

Visual Fatigue and Telework in University Staff: Case Study

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Abstract

The test applied to the teaching and administrative staff of the National University of Chimborazo shows that 9.9% are exposed from 2 to 4 hours as computer users and 90.1% for more than four hours, which causes fatigue and visual fatigue. The objective of this research is to determine the level of visual computer syndrome by applying the CVSS 17 test for exposure to computer use. The reliability of the instrument is 0.594 and the reliability is 0.931, which is good and very good, respectively. The results obtained from visual fatigue are: 47.7% are symptomatic and 52.3% are asymptomatic. The conclusions determined are the test determines the ocular and visual symptomatology between medium and high, which represents short-term damage to the ocular organ with serious problems for the health of the personnel. The presence of clinical alteration is associated with teleworking due to excessive computer use and inappropriate factors in the environment, as well as the Covid 19 pandemic, age, previous visual diseases that have worsened over time, and lack of prevention.

Keywords— Teleworking, Covid 19, teaching and administrative staff, CVSS 17, computer

INTRODUCTION

In the year 2019, the sickness by coronavirus (COVID-19), an infectious disease caused by the SARS-CoV-2 virus, appears all over the world and in Ecuador forcing work, educational and social centers to change their lifestyle to a different modality of work known as teleworking, the activity of the human being who uses a computer known as digital display screens (PVD) which causes a physical and mental load of working for tasks in front of a computer beyond your work schedule (8 hours).

People work in front of a computer excessively, this causes the organ of vision to receive all the time the luminous reflections of

the screen, and others such as the bad location of the computer concerning the window, little or excess of natural or artificial lighting make that gradually the vision of all people, in general, is affected by any symptoms or loss of vision.

Companies and departments of Human Talent Management with the desire to modify their structures make their actions result in improving production and their indices of functionality, the moment of entry and induction of personnel to the company seek to have the ideal personnel for the task to reduce accident rates, occupational diseases due to the lack of prevention in occupational safety and

health. This modality of teleworking is a different option to perform the work that needs to be analyzed in all its context. The work centers and support to society in aspects of calls for help or specialized business are used as a work tool. (Borda, 2020) and (Fernández, 2020).

The International Work Organization (ILO), states that teleworking is a way of doing work with the transfer of the workplace to your home as a way to avoid the contagion of personnel by Covid 19 this makes the use of ICT (Information and Telecommunication Technologies) the fundamental tool of carrying out the task entrusted and means of communication with your company. (Ubieto, 2020). The "Eye Fatigue Syndrome and its relationship with the workplace" expressed by (Molina-Granja, et al., 2022) establish that work in the face of a PVD generates eye problems such as fatigue, and loss of sight, so they suggest taking work breaks (active, passive and compensatory) as a preventive measure.

The National University of Chimborazo UNACH, an accredited educational institution of higher level created in the year 1995 in the city of Riobamba, currently has more than 10000 students both undergraduate and graduate, academic and administrative work went from the face-to-face modality to virtual and today with a progressive return to face-to-face, this has generated those teachers, students, employees, and worker develop telework for the different activities entrusted. After more than a year of this modality can be seen in the staff presents symptoms such as eye irritation, dry eyelids, loss of vision, emotional fatigue, physical, stress, and musculoskeletal disorders due to long hours due to inadequate furniture. To assess health problems in university staff, especially in the field of vision which generates eye fatigue, it has a direct impact on the performance of its officials at work and absenteeism in the institution.

Teleworking and ICT make communication flow in a good way for the fulfillment of the task with advantages and disadvantages for the actors of the process such as reduction of travel times home - office and vice versa, low

downtime due to other actions, disconnection family - friends, high volume of tasks, long times, in which teleworking must be organized and planned properly by daily goals and objectives as well as the *hours dedicated to work as stated*: (Bellido, 2006). Eye fatigue is increasingly noticeable when doing virtual work than face-to-face and it is necessary to prevent its symptoms that can have a serious consequence on the worker's vision.

The International Work Organization (ILO) and the World Health Organization, establish that occupational health is a vital process in the human being, which guarantees not only occupational safety and health to prevent occupational accidents and diseases, but also to control physical and mental factors. (Palencia, 2020), teleworking does not disassociate the worker from the company and does not violate the rights and obligations of the worker, rather it is a modality that companies or public and private work centers such as education adapts to a new reality and context. (Ministry of Work, 2020).

The exponential growth of computer and ICT use worldwide, according to data from Europe in 2015, shows that: 37% of workers use PVD for 4 to 8 hours and 20% for less than 2 hours. (Eurofund, 2017), this is corroborated by studies of 426 Spanish workers, in which the visual fatigue syndrome was 53%, caused by the use of the computer for 6 or more hours, in which contact lens wearers have high probabilities of affection between 65% and 50% of those who do not wear lenses respectively. (Sheppard, 2018).

Results obtained in similar research carried out in the administrative personality of the National University of Chimborazo of the Faculty of Engineering have: 22.2 % are asymptomatic and 77.8 % have visual fatigue. 22.2% have moderate fatigue level 3, 66.7% moderate level 4, and 11.1% Severe Level 5. (Espinoza & Cabezas 2021).

According to Seguí et al, states that the protocols of surveillance of the visual health of the users of PVD must be analyzed to guarantee substandard conditions of visual comfort, Molina et al, establish that the oculo-visual and

musculoskeletal alterations of the work environments are systemic so they must be improved as strategies of a health and prevention of occupational diseases.

The general and/or localized lighting in the context of PVD its excess or lack makes it contrary to the stipulations of the regulations and implies immediate actions to correct it (Ramírez, 2014). The stable regulations in PVD acceptable levels that fluctuate between 300 and 500 lux, being necessary to use natural light, implement or reduce the number of luminaires if applicable, maintenance among other measures to improve the environment and its effect on the user that affect and cause visual fatigue.

Blehm et al. (2005), states that the oculo-visual syndrome (OSO), presents several symptoms: eyes with pain, tired, itching, burning, watery, dryness, blurred vision, double, headache, neck, shoulders or back sore, high sensitivity to light, low concentration, with a feeling of not being able to keep the eyes open, among others. The elevated symptomatology is due to the frequency of use and presents as visual fatigue (Portello, Sa et al, 2012 & Kowalska et al, 2011), burning of the eyesight (Agarwal et al, 2013), the difficulty in vision, frequent tearing, dryness of the vision organ and severe headaches. (Talwar et al, 2009).

Visual fatigue is due to the frequency and intensity of different characteristics between people despite being presented with the same clinical picture, symptomatology manifests it: (Rodríguez, 2015), this makes work performance is affected by the fact that visual demand is required to perform the task, the person s and exposes to problems such as diplopia, change in posture, blurred vision, headache, eye fatigue, eye burning, dry eye, musculoskeletal disorders, frequent blinking with changes in the tear film of the eye. (Forero, 2022).

The high exposure time causes the ocular surface to dilate due to the low frequency of eyelids, a high tear evaporation is caused, with greater dryness of the eye. (Tauste et al., 2014), the use of contact lenses helps the appearance of symptoms (Cabezas, 2021). Studies carried

out in Europe and Asia, establish that the use of the computer presents symptoms such as neck and neck pain (Talwar et al, 2009). The vertebrae of the spine, ligaments, muscles, joints, and nerves cause disability with pain, tendinitis, herniated discs, painful trauma from blows or fractures, infectious processes, inflamed disorders thorium, or congenital that lead to absenteeism from work and compensation by companies to their workers. The lack of adequate coping causes the worker to consume coffee, tobacco, and other substances that generate addiction and disorders of the central nervous system.

The musculoskeletal problems studied by postgraduate teachers of the UNACH due to lack of ergonomic furniture aggravate bodily injuries such as the cervical, thoracic and lumbar areas, as well as the upper extremities that can cause carpal tunnel or epicondylitis (Barahona & Cabezas, 2021).

The National University of Chimborazo (UNACH) within the research area proposes that after the partial return to face-to-face activities due to Covid 19 and telework tasks with high exposure time in front of a computer, it is desired to evaluate the effects that tend to damage the organ of vision and presents symptoms of visual fatigue so it is desired to determine if teleworking is the root cause of the problem in the teaching and administrative staff of the University.

The research question that arises is: **Does the CVSS 17 test allow to determine visual fatigue and establish preventive measures to reduce symptoms in the teaching and administrative staff of the National University of Chimborazo?**

Methodology

Type of study and sample:

The study was qualitative-quantitative, cross-sectional type with single-time analysis to collect data for the corresponding analysis, the study was observational, descriptive of the phenomenon and its symptomatology as presented, for the analysis was carried out utilizing a statistical approach univariate to determine the correlation of sociodemographic

variables with visual fatigue. The applied test was carried out in the google forms, and the link was shared by mass mailings to the staff of the institution of the National University of Chimborazo, who freely and voluntarily answered 172 people among teachers, employees and workers, so it was decided to work with everyone.

Data collection

The data collection was carried out through the test generated in Google forms and disseminated the link to the staff of the National University of Chimborazo through the Department of University Communication, the data are exported to the SPSS V23 for the respective programming according to the scale of lickers raised by the CVSS17 test and obtain the results of the problem investigated. Sociodemographic variables of the officials, and exposure to the computer, were established to determine the correlation between them and visual fatigue. The Crombach Alpha and the KMO were determined to determine the reliability and reliability of the test, other studies on the questionnaire state that it is 0.87, which indicates a high consistency to finish the reliability (Huapaya, 2019).

Applied the CVSS17 test, to measure visual fatigue due to the use of display screens and teleworking due to excess exposure to it.

In the test with 17 questions, each answer is evaluated according to the scale of lickers according to the choice of the respondents, The number of options for each question is described below:

- ✓ 10 items of four options: never, rarely, frequently, and constantly.
- ✓ 6 items with options of nothing, if very little, if a little, if moderately, if much, if a lot.
- ✓ 1 item with option: never, almost never, little time, part of the time, a long time, almost always, always.

To determine the final score of the CVSS17 test = (Total score of all questions).

The score is between 17 and 53 points; or with higher scores, the symptomatology is evident of the syndrome, with scores equal to or greater than 36 you will be considered a symptomatic subject for visual fatigue, and values less than 36 will be related as asymptomatic (Arlanzón Lope, 2018).

The CVSS 17 questionnaire is an easily accessible tool, which can be used for medical surveillance by any health specialty that has been previously trained in the context of occupational safety and hygiene, its feasibility in interpretation and its availability in different languages favors a process of cultural adaptation and acceptance with reliability ranges that demonstrate internal consistency ensuring its validation. (Huaypaya Caña, 2019) Eye strain occurs at different levels ranging from 1 to 6 to determine the severity it goes: from mild to severe.

Mild Fatigue

- ✓ Level 1 goes from 17 to 22 points
- ✓ Level 2 goes from 23 to 28 points

Moderate fatigue

- ✓ Level 3 goes from 29 to 35 points
- ✓ Level 4 ranges from 36 to 42 points

Severe Fatigue

- ✓ Level 5 goes from 43 to 49 points
- ✓ Level 6 goes from 50 to 53 points

Results and discussion

The CVSS 17 test generates the following results in the university staff of the National University of Chimborazo. Table No. 1 presents the reliability of the CVSS17 test as follows:

Reliability statistics	
Cronbach's alpha	N of elements
0.594	17

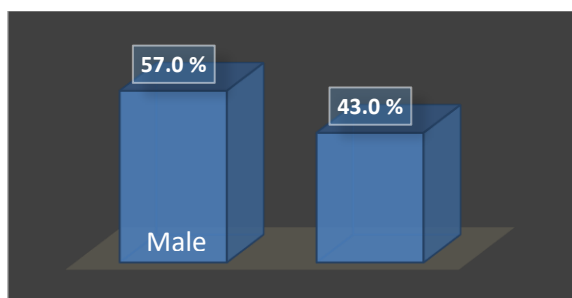
Table No. 1 Reliability of the CVSS 17 test applied

The reliability of the test through the Cronbach's Alpha is 0.594 which means that the test is good, it could be improved by eliminating questions however it can be applied.

KMO and Bartlett test	
Kaiser-Meyer-Olkin sampling adequacy measure	0.931

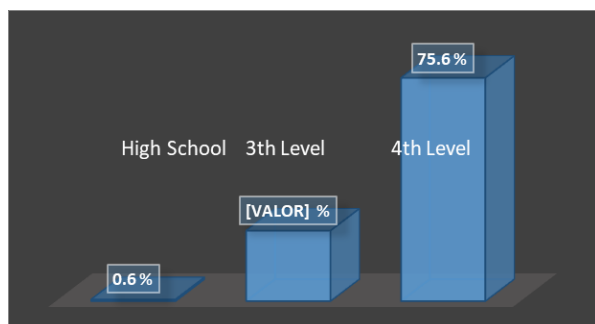
Table No. 2 Reliability of the CVSS17 test

The reliability of the test through the KMO is 0.931 which means that the test is very good and can be applied. In graph No. 1 the gender of Unach staff is presented.



Graph No. 1 Gender of UNACH Staff

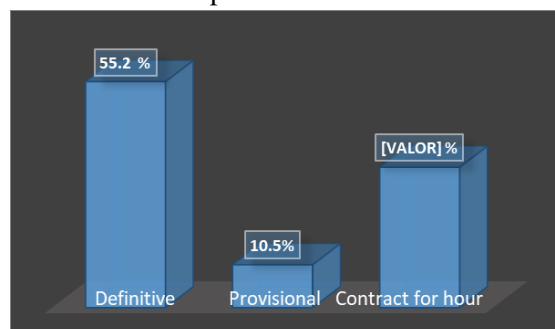
Regarding the gender of the staff of the National University of Chimborazo, there is: 57% are men and 43% women, it is determined that the respondents approximately answered in % equal by gender being participatory the subject. Graph No. 2 presents the educational level of UNACH staff.



Graph No. 2 Level of Education of UNACH Staff

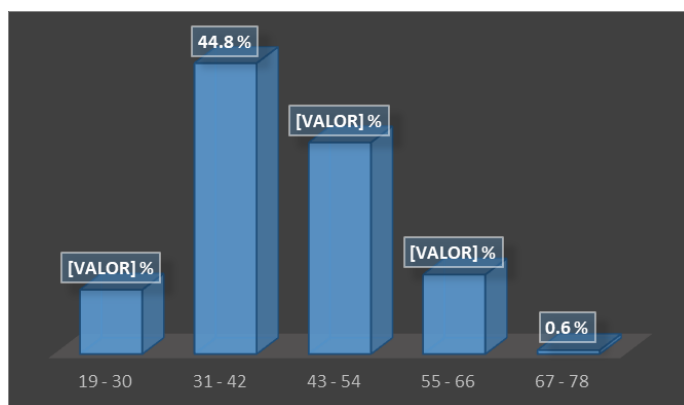
Regarding the educational level of the staff of the National University of Chimborazo, we have 0.6% with high school training, 23.8%

with the third level, and 75.6% fourth level so it can be concluded that there is a medium-high % with a high level of preparation. In Graph No. 3 the type of employment relationship of UNACH staff is presented.



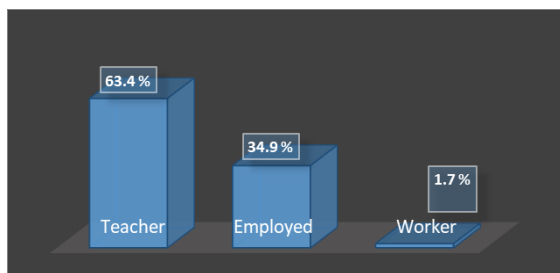
Graph No. 3 Employment Relationship of UNACH Staff

Regarding the type of Unach staff action we have: 55.2 % have a definitive appointment, 34.3% hourly treatment, and 10.5% with a provisional appointment. It can be determined that there is a high link with a definitive appointment with the university that motivates the staff to their commitment to work. In Graph No. 4 the age of Unach staff is presented.



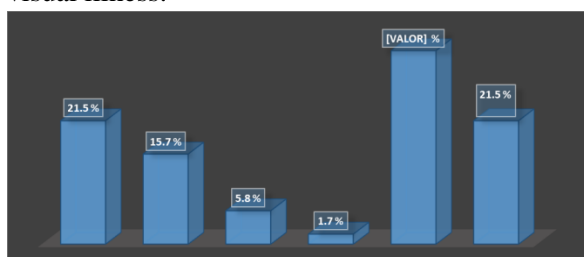
Graph No. 4 Age of UNACH Staff

Regarding the age of the staff of the National University of Chimborazo, we have: 9.9 % are between 19 to 30 years old, 44.8% are from 31 to 42 years old, 32.6% are from 43 to 54 years old, 12.2% are between 55 to 66 years old and 0.6 from 67 to 78 years old being the staff in its highest percentage young. Graph No. 5 presents its role in UNACH.



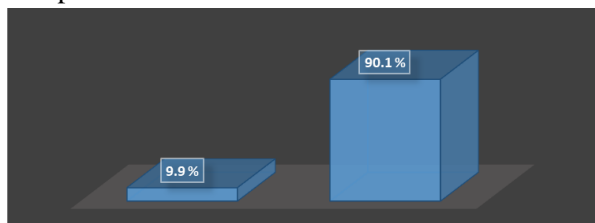
Graph No. 5 Role of UNACH

Regarding the role it plays at the National University of Chimborazo we have: 63.3% surveyed is a teacher, 34.9% employed, and 1.7% workers which you can see greater participation of teachers. Graph No. 6 is presented if UNACH staff have had a chronic visual illness.



Graph No. 6 Chronic Visual Illness of UNACH Staff

Regarding the staff of the UNACH, if you suffer from any chronic visual disease we have: 21.5% have myopia, 15.7% have astigmatism, 5.8% have presbyopia, 1.7% have farsightedness. 33.7% have two or more diseases and 21.5% do not have any disease which allows us to conclude that these diseases are Ocular due to the effect of teleworking and the frequent use of PVD aggravating to have the presence of the syndrome. Graph No. 7 shows the number of hours in front of the Unach staff's computer.

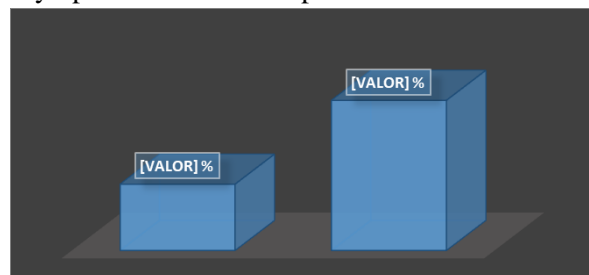


Graph No. 7 Hours in front of the UNACH Staff Computer

Regarding the number of hours in front of a computer, the staff of the University have: 9.9% of 2 to 4 hours use the computer and 90.1% use more than 4 hours, it is concluded that the

frequency is one of the causes for visual fatigue.

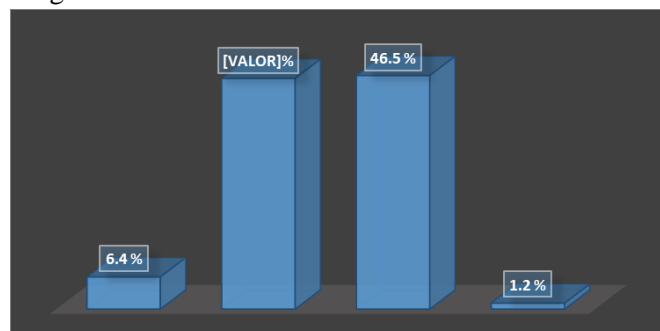
In Graph No. 8 the levels of CVSS syndrome 17 are presented in symptomatic and asymptomatic UNACH personnel.



Graph No. 8 Levels of CVSS syndrome 17 of UNACH Staff

Regarding the levels of visual fatigue: 52.3% are asymptomatic and 47.7% have visual fatigue due to the use of PVD, treatment and preventive measures are recommended to avoid the loss of the vision organ.

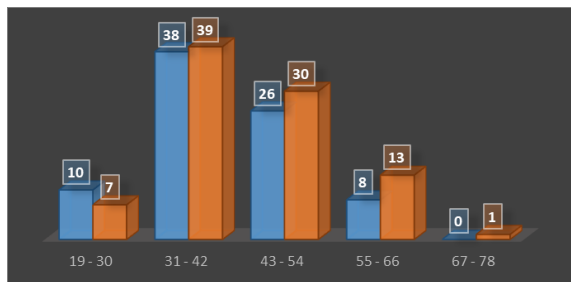
Graph No. 9 presents the levels of visual fatigue of UNACH staff.



Graph No. 9 Levels of visual fatigue of UNACH Staff

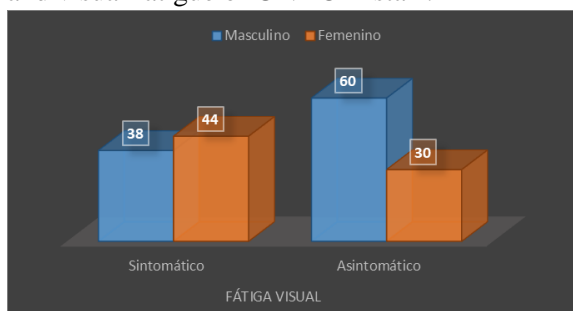
Regarding the levels of visual fatigue we have: 6.4 % have mild fatigue level 2, 45.9% medium fatigue level 3, 46.5% medium fatigue level 4 and 1.2% Severe level 5, there is presence of medium - high eye fatigue so it is recommended to implement a health surveillance plan.

Graph No. 10 shows the correlation between age and eye strain of UNACH staff.



Graph No. 10 Correlation between age and CVSS 17 syndrome of UNACH Staff

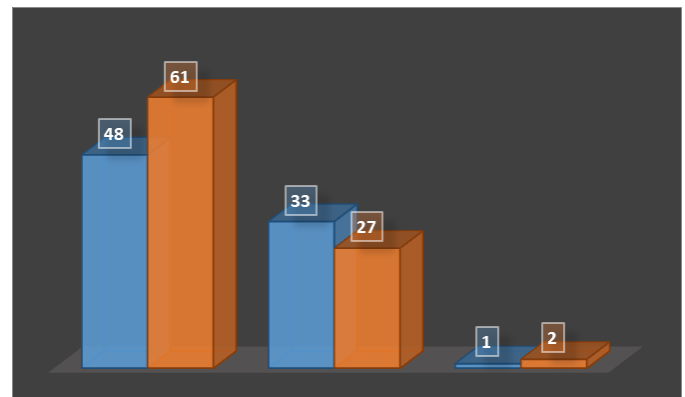
The correlation between age and visual fatigue through Cramer's V is 0.124 the effect between the variables is small, it can be observed that 10 people are symptomatic and 7 asymptomatic in ages of 19 to 30 years; 38 are symptomatic and 39 are asymptomatic between 31 and 42 years; 26 symptomatic and 30 asymptomatic between 43 and 54 years; 8 symptomatic and 13 asymptomatic aged between 55 and 66 years; 1 asymptomatic between 67 and 78 years. Graph No.11 shows the correlation between gender and visual fatigue of UNACH staff.



Graph No. 11 Correlation between gender and visual fatigue of UNACH staff

The correlation between gender and eye strain through Cramer's V is 0.205 is small among the variables analyzed, it has to refer to visual fatigue: 38 men, 44 women are symptomatic; 60 men and 30 women are asymptomatic so it requires specialized care to reduce the incidence of eye strain.

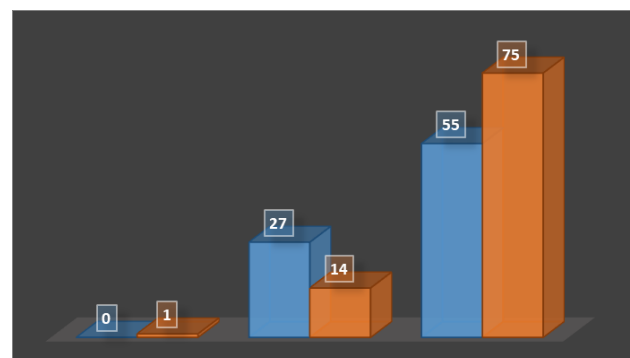
Graph No.12 presents the correlation between the role it plays at the University and the visual fatigue of UNACH staff.



Graph No. 12 Correlation between the role it plays at the University and the visual fatigue of UNACH Staff

The correlation between the role he plays in college and eye strain through Cramer's V is 0.111 is small among the variables, has 48 symptomatic teachers and 61 asymptomatic; 33 symptomatic employees and 27 asymptomatic; 1 symptomatic worker and 2 asymptomatic, so it is necessary to implement preventive measures and epidemiological surveillance in the staff to guarantee a good state of visual health,

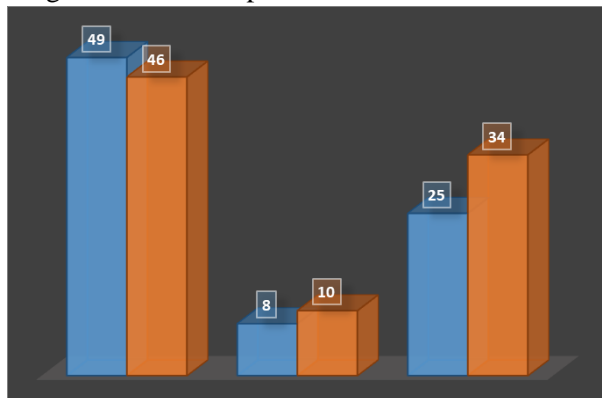
Graph No.13 presents the correlation between the level of education and the visual fatigue of UNACH staff.



Graph No. 13 Correlation between education level and visual fatigue of UNACH staff

The correlation between educational level and eye strain through Cramer's V is 0.214 is small among the variables, she has: 1 person from secondary school is asymptomatic; 27 symptomatic and 14 asymptomatic from the third level; 55 symptomatic and 75 asymptomatic from the fourth level so it is necessary to reduce levels and reduce exposure to computer use.

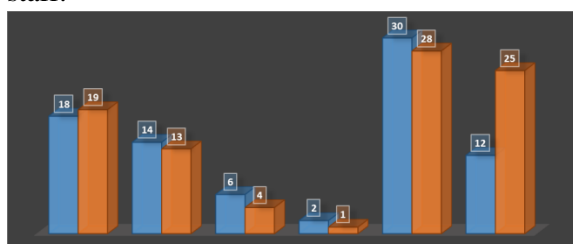
Graph No.14 presents the correlation between the type of personnel action and the visual fatigue of UNACH personnel.



Graph No. 14 Correlation between the type of personnel action and the visual fatigue of UNACH Personnel

The correlation between the type of staff action and the visual fatigue of the staff of the National University of Chimborazo through the V of Cramer is 0. 088 the relationship is negligible between the variables, we have: definitive appointments 49 symptomatic and 46 asymptomatic; with provisional appointment 8 symptomatic and 10 asymptomatic; contract for hours 25 symptomatic and 34 asymptomatic so it is concluded that the relationship of functions has nothing to do with visual fatigue, it is due to other factors.

Graph No.15 shows the correlation between chronic illness and visual fatigue of UNACH staff.

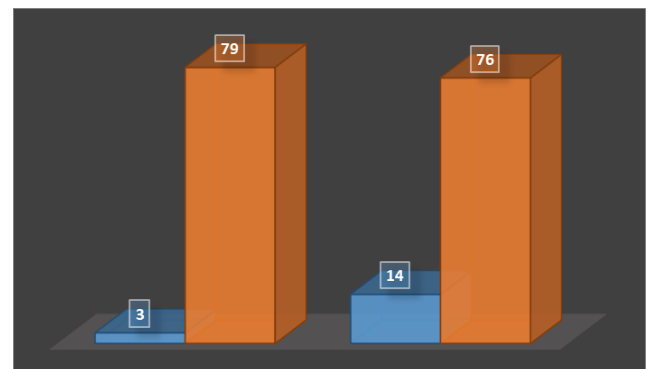


Graph No. 15 Correlation between chronic disease and eye strain of UNACH Staff

Regarding the correlation between chronic disease and visual fatigue in the staff of the National University of Chimborazo through the V of Cramer, we have 0. 172 there is a small relationship between the variables, there are: 18 symptomatic people and 19 asymptomatic with myopia; 14 symptomatic and 13 asymptomatic with astigmatism; 6 symptomatic and 4

asymptomatic with presbyopia; 2 symptomatic and 1 asymptomatic with farsightedness; 30 asymptomatic and 28 asymptomatic with 3 or more eye diseases; 12 symptomatic and 25 asymptomatic without any eye disease, the highest percentage occurs in people with two or more diseases and people with none is necessary to protect with health surveillance.

Graph No.16 presents the correlation between the level of frequency in front of the computer and the visual fatigue of UNACH.



Graph No. 16 Correlation between frequency level and visual fatigue of UNACH staff

Regarding the correlation between the level of exposure to the computer and visual fatigue in the staff of the National University of Chimborazo utilizing V de Cramer we have: 0.199 is small among the variables, we have 3 symptomatic people with exposure of 2 to 4 hours and 79 symptomatic with an exposure of more than 4 hours; 14 people to symptomatic with an exposure of 3 to 4 hours and 76 asymptomatic with an exposure of more than 4 hours it is necessary to implement preventive measures.

Conclusions

The symptoms of visual fatigue detected in the staff of the National University of Chimborazo present vision problems due to the excess exposure time in front of a computer so it must be prevented and given adequate medical treatment because they present problems of inadequate postural habits due to the lack of ergonomic furniture, poor lighting that generates visual discomfort.

Dry eye syndrome is one of the symptoms present in visual fatigue that produces dryness of sight due to environmental factors that cause excessive evaporation of tears in the eye, in the case of the research is detected that 47.7% is symptomatic and 52.3.8% is asymptomatic caused by the use of PVD.

The correlation between the sociodemographic variables to visual fatigue is small so it has no relation to the presence of the syndrome, it is due to the number of hours of computer use and that is aggravated by the presence of pre-existing diseases.

Regarding the levels is presented: mild fatigue level 2 in 6.4%, 45.9% average fatigue level 3, 46.5% medium fatigue level 4, and 1.2 5 severe visual fatigue level 5, it is concluded that it is necessary for the University to perform ophthalmological examinations to have an adequate diagnosis, reduce exposure to the computer as a measure preventive and implement exercises 20-20-20 to decrease the effect additionally should be used artificial tears.

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