A SITUATIONAL ANALYSIS OF VISUAL ERGONOMICS AND OCULAR SYMPTOMS AMONG CALL CENTRE AGENTS: CITY OF TSHWANE CALL CENTRES

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Mini-dissertation

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DECLARATIONS

(i) “I, Gloria Tsholofelo Tamenti declare that the coursework Master’s Degree mini-dissertation that I herewith submit for the Master’s Degree qualification M. Optometry at the University of the Free State is my independent work, and that I have not previously submitted it for a qualification at another institution of higher education.”

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ABSTRACT

Introduction:

The large municipalities or metros in South Africa are currently using call centres as a tool to deliver public services and provide access to public information. These call centres utilise computers, which are visually demanding. The aim of the study was to investigate the visual ergonomics of call centres and describe the working conditions in call centres, as well as estimate the prevalence of ocular symptoms associated with computer vision syndrome among call centre agents in the City of Tshwane call centres.

Method:

A cross-sectional, quantitative survey and observational study design was used to collect data among call centre agents. Data on demographics, occupation and ergonomics, visual information, as well as messages on symptoms experienced during and after computer work and ergonomics were gathered. Workstation measurements were taken, which consisted of viewing distances between computer screens and the eyes of the call centre agents as well as calculated viewing angles.

Results

A total of 175 call centre agents, aged between 21 and 63 years, participated in this study. The call centre agents were predominantly female (69%). About 62% of participants worked more than 8 hours per day and 38% worked 7-8 hours per day. All participants used desktop computers. Most participants (58%) spent more than 8 hours per day working on their computers during their working shift. Sixty three percent (63%) worked in a room with windows and 37% in a room without windows. The participants (90.29%) took breaks of 8.2 minutes on average in between work other than meal breaks. Most participants (61.7%) worked at further viewing distances from their computers than the recommended distance of 50-70cm. The examiner observed that 58% of participants had the centre of the computer at eye level. The mean viewing angle was 18.17 degrees. The mean room illumination for the three

(3) call centres was 90.04 lux, which is notably below the recommended average of 350 lux. The most common ocular symptoms reported by the participants were tired, strained eyes (95.43%), increased sensitivity to light (83.43%), burning eyes (82.86%) and itchy eyes (82.86%). Musculoskeletal symptoms were reported, such as backache (89%), shoulder ache (87%), neck pain (84%) and neck stiffness (84%). The prevalence of ocular symptoms associated with computer vision syndrome was 69.66%. A higher prevalence of ocular and musculoskeletal symptoms occurred among participants who worked more than 8 hours and those who worked at a viewing distance of 71-90cm.

Conclusion

There is a need for appropriate lighting and the redesigning of workstations in the call centres of the City of Tshwane. This will help to reduce the prevalence of ocular and musculoskeletal symptoms associated with computer vision syndrome.

Keywords:

Call center agents, Computer Vision Syndrome, Ergonomics, Prevalence, Computer use, Lighting, Ocular symptoms, Musculoskeletal symptoms.

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CHAPTER 1: INTRODUCTION

Information technology has significantly advanced over the past 20 years. Computer use has dominated personal and work environments, leading to ~~an~~ increased production, communication and easy access to information (Gangamma & Rajagopala, 2010; Loh & Reddy, 2008; Žunjić, 2004; Torrey, 2003; Gur, S *et al*., 1994). Internet access through computers and mobile devices makes information search, communication and educational activities easier and increase access. (Tlabela, K *et al*., 2007). South Africa has the highest Internet penetration rate amongst African countries, with 33.7% of the population using Internet (Calandro, E *et al*., 2012).

The use of computers has become an indispensable tool for growth in the business world. Businesses keep customers informed about their products and services by supplying information and support to both existing and prospective customers via the electronic environment. In the City of Tshwane, this is done through a call centre environment. Here, the customer service portion of the business rely mainly on computers and telephones in order to help customers (Aksin, Z *et al*., 2007). The call centre industry has grown tremendously in the past years and continues to grow in line with telecommunication and information technology developments (Banks & Roodt, 2011; Sprigg & Jackson, 2006; Holman, D *et al*., 2003).

The use of computers is widespread at call centres globally and is key to their operations in this century. The use of computers are visually demanding (Verma, 2011; Anshel, 2005). The more hours spent on computers thus increase the demands on the visual system. This increase in demands on the visual system often result in visual and ocular symptoms amongst the exposed (Sheedy & Shaw-McMinn, 2003). However, there are other factors that can aggravate ocular symptoms during computer use. These factors are environmental conditions, such as poor lighting, glare, screen resolution and working distance (Ihemedu, & Omolase, 2011; Wimalasundera, 2006).

Collectively, they are known as ergonomics. Frequent visual and ocular symptoms may cause visual system strain when these demands exceed the individual ability to perform tasks comfortably and efficiently. The term that is generally given to the visual and ocular symptoms related to computer use, is known as computer vision syndrome (CVS).

Visual and ocular symptoms associated with CVS may be blur, double vision, eyestrain, light sensitivity, headaches, eye-aches, dryness, irritation and burning eyes (Gowrisankaran & Sheedy, 2015). Call centre agents spent more time in-front of computers and are thus more inclined to visual and ocular symptoms. The aim of this study was to investigate the relation between visual ergonomics and ocular symptoms amongst call centre agents from the City of Tshwane's call centres.

In this mini-dissertation, the first chapter provides an overview of the use of computers in call centres in the City of Tshwane and the general relation thereof with ocular and visual problems is explained. A literature review, regarding the working conditions and ergonomics for general computer users and call centre agents, is undertaken in Chapter 2. The prevalence of ocular signs (tired, strained eyes, increased light sensitivity, burning and itchy eyes) associated with computer vision syndrome in computer users and call centre agents is also discussed. Thereafter, the aim, motivation and objectives of this research study are outlined. Chapter 3 is focused on the study design, sampling criteria, selection criteria and data collection. Chapter 4 presents the obtained results. Chapter 5 provides a discussion of the gathered results. Limitations of the study are indicated thereafter. Conclusion and recommendations are detailed in Chapter 6.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Call centres are primarily used as channels of communication with customers and one way to deliver services (Banks & Roodt, 2011). These are highly regulated and controlled environments, which mostly focus on call quantity, number of calls waiting, ratio of calls answered, average time spend on calls and customer waiting time (Banks & Roodt, 2011). The latest telecommunications and information technology allow call centres to be the virtual embodiment of geographically dispersed operations, few or many, that may be connected over several continents (Gans *et al*., 2003).

Despite the remarkable growth in, the call centre industry it has a high staff turnover rate. This is attributed to the nature of call centre work, associated with high stress levels, substantive workloads and, in many cases, poor working conditions, low wages and a lack of employee training (Sawyerr *et al*., 2009). Many agents work part-time or flextime, either from home or via satellite offices. Some call centre agents work in split shifts, coming in only during peak times of day, or peak seasons of the year (Voss *et al*., 2000)

There are two types of call centres, namely inbound and outbound. They are differentiated by the mode of operation, which is imposed by the demands of visual display units (such as computers) and telephone technologies (Gans *et al*., 2003; Koole & Mandelbaum, 2002; Taylor & Bain, 1999). Inbound call centres receive incoming calls and automatically channels them to waiting call centre agents according to preprogrammed instructions. This mode removes the need for switchboard operators. In a case where all agents are occupied with calls, those waiting are lined up and distributed systematically as agents become available. The agents, also called customer service representatives, sit in front of a visual display unit (VDU) and keyboard while taking a call through a headset with an earpiece and small microphone (Gans *et al*., 2003; Taylor & Bain, 1999). During the call and conversation, the call centre agent

retrieves, adds or manipulates data on the VDU. Operations in an inbound call centre are predominantly dependent on the calls initiated by customers. It is labour intensive and its focus is on customer service (Banks & Roodt, 2011),

An outbound call centre, also known as telemarketing, mainly makes outgoing calls and are sales orientated (Koole & Mandelbaum, 2002). Outbound operations are mostly dependent of the call centre agent to sell or create interest in a particular product or service (Koole & Mandelbaum, 2002; Taylor & Bain, 1999).

There are various developments within the call centre industry according to Paul & Huws (2002). It includes:

1. Call centres are increasingly replacing direct, face-to-face contact with customers.
2. Contact, based on only voice interaction, and is being integrated more and more with other forms of communication, such as internet or email-based communication.
3. National, regional and local governments are progressively using call centres to deliver public services and provide access to public information.
4. Call centres are gradually being relocated to independent facilities. It might be nearby to the head office of an organisation or even in another region, country or continent.
5. Call handling functions and services are frequently outsourced to service providers specialising in call centre services. But they often also operate by delivering a range of services for different customers and clients, all from under the same roof.
6. There is some evidence of growth in the use of homeworkers as virtual call centre operators, although this remains a minority practice.

The central characteristic of a call center is its capacity to handle inbound or outbound traffic. This encompasses all categories mentioned above, which are the core activity of all call centers.

The growth in South Africa in call centres began in the early 1990s. During that time, a number of call centres emerged in the telecommunications and banking industries. This then spread to other sectors, which created employment for approximately 80 000 people with a projected 15–20% annual growth in future (Benner, 2006). This dramatic global growth of call centres signifies a potentially valuable employment opportunity for South Africa (Benner, 2006) and improvement in service delivery.

The subsequent literature review discusses research on working conditions, ergonomics and ocular symptoms for general computer users and call centre agents.

2.2 Computer users in general

Smith *et al*., (1981) conducted a survey on working conditions, job stress, health complaints and psychological status among 250 video display terminal (VDT) operators and compared the results to 150 workers who did not use VDT's. Eyestrain (78%) and burning eyes (60%) complaints were more prevalent among VDT operators. It was concluded that VDT use job content, task requirements, workload and environmental factors (lighting and workstation ergonomics), were contributing to the operators' stress level, health problems and visual discomfort.

Chiemeke *et al*., (2007) undertook a study to assess ergonomics and vision related problems among computer users in the University of Benin, Nigeria. A structured questionnaire was administered to 121 computer users between the ages of 10 and 35 years. The five most common visual symptoms reported were eyestrain (42.7%), blurred distance vision (45.7%), headaches (28.2%), double vision (29.2%) and moderate to severe eye redness (29.1%). Visual problems were more pronounced among those who spend more than 8 hours daily on computers and those viewing the display at an angle of 30-50 degrees. Visual symptoms were less among those who use VDU screens with a dark background. The research concluded that proper computer workplace illumination, screen contrast, work intervals by means of breaks, viewing

distances and viewing angles could assist to prevent the occurrence of adverse visual symptoms amongst call centre agents. It thus highlighted the need for proper computer workplace ergonomics.

A community based, cross sectional study was conducted among 419 computer operators in India to determine the prevalence of asthenopia (Bhanderi *et al*., 2008). This research indicated that the prevalence of asthenopia with computer users was 46.3% and it was more amongst females. The occurrence of asthenopia was associated with computer operators who started using computers at a very early age, presence of refractive errors, viewing distance, level of computer screens to the eye, the use of antiglare screens, adjustment of computer screens' contrast and screen brightness.

Mashige *et al*., (2013) investigated which ergonomic factors might have lead to computer vision syndrome (CVS) among 87 non-presbyopic computer users. The research focused on University of Kwa-Zulu Natal staff. The age of participants ranged from 21-37 years and the majority (88%) of them used computers for 5-6 hours. Results showed that most users were viewing computer screen sat higher viewing angles of more than the recommended angle of 10-20 degrees below eye level. The presence of glare also contributed to the visual complaints. Computer stations were not designed to minimise environmental factors that could contribute to complaints associated with the use of computers. The most common reported complaints were eyestrain and visual fatigue (89%), headaches (81%), neck and back pains (77%) and blurred vision (64%).

A cross sectional study conducted among university students in the suburban area of Chennai, indicated that more than three-quarters of them complained of at least one or more of the symptoms associated with CVS while working on computers (Logaraj, Madhupriya & Hegde, 2014). Students who used a computer for 4-6 hours per day were at higher risk to develop neck and shoulder pain, ocular burning sensation, blurry vision, dry eyes and redness than students who used a computer for less than 4 hours per day. Students

who took frequent breaks while working on computers were at lower risk to develop symptoms of CVS compared to those who did not take breaks.

2.3 Call centre agents

Žunjić, (2004) analysed the visual performance of Serbian call centre VDT operators. The two-fold aim of the study was to establish the extent to which call centre VDT operators' work can be considered as visually demanding, as well as to find solutions which could ease their work visually and make it more comfortable and less fatigable. The research was conducted among 33 call centre operators with an average age of 25.5 years. Eighty-two percent (82%) reported headaches whilst working, 72% complained of eyestrain and eye irritation, 52% prevailed with problems in terms of accommodation and convergence, 36% indicated screen flickering and 21% had problems with fixation. All call centre agents were exposed to high visual demands, because of the extensive duration of their computer work. These are reported risk factors for eye related symptoms associated with CVS.

Norman *et al*., (2004) investigated the working conditions and related ocular symptoms amongst call centre employees in Sweden. The research consisted of a cross-sectional survey completed by 57 call centre employees, together with a reference group of 1459 professional computer users from other occupations. The call center operators' ages ranged from 20 to 53 years. The research stated that call center operators were exposed to working conditions that increased their risk to develop musculoskeletal disorders. Challenging working conditions included deficiencies in the workspace, as well as keyboard and input device placement. The majority (86%) of female call centre operators reported headaches and musculoskeletal symptoms. The prevalence amongst females was higher than reported by their male colleagues. However, these ocular symptoms occurred more among computer workers in other labour market sectors.

Rocha *et al*., (2005) carried out an ergonomic work analysis with the aim to identify the risk factors leading to musculoskeletal symptoms among 108 call

centre operators at a bank in São Paulo, Brazil. The majority of the participants were women (88%) with an age range of 18 to 23 years. The prevalence of neck, shoulder symptoms were 43% and wrist hand symptoms were 39%. The research reported that risk factors associated with neck and shoulder symptoms were less rest breaks and inadequate thermal comfort. Risk factors linked with wrist and hand symptoms were inadequate height of tables and handling more than 140 calls per day. The research concluded that an integrated approach to improve workstation design, the thermal comfort environment, a well-scheduled work-rest regime, with adequate breaks, and realistic production goals would help to prevent musculoskeletal disorders among call centre operators.

Cabrera *et al*., (2010) conducted a survey of eye-related complaints among 277 call-centre agents in Metro Manila. The study reported that eyestrain (68%); headaches (66%) and blurred vision - from near to distance or from distance to near - (53%) were common complaints experienced. Most of the call-centre agents worked for a minimum of eight hours per day and the majority of the agents experienced these ocular symptoms after they had been sitting in front of the computer screen for at least four hours. The severity of ocular symptoms was correlated with the duration of computer use as well as the time-span of employment as a call centre agent.

Sa *et al*., (2012) investigated the work conditions, estimated the prevalence and described the risk factors associated with CVS among 476 operators of two call centres in São Paulo, Brazil. The call centre operators were mainly female and their ages ranged from 15 to 24 years. The prevalence of CVS was 54.6%. The symptoms reported were eye fatigue (73.9%), increased weight in the eyes (68.2%), burning eyes (54.6%), tearing eyes (43.9%) and weakening of vision (43.5%). The prevalence of CVS was attributed to a lack of recognition at work, the ergonomic organisation in a call centre and mostly, to the high demands at work. The research suggested that the ergonomic organisation and psychosocial factors in the work environment should be included in visual syndrome prevention programs among call centre operators.

The above mentioned research indicates that the prevalence of ocular symptoms associated with CVS is more common among female call centre agents. However, most of the call centres employed more female agents than male agents, which need to be noted. There are evidence that work conditions and ergonomic factors, including the duration of computer use, long working hours, non-adjustable workstations and unfavorable postures affect call centre agents. It thus makes them susceptible to musculoskeletal and eye related symptoms. Thomson, (1998) reported that the recommended computer viewing distance must be between 50 and 70 cm. The computer viewing angle should be between 10 to 20 degrees below eye level, to the centre of the monitor. The average gaze angle needs to be 15 degrees. It is further recommended to take breaks from the computer screen every 2 to 3 minutes after 30 minutes of computer work and every 10 to 15 minutes after every hour of computer work. There is at present no published research on ocular symptoms and visual ergonomics among call centre agents in South Africa.

2.4 AIM AND OBJECTIVES

The aim of the study was to investigate visual ergonomics and ocular symptoms among call centre agents in the call centres of the City of Tshwane.

2.4.1 Research Objectives

- To describe the working conditions of call centre agents at the three call centres of the City of Tshwane.
- To estimate the prevalence of ocular symptoms associated with computer vision syndrome amongst call centre agents at the three call centres of the City of Tshwane.
- To describe the ocular symptoms among call centre agents.

To describe the ergonomic factors of these call centres and the musculoskeletal symptoms of the participating call centre agents.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This study was conducted after it was approved by the Research Ethics Committee of the Faculty of Health Sciences of the University of the Free State (Appendix A).

This chapter describes the research design and methodology used in the situational analysis of the visual ergonomics of call centres in the City of Tshwane associated with ocular symptoms amongst their call centre agents.

3.2 Study design

This study was cross-sectional and an observational study design was used. A cross sectional study was selected, because of its appropriateness for a symptoms survey (Checkoway, *et al*., 1989). Data was collected by means of a survey and the researcher also made observations and measurements in the call centre. The questions on symptoms and ergonomics in the questionnaire were informed by the literature review on probable symptoms experienced, related to computer vision syndrome, and the general ergonomics during computer use in call centres.

3.3 Sampling and study participants

Three call centres in the City of Tshwane were selected. A letter was sent to the director of the call centres to request permission to conduct the study in the three call centres (Appendix B). Convenience sampling was applied. Thus, anyone working as a call centre agent within the identified call centres that was willing to participate and met the inclusion criteria, was enrolled for the study. All participants were informed about the aim and purpose of the study and an information document was distributed to them (Appendix C). Written consent was obtained from each one of them (Appendix D).

3.3.1 Sample size

The pre-calculated, estimated number of call centre agents to be included in the study was 377. This was estimated by using a response distribution of 50% with 95% confidence interval and a 5% margin of error. However, there were fewer than 200 agents employed in the three identified call centres in the City of Tshwane.

3.2.2 Inclusion Criteria

All participants who were using a computer at least three hours or more per day and were willing to participate were enrolled in this study.

3.2.3 Exclusion Criteria

Prospective participants who worked less than three hours per day and those who were not willing to comply with the research guidelines, irrespective of meeting the inclusion criteria, were excluded.

3.4 Measuring instruments

3.4.1 Questionnaire

Participants completed a structured questionnaire (Appendix E). The questionnaire consisted of four sections, namely demographic information, occupational information, work ergonomic evaluation and symptoms experienced during, or after, computer work.

3.4.2 Workstation measurements

Workstation measurements were taken by the researcher. All measurements were taken according to habitual prescription and at the position that the participants normally sit. The following measurements was taken by the researcher:

3.4.2.1 Viewing distance

The viewing distance was measured in centimetres, from the outer canthus of the right eye to the top of the computer screen, using a measuring tape (Ankrum & Nemeth, 1995). Viewing distance, from the eye to firstly the bottom

of the display screen, to secondly the keyboard and to thirdly the hard copy paper, was also measured.

3.4.2.2 Viewing angle

The viewing angle was calculated using the following formula:

$$\text{Viewing angle} = 2 \times \textit{tan} - 1 ((\text{screen height} / 2) / \text{distance})$$

The screen height denotes the viewable area of the computer screen. The distance implies the measurement from the eye to the computer screen, in degrees.

3.4.2.3 Light luminance

The room and screen luminance was recorded with the use of a lux meter and the unit of measure was lux.

3.5 Data Analysis

Data from the observation, measurements and structured self-administered questionnaire were analysed. The questionnaire data was coded and captured on a Microsoft Excel spreadsheet for analysis purposes. Descriptive statistics and figures were generated for interpretation. The gathered information provided a clear understanding of the operations of call centre agents, their working conditions and symptoms associated with the former.

CHAPTER 4: RESULTS

4.1 Demographic Information

One hundred and seventy five (175) call centre agents, consisting of 121 females (69%) and 54 males (31%) participated in this study. The age of the participants ranged between 21 to- 63 years with a mean of 31 (± 7.6) years. The sample consisted of 94% black and 5% white call centre agents. Thirty three percent (33%) of participants had a post matriculation certificate, 29% had a post matriculation diploma and 25% had a matriculation certificate.

4.2 Occupational Information

The job titles of the participants ranged from call centre agents (88%), senior call centre agents (9%) supervisors (6%), call centre supervisors (2%) to a deputy director (1%). From the cohort of senior call centre agents, 3% were doing exactly the same job as the general call centre agents, The call centre agents' daily routine was to answer phones and customer care. It entails the typing of emails and logging of calls on the computer. The supervisors and deputy director supervised the call centre agents, tracking management systems and monitoring queues on the computer on a daily basis.

Most of the participants (75.43%) had never worked in a call centre before their current employment. Those who hád previous experience of working in call centres varied from less than a year to more than 6 years in terms of the duration of their previous experience. Most of the call centre agents (9.14%) had prior experience of 1 to 2 years. The number of their years working in call centres at the City of Tshwane varied from less than a year to more than 6 years. Most participants have been working between 1 and 4 years at their current location.

4.3 Working conditions and ergonomics

There was some variation in the number of hours spend on the job among the participating call centre agents. Most participants (62%) worked more than 8 hours per day and 38% worked 7-8 hours. Most (58.28%) spent more than 8

hours per day working on computers during their shift. It is interesting to note that participants still spent time on computers, smartphones and tablets after their work shift. But most participants spend, on average, less than an hour on these devices after hours.

The majority (90.29%) of participants reported that they took breaks during work hours, other than meal breaks. Close to ten percent, 9.71% to be exact, reported *not* to take breaks during work except for meal breaks. Most of the participants (56%) reported that, during these breaks, they moved around. This group was followed by participants (7.43%) who indicated that they did not concentrate on a computer screen. These breaks also refer to body and smoke breaks. Participants reported the average duration of these breaks to be between 1 to 60 minutes, with a mean of 8.2 minutes, per shift. Forty nine percent (49%) of participants reported that they took a meal break for about 30 minutes, while 42% used one (1) hour for their meal breaks.

Fluorescent lights are the common type of lighting used in call centres. This was reported by participants and observed by the researcher. (Figure 4.1). Most participants indicated that the room lighting was fair (39%) to good (32%). The light in the working area was rated as bright (48%), medium (47%) or dim (5%). Only 6% of participants rated the room temperature as excellent and 32% indicated it as being good.

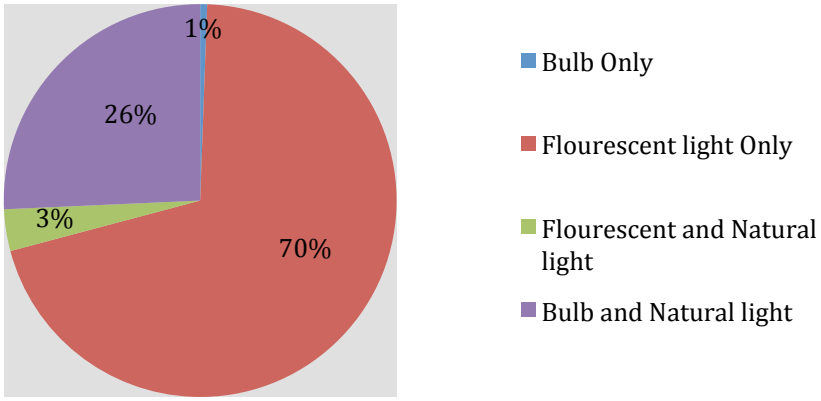

Figure 4.1. Room lighting and type of lights used at three call centres in the City of Tshwane

Most call centre agents (63.86%) reported that there were windows in their working area (Table 4.1). Light control measures were confirmed with the positive identification of blinds present in front of windows (49.55%). A total percentage of participants, namely 48.65%, reported bare windows without blinds in their call centre. Most participants (65,52%) indicated the position of the window light relative to the computer screen to be on the side of the computer.

Table 4.1 Ergonomics factors

Presence of windows in working room	
Yes	62.86%
No	37.14 %
Position of window light	
In front of the computer	6.03%
Behind the computer	6.03%
To the side of the computer	65.52%
Not near the computer	22.41%
Window light control	
Curtains	1.14%
Blinds	30.86%
Bare windows	30.86%

The results indicated that most participants (83%) used black letters on the computer screen and the most common background colour on the computer screens was indicated to be white (43%). The call centre software programmes were usually pre-programed with these colors. Only 18% of participants noticed the flickering of light on their computer screens. Of these participants, 7% made use of glare filters.

Fifty nine percent (59%) of participants reported that they perceived their sitting position as the correct distance from the computer screen. About 31% indicated that they sat closer than recommended to the computer screen. Participants further reported that they either leant forward (52%) or sat backwards (32%) when they were tired. The calculated viewing angle ranged from 12.57 to 35.13 degrees, with a mean of 18.17 degrees (± 2.70). The viewing distance from the eye to the centre of the display screen ranged from 36.33 to 104.33 cm, with a mean of 75.11 cm (± 9.89 cm). The measured room luminance was between 19 and 388 lux, with a mean of 94.02 lux (± 64.48 lux). The display screen luminance was between 19.67 and 225.67 lux, with a mean of 78.88 lux (± 37.67 lux) (Table 4.2).

Table 4.2 Workstation measurements

Workstation measurements	Minimum	Maximum	Mean	Standard Deviation
Viewing angle (degrees)	12.75	35.13	18.17	2.70
Viewing distance from eye to centre of screen (cm)	36.33	104.33	75.11	9.89
Distance from the eye to the top of the computer screen (cm)	40.00	104.67	74.99	10.18
Distance from the eye to the bottom of the computer screen (cm)	44.67	106.33	77.66	9.65
Room illumination (lux)	19.00	388.00	94.02	64.48
Display screen luminance (lux)	19.67	225.67	78.88	37.67

Most (51,43%) of the participants indicated that the centre of the computer screen was at eye level, while 27,43% pointed out that the screen was below eye level. The remaining 21,14% marked that the screen was above the eye level. However, the examiner observed that 58,29% of participants hit the centre of the computer at eye level and 36,57% at a position below eye level (Table 4.2).

Table 4.3 Position of computer to eye level

Centre of screen position to the eye	Examiner Observation	Participants self-rating
Above eye level	5.14%	21.14%
Equal to eye Level	58.29%	51.43%
Below eye level	36.57%	27.43%

4.4 Prevalence of ocular symptoms

The prevalence of ocular symptoms related to CVS was 69.66% amongst participants. Prevalence was indicated if participants presented with one or more ocular symptoms. The most common symptoms reported were tired strained eyes (95.43%), increased sensitivity to light (83.43%), burning eyes (82.86%) and itchy eyes (82.86%) (Table 4.4). The least reported ocular symptoms were dry eyes and double vision. Those (58%) who work more hours on a computer reported more symptoms ($p < 0.05$) related to CVS compared to those who worked less than 8 hours on a computer. Symptoms were reported to occur during and also after work.

Table 4.4 Frequency of ocular symptoms

Ocular related symptoms	Percentage
Tired, strained eyes	95.43%
Increased light sensitivity	83.43%
Burning eyes	82.86%
Itchy eyes	82.86%
Red eyes	69.14%
Watery eyes	68.00%
Blurred, near vision	64.00%
Blurred, distance vision	62.86%
Sandy feel	61.14%
Double vision	48.57%
Dry eyes	48.00%

4.5 Working conditions related to ocular symptoms.

Most participants who reported ocular symptoms (tired, strained eyes, increased light sensitivity, burning and itchy eyes) had a viewing distance of 71 to 90 cm to the computer screen, used the computer for 9 to12 hours at work and hit the centre of the computer screen at eye level (Table 4.5). The participants (65%) who worked at a viewing distance of 71 to 90 cm reported more symptoms ($p < 0.05$) related to CVS compared to those who worked at a 50 to 70 cm distance from the computer screen.

Table 4.5. Percentage of participants who reported ocular symptoms for different working conditions and according to ergonomics (viewing distance, hours of computer use and angle of the computer screen to the eye)

Viewing distance (from eye to computer screen)	Number of participants (n)	Tired strained eyes (%)	Increased light sensitivity (%)	Burning eyes (%)	Double vision (%)	Itchy eyes (%)
< 50 cm	1	0.57%	0.57%	0.57%	0.57%	0.57%
50-70 cm	51	28.57%	26.29%	25.14%	16.00%	25.71%
71-90cm	114	61.71%	52.57%	53.14%	29.71%	52.57%
91-106 cm	9	4.57%	4.00%	4.00%	2.29%	4.00%
Hours of computer use at work						
< 4 hours	1	0.57%	0.57%	0.57%	0.57%	0.57%
4-8 hours	72	39.43%	34.29%	33.14%	34.86%	35.43%
9-12 hours	102	55.43%	48.57%	49.14%	48.57%	46.86%
Screen position to the eye						
Above eye level	9	4.57%	4.00%	4.00%	4.57%	4.00%
Equal to eye level	102	56.57%	48.57%	48.57%	48.57%	48.00%
Below eye level	64	34.29%	30.86%	30.29%	30.86%	30.86%

4.6 Prevalence of musculoskeletal symptoms

Even though the study was focused on ocular symptoms, the researcher decided to additionally analyse musculoskeletal symptoms. Most participants (88.57%) reported symptoms of backache followed by shoulder pain (87.43%), neck pain and neck stiffness (84%), leg pain (62.29%) and wrist pain (58.86%). Symptoms were reported to occur during work and also after work.

Table 4.6 Percentage of muscoskeletal symptoms

Musculoskeletal symptoms	Percentage
Backache	88.57%
Shoulder pain	87.43%
Neck pain	84.00%
Neck stiffness	84.00%
Leg pain	62.29%
Wrist pain	58.86%

4.7 Working conditions compared to musculoskeletal symptoms

The most common musculoskeletal symptoms reported were backache, shoulder pain, neck pain and stiffness at a viewing distance of 71 to 90 cm from the computer screen. These symptoms were also reported when computers were used for 8 to 12 hours while on duty. Most participants (52%) who reported to view the computer screen at eye level indicated higher symptoms of backache (Table 4.7).

Table 4.7 Percentage of participants who reported musculoskeletal symptoms for various working conditions and ergonomics

Viewing distance	Number of participants (n)	Backache (%)	Shoulder Pain (%)	Neck Pain (%)	Neck Stiffness (%)	Leg Pain (%)	Wrist Pain (%)
< 50 cm	1	0.57%	0.57%	0.57%	0.57%	0.57%	0.57%
50- 70 cm	51	26.86%	26.29%	26.86%	26.29%	20.57%	20,00%
71-90cm	114	57.14%	56.57%	53.14%	53.14%	39.43%	36.57%
91- 106 cm	9	4,00%	4,00%	3.43%	4,00%	2.86%	2.29%
Hours of computer use at work							
< 4 hours	1	0.57%	0.57%	0.57%	0.57%	0.57%	0.57%
4- 8 hours	72	33.71%	36.57%	35.29%	33.14%	24.57%	20.57%
8- 12 hours	102	54.29%	50.29%	49.14%	50.29%	37.14%	37.71%
Screen position to eye							
Above eye level	9	4.57%	4.57%	4.57%	4,57%	3.43%	4.00%
Equal to eye level	102	52.00%	49.14%	49.71%	49.14%	38.29%	36.57%
Below eye level	64	32.00%	33.71%	29.71%	30.29%	20.57%	18.29%

4.8 Knowledge and perceptions towards eye testing

The majority of participants (89%) indicated that they had an eye test previously and 11% reported to no preceding eye test before. Most participants (44%) had an eye test less than a year ago, followed by 28% who went for an eye test in the year preceding the previous year. Of participants (11%) who never had an eye test, most (8%) reported that they needed an eye test, because of systemic conditions and their own personal discomforts. In terms of the perception towards the necessity of eye testing, fifty three percent (53%) of participants indicated that an eye test should be done annually, 22% prescribed it bi-annually and 19% were not sure. Twenty seven

percent (27%) of the participants reported that they wore spectacles when working on the computer and only 1% wore contact lenses.

CHAPTER 5: DISCUSSION

5.1 Prevalence of ocular symptoms

The prevalence of ocular symptoms in this study, associated with CVS, was 69.66%. This percentage is higher compared to Sa *et al*. (2012) for Brazil. One of the reasons may be because their criteria excluded those who had visual disturbances, which contained photosensitivity and difficulty focusing (blurred vision). CVS, according to Sa *et al.* (2012), is associated with symptoms of eye fatigue, heavier weight experienced in eyes, burning eyes, tearing and the weakening of vision. This study included photosensitivity and difficulty focusing (blurred vision both at a distance and close by which may have contributed to the increased prevalence. The prevalence in this study is compared to that of Malaysian university students with prolonged computer use (Reddy *et al*., 2013; Akinbinu & Mashalla, 2013) which also reported high prevalences of CVS among computer users in Nigeria.

Ocular symptoms associated with CVS were more prevalent amongst females than in males. However, it is worth noting that there were more females in this study than males. This agrees with Sa *et al*., (2012) who also reported a higher prevalence in females with regard to ocular symptoms associated with CVS. Rocha *et al*. (2005) in Brazil and Norman *et al*. (2004) in Sweden also indicated that call centre operators are mainly females. These authors also suggested that CVS symptoms were more prevalent with females. A possible explanation may be the unbalanced representation of gender in these studies, because of generally more females in call centres.

The most common ocular symptoms reported were tired, strained eyes, increased sensitivity to light, burning eyes, itchy eyes, red eyes, watery eyes, blurred near vision, blurred distance vision and a sandy feeling in the eyes.

Similarly, Sa *et al*. (2012) reported eye fatigue, a weight or heaviness within the eyes, burning eyes, tearing eyes and weakening of vision among call center operators in Brazil. Cabrera *et al*. (2010) reported eyestrain or tiredness, headaches and blurring of vision as the most common complaints experienced among call center agents in Manila. There is agreement amongst all these studies, namely that call centre agents complain of ocular symptoms related to CVS.

Research on normal visual display units (VDU) indicated common visual symptoms as eyestrain, blurred distance vision, headaches, double vision and redness, a burning sensation and dry eyes (Chiemeke *et al*., 2007; Mashige *et al*., 2013; Logaraj *et al*., 2014). It agrees with the identified symptoms in this study.

5.2 Prevalence of musculoskeletal symptoms

This study indicates that the most common musculoskeletal symptoms associated with CVS are backache, shoulder ache, neck pain, stiffness, leg pain and wrist-ache. These findings are in agreement with the findings of Odebiyi *et al*., (2016) regarding call centre operators in Nigeria. Norman *et al*., (2004) also reported a high prevalence of neck and upper extremity symptoms associated with major work stress. The stress related to shift work, as well as a lack of control and support from the work environment within call centres in Sweden.

The findings of this study also coincide with Rocha *et al*., (2005) who signaled the prevalence of neck, shoulder symptoms and wrist hand symptoms. Rocha *et al*., (2005) further indicated that these symptoms among call centre operators in Brazil are due to the inadequate height of tables, too few rest breaks and insufficient thermal control. In addition, the cause of these musculoskeletal symptoms associated with CVS may be due to the improper viewing position and angle during computer use and the static nature of the call centre environment (Sommerich *et al*., 2001).

The findings of this study also concur with Mashige *et al*. (2013) who reported that neck and back pains were more prevalent among university staff populations. These symptoms were said to be caused by computer workstations that were not ergonomically designed.

5.3 Working conditions and ergonomics

The study showed that most participants had their computer screens positioned at eye level. Associated with eye levels, tired, strained eyes were the most common reported symptoms. This was in agreement with Jaschinski *et al*., (1998) who reported more symptoms of eyestrain when the computer screen centre was at eye level compared to when placed below eye level. According to Ankrum & Nemeth (2000), when a computer screen is positioned at 10 to 20 degrees below eye level, it reduces the occurrence of head tilt and an extended head neck posture which results from screens at eye level.

This study also showed that most participants preferred a viewing distance to computer screens of 71 to 90 cm. At this distance mostly tired, strained eye symptoms were reported. This is in agreement with Jaschinski *et al*., (1998) reported most computer users complained more about eyestrain when their viewing distances as between 70 and 90 cm. The recommended viewing distance between eyes and computer screens is indicated between 50 and 70 cm (Thomson, 1998). The viewing distance of 71 to 90 cm shown in this study subtends an average viewing angle of 17.23 degrees, ranging between 14.56 to 22.14 degrees (± 1.39 degrees). The viewing angle affects the posture of t computer users, which may also have an impact on the visual system and musculoskeletal comfort of the user according to Allie *et al*., (2005) may. The recommended viewing angle is 10 to 20 degrees below eye level to the centre of the monitor, with an average gaze angle of 15 degrees (Thomson, 1998)

This study revealed the highest prevalence of eye related symptoms, associated with CVS, among participants who work on computer for more than 8 hours per day, followed by participants spending 4 to 8 hours per day on computers. This is in agreement with Logaraj *et al*. (2014) and Chiemeke

et al. (2007) who concurred that visual symptoms were higher amongst participants who daily spend more than 8 hours on computers. Subsequently, it also increases the risk of ocular symptoms associated with CVS. However, the findings of this study did not correlate with the findings by Akinbinu & Mashalla (2013). They reported higher symptoms of CVS amongst participants who spends an average of 6 to 8 hours on computers daily than those who spend more than 8 hours per day on computers. The reason for the difference may be that participants older than 40 years were excluded from the research by Akinbinu & Mashalla (2013) and their sample size differed significantly from this study.

In this study, most participants were taking breaks additional to meal breaks. But the study also indicated that, even though there are breaks allocated to participants of call centres within the City of Tshwane, not all participants took these breaks. This might have caused the identified ocular and musculoskeletal symptoms. Thomson, (1998), recommended breaks of 2 to 3 minutes after every 30 minutes of focused concentration on computer screens and 10 to 15 minutes breaks after every hour of computer work. Sommerich *et al*. (2001) indicated that taking short breaks of 5 minutes every hour, additional to the normal 15 minutes morning and afternoon breaks and a lunch break, will decrease symptoms of eye and musculoskeletal discomfort. It will also not impede productivity. Enough breaks between computer use intervals are recommended and viewed as preventative measures to relief CVS symptoms (Reddy *et al*., 2013).

Room illumination in two call centres was not conducive for computer work. The room illumination varied from 19 lux, which is dim, to 388 lux, which is acceptable. Anshel (2005) and Ankrum, (1999) reported the recommended light levels for normal computer environments as 200to 500 lux. An average of at least 350 lux is actually required. Good lighting is important for the visual comfort of computer users. It is also worth noting that light requirements may vary with tasks. For example, there may be a need for increased light for reference documents. There have been limited research on lighting within call centre environments. The screen brightness in one call centre was dim (19.67

lux) compared to the recommended screen brightness which ranges between 80 and 120 lux, with an average of 100 lux for computer workstation environments (Anshel, 2005). The imbalance between the computer screen and the room brightness may be the cause of increased light sensitivity and tired, strained eyes reported by call centre agents. It is also important to note that there are different light requirements for younger and older workers. Thus, the provision of adequate light for tasks may be necessary to accommodate the visual needs of the older workforce (Sheedy & Shaw-McMinn, 2003). The majority of call centre agents had adequate knowledge about the importance of eye tests and most of them have had eye examinations.

CHAPTER 6: CONCLUSION

6.1 Main findings

The prevalence of ocular symptoms associated with computer vision syndrome (CVS) amongst call centre agents at the three call centres in the City of Tshwane was 69.66%. The common ocular and musculoskeletal symptoms related to CVS were tired and strained eyes, increased sensitivity to light, burning eyes, itchy eyes, backache, shoulder pain, neck pain, neck stiffness and leg pain.

Most of the participants worked more than 8 hours per shift. However, most of them took breaks as recommended for computer users. There was a high prevalence of both ocular and musculoskeletal symptoms amongst participants who worked more than 8 hours in a call centre This may be related to the far viewing distance for these agents in terms of the computer screen and poor lighting, It did not conform to the recommended viewing distance and lighting for computer users.

6.2 Contribution of the study

A study of this nature has never been conducted among call centre agents in South Africa. Only a few such studies were done worldwide, with most being conducted on a small sample size. This study will contribute to knowledge with regard to recommended call centre vision ergonomics and the prevalence of ocular and musculoskeletal symptoms associated with CVS in call center environments in the City of Tshwane. This study may therefore positively contribute to the literature on optometry and ergonomics with regard to the call centre agents and their working environment. The results will also serve as baseline for education on visual ergonomics and ocular symptoms related to computer use among call centre agents.

6.3 Recommendation

- The lighting in all the call centres should be between 200 and 500 lux
- The screen brightness should be adjusted to be between 80 and 120 lux
- The viewing distance between the eyes of a call centre agent and computer screen should be between 50 and 70 cm.
- The viewing angle should be adjusted to be between 10 to 20 degrees below eye level, to the centre of the monitor.
- The workstation table, computer height and chair should be adjustable in order to cater for various and different call centre agents.
- All call centre agents should be encouraged to take regular breaks from computer screens, besides their meal break.
- Establishment of ergonomics guidelines, training on computer health and safety should be given to all call centre agents.
- Further studies are recommended for other call centres in South Africa.
- Future studies should include pre-selection procedures, involving visual examinations and history taking to avoid exaggeration of ocular symptoms. It should be remembered that some of the anticipated symptoms could also be associated with presbyopia, uncorrected

refractive errors, binocular vision anomalies, ocular pathology and contact lens wear.

6.4 Limitations of the study

The study sample included only 175 participants, because of the limited, available population number of call centre agents in the City of Tshwane. The study results may thus not be generalised to other call centres. The study was done as a survey and it would have been appropriate to have a qualitative study with focus groups to explore some of the information provided. The depth of CVS may not have been established due to the fact that a structured questionnaire was used and ergonomics measurements are not always sufficient without visual examination.

Although some of the ocular symptoms associated with computer use are due to poor ergonomic factors compliance, these symptoms are not specific to persons experiencing CVS only. Presbyopia, uncorrected refractive errors, binocular vision anomalies, ocular pathology and contact lens wearers often present with similar symptoms. Therefore, the high prevalence of ocular symptoms could have been influenced by the inclusion of persons with these conditions. A visual examination needs to be conducted to ascertain visual statuses and rule out pathologic interferences in terms of findings.

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Appendix A: Ethical clearance letter

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA

UFS·UV
HEALTH SCIENCES
GESONDHEIDSWETENSKAPPE

IRB nr 00006240
REC Reference nr 230408-011
IORG0005187
FWA00012784

27 January 2016

MRS TG TAMENTI (PROF TA RASENGANE)
DEPARTMENT OF OPTOMETRY
FACULTY OF HEALTH SCIENCES
UFS

Dear Mrs Tamenti

ECUFS NR 239/2015
PROJECT TITLE: A SITUATIONAL ANALYSIS OF VISUAL ERGONOMICS AND VISUAL SYMPTOMS AMONG CALL CENTRE AGENTS: CITY OF TSHWANE CALL CENTRES

1. You are hereby kindly informed that, at the meeting held on 26 January 2016, the Health Sciences Research Ethics Committee (HSREC) approved the following project after all conditions have been met.

2. The Committee must be informed of any serious adverse event and/or termination of the study.

3. Any amendment, extension or other modifications to the protocol must be submitted to the HSREC for approval.

4. A progress report should be submitted within one year of approval of long term studies and a final report at completion of both short term and long term studies.

5. Kindly use the ECUFS NR as reference in correspondence to the HSREC Secretariat.

6. The HSREC functions in compliance with, but not limited to, the following documents and guidelines: The SA National Health Act. No. 61 of 2003; Ethics in Health Research: Principles, Structures and Processes (2015); SA GCP(2006); Declaration of Helsinki; The Belmont Report; The US Office of Human Research Protections 45 CFR 461 (for non-exempt research with human participants conducted or supported by the US Department of Health and Human Services- (HHS), 21 CFR 50, 21 CFR 56; CIOMS; ICH-GCP-E6 Sections 1-4; The International Conference on Harmonization and Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH Tripartite), Guidelines of the SA Medicines Control Council as well as Laws and Regulations with regard to the Control of Medicines, Constitution of the HSREC of the Faculty of Health Sciences.

Yours faithfully

.....
PROF WJ STEINBERG
FOR CHAIR: HEALTH SCIENCES RESEARCH ETHICS COMMITTEE

Health Sciences Research Ethics Committee
Office of the Dean: Health Sciences
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www.ufs.ac.za

Appendix B: Letter of permission from The City of Tshwane

CITY OF TSHWANE
IGNITING EXCELLENCE

Office of the Executive Mayor
Research and Innovation Unit

Innovation Hubl Mark Shuttleworth Street I Sappi Technology Centre I Lynwood I 0087
PO Box 440 I Pretoria I 0001
Tel: 012 358 2000 I Fax: 012 358 4464
Email: Zukiswanc@tshwane.gov.za I www.tshwane.gov.za | www.facebook.com/CityOf Tshwane

My ref:	Research Permission	Tel:	012 358 2000
Your ref:		Fax:	012 358 4464
Contact person:	Zukiswa Ncunyana	Email:	Zukiswanc@tshwane.gov.za
Section/Unit:	Research and Innovation		

TO: **Ms Gloria Tamenti**
P.O Box 39952
Faerie Glen
0043

DATE: 17 September 2015

Dear Ms Tamenti,

Approval To Conduct Research Within The City Of Tshwane Metropolitan Municipality

I have the pleasure to inform you that your request to conduct research on the topic "***A Situational Analysis of Computer Related Visual Symptoms in a Call Center: Tshwane Metro***" has been reviewed and permission is hereby granted for you to conduct research in the City of Tshwane Metropolitan Municipality.

It is noted that your research seeks to investigate computer vision syndrome among Tshwane Metro call center agents. The City of Tshwane further notes that all ethical aspects of your research study will be covered within the provisions of the University of the Free State's Research Ethics Policy and adherence to Helsinki Declaration. In addition, as a researcher you are required to sign the Confidentiality Agreement Form with the City of Tshwane prior to conducting the research.

Research and Innovation Unit will be facilitating the process; therefore all correspondence should be directed through the unit. Upon completion of your research, you are reguired to present and submit final report on the findings to the City of Tshwane Metropolitan Municipality.

Yours faithfully

17.09.2015
Date

Dorah Nteo (Ms)
Acting Chief of Staff
Office of the Executive Mayor

C40 CITIES
CLIMATE LEADERSHIP GROUP

Kgoro ya Dinyakišišo le Mpšafatšo Umnyango • Wezokucwaninga Nezobuchule • Departement Navorsing en Innovering •
Lefapha la Tlhotlhomiso le Boitlhamedi • UmNyango wezokuTlama nokuRhubhululula •
Research and Innovation Department

Appendix C: Professional Editor

Wordhouse

To whom it may concern

I, JD Liebenberg for **Wordhouse**, language edited the thesis:

A situational analysis of visual ergonomics and ocular symptoms among call centre agents: City of Tshwane call centres

of

Gloria Tsholofelo Tamenti,

for the fulfilment of the degree M Optometry in the Departement of Optometry in the Faculty of Health Sciences at the University of the Free State

JD Liebenberg

JD Liebenberg
2017-06-02

Appendix D: Information document

Title of Study: A Situational Analysis of Visual Ergonomics and Ocular Symptoms among Call Centre Agents: City of Tshwane call centres

Researcher:

Name: G.T Tamenti

Master of Optometry student; University of the Free State

Address: P. O. Box 39552, Faerieglen, 0043

Phone: 0824295906

E-mail: tsholo@tamenti.co.za

You are being invited to take part in a research study. Before you decide to participate in this study, it is important that you understand why the research is being done and what it will involve. Please take the time to read the following information carefully. Please ask the researcher if there is anything that is not clear of if you need more information.

The purpose of this study is: to determine the working conditions, eye symptoms related to computer use amongst call centre agents.

How many people will take part in this study?

All call centre agents will be encouraged to take part in this study. The study will take place in the working place of the participants.

What is involved in this study?

You will be asked to complete a questionnaire. This questionnaire includes questions on personal information such as date of birth, level of education, home language and marital status; your work history; working hours; the characteristics of the computer screen and workstation and symptoms experienced during or after computer work. It will take 20 minutes to complete the questionnaire.

The researcher will also observe and take the following measurements

- Measurements such as the distance from your eye to the computer, keyboard and hard copy.
- The room lighting and computer screen brightness

This observation and measurement will take about 5 - 10 minutes.

What are the risks?

There are no direct risks involved. In completing the questionnaire you may decline to answer any or all questions and you may terminate your involvement at any time if you choose.

Are there benefits for taking part in this study?

There will be no direct benefit to you for your participation in this study. However, we hope that the information obtained from this study may help computer users, by increasing awareness regarding symptoms associated with computer use. This might also lead to new clinical approach in treating computer related visual discomfort and will also be used to provide basis for work ergonomic guidelines in any environment requiring the use of computer as a daily activity.

Will my information be kept private?

Your responses will remain confidential. Every effort will be made by the researcher to preserve your confidentiality including the following:

Assigning code names/numbers for participants that will be used on all researcher notes and documents.

Questionnaire and data sheets and any other identifying participant information will be kept in a locked file cabinet in the personal possession of the researcher. When no longer necessary for research, all materials will be destroyed,

The researcher will review the collected data. Information from this research will be used solely for the purpose of this study and any publications that may result from the study. All participants involved in this study will remain confidential, including the final publication.

Participants have the opportunity to obtain a transcribed copy of their questionnaire. Participants should tell the researcher if a copy of the questionnaire is desired. Participant data will be kept confidential except in cases where the researcher is legally obligated to report specific incidents.

Can I refuse to take part in this study?

Your participation in this study is voluntary. It is up to you to decide whether or not to take part in this study. If you do decide to take part in this study, you will be asked to sign a consent form. If you decide to take part in this study, you are still free to withdraw at any time and without giving a reason. You are free to not answer any question or questions if you choose. This will not affect the relationship you have with the researcher or the work benefits.

What are the costs?

There will be no additional costs to you as a result of being in this study. There is no remuneration for participating in this study.

Whom do I call or contact if I have questions or problems

Should you have any questions about the research or any related matters, please contact the researcher at tsholo@tamenti.co.za or 0824295906 during regular business hours. For questions about your rights as a research participant or for reporting of complaints, contact the Secretariat of the Ethics committee of the Faculty of Health Sciences, University of the Free State at 051 401 7795.

Appendix E: Consent form

A Situational Analysis of Visual Ergonomics and Ocular Symptoms among call centre agents: City of Tshwane call centres

By signing this consent form, I confirm that I have read and understood the information and have had the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and without cost. I understand that I will be given a copy of this consent form. I voluntarily agree to take part in this study.

_____	_____	_____
Name of Participant	Signature	Date
_____	_____	_____
Researcher's name	Signature	Date
_____	_____	_____
Witness	Signature	Date

Appendix F: Questionnaire

A situational analysis of visual ergonomics and visual symptoms among call centre agents: Tshwane Metro call centre.

QUESTIONNAIRE Study ID_____

How to complete the questionnaire:

1. Complete the blank space _____. Example: Age __25__ years
2. Please tick the relevant box, example Gender:

Female	X
Male	

Section A: Demographic information

Date_____

1. Age: _____years

2. Gender:

Female	
Male	

3. Race:

Black	
Indian	
White	
Coloured	

4. Level of Education

< Matriculation	
Matriculation	
Certificate	
Diploma	
Degree	
Post Grad	

Section B: Occupational information

5. Job Title_____

6. Explain your daily work routine _____

_____

7. Have you ever worked in a call center before this occupation?

Yes	
No	

If no go to question 9, if yes answer question 8

8. How many years in previous occupation,

< 1year	
1 – 2 years	
3 – 4 years	
5 – 6 years	
> 6 years	

9. Number of years and months on the current occupation

< 1year	
1 – 2 years	
3 – 4 years	
5 – 6 years	
> 6 years	

10. Rate your job satisfaction

Extremely Satisfied	
Slightly Satisfied	
Slightly dissatisfied	
Extremely dissatisfied	
Neither satisfied nor dissatisfied	

11. Numbers of hours spend at work

1 – 2	
3 – 4	
5 – 6	
7 – 8	
> 8	

12. Which type of computer are you using at work?

Desktop	
Laptop	

Working Hours

13. Number of hours per day at work of computer viewing

1 – 2	
3 – 4	
5 – 6	
7 – 8	
> 8	

14. Number of hours after work of computer viewing

< 1	
1 – 2	
3 – 4	
5 – 6	
> 6	

15. Number of hours on Smartphone or Tablets at work

< 1	
1 – 2	
3 – 4	
5 – 6	
> 6	

16. Number of hours on Smartphone or Tablets after work

< 1	
1 – 2	
3 – 4	
5 – 6	
> 6	

Type of work habits:

17. Do you take breaks (except meal breaks) when working?

Yes	
No	

If answer is no, go to Question 20

18. If yes, what type of breaks do you take?

Look away	
Move around	
Other	

Duration of your break _____min.

If answer is other, go to Question 19

19. If your answer is other, please fill in the type of break

_____

20. How long do you work without a break?

< 1 hour	
1 – 2 hours	
3 – 4 hours	
5 – 6 hours	
> 6 hours	

21. How long is your meal break?

< 30 min	
30 min	
1 hour	
> 1 hour	

Section C: Ergonomics

Environment:

22. Type of lights in the work area

Bulb light only	
Fluorescent light only	
Natural light	
Bulb light and Fluorescent light	
All of the above	

23. In your opinion, how is the room lighting?

Excellent	
Good	
Fair	
Poor	
Bad	

24. Is there any additional lighting such as;

Desk lamp	
Task lamp	
Natural light	
None	

25. Are there windows in your working room/office?

Yes	
No	

If no go to Question 29

26. What is the position of the window light relative to the computer?

In front of the computer	
Behind the computer	
To the side of the computer	
None	

27. The window light control is through

Curtains	
Blinds	
Bare Windows	

If the answer is, curtains go to question 29

28. What is the direction of blinds in your room/office?

Vertical	
Horizontal	
Not applicable	

29. Rate the brightness of the room

Medium	
Dim	
Bright	

30. Rate your workspace layout

Excellent	
Good	
Fair	
Poor	
Bad	

31. Explain workspace layout in your own words_____

_____

32. Rate the Room Temperature

Excellent	
Good	
Fair	
Poor	
Bad	

33. Explain room temperature in your own words _____

_____

Display Screen:

34. Color of the letters on your screen

Black	
Blue	
Green	
Grey	
Orange	
White	
Other	

If you chose other, please specify_____

If more than one color please explain _____

35. Color of the background on your screen

Black	
Blue	
Green	
Grey	
Orange	
White	
Other	

If you chose other, please specify_____

If more than one color please explain_____

36. How often do you clean your display screen?

Daily	
Weekly	
Monthly	
Other	

If you choose other, please specify_____

37. Do you notice any flickering of light on your screen?

Yes	
No	

38. Do you use a glare filter on your screen?

Yes	
No	

If no, go to Question 40

39. If yes, what kind

Glass	
Mesh	
Not applicable	

40. Is your screen adjustable (back and forth)?

Yes	
No	
Not sure	

41. Is your screen height adjustable?

Yes	
No	
Not sure	

42. How far do you sit away from the screen?

Close	
Far	
Just right	

43. What is position of the top of display screen position with respect to your eyes?

Above eye level	
Equal eye level	
Below eye level	

Section D: Visual Information and Symptoms experienced during or after computer work

44. Please choose the appropriate.

Tired and strained eyes

Never	
Sometimes	
Always	

After work	
During work	
During and after work	

Headache

Never	
Sometimes	
Always	

After work	
During work	
During and after work	

Burning, sore eyes

Never	
Sometimes	
Always	

After work	
During work	
During and after work	

Double vision

Never	
Sometimes	
Always	

After work	
During work	
During and after work	

Dry eyes

Never	
Sometimes	
Always	

After work	
During work	
During and after work	

Itchy, discomfort of eyes

Never	
Sometimes	
Always	

After work	
During work	
During and after work	

Increased sensitivity to light

Never	
Sometimes	
Always	

After work	
During work	
During and after work	

Red eyes

Never	
Sometimes	
Always	

After work	
During work	
During and after work	

Sandy feeling in the eyes

Never	
Sometimes	
Always	

After work	
During work	
During and after work	

Watery eyes

Never	
Sometimes	
Always	

After work	
During work	
During and after work	

Neck Pain

Never	
Sometimes	
Always	

After work	
During work	
During and after work	

Neck Stiffness

Never	
Sometimes	
Always	

After work	
During work	
During and after work	

Shoulder pain or ache

Never	
Sometimes	
Always	

After work	
During work	
During and after work	

Backache

Never	
Sometimes	
Always	

After work	
During work	
During and after work	

Wrist ache

Never	
Sometimes	
Always	

After work	
During work	
During and after work	

Legs pain

Never	
Sometimes	
Always	

After work	
During work	
During and after work	

Blurry vision at near

Never	
Sometimes	
Always	

After work	
During work	
During and after work	

Blurry vision at distance

Never	
Sometimes	
Always	

After work	
During work	
During and after work	

45. Do you experience any other symptoms not mentioned above

Yes	
No	
Sometimes	

If no go to Question 47

46. If yes, please state the symptoms you feel

_____

47. Do you wear glasses while working at the computer?

Yes	
No	
Sometimes	

If no, go to Question 49

48. If yes or sometimes, what kind

Single Vision	
Bifocal	
Multifocal	
I do not know	
Not applicable	
Other	

If other, please specify _____

49. Do you wear contact lenses while working at the computer?

Yes	
No	
Sometimes	

If no go to Question 52

50. If yes, what kind

Soft contact lenses	
Hard contact lenses	
I do not know	

51. Period of Contact lens replacement:

Daily	
Bi-Weekly	
Monthly	
Yearly	
Not applicable	

52. Have you ever had an eye test before?

Yes	
No	

If no, go to Question 54

If yes, proceed with Question 53

53. When was your last eye examination?

< 1 year	
1 year	
2 years	
3 years	
≥ 4 years	

If you answered 53, go to Question 56

54. Do you think you need an eye test?

Yes	
No	

If No, go to Question 56
If yes, answer Question 55 and 56

55. Why do you think you need an eye test?

_____

56. How often do you think you have to test your eyes?

Every year	
Every 2 years	
Every 3 years	
I am not sure	
Only when there is a problem	

Appendix G: Data collection form

Study ID _____

Data Sheet

Workstation Objective Measurements:

Viewing angle from the eye to the top and bottom of screen _____degree.

Viewing distance from eye to display screen (centre)_____/_____/_____cm.

Viewing distance from the eye to keyboard _____/_____/_____cm.

Viewing distance from the eye to hard copy material: _____/_____/_____cm.

Top of display screen position is

Above eye level	
Equal to eye level	
Below eye level	

Top of display screen position from the eye is _____/_____/_____cm

Bottom of display screen position from the eye is _____/_____/_____cm

Height of the screen (viewable area) _____/_____/_____ cm

Room luminance _____/_____/_____lux

Display screen luminance_____/_____/_____lux

Room lights

Bulb light only	
Fluorescent light only	
Natural light	
Bulb light and Fluorescent light	
All of the above	

Posture observation _____

Notes: _____

_____