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Impact of Statics Ametropia on Academic Performance of University Students of Kinshasa

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Abstract

Purpose: We aimed to evaluate negative impact on academic performance of University students in Kinshasa associated to statics ametropia in our setting. **Methods:** A cross-sectional study was performed in the Department Ophthalmology of University Hospital of Kinshasa from January to June 2022. The Faculties, department and audience were taken to carry out a survey of three-stage probability sampling technique while the students were enrolled on the register's presence to space four names (k = 4). The students have been taken ophthalmologic exam systematically visual acuity (Monoyer Ladder), slit lamp, fund ophthalmoscopy and automatic refractometer KR-920Top Con to determine ametropia. Academic performance was classified in this ways: poor (40% - 49%), passable (50% - 59%), fairly (60% - 69%), good (70% - 79%), very good (80% - 89%) and excellent (90% - 99%). Sociodemographic and clinical data have been systematically recorded in this study. Data was enrigestred in Excel software. We used SPSS version 20.0 for statistical analysis and Chi-square was used to compare proportion. Univariate and multivariate analyses were used to test association between statics ametropia and environmental factors. *p*-value inferior to 0.05 or equal was considered significant. **Results:** A total of 600 students were examined. Their age ranged from 18 to 56 years and mean age ± SD was 24.6 ± 7.1 years. Sex ratio was 1.2. The main complaints were difficulty to watch the black board 30.3%, photophobia 14.6%, blurred vision 14%, tired vision 12.1%, headache 7.8%, ocular eyes, tearing eyes 4.3%, low visual acuity 4.1%, ocular prickling 2.6%, vertigo 2.3%, itchy eyes 2.1% and red eyes 1.3%. Myopia represented 36.6%, Hypermetropia 19.8%, Simple Astigmatism myopia 8.8%, Compose Astigmatism myopia 6.5%, Mix astigmatism 3.1% and spherical anisometropia 1.8%. Video playing, telephone and computer using and light in the classroom were statistically significant to the factors risk of ametropia. **Conclusion:** This study showed sta-

tistically significant association between Myopia and successful percentage (p = 0.01).

Keywords

Impact, Statics Ametropia, Academic Performance, University Student

1. Introduction

The World Health Organization estimates that approximately 2.3 billion people live with static ametropia. Of these 2.3 billion, 6.3 million live in Africa and the most common static ametropia are myopia, hyperopia and astigmatism according to Holden et al. (2000) and Kovin (2008).

According to Jobke et al. (2008) and Sachan et al. (2018), Static ametropia is optical defect of the eye where the object image of the external world is formed either in front of the retina or behind the retina and when accommodation is zero.

Static ametropia is the most frequent reason for ophthalmological consultations (Ebana Mvogo et al., 2001).

Abbasi et al. (2013) reported that uncorrected static ametropia leads to a decrease in vision and these optical defects have a negative impact on the social, economic, individual or community level limiting academic activities and potential employment according to Shrestha et al. (2011).

In Africa, several studies on static ametropia have been devoted to the school environment, particularly in its aspects on the frequency, prevalence and negative impact on school performance according to Ayed et al. (2002), Sounouvou et al. (2008), and Nonon et al. (2013). However, few studies have addressed static ametropia in academia. The present study aimed to determine the negative impact of static ametropia on the academic performance of students associated with statics ametropia, describe the socio-demographic characteristics of Kinshasa students with static Ametropia, determine the frequency of static ametropia among students of the UNIVERSITY of Kinshasa and determine environmental factors associated with static ametropia.

- **Organisation of study**

The study was organized into an introduction, methods and other topics including the socio-demographic characteristics of students, complaints, distribution of students according to Faculty, Visual acuity brut of two eyes with statics ametropia, distribution of students with statics ametropia according to successful percentage and environmental factors (Risk factors) such as videogames, using Smartphone or computer, light intensity, personal reading hours and position in the audience.

2. Methods of Study Design

- **University of Kinshasa**

The University of Kinshasa is an official in the Democratic Republic of the

Congo. It is located in Kinshasa capital; it has 8 Faculty and mean of ten billion hundred students.

This University has the mission to contribute to solving the problems of Congolese society.

- **Static ametropia**
- **Spheric Anisometropia**

The difference of dioptric was equal or superior 1 between the two eyes.

- **Myopia:** is defined in this way:

Simple Myopia: dioptria is inferior to 3 DS.

Moderate: Dioptria varies from 3 - 6 DS.

Degenerative Myopia (Strong): Diopitria is superior to 6 DS.

- **Hypermetropia** is defined in this way:

Simple Hypermetropia: Dioptria is inferior to 3 DS.

Moderate Hypermetropia or Hypermetropia Strong: Dioptria is superior to 3DS.

- **Astigmatism**

The astigmatism is classified in this way:

Simple myopic astigmatism: when one the focal is before the retina.

Simple hypermetropique astigmatism: when one the focale is behind the retina.

Compound Hypermetropic astigmatism: Both focal lengths are behind the retina.

Compound Myopic astigmatism: Both focal lengths are before the retina.

Mixed astigmatism: when one focal length is in front and the other behind the retina.

- **Academic Performance**

Academic performance was defined according to the percentage of success in the previous year: insufficient (40% - 49%), fair (50% - 59%), good (60% - 69%), fairly good (70% - 79%), very good (80% - 89%) and excellent (90% - 99%).

- **Risk factors**

The risk factors included respectively videogames, using Smartphone or computer, light intensity, personal reading hours and position in the audience.

Light intensity: 300 - 500 lux = 1, ≥600 lux = 2, Smartphone: using = 1, no using = 2, Videogames: using = 1, no using = 2, Computer: using = 1, no using = 2.

Position in the audience: 1st - 3rd row = 1, ≥4th row = 2.

Number of personal reading: 1 to 2 hours = 1, equal and or superior = 3.

Mode of teaching: Magistral = 1, Power- point = 2.

Sample size

The sample size had been calculated using the Schwartz formula:

$$N = Z\alpha^2 * p * q / d^2$$

N = Sample size = 600, p = prevalence = 0.43, q = 1 − 0.43 = 0.57, d = level precision = 0.04, α = error risk = 0.05, Necessary of students is 600 students.

- **Participants' selection**

- **Inclusion criteria**

The inclusion criteria included:

- Any student of the University of Kinshasa regularly registered for the academic years 2022-2023;
- Any student who has given informed consent to participate in the study.

Exclusion criteria

- Any student with an acute or chronic eye condition in transparent environnements;
- Any student who refused to participate in the study;
- Any student wearing glasses.

Statistically Analysis

The qualitatives variables included sex, age, complaints, visual acuity, statics ametropia, success percentage and qualitatives variables were expressed as a percentage. Comparison of proportions was done with Chi-square test and Fisher's exact test was used if the chi-square conditions were not fulfilled. Univariate regression analysis with backward elimination was used to determine the level of association between potential risk factors and statics ametropia. Odds ratio (OR) and its 95% confidence Intervals (CI) for potential risk factors were assessed by univariate analysis and independent association was confirmed by multivariate analysis. The independent variables included videogames, using smartphone, computer, light, position in the classroom, hours number of personal reading hours and teaching mode. The significance level was set to a value of $p < 0.05$.

Ethical approval

The study received approval from the section of the Ministry of Public Health and the head committee n˚350/CNES/BN/PMMF/2022.

3. Results

Sociodemographic, clinical and environmental data were systematically recorded in this study.

Overall, 600 students were examined, their ages ranged from 18 to 56 years, with mean age ± standard deviation (SD) being 24.6 ± 7.1 years. Gender male for males was 1.2 (330 males for 270 females). Group age from 18 to 30 years was predominated with 87.2% in Table 1.

In Figure 1, the main complaints were in decreasing order difficulty seeing the board 30.3%, followed by photophobia 14.6%, blurred vision 14%, asthenopia 12.1%, headache 7.8%, tearing 4.3%, low visual acuity 4.1%, ocular eyes 3%, ocular prickling 2.6%, vertigo 2.3%, itchy eyes 2.1%, red eyes 1.3% and diplopia 1%.

Of all the students examined in the different faculties, myopia was statistically significant (40% vs 20.6%, 38.6 vs 47.3%) ($p = 0.0001$), simple myopic astigmatism was statistically significant (4% vs 16%, 4.6 vs 10.6%) ($p = 0.0004$), emmetropia was statistically (30% vs 24%, 22% vs 16.6%) ($p = 0.037$), Compound Myopic astigmatism was not statistically significant (5.3% vs 6.6%, 8% vs 6%) (p

Table 1. Sociodemographic characteristics of students.

Age/years	All students	Sex				*p*-value
		M		F	Total	
	n (600)	n (330)	%	n (270)	%	
18 - 30	523	275	52.5	248	47.4	0.009
31 - 43	51	38	74.5	13	25.4	0.001
44 - 56	26	17	65.3	9	34.6	0.142

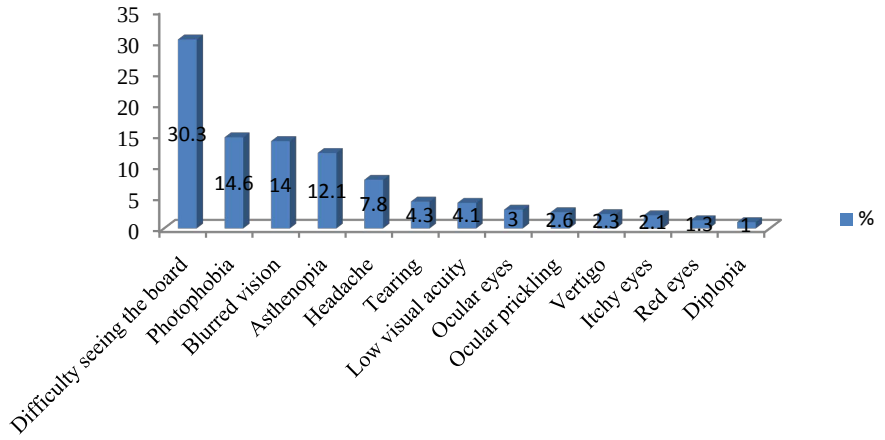

Figure 1. Complaints of Students with statics ametropia.

= 0.8), Mixed astigmatism was not linked statistically significant (2.6% vs 3.3%, 4% vs 4%) (p = 0.89), Spheric anisometropia was not associated statistically significant (2% vs 2.6%, 1.3% vs 1.3%) (p = 0.79) to the academic performance in Table 2.

In Table 3: 47.6% of the students had a visual acuity between 1.0 - 0.8, 41.5% had a visual acuity of 0.7 - 0.5 while 10.8% had a visual acuity between 0.4 - 0.2.

In Table 4, Emmetropia had statistically significant association with success percentage (32.2% vs 21.4, 35.6 vs 25.8) p = 0.008), Myopia had statistically significant association with success percentage (45.1% vs 34.3%, 22.4 vs 37.9) (p = 0.01) while Simple myopic astigmatism had not statistically significant association (6.4% vs 12.2%, 11.8% vs 10.3%) (p = 0.2), Compound Myopic astigmatism had not statistically significant association (3.2% vs 1.2%, 2.0% 1 vs 1.7%) (p = 0.5), Mix astigmatim had not statistically significant association (3.2% vs 5.5%, 8.04% vs 5.1%) (p = 0.3), Spheric anisometropia had not statistically association significant (0% vs 0%, 2% vs 1.7%) (p = 0.44).

In Table 5, the univariate analysis showed that the lighting in the audience, the use of smartphones, the computer and video games were statistically correlated to the risk factors of static ametropia. It is not the case that position in the audience, the number of hours of personal reading, and the mode of teaching were not statistically correlated to the risk factors of static ametropia.

Using the multivariate model, the lighting in the audience, the use of the

Table 2. Distribution of statics ametropia of students according to faculty.

	Medecine		Right		APS		Polytechnique		*p*-value
	n (150)	%	n (150)	%	n (150)	%	n (150)	%	
Spheric Anisometropia	3	2	4	2.6	2	1.3	2	1.3	0.79
Mixed Astigmatism	4	2.6	5	3.3	6	4	4	2.6	0.89
Compound myopic astigmatism	8	5.3	10	6.6	12	8	9	6	0.81
Simple myopic astigmatism	6	4	24	16	7	4.6	16	10.6	0.0004
Emmetropia	45	30	36	24	33	22	25	16.6	0.037
Hypermetropia	24	16	40	26.6	32	21.3	23	15.3	0.047
Myopia	60	40	31	20.6	58	38.6	71	47.3	0.0001

Legend: APS: Administrative Political Sciences, %: Percentage.

Table 3. Visual Acuity brut of students in two eyes with statics ametropia.

Visual acuity	Right eye		Left eye		*p*-value
	N	%	N	%	
1.0 - 0.8	286	47.1	286	47.1	0.99
0.7 - 0.5	249	41.5	249	41.5	0.99
0.4 - 0.2	65	10.8	65	10.8	0.99

Table 4. Distribution of statics ametropia according to success percentage.

	Success percentage								
	70% - 79%		60% - 69%		50% - 59%		40% - 49%		*p*-value
	n (31)	%	n (163)	%	n (348)	%	n (58)	%	
Spheric Anisometropia	0	0	0	0	2	0.57	1	1.7	0.44
Mixed Astigmatism	1	3.2	9	5.5	28	8.04	3	5.1	0.3
Compound myopic Astigmatism	1	3.2	2	1.2	7	2.01	1	1.7	0.5
Simple myopic Astigmatism	2	6.4	20	12.2	41	11.8	6	10.3	0.2
Emmetropia	10	32.2	35	21.4	124	35.6	15	25.8	0.008
Hypermetropia	3	9.6	41	25.1	68	19.5	10	17.2	0.2
Myopia	14	45.1	56	34.3	78	22.4	22	37.9	0.01

Legend: %: Percentage, *p* = probability.

Table 5. Environmental factors associated with statics ametropia (n = 414, N = 600).

Variables	n	OR (Univariate analysis)	CI (95%)	*p*-value	OR (Multivariate analysis)	CI (95%)	*p*-value
Light	300 - 500 lux 258/353	1		0.004	1		0.003
	≥600 lux 156/247	1.72	1.1 - 2.5		1.8	1.2 - 2.6	
Smartphone	No 131/218	1		0.02	1		0.02
	Yes 283/382	1.59	1.09 - 2.3		1.6	1.06 - 2.2	

Continued

Videogames	No 309/470	1		0.001	1		0.0001
	Yes 105/130	2.55	1.5 - 4.2		2.6	1.6 - 4.3	
Computer	No 175/280	1		0.0003	1		0.0001
	Yes 239/320	2.08	1.3 - 3.1		2.1	1.4 - 3.2	
Position in the audience	1st - 3rd row 183/256	1		0.06	1		0.09
	>4th row 231/344	0.68	0.4 - 1.02		0.7	0.4 - 1.05	
Number of hours personal reading	1 - 2 hours 205/304	1		0.05	1		0.08
	≥3 hours 209/296	1.49	0.9 - 2.2		1.4	0.9 - 2.1	
Mode of teaching	magistral 215/306	1		0.29	1		0.1
	power-point 199/294	0.81	0.5 - 1.1		0.7	0.5 - 1.2	

O.R: Odds ratio; C.I: Confidence Interval; p = probability.

Smartphone, computer and video games remains statistically related to the risk factors of static ametropia.

4. Discussion

The present study aimed to determine the negative impact of static ametropia on the academic performance of students at the University of Kinshasa, describe the socio-demographic characteristics of Kinshasa students with static Ametropia, determine the frequency of static ametropia among students of the UNIVERSITY of Kinshasa and determine environmental factors associated with statics ametropia.

The discussion reported on socio-demographic characteristics of students, complaints, distribution of statics ametropia according to Faculty, distribution of statics ametropia according to success percentage, and environment factors (risk factors).

The current study reported the following results: the mean age ± standard deviation was 24.6 ± 7.1 years and the age group from 18 to 30 years was the most represented.

Our results were in nearest of authors such as Ebana Mvogo et al. (2001) respectively found the mean age ± standard deviation of 19.9 ± 8.5 years and the age group of 10 to 19 years was dominant, Alusio et al. (2013) have reported the mean age ± standard deviation of 21.8 ± 3.2 years and Talal (2018) found the mean age ± standard deviation of 27.6 ± 7.5 years.

The present study reported the sex ratio of 1.2 (330 boys/270 girls), these authors respectively reported the sex ratio of 0.5 (840 men for 1644 women), 0.7 (68 men for 86 women) and 0.9 (335 men for 352 women). The difference in our results with these authors could be explained by the sample size and the study design.

In our series, in decreasing order, we have reported the following complaints: difficulty seeing the board 30.3%, followed by photophobia 14.6%, blurred vision

14%, asthenopia 12.1%, headache 7.8%, tearing 4.3%, loss of distance vision 4.1%, eye pain 3%, tingling 2.6%, dizziness 2.3%, ocular itchy 2.1% and ocular redness 1.3%. The difference with other authors such as Ebana Mvogo et al. (2001) could be explained by the environmental context and the ways of life because Ebana Mvogo et al. (2001), Fozailoff et al. (2011), Wen et al. (2013) and had worked in a hospital setting and we worked in an academic setting.

In our series, spherical anisometropia represented 1.8%, followed by mixed astigmatism 3.1%, simple myopic astigmatism 8.8%, compound myopic astigmatism 6.5%, hypermetropia 19.8% and myopia 36.6%. Authors such as Alusio et al. (2013) found myopia 40.4%, myopic astigmatism 32.1%, astigmatism 19.3%, hypermetropia 4.6%, hypermetropic astigmatism 2.8% and presbyopia 0.9%. Some authors such as Alruwaili et al. (2018), reported myopia 53.9% hypermetropia 6.6% and astigmatism 6.6%, Sanjeev et al. (2016) found myopia with 89.4%, hypermetropia 10% and 0.4% a case of keratoconus. Gopalakrishman et al. (2011) found 87.6% myopia, 7.3% hypermetropia and 5.1% astigmatism.

The difference between our results with those of Alusio et al. (2013), Alruwaili et al. (2018), Sanjeev et al. (2016) and Gopalakrishman et al. (2011) would be explained by the sample size, the methodology, the design and the environmental context because in these different studies the students were already informed about the errors of refraction.

The current study reported a statistically significant association between static ametropia (myopia) and student achievement percentage.

In this study, 58% of the students had a passable passing percentage, 27.1% had a fairly good passing percentage, 5.1% had a good passing percentage and 9.6% had an insufficient passing percentage. Success depends on several factors including intelligence quotient, psychological, social and financial conditions. Uncorrected static ametropia induce asthenopia, blurred or blurred vision, headache, difficulty concentrating or performing a long task or being attentive, a feeling of tightness when reading, a feeling that the letters are moving or jumping or split, difficulties in pinpointing the essential in complex spatial information (Chadha, & Subramanian, 2010; Maples & Hoenes, 2007; Shin et al., 2009).

These symptoms affect the quality of life and may explain the association of static ametropia with the academic performance of students.

In this study, we found that the use of video games, computer, smartphone and lighting in the audience increases the risk factors for static ametropia. Video games have a negative impact on eyesight and when you spent too much time staring at a screen, your eyes get tired, irritated and painful. These signs would explain the increase in the association of static ametropia with video games (Vaughn et al., 2006) Smartphone: Smartphone use leads to muscle fatigue and headache (Seong & Sung, 2016). These symptoms could explain the accentuation of uncorrected static ametropia.

The working in front of the computer leads to visual fatigue due to several causes including direct glare, positioning of the screen and reference, inadequate display and readability of information, non-optimal lighting (500 - 700 lux) and

inadequate vision correction (Bruneau et al., 2014). These phenomena could explain the statistically significant link between static ametropia and computer use. Artificial lighting includes public lighting and the lighting of buildings, including the lighting of auditoriums. Audiences use fluorescent lights. According to the French association, the recommended illumination of distance vision for precision, electronics and control is 600 lux. The measurement made for the light intensity in the different audiences showed values varying between 140 to 300 lux. The drop in light intensity generates low-intensity wave rays, which would explain the statistically significant increase in the risk of static ametropia (Risse et al., 1999).

However, in our series, the duration of computer use, smartphone, videogames were not determined. The association between static ametropia (myopia) and the percentage of passing students in the previous year is only a simple statistical association and not a causal relationship.

5. Conclusion

This study showed statistically significant association between Myopia and success percentage ($p = 0.01$).

Impact Statement

Before inscription in University of Kinshasa, all students must make an ophthalmologic exam.

Strengths

Study was carried out for the first time in the Ophthalmology Department of the University Hospital of Kinshasa.

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Contributions Authors

Design: David Kayembe Lubeji.
Data analysis: Léon Muamba Nakashima.
Redaction: Léon Muamba Nkashama, Delux Nsambayi Lukusa.
Data collection: Emmanuel Kakumbu Kakumbu, Léon Muamba Nkashama.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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