
Hazards Associated with Computer Operations

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Abstract

Computer operators are at high risk to developing health disorders, related to prolonged use of computer. We assessed the occupational risk factors for computer-related health disorders and evaluated health conditions of the operators in south-south region of Nigeria. For the purpose of this study, the following areas were considered, the concept of health hazard, types of health hazards in line with computer operators, which includes; physical/mechanical hazard, chemical, biological, psychosocial hazard and ergonomic hazard. Other areas are the concept of computer operators and their workstation, common health complaints of computer operators, health hazard of computer operators and their effects, risk factors of health of computer operators, awareness of health of computer operators. Control measures for health hazards and recommendations were subsequently elaborated in order to enhance a healthy wellbeing among the computer operators. It is also pertinent on other researchers to proffer other effective preventive measures necessary to improve computer operators' health status.

INTRODUCTION

Contemporary technology revolution has made our lives with so much convenient that people would hardly imagine life without computer, internet, cable TV, cellular phones, various tools and gadgets. Computers are one of the main tools in businesses, educational institutes, offices, homes and even in cars. On one hand, these technologies including computers have made lives so much easy but on the other hand have created many risks for human health. The negative risks associated with the usage of these technologies are increasing with their growing demand day by day. Every electronic device including computers and laptops produce a form of Electromagnetic Field (EMF).

This EMF is actually a non-ionizing radiation which release energy from these electronic devices that is not enough to ionize the atoms, hence instead of removing electrons it only excites the electrons. This energy brings negative effects to human health. By using computers, laptops or even sitting in computerized workplaces an individual is exposed to the dangerous waves. These radiations may cause rapidly or slowly several health hazards. It means that individuals especially employees spending number of hours for working on computer are directly exposed to the harmful effects of EMF. ISO quality standards emphasize the need of measuring the quality of products throughout its life cycle i.e. from raw materials to disposal. The purpose is to produce safe environment and its components by examining the impacts of products on it. Thus, it is necessary to examine the direct or indirect effects of computers on human health because the world at this time is heavily dependent upon computers and it is human beings that use computers.

Therefore, this study has made an attempt to investigate the reported health disorders among individuals working at computerized workplaces as a result of prolonged computer use. By conducting a field survey, computer users were asked to highlight health disorders they are facing due to extensive use of computers. The scheme of study is as follows: After introduction, ISO 14040 Life Cycle Assessment, effects of electromagnetic fields and other risk factors on human health are discussed. After it, Research Methodology, results and findings are elaborated. Conclusion and recommendation are discussed in the last section of this paper.

Health Hazards

Health is not just mere absence of disease but the overall physical, mental, social, and emotional state of an individual (Herrman, Saxena & Moodie, 2005). This prized possession should be cherished and cared for, and protected from all harm and danger by all who have it. Hazard connotes danger. It threatens every individual's health. Thus, concerted efforts must regularly be conscientiously made to safe guard health form all hazards. If not, it gradually and regrettably deteriorates by 'disease condition(s).

Hazard is simply the possibility to cause harm (Ali, 2008; Institute of Safety Professional of Nigeria [ISPON], 2012 and Eyayo, 2014). However, Hazard can be a situation, condition or thing that can endanger workers safety or health of workers (Achal, 2000 and Work Safe Alberta, 2015). It is tied to an agent, situation or activity that if left unimpeded could cause harm, illness, loss of property or environmental destruction (America Chemical Society, 2015). Ali (2008), states that it can include substances or machines, work method or other aspects of organization. World Health Organization[WHO] (2001) posit that any existing or potential condition in work place that can by itself or by acting jointly with supplementary varying factors, lead to life loss, injury, loss of property etc. is termed a hazard.

Hazard is not same as risk. Risk is any chance of realization of harm from a hazard (Ali, 2008). Risk according to work safe Alberta (2015) means chance of injury, damage or loss. The probable negative occurrence as hazard consequence and its severity if it eventually occurs is risk. The National Examination Board in Occupational Safety and Health [NEBOSI-I] (2013) rightly defined risk as the odds that-a hazard will cause harm combined with the predictable severity of injury should harm occur. It follows therefore that hazard precede risk- the outcome (qualitative and quantitative) of a hazard. No hazard, no risk.

Hazards fall into safety hazards or health hazards. While both are occupational hazards, safety hazards cause accidents leading to physical loss or injury immediately, health hazards results in development of disease or harm someone's health either immediately or over time (National Examination Board in Occupational Safety and Health (NEBOSH), 20 13; Eyayo, 20 14 and Work Safe Alberta, 2015). World Health Organization (WHO) (2001), states that work which may cause occupational disease or morbidity of other disease or exacerbate existing ill-health that is not originally occupational are concomitant with health hazards.

One can deduce from above that health hazard:

- Can cause ill-health or disease,
- Can worsen existing ill-health or disease,
- Can open way for other diseases,
- Can manifest immediately or overtime,.
- Cannot cause immediate physical injury.

Types of Health Hazards

Four known occupational hazards categories are; biological hazards, physical hazards, chemical hazards, and psychosocial (work safe Alberta, 2015). However most authors like Achalu (2000), WHO (2001), NEBOSH (2013) and Eyayo (2014) finds it more convenient to place the hazards into five classes viz; physical, chemical, biological, psychosocial, and ergonomic hazards. These authors place ergonomic hazards separate instead of putting them together with physical 'hazards.

Physical/Mechanical hazards: This hazard can be seen and felt and involves forms of energy or having mechanical or gravitational basis (Achalu, 2000). Examples are thermal stress such as cold or heat stress; noise; vibrations, light-poor or defective illuminations; ionizing and nonionizing radiations; changes in barometric pressure (i.e. Increase or decrease) and confined space (Achalu, 2000; and WHO, 2001). They can cause occupational disorders and injuries and even death (Eyayo, 2014).

Work Safe Alberta (2011) recognizes the following effects of physical health hazards: radiations (ionizing and non-ionizing) hazards-cause cancer, heating, skin burns, and eye damage. Temperature related hazards causes frostbite and hypothermia from extreme cold, while extreme heat can lead to oedema, rashes, spasms, exhaustion, syncope, stroke and hyperpyrexia.

Chemical Hazards: These are produced by the actions or reaction of chemical substance (Achalu, 2000). They cause occupational poisoning (WHO, 2001). Such poisoning includes pesticide and metal poisoning. They also cause occupational cancers, dermatoses, allergies, and reproductive disorders (Achalu, 2000; Eyayo, 2014 and Ford, 2015). Eyayo (2014) gives the following examples of chemical hazards:

1. Particle, fibers, fumes, and mist; sooth, welding fumes, oil mist.
2. Metals and metalloids: arsenic, calcium, chromium, mercury, zinc.
3. Organic solvents and compounds: acetone, hydrocarbons, benzene.
4. Inorganic gases; carbon monoxide, hydrogen sulphide, and Sulphur dioxide.

Others are dye, explosives, fertilizers and paints, sanitizers, disinfectants, cream, printer's emissions and inks, pesticides, silicosis and asbestosis (WHO, 2001, and Work Safe Alberta, 2011).

Biological hazards: These are living things such as plants, animals, microbial disease causal agents (Achalu, 2000). Examples of the disease are hepatitis, tuberculosis, asthma plus parasitic diseases (Eyayo, 2014). Examples of biological hazards are: bacteria, virus, rickettsia, fungi, yeast, spores, parasites, allergens, blood bore pathogens and bodily fluids, sewage, animal/pest waste, pandemic/influenza (Achalu, 2000, WHO, 2001). The main type's .of biological hazards according to Safe Work Astralalia (2011) are:

1. Human body fluid or waste products such as blood, tissues, vomit, urine, saliva, breast milk, urine, and faeces.
2. Animal products such as diary, meat, bones, skins and hides, offal and blood.
3. Live animals such as mammals, fish, invertebrates, their waste products too.
4. Biohazard waste, sewage and rubbish.
5. Laboratory cultures.

Eyayo (2014) opined that these can be classed into organic dusts and mist, human tissues and body fluids, genetically modified organisms, animals and animal products and microbial pathogens. Biohazards do not only include substances that damage property but also those that cause degradation of environment and disrupt society and economy such as insect plagues or infestations (Safe Work Astralalia, 2011). Its (biological hazards) exposure is widespread but with obscured exposure risk.

Psychosocial hazards: It is both psychological and social hazards combined. WHO (2001) argue that its bases are individual psychology and social group function that influence health and health service and community well-being, and examples are cultural characteristics, psychological characteristics and personal factors. It means that psychological hazards comprises of a persons' or groups' identity, mentality, relationship and abilities and adaptability towards work and its entire environs.

For GrifT ths in Léka and Jain (2015), psychological hazards consist of work management and design, management, organization and social context with psychosocial or physical harm potentials. WHO (2001) and Leka and Jain (2015) stated the following examples of psychological hazards:

1. Job content- no variety or short work cycles, fragmented, short cycled meaningless work, under use of skills, high inactivity, continuous exposure to people and rough work.
2. Task or work schedule- overload or under load, machine pacing, high level time pressure, continua! Subjection to deadlines, work speed, shift working, night duties, inflexibility in schedule, long or unpredictable work hours.
3. No control over job decisions, workload, pacing etc.;
4. Ambiguous and conflicting role in organization, and inadequate resource or authority to accomplish job.
5. Work environment- poor aesthetics, conditions such as, lacking space, bad lighting, noise, inadequate equipment and maintenance.
6. Organizational culture and functions- poor communication, changes, conflicts with organizational goals, little support, no support in face of problem, lack of opportunity for personal development, ambiguous organizational objectives.
7. Interpersonal relationships at work- isolation, poor superior- subject relationship, bullying, conflicts (intra or interpersonal), lacking support, bullying, harassment.
8. Stagnation in carrier development and, under protection and overprotection, poor pay, job uncertainty and insecurity, new responsibility beyond level, underemployment.
9. Homework interference.

These hazards affect a person behavior and attitude towards work. Literature evidence links psychosocial hazard to musculoskeletal disorders (Laka and Jain, 2010). It causes sleep disturbances, burn-out symptoms and depression, cardiovascular disorders like hypertension from work stress, and psychological traumas among workers 'with serious shattering experiences or major accident (Eyayo, 2014).

Ergonomic hazards: This deals with body position relative to work (Achal, 2000). It is a multidisciplinary science covering human, physiological and engineering factors, occupational anthropometry and biomechanics as well (WHO, 2001 and Jain and Rao, 2011). According to WHO (2001) ergonomic studies complex work relationship between 'workers, job demands and methodology, and both psychological and physical work environment characteristics, job demands and work methods. This definition is elaborate enough. It stresses on matching jobs to workers not adapting workers to match jobs.

Examples of ergonomic hazards according to Achalu (2000), are; posture, mismatch between man and machine. Others are physical workload, lifting or moving heavy stuffs, repetitive manual tasks (Eyayo, 2014). The effect includes musculoskeletal injuries and disorders, undesirable errors, decrease in physical or mental health (WHO, 2001). Ergonomic hazards can place so much physical demands and stress on body tissues, drain so much energy from the exposed worker.

Computer Operators

The Council of Technical Education and Vocational Training [CTEVT] (2014), sees computer operator as skilled in basic computer application and can perform the following tasks: handle operating System; programs or packages like processing, spreadsheet, presentation, database, photo-editing, E-mail and internet plus common knowledge of hardware. The computer operator is equipped with knowledge, skills, and attitudes to clerical occupation (CTEVT, 20 14), and to pursue new opportunities in ICT, thus, he/she can be employed in all field of life or even be self-employed

Also the National Vocational and, Technical Training Commission [NAVTTTC] '(2014) mentioned the responsibilities of computer operators in organizations or company to include system monitoring and control. Further, his/her duties include troubleshooting, systems maintenance and performance enhancement and online availability, documentation of applications, and to assist personnel who have computer problem. He/she may also support customers, do system backup and maintain other accessories such as printers, copiers and storage devices in computer room (NAVTTTC, 2014).

From the above one can infer that computer operations include the technical aspect of computer maintenance and the applications of various software packages to process data, that is, database management. Again, the employer decides if the operator performs both tasks. Therefore a computer operator may be one who does technical work with the computer or use -the computer effectively to process and manage data, for internet services and other purposes.

Computer Operators for this research purpose are computer end-users who are skilled in applications of various software packages and are engaged in the provision of computer work related services as their job on part or full time basis. Computer professionals such as programmers, system analysts, quality control, production engineers, etc., are not included. Other end-users such as lawyers, bankers, lecturers, students, etc., who due to access to computer took the advantage of its user friendly build and can perform some basic task with the computer are not also included.

The Computer Workstation

Computer work is usually done in a place which can be called workstation within a work place (environment) (The Hartford, 2012). This work environment include various parts of computer like display screen, keyboard, mouse, etc.; computer accessories such as document holder, telephone, palm and foot rest, etc.; work furniture such as chair, desk, and ambient factors like lightings noise, glare, temperature, humidity, and electrostatic build up (Oregon Occupational Safety and Health Administration [Oregon-OSHA], 2009). Department of Labor (201 0), argue that this is typical of an office base computer workstation.

Different' workstations configuration are available for computer based work (Work Place Health and Safety Queensland, 2012). However, the general guiding principle in designing workstations is to allow adequate height and work surface to suite the user(s), work type and contain the equipment used (Work Safe Victoria, 2006 and Workplace Health and Safety Queensland, 2012). It should be flexible and large to contain even growing task to be performed by it (Work Safe Victoria, 2006). The elements of computer workstation design according to Work Safe Alberta (2011) are:

1. Height of work surface
2. Storage height
3. Location of items
4. Sit-stand stools
5. Foot rest

6. Fatigue preventing
7. Beveled or rounded edges on tables, ledges and shelves.

Although people use computer anywhere they can, especially with laptop, there are certain standards that meets the requirement for computer workstation. This workstation when appropriate makes computer use more enjoying, less stressful and less harmful. The table below summarizes various computer workstation components features and acceptable standards.

Common Health Complaints of Computer Operator

It is expected given the myriad of hazards exposure, that computer operators give certain common health complaints. These complaints are health problems experienced and frequently reported by most computer users and are usually computer work related. These complaints which increases with increase computer use ranges from aches, physical pain in various body parts, eye visual problem, psychological problems like stress, to irritability, respiratory tract problem and impaired hearing (Awadi, Solima & Ahmed, 2006 and Ezechota et al, 2014). One or more of the complaints is reported in 89% of people using computer (Shrivastava & Bohate, 2012). They also noted citing Shah et al. and Sjogren-Rouka et al., that 91.8% operators had one health complaints at least. Reports on most common or frequent computer operators' health complaints are inconsistent. On one hand, some researchers reports Computer Vision Syndrome (CVS) as most common. Verma in Ezetoha et al (2014) states that CVS is the commonest a view earlier held by AOA, (2013).

According to Shrivastava and Bohate (2012), ocular discomfort is the commonest complaints (67%) followed by musculoskeletal disorders (MSDs) (63%) and psychological problem of stress (44%). However they identified visual problems (80.6%), MSDs (84.7%) and stress (77%) as the commonest in 35-50 years, >50 years and 20-35 years age group respectively. While stress is commonest in male (47.3%) than female, MSDs were common in female (67.1%) than male. Ellahi et al., (2011) found CVS as the leading health complaint at 25%, followed by MSDs 13.33% and then stress (3.33%). Hiremath (2015) also opined that the commonest complaints are ocular discomfort, MSDs and psychosocial problems.

On other hand other, researchers have reported MSDs to be the leading health complaints ahead of ocular discomfort. Blagojevic et al (2012) reports MSDs (55.8%), ocular discomfort (27.3%) and mental disorder (7.1%) as most frequently complained. Giri et al in Prasad Wagh and Mudey, (2014) found MSDs (73.8%), ocular discomfort (65.3%) and psychosocial (40.0%) as most common. Mvungi et al' (2008) reports MSDs as most frequent with 63% followed by eye problems. However, Health Safety Executive (HSE) (2013) opined that MSDs, fatigue and stress and eye effects are most common.

CVS prevalence is between 64-70% among those using computer according to Akinbinu and Mashalla (2014). Adepoju, Pam and Owoeye (2005) noted many computer users complained of eye discomfort and they attribute this to their work on the computer monitor. According to American Federation of State, County and Municipal Employees [AFSCME] (2006), the symptoms of this common eye-vision problem include headaches, eye fatigue or strain (asthenopia), blurred visions, burning eyes, irritating or ripping eyes, and temporary inability to identify colours. Others are redness, difficulty in changing focus, lacrimation, double vision and headache (Adepoju et al., 2005).

A NIOSH study revealed that 75% of visual display terminal (VDT) users occasionally complain of aching or blurring eyes at work with blurred vision following and 90% report eye irritation and problems with vision (Awad et al., 2006). They reported visual symptoms

frequency to be; tearing eyes (37.8%), eye redness (26.2%), itching eyes (22.3%) and headache (24.7%). For AlAwadi et al.

(2013) the most complained of the eye problems are tired eyes (92%), dry sore eyes (37.33%), headache (68%), blurred distant vision (68%), asthenopia (45.33%). But for Chiemeké et al., (2007), the most complained of CVS are eyestrain (83%), headache (53.4%), double vision (43.7%) and redness of eyes (36.9%)

MSDs are serious health complaints computer operators make. Examples of MSDs according to HS'E (2003) and Department of Labor (2010) are: epicondylitis, carpal tunnel syndrome, soreness in the limb, peritendinitis, and cramp. And umbrella terms like repetitive strain injuries (RSIs), gradual process injuries (GPIs), occupational over use syndrome (OOS) have been used in literature to describe their symptoms. The symptoms of MSDg such as pain, muscle fatigue and uneasiness, inflexibility, burning sensations, numbness or deadness and tingling worsening during the day, through the week and improve at weekends and holidays (Department of Labor, 2010).

The commonest according to AFSCME (2006) are:

1. Carpal Tunnel Syndrome with pain, numbness and hand irritation as symptoms following median nerve pressure.
2. Tendon disorders which includes:
 - a) Tendinitis -symptoms are pain and inflammation in arm and elsewhere.
 - b) Epicondy itis- symptoms are pain form elbow to forearm.
 - c) Tenosynovitis- swollen of synovial sheath following buildup of extra fluid.
 - d) Stenosing tenosynovitis- sheath is inflamed following rough tendon or irritation.
 - e) Ganglionic cysts- where fluid buildup the tendon sheath on back of wrist forming a bump.
- 3 Back, neck, shoulder problems (mostly pains).

Blagojevic et al. (2012) state that these complaints of neck, shoulders and arms MSDs among computer workers are not due to severe trauma, or systemic diseases. Liu, Kuziez and Ong (2012) found that the neck (37.8%), lower back (35.6%), shoulder (22.2%), hand and wrist (21.1%) upper back (13.3%) suffer the discomforts the most. Findings of Joshi Karki and Sharma (2015) are in line with Lui et al. (2012) but places upper back ahead of knee, then shoulder, hand and the wrist in that order.

The next most common health complaints of computer Workers are stress related. According to AFSCME (2006), stress leads to physiological changes in body. Examples are release of hormones, increased breathing and pulse and production of gastric acid. The symptoms are increased headaches, depression, heart diseases, sleeplessness, loss of appetite, shot temperedness, ulcers, weakened body defense system, physical pain, concentration difficulties, difficulty in thinking logically, feeling of less commitment, tiredness, and poor decision making (AISCME, 2006 and Department of Labor, 2010).

Frequently complained stress related disorders after computer use are mental conclusion or concentration less, tiredness, sleeplessness, irritability, anxiety, and appetite loss (Blagojevic et al, 2012). Complaint of irritability is found in 1 1.5% of persons using computer (A wadi et al, 2006). These psychosocial health problems affect the workers attitude towards work and people.

Health Hazards of Computer Operators and Effects: Healy, Lawler, Thorp, Neuhaus... & Dunstan (2012) consider computer work as sedentary work. It requires sitting at position for long time and focusing the screen with so much concentration. It also involves performing

some repetitive task or repetitive movement of some body parts. This is done in an environment which may or not be suite the work. Hence, computer work exposes one to some health hazards. This is even worse for the computer operators who use the computer regularly for long hours.

The hazards widely reported in literature are those of ergonomics, psychosocial and physical linked with health problems like physical and visual discomfort, pain, stress and exhaustion (Barredo & Mahon, 2007; Department of Labor, 2010; Blagojevic et al., 2042 and American Optometric Association [AOA], 2013). These hazards are consequent to their jobs.

Physical Health Hazards: Computer users face harmful electromagnetic field (EMF) radiations effects (Ellahi, Khalu & Akram, 2011). They further argued that hazardous effects of this EMF on human health are not comprehensively explored. However, available literature reveal that radiations from computers are way below the recommended exposure limit by international standard to harm the users health (Health Safety Executives [HSE], 2003; The Hartford, 20 12; AOA, 2013 and Akinbinu & Mashalla, 2014).

Consequently, Health Safety Executives (HSE) (2013) suggests that action to drop radiation levels is unnecessary likewise attempt to measure emissions considering the difficulty involve in interpreting the data. Also anti-radiation screen is needless. HSE (2003) also refute the claim of effect of radiation from computer on pregnancy or inducing epileptic seizures or facial dermatitis which is more environmental factors (like low relative humidity or static electricity) related depending on the susceptibility of the individual (HSE, 2003). Lighting is another hazard they face. Inadequate lighting whether too little or too much light, type and inappropriate positioning of the light can be hazardous (HSE, 2003; Department of Labor, 2010 and Ellahi et al., 201 1). These cause glare and reflections. Unequal brightness of work area and the work background causes glare, thus the eyes keep adjusting to the prevailing change in light amount (Work Safe Victoria, 2003). Reflections occur when light waves bounces off polished surfaces. It reduces task contrast and interferes with the visual ease and efficiency, the result is discomfort and annoyance (Department of Labor, 2010). According to A. lAwadi et al. (2013), glare from bright light sources causes symptoms of asthenopia while improper lighting account for up t8 30% •of visual symptoms reported by computer operators. AOA, (2013) citing Briggs (1991) and Wan (1992), report that reflections and glare on screen reduce letter contrast level to the background making it difficult to view the screen without some discomfort. Eye strain is also reported by Akinbinu and Mashalla (2014), and headache and eye strain (Oregon OSHA, 2009).

Another physical health hazards known is noise (Blagojevic et al., 2012). Internal sources of noise includes equipment like printers, photocopiers, people conversation, background from building and computer work station whereas external noise are from the general environment where work is located including road traffic (HSE, 2003 and Work Safe Victoria, 2006). Noise effects include interferences with communication, distraction, hearing defect and annoyance (Work Safe Victoria, 2006).

Other physical hazards Of computer operators include dry environments irritating the cornea (AlAwadi et al., 2013); poor ventilation, heat from workstations equipment which modify thermal environment can discomfort the operator and he/she loses concentration (HSE, 2003). More need to be learnt on temperature related hazard although the work environments of today are well equipped with conditioners. These may not be true for Nigeria and other developing African countries.

Chemical Hazards: Although there is paucity of literature on chemical hazards of computer operators, Blagojevic (2012) found dust and chemical pollutant as factors causing health

disorders for computer operators. Work Safe Alberta (2011), state that ink from printers, toner dust from lesser and photocopier, sanitizer and cream and body spray from people could also cause harm such as airway tract irritations.

Ergonomic Hazards: Ergonomic hazards are mostly reported hazards of computer operators in literature. This include prolong sitting and concentrated viewing of screen, screen not legible enough, improper positioning of keyboard and document source, viewing distance and angle shorter or longer than recommended, poor work place design, uncorrected vision problem all of which places high visual demand on the eye of the operators (HSE, 2003; Department of Labor, 2010; Ellahi et al., 2011; AOA, 2013 and Akinbinu & bMashalla, 2014).

Most common health effect are vision related problems like eye strain, visual fatigue, headache, distorted vision, pain, redness of the eye, burning sensation, watering eye and dry eyeso collectively called Computer Vision Syndrome (CVS) (Blehm, Vishhnu, Khattak, Mitra & Yee, 2005; Ellahi et al., 201 1; ALAwadi et al., 2013 and Akinbinu & Mashalla, 2014). The extent of the effect depends on one's visual ability (AOA, 2013).

These hazards cause no permanent eye defects as the visual discomfort are temporary and decline after stopping computer work (HSE, 2003; Chiemeké et al., 2007 and Department of Labor, 2010). It is not associated with cataract (AOA, 2013). If CVS stops after stopping computer work for the day then the effect will be more with continuing computer use without brakes. Chiemeké et al. (2007) assert that the CVS set in after an hour of computer use.

The other ergonomic hazards of computer operators relates to MSDs. :Examples of such hazards are: repetitive task relating to keyboards and pointing devices, frequent bending, pulling or pushing of muscles, awkward posture, unsupported sitting position, overexertion, improper workstation design such as use of chair without lower back support; chair too hard or too soft; inappropriate height of desk, chair and monitor; sit pan edge pressing on the thighs and improper arm rest height etc.; bending, tight space for leg etc.; and incompatible machines and software design (I-ISE, 2003; Oregon OSHA, 2009; Department of Labor, 2010; Ellahi et al., 201 1; Liu, Kuziez& Ong, 201 1; Blagojevic et al., 2012; AOA, 2013; ALAwadi et al., 2013 and Joshi et al., 2015).

Effects of ergonomic hazards are mind bugling. They relate mainly to musculoskeletal systems. According to Roth (2011), the fastest growing disorders related to work are those of ergonomics and thousands of illness known to OSHA is accounted for by them. Lui et al. (2011) argue that poor workstations design is a major cause of thousands of illness, MSDs inclusive, diagnosed yearly among individuals who use computer. Healy et al. (2012) report that constrained sitting posture in computer related jobs is associated with elevated incidence of MSDs with estimated prevalence of 50%.

Physical discomforts due to ergonomics hazard of computer operators include those affecting the skin, bones, joints, muscles, tendons and ligaments, circulations and nerves (Department of Labor, 20 10). HSE (2003), states that most common MSDs include the arm, hand, shoulder and neck pains commonly called Upper Limb Disorders (ULDs) or Work-Related Upper Limb Disorders (WRULDs). Barredo & Mahon (2007), report 50% incidence of MSDs among computer workers citing Tittiranord et al. (1999) and Gerr et al. (2002).

Psychosocial Hazards: It's been found by Blagojevic et al. (2012) that psychosocial factors affect computer workers health. Krause, Vurgel and Rempel (2010) states that recently, the Effort-Reward Imbalance (ERI) model presents a new theoretical approach for an elaborate concept of psychosocial work hazards. That is, ERI (especially where an individual spends high effort and receive low reward) is enough psychosocial hazard that affects the individual mental physical health.

Others are high or low workloads, tight deadlines, poor workstation, poor social support, job insecurity, work-home conflict demand, lack of control over work, monotonous work, poor communications (HSE, 2003 and Department of Labor, 2010). The hazards affect the psychology of computer operators, their physical health too. These hazards can cause higher stress and fatigue, lack of concentration, increase danger, poor job performance, disagreement with customers and colleague and absenteeism. These worsen with increased demands and pressures that the computer operator, lack the knowledge, resources or ability to tackle' (Department of Labor, 2010). HSE, (2003) argue that convincing literature abound on psychosocial hazards and MSDs relationship.

Risk Factors of Health Hazards of Computer Operators

Risk factors according to Ellahi et al. (201 1) are the probability of a disease to occur 'in a person. Risk factors will increase ones susceptibility to a hazard effect. They increase chances of harm or damage. These risk factors include, awkward positioning, long work hours, insufficient time to recover, force/pressure, works organization, uncomfortable work environment, repetition and long sitting period (HSE, 2003 and Ellahi et al., 201 1).

HSE (2003) further divide these factors into non-work factors: examples are hobbies, previous injuries and sports, and work related factors: examples are task, work environment, prolong fixed posture of back, head and neck, •awkward positioning of heads, hands and wrists. The non- work factors are of extrinsic origin whereas the work related factors are of intrinsic origin. Both can work -together to worsen the worker's health. The worker habit or life style is major non-work factors

Wang in Ellahi et al. (201 1) found that using computer above 30 hours in one week above ten years increases depression, obsession and disorders of the physical body, Joshi et al (2015) assert that postural hazards result from longer period of unsuitable working postures that can cause pain. MSDs and intense and prolong computer use are associated (Healy et al., 2012 and Joshi et al., 2015). Ariens et al., in Liu et al (201 1), found that Sitting for over 95% of total work time is another risk factor for pain in neck, and associated MSDs with unnatural positions.

In case of CVS, individual factors like uncorrected or under corrected vision problem, increases the percentage of computer operators coming down with visual discomfort (AOA, 2013). The studies of Smita, Goels, & Sharma (2013) and Chiemekwe et al. (2007) indicate that those who worked over* six hours with computer complained more of vision problems. Akinbinu Mashalla (2014) found 48.9% of people that spent six-eight hours daily on computer work reported CVS symptoms as against 23.7% for three to five hours and 0.72% for one to two hours.

HSE (2003) describes psychosocial risk factors in two work aspect namely work context and work content. Work context include organization and management or work and over all social environment while work content refers to specific jobs elements. Other reported risk factors are age, smoking, body mass index, over time work and negative working atmosphere (Blagojevic et al., 2012).

Awareness of Health Hazards of Computer Operators

Health hazard awareness is the knowledge that hazards exist and have economic importance. Obviously, the work of computer operators has hazards capable of serious health issues as this literature review has presented. The question is, are the computer operators aware? For Chiemeké et al. (2007) awareness of these perils is been minimally emphasized especially in developing nations such as Nigeria whose industries are still developing. This implies uncertainty on awareness level.

In Hiremath (2015) findings, the difference found between pre and post-test knowledge mean score of 9.04 and 18.24 respectively regarding hazard prevention among all using computer suggest low level of awareness. Interestingly, the test for knowledge and demographic variables showed non-significant for- age, years of experience and hours of daily posture. It means some have worked for years, garnered experience in their job, yet are poor in the knowledge of the hazards they face.

Devesh & Al-Bimani (2012), found that 62% of male and 61% of female had inadequate knowledge of ergonomic issues as against 19% male and 17% female who had knowledge. Again this reveals that most computer operators are unaware of the hazards inherent in their work. Palmer in Devish& Al-Bimani (2012) suggests that educating the staff on elementary ergonomic problems in connection with computer use is needful. Similarly, 99% of Chiemeké et al. (2007) subjects were unaware of ergonomic guidelines.

In the view of Joshi, Karki & Sharma (2015), more should be done to add to available literature. This is invariably a revelation of information paucity regarding knowledge of persons using computer on computer workstation designing and occupational hazards. So far the-picture seems to be clear that most users of computer are unaware of computer work related hazards.

Control of Health Hazards

Hazard control is crucial in workplace for workers efficiency. The best way to prevent hazard is by complete elimination, but Achalu (2000) argued that to eliminate hazard is tantamount to eliminating the job process or the job itself. And this may be impracticable; hence the containment (control) is the alternative. Achalu (2000) stated that substitution of the process or product with a safer one, and change of work process are ways of complete hazard elimination. He further opined the following containment measures: containment at the source of hazard, using total enclosures of hazards, use of partial enclosure of hazards of dangerous machines process session, time limit or regulated exposure of hazard, personal protection, segregations of harmful Work process from direct touching workers, maintenance of cleanliness and good housekeeping, and use of legislation for elimination or exposure reduction.

To control hazard 'hierarchy of controls' should be obeyed and the hazard possessing the greatest risks should be addressed first (Oregon OSHA, 2013 and Work Safe Alberta, 2015). It is taking the options of control considering order of importance or effectiveness, where methods most effective comes at the top and the least effective is at bottom (NEBOSH, 2013). In hierarchy of control, the more effective engineering control comes first, followed by administrative control and then personal perspective equipment. Example of these control measures as given by WHO (2001), Oregon OSHA (2013) and Work Safe Alberta (2015) are as follows:

Engineering control: controlling hazards at its source by isolation, insulation, substitution, ventilation guards, shields and barriers use, use of trolleys or hoist, design, enclosure, safety engineered services.

Administrative control: control between hazards and workers along hazard path by safe work habits and procedures, training and education, supervision of workers, limiting exposure time, rotating jobs (shift) or schedules, purchasing standards, exposure monitoring, health assessment, warning signs, maintenance and clearing programs and provision of separate lunchroom and break facilities. **Personal protective equipment (PPE):** Controlling direct workers contacts with hazard by use of gloves, hard hats, reflective vest, eye protection, safety harness, appropriate foot protection wears, ear plugs and muffs, aprons and respiratory protection.

Recommendations

Upper and Lower Back Pain

When sat in your desk chair, your spine should be in an upright position. Avoid slouching down into your chair or leaning forward onto the desk, as this can cause strains, aches and pains. Your lower back (lumbar) should be supported by the chair or a cushion so that sitting upright doesn't feel uncomfortable or unnatural.

To help keep your back free of strain:

- Stand up and walk around every hour or so, so that you're not sat in the same position all day.
- Slowly lean your torso over to one side of the chair and then the other to stretch your sides and spine.
- Stand up and put your hands together, elbows out, then slowly twist to the left and then to the right.

Also, keep your neck straight as much as possible. Your eyes should be level with the top of your monitor. Adjust the tilt and height of your screen or your chair if you need to and, if you have a laptop, you should use a stand to raise it up. If you ever have to angle your head upwards or downwards to see the screen, then tension can build up in your neck and cause headaches and fatigue.

Reduce tension by regularly moving your neck and shoulders:

- Sit up straight and slowly tilt your head down to one shoulder and then to the other to stretch your neck.
- Move your shoulders around in small circles, first in one direction and then the other.
- Slowly bring your chin down to your chest, hold for 3 seconds, and then release.

Repetitive Strain Injury (RSI)

There should be enough room in front of your keyboard to support both your forearms and your wrists on the desk. Push your computer screen and your keyboard back a bit if necessary. This desk support helps prevent your arms from becoming tired or achy. When typing, keep your wrists straight. If you have to bend your wrists upwards to reach the keyboard then use a wrist support, otherwise you are at risk from a repetitive strain injury.

To keep your arms and wrists ache-free:

- Reach your arms out in front of you and draw big circles with your wrists, first in one direction and then the other.
- Stretch your arms out to the side as far as you can and then above your head as high as you can to stretch your arms, wrists and back.
- Interlock your fingers and then push them out in front of you, with palms facing out.

Strain in Legs and Feet

Your desk chair should be positioned so that you can sit comfortably with your feet flat on the floor and your lower legs vertical. Use a footrest underneath your desk if you need more support, or if the chair is putting pressure on your thighs. Make sure that there's enough space to change position and stretch your legs out every now and then, too.

To prevent stiff legs, ankles and feet:

- Rotate your ankles round in circles under the desk, first one way and then the other.
- Stand up and march on the spot for 30 seconds to improve the blood flow in your legs.
- Stand on your tiptoes and stretch upwards, as tall as you can, to release some of the tension in your ankles, legs, back, arms and neck.

Eye Strain and Headaches

Prolonged use of a screen can cause visual fatigue and eye strain, so it's important to look after your eye health.

If your job involves working with a display screen for the majority of your day, whether it's a desktop computer or a tablet, then your employer is required to provide you with eye tests so you can make sure you're able to see the screen clearly and work comfortably.

If an eye test shows that you need glasses specifically for computer work, then your employer is required to pay for the basic frames and lenses under the Health and Safety (Display Screen Equipment) Regulations 1992.

To reduce the risks of visual problems:

- Reposition the screen to avoid glare from lights or windows.
- Keep the screen clean and use a desk lamp to make it easier to see.
- Ensure the screen colours are easy to look at, and that the characters are sharp and legible.
- Look away from the screen into the distance for a few moments to relax your eyes. Use the 20-20-20 rule for this: focus on something 20 metres away for 20 seconds every 20 minute.

Conclusion

Working at a computer can cause back, neck and shoulder pains, headache, eyestrain and overuse injuries of the arms and hands.

Individuals can help avoid computer-related injuries with proper furniture, better posture and good working habits. The computer is a vital tool in many different jobs and activities, for adults and children. But long periods of using a computer can increase your chance of developing an injury. Inappropriate computer use can cause muscle and joint pain, overuse injuries of the shoulder, arm, wrist or hand, and eyestrain.

Children can experience particular physical and psychological problems if they play computer games too much. One can reduce or avoid these risks with the correct furniture, better posture and good habits, such as taking rest breaks and restricting time spent playing computer games.

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