guidelines. *Int J Ophthalmol*. 2019;12(7):1194–1201. <https://doi.org/10.18240/ijo.2019.07.22>
- Abia State Government. Strategic Health Development Plan (2010–2015) [homepage on the Internet]. Umuahia; 2010 [cited 2018 Jun 10]. Available from: <https://studylib.net/doc/18363218/abia-state-government-strategic-health>
- Ovenseri-Ogbomo GO, Ovigwe PE. Vergence findings and horizontal vergence dysfunction among first year university students in Benin City, Nigeria. *J Optom*. 2016;9(4):258–263. <https://doi.org/10.1016/j.optom.2016.01.004>
- Williams WR, Latif AH, Hannington L. Hyperopia and educational attainment in a primary school cohort. *Arch Dis Child*. 2005;90(2):150–153. <https://doi.org/10.1136/adc.2003.046755>
- Krumholtz I. Results from a pediatric vision screening and its ability to predict academic performance. *Optometry*. 2000;71:426–430.
- Maples WC. Visual factors that significantly impact academic performance. *Optometry*. 2003;74:35–49.
- Goldstand S, Koslowe KC, Parush S. Vision, visual-information processing, and academic performance among seventh-grade schoolchildren: A more significant relationship than we thought? *Am J Occup Ther*. 2005;59:377–389. <https://doi.org/10.5014/ajot.59.4.377>
- Hopkins S. *A visual profile of Queensland indigenous and non-indigenous school children, and the association between vision and reading [Doctoral dissertation] [homepage on the Internet]*. Queensland University of Technology; 2014 [cited 2016 Aug 16]. Available from: https://eprints.qut.edu.au/71393/2/Shelley_Hopkins_Thesis.pdf
- The Optical Workforce Survey [homepage on the Internet]; 2015 [cited 2021 Nov 8]. Available from: <https://www.college-optometrists.org/uploads/assets/34645cb2-9582-4911-84672b5c888a2f22/Optical-Workforce-Survey-full-report.pdf>
- Dussault G, Dubois CA. Human resources for health policies: A critical component in health policies. *Hum Resour Health*. 2003;1:1. <https://doi.org/10.1186/1478-4491-1-1>
- Hard AL. Results of vision screening of 6-year-olds at school: A population-based study with emphasis on screening limits. *Acta Ophthalmol Scand*. 2007;85(4):415–418. <https://doi.org/10.1111/j.1600-0420.2006.00865.x>
- Atowa UC, Wajuihian SO, Hansraj R. Vergence profile and prevalence of non-strabismic vergence anomalies among school children in Abia State, Nigeria. *Ophthal Epidemiol*. 2019;26(2):121–131. <https://doi.org/10.1080/09286586.2018.1532523>
- Atowa UC, Hansraj R, Wajuihian SO. Accommodative anomalies among school children in Abia State, Nigeria. *Afr Vision Eye Health*. 2019;78(1):a465. <https://doi.org/10.4102/aveh.v78i1.465>
- Palomo-Alvarez C, Puell MC. Binocular function in school children with reading difficulties. *Graefes Arch Clin Exp Ophthalmol*. 2010;248:885–892. <https://doi.org/10.1007/s00417-009-1251-y>