1  **Title:** The Prevalence and Progression of Ametropies in Medical Students

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18

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25

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31

32  **Facebook:**

33  • https://www.facebook.com/profile.php?id=676871248

34  • https://www.facebook.com/glaucia.veiga.58

35

36  **Discussion Points:** The current study shows us a high prevalence of ametropies among medical

37  students at FMABC, especially Myopia, expressive data when compared to studies in the literature with

38  a similar target population. There is significant data regarding an increase in the grade (diopters) of

39  students from 1st to 4th year throughout college, in addition to a need to update their degree during the

1course. In the present study, it is worth mentioning the time used for daily study and reading and the

2abusive use of high-tech electronic devices.

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4**Publisher's Disclosure:** *This is a PDF file of an unedited manuscript that has been accepted for*

5*publication. As a service to our readers and authors we are providing this early version of the*

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8*be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.*

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1    **ABSTRACT.**

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3    **Background:** Uncorrected refractive errors (Myopia, Hyperopia and Astigmatism) are one of the main
4    causes of poor vision, attributing to 43% of vision deficiencies. Myopia is the most common visual
5    disorder in the world and can progress until the age of 20-25, when many people are in universities.
6    The etiological factors that cause myopia are still unclear and deserve to be studied. Our aim was to
7    identify the prevalence of ametropies and self-perception of ophthalmic health in medical students at
8    the Centro Universitário Saúde ABC/FMABC.

9

10   **Methods:** This is a cross-sectional study with data collected at Centro Universitário Saúde
11   ABC/FMABC from medical students. A total of 232 students participated in the survey, from the 1st to
12   the 4th year of graduation. The data of the study were obtained from the application of a questionnaire,
13   which evaluates the presence or not of some ophthalmologic health ametropia and self-perception.

14

15   **Results:** It was observed that 74.57% of the students had some type of ametropy, being myopia the
16   most recurrent (59.05%). The study shows us significant data to an increase in the grade of students
17   from 1st to 4th grade throughout college. It was observed that the average daily study time of the
18   students was 9.68 hours and a high average time of use of electronic means.

19

20   **Conclusion:** The study presented a high prevalence of ametropies among students, in addition to a
21   high prevalence of multifactorial myopia and a need to update their diopters (degrees) during the
22   course.

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24   **Key Words**: **:** Ametropies, students, medicine, multifactorial.

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1 **INTRODUCTION.**

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3 The promotion of eye health is a basic principle of increasing the quality of life, because a better visual

4 capacity allows the development of potentialities, improvement school performance and full

5 participation in society. [1] According to the World Health Organization (WHO) [2], uncorrected refractive

6 errors (Myopia, Hyperopia and Astigmatism) are one of the main causes of low vision, attributing 43%

7 of vision deficiencies. [3]

8

9 Myopia is the visual disorder that deserves to be highlighted in this scenario. It is a pathology in which

10 the image is focused before it reaches the retina, causing distant images to be visualized with low

11 clarity. It is estimated that by 2020 the prevalence of myopia will be 22.9% in the world population, and

12 by 2050 that prevalence will be 49.8. [4] In Brazil, the prevalence varies from 11% to 36%, representing

13 approximately a population between 22 and 72 million people. [5]

14

15 Despite the high prevalence in the population, the development of refractive errors is still an unclear

16 issue, mainly regarding possible etiological factors. [6] As much as heredity is known as the main factor

17 influencing the appearance of refractive disorder, lifestyle appears as a factor of great attention for

18 ophthalmologic studies, because the excessive utilization of vision for studies, which includes frequent

19 and regular reading, in addition to studies with a continuous focus, apparently also  constitute a risk

20 factor. [7, 8]

21

22 Thus, studies describe a high prevalence in students from various fields.[9] Among the most prevalent

23 groups are medical students, who due to a lifestyle with intensive studies for several years, constitute

24 a group at risk for myopia and worsening of vision after the beginning of the study.[9, 10]

25

26 Thus, the present work aims to identify the prevalence of ametropies (refractive error) and self-

27 perception of ophthalmic (visual) health in medical students of Centro Universitário Saúde

28 ABC/FMABC, in a metropolitan region of São Paulo, Brazil.

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1 **MATERIALS OR PATIENTS AND METHODS.**

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3 It is a cross-sectional study with medical students at Centro Universitário Saúde ABC/FMABC, carried

4 out from July 2017 to July 2020 (during the three years). The study was approved by the Ethics

5 Committee of Centro Universitário Saúde ABC/FMABC (protocol number 2.391.695) and is in line with

6 the resolution 466/12 of the National Health Council.

7

8 **Selection and Description of Participants**

9 The sample consisted of 232 medical students from the 1st to the 4th year, without restrictions regarding

10 gender and age. The data were obtained through a self- administered questionnaire structured by the

11 researcher himself, which consisted of 12 dissertation questions [11]. The consent was obtained from the

12 study participants (i.e., oral or written).

13

14 Application of the questionnaire occurred during the class period. The students were identified through

15 the following information: initials of the name, age, sex, type of visual disorder (Myopia, Hyperopia and

16 Astigmatism), methods of correction used, interest in refractive surgery, daily time devoted to studies,

17 daily time spent in front of the means of technology and heredity. The present study was carried out in

18 accordance with the relevant guidelines and regulations/ethical principles of the Declaration of Helsinki.

19

20 **Statistics**

21 Descriptive statistics were used to describe and summarize the data set, presenting distributions in

22 measures of central tendency and variability, mean and standard deviation. Age comparison was

23 performed by Kruskal-Wallis test. To assess the sample normality, the Shapiro-Wilk test was performed

24 and the variables were considered normal when the p value> 0.05. For qualitative variables the absolute

25 and relative frequency were performed. For qualitative variables the chi-square test was used. To define

26 the sample number it was used the GPower software version 3.1. The significance level adopted was

27 5%. The statistical program used was Stata® version 12.0.

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1  **RESULTS.**

2  Table 1 shows the characteristics of the sample, consisting of 232 students, the majority being female

3  with 157 (67. 67%) students and the fourth year with 86 (37.07%) and the average age of the students

4  was 21.78. Among the self-declared changes were Astigmatism, Hyperopia and Astigmatism, Myopia

5  and Astigmatism.

6

7  The time that students spend in front of electronic media daily deserves to be highlighted. Only 26.29%

8  of students spend less than 1 hour in front of electronic media, with 47.41% staying between 1-5 hours,

9  21.98% for 6-11 hours and 4.31% for more than 11 hours a day. A high number, but understandable by

10  the current modernity of current media technology and the use of technology media in classrooms.

11

12  Among the sample, 173 (74.57%) students reported some type of ametropia and 59 (25.43%) reported

13  no type of ametropia. In relation to ametropies, myopia presents higher prevalence followed by

14  astigmatism and hyperopia (Table 2). When analyzing the ametropies among the students according

15  to the year of course, there was no statistically significant difference. In relation to age, a significant

16  difference was observed between the years of the course, being the 4th with the highest mean age.

17

18  Table 3 shows a statistically significant difference in the perception of the increase in the grade of

19  students according to the school year, with the 4th grade students seeing the most increase in the grade

20  of vision.

21

22  The table 4 illustrate the ophthalmological characteristics of the students with ametropies, according to

23  the year of the course. No statistically significant difference was observed between any variables

24  studied.

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1 **DISCUSSION.**

2 This study showed a high prevalence of ametropies among students. The results of the study found

3 significant differences in relation to the degree increase reported by students since entering the course.

4

5 It was observed that 74.57% of the students of the Medicine course at Centro Universitário Saúde

6 ABC/FMABC (FMABC), from the 1st to the 4th academic year, had some ametropia, with myopia being

7 the most recurrent in 59.05% of the cases. This prevalence is higher than the average of the world

8 population, which estimates that 22% of the world population has myopia.[4]

9

10 It is believed that the highest prevalence of myopia is observed in adults in Southeast Asia.[12] Studies

11 carried out with populations of average age similar to the current one, as in Singapore, with a sample

12 of 15 to 25 years old, observed a prevalence of myopia of 48.5%, in China 34.7% and 24.5% in

13 Peninsular Malaysia.[13] However, North American studies [14], in which they obtained a database of

14 individuals aged 18-24 years, with 12 years or more years of study in their lives, a prevalence of 42.6%

15 was observed. In a study carried out by the Department of Ophthalmology, Faculty of Medicine of

16 Botucatu (UNESP) [15], in a population examined in the cities of the central-west region of the state of

17 São Paulo, the prevalence of myopia was higher between the second and third decade of life (43.3%

18 for men and 42.1% for women). The differentiation of prevalences found in these studies may be

19 associated with the evaluation method, as well as genetic factors and lifestyle habits, however, all of

20 them present lower values than those found in FMABC students.

21

22 Although the prevalence of ametropies between school years is similar and all of them are high, the

23 current study shows us significant data regarding an increase in the grade (diopters) of students from

24 the 1st to the 4th year throughout college.

25

26 To find out the reasons for this increase in diopters in medical students at FMABC, the average time in

27 which students studied and / or used for reading throughout the day was analyzed. An average study

28 time of 9.68 hours was obtained, and of this average, 7 hours (maximum time of their classes throughout

29 the day) represented the period they spent in the classroom, that is, it is a very high number, with an

30 association between the high time dedicated to daily studies / readings and a high prevalence of myopia

31 (in addition to the increase in the degree of myopia throughout college). In studies of systematic review

32 in Australia [16], young people with low time of outdoor activities and high time of use of vision for activities

33 of approximate reading were two to three times more likely to be nearsighted compared to those who

34 did little work. Near and high outdoor activities, moreover, found a consistent correlation between higher

35 educational level and higher prevalence of myopia. In Saudi Arabia [17], in a study regarding the presence

36 of myopia, which included 504 medical students aged between 18 and 27 years (mean of 21 years), a

37 high prevalence of myopia was also observed among medical students.

38

39 Studies show that myopic young people tend to spend more time on computers, whether reading or

40 writing, during periods outside the work or school environment than non-myopic young people.[18] The

1  use of computers and electronic means (an average of 3.8h / day) may be associated with a longer
2  axial ocular length [19], suggesting that each activity has a unique effect and a different mechanism to
3  affect myopia. An association between a high level of higher education and the use of electronic means
4  (since education involves several types of close work, such as reading and using the computer)
5  demonstrates to be factors in the development of myopia.[20, 21]
6
7  With regard to heredity, the prevalence of ametropies in their respective parents was observed in the
8  current study, with 79.74% of fathers having some ametropia and 75.86% of mothers. However, it is
9  worth mentioning that presbyopia appears as a highlight in this absolute value, and it is not possible to
10  analyze only the prevalence value of myopia in the parents of the participants, since the majority of
11  students did not know what type of ametropia their parents owned. Heredity is considered as the main
12  influencing factor for the appearance of refractive disorder.[6-8] In a study carried out with young people
13  with one or two myopic parents, their risks were two to eight times higher, respectively, of developing
14  myopia compared to those without myopic parents. In addition, an increasing severity of parental
15  myopia has led to an increased risk of myopia.[22]
16
17  The study, by means of a self-reported questionnaire, may underestimate the prevalence of ametropies.
18  Thus, it is possible to say that the prevalence of myopia and the increase in the diopters of medical
19  students at FMABC must be even higher, since 20.18% of respondents with ametropia (s) stated that
20  they believe that their degree needed updating. In addition, 13.36% of students usually go to the
21  ophthalmologist every two or more years and 27.16% when they believe it is necessary, however,
22  according to recommendations of specialists of the Brazilian Council of Ophthalmology, consultations
23  should be made performed at least annually.
24
25  The limitation of this study include the lack of discrimination between the Medical School years studied.
26  Considering that, there is possibly that exist a difference in exposure reading and / or electronic
27  equipment use between the students of the first two years and the other years of Medicine School. It
28  possible that if we compared each group according to the year of Medical School, we would have even
29  better results. Perhaps, the use of more precise methods, to apply only the questionnaire, avoided this
30  kind of bias. Finally, we could be still apply an analysis of the optical correction method of students with
31  ametropia, remembering that many have both contact lenses and glasses to wear on different
32  occasions; only 1.74% of respondents have already had refractive surgery, which is understandable,
33  since the minimum average age for indication of refractive surgery is 20 years (according to the First
34  Brazilian Census on Refractive Surgery).[23]
35
36  The current study shows us a high prevalence of ametropies among medical students at FMABC,
37  especially Myopia, expressive data when compared to studies in the literature with a similar target
38  population. There is significant data regarding an increase in the grade (diopters) of students from 1st
39  to 4th year throughout college, in addition to a need to update their degree during the course. In the

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1 present study, it is worth mentioning the time used for daily study and reading and the abusive use of
2 high-tech electronic devices.
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1   **TABLES.**

2

3   **Table 1.** General data on interviewed students

| Variable | n (%) |
|---|---|
| **Sample** | 232 (100) |
| **Sex** | |
| Female | 157 (67.67) |
| Male | 75 (32.33) |
| **Graduation Year** | |
| 1st Year | 52 (22.41) |
| 2nd Year | 49 (21.12) |
| 3rd Year | 45 (19.40) |
| 4th Year | 86 (37.07) |
| **Autodeclared Ametropies Changes** | |
| Astigmatism | 17 (7.33) |
| Hyperopia | 5 (2.16) |
| Hiperopia and Astigmatism | 14 (6.03) |
| Myopia | 62 (26.72) |
| Myopia and Astigmatism | 75 (32.33) |
| None | 59 (25.43) |
| | **Mean (SD)** |
| **Age** | 21.8±2.5 |

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1    **Table 2.** Distribution of the Ametropies second year of the course.

| Variable | 1st Year | 2nd Year | 3rd Year | 4th Year | Total | p |
|---|---|---|---|---|---|---|
| | n (%) | | | | | |
| **Has Ametropia** | | | | | | |
| Yes | 33 (63.46) | 40 (81.63) | 33 (73.33) | 67 (77.91) | 173 (74.57) | 0.157 |
| No | 19 (36.54) | 9 (18.37) | 12 (26.67) | 19 (22.09) | 59 (25.43) | |
| **Astigmatism** | | | | | | |
| Yes | 19 (36.54) | 26 (53.06) | 20 (44.44) | 41 (47.67) | 106 (45.69) | 0.393 |
| No | 33 (63.46) | 23 (46.94) | 25 (55.56) | 45 (52.33) | 126 (54.31) | |
| **Hiperopia** | | | | | | |
| Yes | 6 (11.54) | 5 (10.20) | 1 (2.22) | 7 (8.14) | 19 (8.19) | 0.366 |
| No | 46 (88.46) | 44 (89.80) | 44 (97.78) | 79 (91.86) | 213 (91.81) | |
| **Myopia** | | | | | | |
| Yes | 26 (50.00) | 31 (63.27) | 28 (62.22) | 52 (59.77) | 137 (59.05) | 0.497 |
| No | 26 (50.00) | 18 (36.73) | 17 (37.78) | 34 (39.53) | 95 (40.95) | |
| **Mean (SD)** | | | | | | |
| **Age** | 19.8±2.1 | 21.1±2.0 | 22.2±2.2 | 23.1±2.4 | | **<0.001**\*\* |

2    \* Chi-square $p<0.05$; \*\*Kruskal-Wallis $p<0.05$; SD- Standard Deviation

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1    **Table 3.** Student characteristics in relation to health habits and perception during three years.

| Variable | 1st year | 2nd year | 3rd year | | | 4th year | Total | p |
|---|---|---|---|---|---|---|---|---|
| | | | | n (%) | | | | |
| **What periocity goes to the ophthalmologist** | | | | | | | | |
| At least one consultation a year | 25 (48.08) | 28 (57.14) | 28 (62.22) | | | 57 (66.28) | 138 (59.48) | 0.383 |
| Every two or more years | 9 (17.31) | 9 (18.37) | 4 (8.89) | | | 9 (10.47) | 31 (13.36) | |
| When you believe it is necessary | 18 (34.62) | 12 (24.49) | 13 (28.89) | | | 20 (23.26) | 6 (27.16) | |
| | **There's been an increase in your degree since you went to college.** | | | | | | | |
| Yes | 3 (9.09) | 18 (45.00) | 18 (54.55) | | | 37 (55.22) | 76 (43.93) | |
| No | 21 (63.64) | 15 (37.50) | 13 (39.39) | | | 26 (38.81) | 75 (43.35) | **<0.001*** |
| Does not know | 9 (27.27) | 7 (17.50) | 2 (6.06) | | | 4 (5.97) | 22 (12.72) | |
| | **Do you believe your vision has gotten worse since you went to college** | | | | | | | |
| Yes | 22 (42.31) | 17 (34.69) | 9 (20.00) | | | 37 (43.02) | 85 (36.64) | |
| No | 29 (55.77) | 32 (65.31) | 36 (80.00) | | | 46 (53.49) | 143 (61.64) | 0.066 |
| Does not know | 1 (1.92) | 0 (0) | 0 (0) | | | 3 (1.92) | 4 (1.72) | |
| | **Do you believe your needs updating** | | | | | | | |
| Yes | 9 (17.31) | 9 (18.37) | 6 (13.64) | | | 22 (26.51) | 46 (20.18) | |
| No | 40 (76.92) | 37 (75.51) | 36 (81.82) | | | 61 (73.49) | 174 (76.32) | 0.246 |
| Does not know | 3 (5.77) | 3 (6.12) | 2 (4.55) | | | 0 (0) | 8 (3.51) | |
| | **Time spent in front of the electronic media daily** | | | | | | | |
| Less than 1 hour | 15 (28.85) | 12 (24.49) | 9 (20.00) | | | 25 (29.07) | 61 (26.29) | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1h-5h | 27(51.92) | 19 (38.78) | 19 (42.22) | | | 45 (52.33) | 110 (47.41) | 0.053 |
| 6h-10h | 9 (17.31) | 12 (24.49) | 15 (33.33) | | | 15 (17.44) | 51 (21.98) | |
| 11h-15h | 1 (1.92) | 6 (12.24) | 2 (4.44) | | | 1 (1.16) | 10 (4.31) | |
| **Daily study time** | | | | | | | | |
| 6h-10h | 38 (73.08) | 34 (69.39) | 27 (60.00) | | | 62 (72.09) | 161 (69.40) | 0.596 |
| 11h-15h | 13 (25.00) | 15 (30.61) | 18 (40.00) | | | 23 (26.74) | 69 (29.74) | |
| greater than or equal to 16 | 1 (1.92) | 0 (0) | 0 (0) | | | 1 (1.16) | 2 (0.86) | |
| | | | | **Mean (SD)** | | | | |
| **Avarage of study** | 9.9±1.8 | 9.4±1.8 | 9.8±1.7 | | | 9.5±1.8 | 9.7±1.8 | 0.330 |

1  * Chi-square $p<0.05$; **Kruskal-Wallis $p<0.05$; SD- Standard Deviation
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1    **Table 4.** Ophthalmological characteristics of students with ametropies, according to the year of the course:

| Variable | 1st year | 2nd year | 3rd year | 4th year | Total | p |
|---|---|---|---|---|---|---|
| | | n (%) | | | | |
| **Which age started the ametropia** | | | | | | |
| 1-5 years | 4 (9.52) | 0 (0) | 1 (3.33) | 3 (4.62) | 8 (4.65) | |
| 6-10 years | 6 (14.29) | 9 (25.71) | 4 (13.33) | 8 (12.31) | 27 (15.70) | |
| 11-15 years | 12 (28.57) | 12 (34.29) | 11 (36.67) | 28 (43.08) | 63 (36.63) | 0.261 |
| 16-20 years | 16 (38.10) | 11 (31.43) | 11 (36.67) | 24 (36.92) | 62 (36.05) | |
| 21-25 years | 1 (2.38) | 1 (2.86) | 3 (10.00) | 2 (3.08) | 7 (4.07) | |
| Does not know | 3 (7.14) | 2 (5.71) | 0 (0) | 0 (0) | 5 (2.91) | |
| **Use glasses** | | | | | | |
| Yes | 38 (92.68) | 34 (94.44) | 24 (85.71) | 61 (91.04) | 157 (91.28) | 0.648 |
| No | 3 (7.32) | 2 (5.56) | 4 (14.29) | 6 (8.96) | 15 (8.72) | |
| **Use lenses** | | | | | | |
| Yes | 18 (43.90) | 16 (44.44) | 15 (53.57) | 26 (38.81) | 75 (43.60) | 0.621 |
| No | 23 (56.10) | 20 (55.56) | 13 (46.43) | 41 (61.19) | 97 (56.40) | |
| **Cirurgy** | | | | | | |
| Yes | 1 (2.44) | 1 (2.78) | 0 (0) | 1 (1.49) | 3 (1.74) | |
| No | 40 (97.56) | 35 (97.22) | 28 (100.00) | 66 (98.51) | 169 (98.26) | 0.835 |
| **Does your father has ametropia** | | | | | | |
| Yes | 39 (75.00) | 39 (79.59) | 36 (80.00) | 71 (82.56) | 185 (79.74) | |
| No | 9 (17.31) | 8 (16.33) | 6 (13.33) | 9 (10.47) | 32 (13.79) | 0.899 |
| Does not know | 4 (7.69) | 2 (4.08) | 3 (6.67) | 6 (6.98) | 15 (6.47) | |
| **Does your mother has ametropia** | | | | | | |
| Yes | 37 (71.15) | 40 (81.63) | 38 (84.44) | 61 (70.93) | 176 (75.86) | |
| No | 11 (21.15) | 7 (14.29) | 4 (8.89) | 20 (23.26) | 42 (18.10) | 0.458 |
| Does not know | 4 (7.69) | 2 (7.69) | 3 (6.67) | 5 (5.81) | 14 (6.03) | |
| **Does your brother/sister has ametropia** | | | | | | |
| Yes | 25 (48.08) | 26 (53.06) | 26 (57.78) | 38 (57.78) | 115 (49.57) | |
| No | 23 (44.23) | 21 (42.86) | 16 (35.56) | 43 (50.00) | 103 (44.40) | 0.774 |
| Does not know | 4 (7.69) | 2 (4.08) | 3 (6.67) | 5 (5.81) | 14 (6.03) | |

2    * Chi-square $p < 0.05$.

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