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Internet-based Behavior of IT Professionals: Implications for Online Ergonomic Education to Prevent Work-Related Musculoskeletal Disorders

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Internet-based Behavior of IT Professionals: Implications for Online Ergonomic Education to Prevent Work-Related Musculoskeletal Disorders

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University

by

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Dedication

To Nandu and Sanji

Acknowledgement

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Abstract

INTERNET-BASED BEHAVIOR OF IT PROFESSIONALS: IMPLICATIONS FOR ONLINE ERGONOMIC EDUCATION TO PREVENT WORK-RELATED MUSCULOSKELETAL DISORDERS

By Priyadarshini Pattath, Ph.D.

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University

Virginia Commonwealth University, 2017

Director: Dr. Robin Hurst, Assistant Professor of Adult Learning, Teaching and Learning, School of Education

The purpose of this study was to explore the preferences of medium of ergonomic education and views about self-directed online training modules to prevent musculoskeletal disorders in computer professionals and understand their perspectives and experiences about online health information seeking using a self-directed learning framework. To accomplish this, a qualitative research design was used to analyze data from interviews and observation. An exploratory case study research design was employed to examine the experiences of fifteen information technology professionals from a mid-Atlantic state organization. The findings revealed that the computer professionals were aware of the risk factors of musculoskeletal disorders due to their work; and had made adjustments to their work-station. They sourced this

information from different sources like workplace and the Internet. The sources included healthcare providers, friends, family and colleagues. Media like television, and print media was also referred for health information. Findings indicated that many of information technology preferred a participatory approach for ergonomic education, while some preferred the online medium of delivery. A combination of delivery approaches was also preferred. Follow-up after the intervention was identified as a critical aspect for the success of the intervention. Findings indicated that the online medium of ergonomic delivery was relevant and trustworthy and empowered the information technology professionals, but varied as per personal attributes.

Findings illustrated that Internet was the first source of reference for wellness and prevention information to maintain a healthy lifestyle, alleviate and prevent work-related musculoskeletal disorders. The findings highlighted the role of the Internet in making significant lifestyle modifications, and individual contextual factors like ergonomic adjustments in work-station. Additionally, findings emphasized the role of the health information seeking behavior on the Internet in making the information technology professionals more confident in their treatment options and to better manage their healthcare. Finally, the findings highlighted the barriers that were faced when seeking health information on the Internet; volume of information, issues of trust and credibility and distractions. The findings of this study were limited by the nature of the research and sample size. Additional research is needed to support the findings. Implications for research and practice are discussed.

Chapter 1

Introduction

Background of the Study

Work-related musculoskeletal disorders (WMSD) are a leading cause of occupational

morbidity, absenteeism, and lost productivity in the workplace worldwide (Silverstein &

Evanoff, 2011). According to the US Bureau of Labor Statistics, there were 356,910

musculoskeletal disorder cases in 2015, accounting for 31 percent of all injury and illness cases

(Bureau of Labor Statistics, 2015). According to the American Federation of Labor and Congress

of Industrial Organizations (AFL-CIO, 2012) the median number of days away from work was

11 for WMSD while the direct costs of musculoskeletal disorders was $ 1.5 billion for the year

2007 and the indirect costs was $ 1.1 billion (Bhattacharya, 2014). Musculoskeletal disorders

(MSD) can be caused by incorrect postures and a combination of other risk factors leading to

disorders located at different anatomical locations (Bernard, 1997). MSD prevalence also varies

by industries and occupations, as certain risk factors caused by various work activities in

different occupations are associated with the development of work-related MSD (NIOSH, 1997).

Using computers are an integral part of everyday life and work, with evidence in the literature

suggesting that computers users are at an increased risk of neck and upper extremity MSDs

(Bohr, 2000; Erdinc, 2011; Greene, DeJoy & Oljnik, 2005; Gerr, Marcus & Monteilh, 2004;

Ketola, Toivonen, Hakkanen, Luukkonen, Takala & Viikari-Juntura, 2002; Kreuzfeld, Seibt,

Kumar, Reiger & Stoll, 2016; Shikdar, khadem & Al-Harthy, 2008; Trujilo & Zeng, 2006;

Wahlstrom, 2005;; Tiric-Campara, Krupic, Biscevic, Spahic, Maglajlija, Masic, Zuic & Masic, 2014; Waested, Hanvold & Veiershed, 2010). Some of the risk factors or mechanical stressors while using computers include awkward postures, repetitive motions and contact stressors (Bao, 2015). While low-back problems have been historically the most common MSD, increased use of computers in the workplace due to technology changes has created sedentary workers leading to neck and upper extremity problems. Neck pain has been identified as a prevalent and costly musculoskeletal condition in the United States adult working population with about 15% having neck pain, and associated cost for back and neck problems are an estimated $ 86 billion in medical care (Yang, Hitchcock, Haldeman, Swanson, Lu, Choi, Nakaha & Bakev, 2016). As part of the studies of the National Institute of Occupational Safety and Health (NIOH), carpel tunnel syndrome has been associated with repetitive motion of the wrist (Fan, Harris-Adamson, Gerr, Eisen, Hegmann, Bao, Silverstein, Evanoff, Dale, Theiese, Garg, Kapellusch, Burt, Merlino & Rempel, 2015). The median days away from work due to carpal tunnel syndrome was 25, more than three times high for all other types of injuries in the year 2010, with an estimated direct cost of $ 0.1 billion and indirect costs of $0.1 billion for the year 2007 (Bhattacharya, 2014).

A variety of preventive strategies have evolved to address the growing number of work-related musculoskeletal disorders in computer users. Since musculoskeletal symptoms in computer users are believed to have multi-faceted etiology- like non-neutral wrist, arm and neck postures, work station design, and duration of work on the computer, there exists a wide range of evidence-based preventive approaches in the literature. These include ergonomic design of the workplace, and education/ training of the employees to develop ergonomic awareness and avoid MSD causing situations (Bohr, 2000; Wahlstrom, 2005).

Studies focusing on ergonomic intervention in work to improve the physical ergonomics of the work-station have been found to be effective (Ketola et al., 2002; Greene et al., 2005 & Tappin, Vitalis, & Bentley, 2016). Didactic educational training of the employee (Bohr, 2000) and the use of participatory ergonomics approach, by involving the worker input improves work postures, work practices, risk factor exposure and pain (Greene et al., 2005 & Tappin, Vitalis, & Bentley, 2016). Educational programs using computer based office ergonomics education/training have been assessed (Harrington & Walker, 2004; Trujillo & Zeng, 2006). Both Harrington et al., (2004) and Trujillo and Zeng (2006) have focused on using computer based prevention intervention and reported usability and acceptance with behavior change. Though there is evidence that computer users were able to adjust their own workplace setting following online instructions (Splittstoesser, Korbmezz, Sommerich & Lavender, 2007), the feasibility of this form of online intervention has not been explored.

Online ergonomic training provides an opportunity for the user to interact with their workstation immediately and make the same adjustments as an ergonomist (Splittstoesser et al., 2007), and have fared better when compared to non-online interventions to achieve behavior change outcome (Wantland, Portillo, Hozemer, Slanghker & McGhee, 2004). However the health information seeking behavior related to ergonomics awareness/education has been scarcely explored. Online interventions have been defined as "systematic treatment or prevention programs, usually addressing one or more determinants of health…. Delivered largely via the Internet… and interfacing with an end user" (Bennett & Glasgow, 2009, p. 274). Health education and health promotion professionals have been using information and communication technology with the rapid growth of the Internet (Skinner, Maley & Norman, 2006). As per the January 15, 2013, the most recent Health Online - Pew Internet and American life Study, about

35 % of the U. S. adults have accessed the Internet to seek health information, with one in three American adults seeking information about a medical condition (Health Online, 2013). The motivation for seeking health information on the Internet may be in response to a health event (Rice, 2005; Valente, 2005), and online interventions have shown success in promoting behavior change, but they have been understudied among computer users with work-related musculoskeletal disorders. Also, though self-directed online learning intervention modules have been successfully studied in different health fields (Cowie, Bowers, Kuling, Premkumar, Burbridge & Markel, 2014; Mancini, Cazzell, Kardong-Edgren & Cason, 2009), few have explored the use of online ergonomics to promote well-being of the employees (Randelin, Saaranen, Noumanen & Louhevaara, 2011).

Statement of the Problem

Work-related musculoskeletal disorders are costly to both the employer and the employees. Although there are many studies relating to the efficacy of various modes or ergonomic education/training intervention, there is no study to identify computer users' preference of mode of intervention and adherence. Most of the studies have focused on the objectively measured outcome or behavior change (Bohr, 2000; Harrington & Walker, 2004; Ketola, 2002; Splittsoesser et al., 2007; Trujillo et al., 2006; Wantland et al., 2004). However, other factors like user preference (Robroek et al., 2010; Rothmore et al., 2014) and acceptance of self-directed online training modules may have an important influence on the effectiveness of the ergonomic education program (Eerd et al., 2015). Also, the Internet health information seeking behavior related to prevention of work-related musculoskeletal disorders in computer users have not been assessed.

Rationale for the Study

Exploring the health information seeking behavior on the Internet of computer professionals and exploring their perspectives and their preference about the medium of intervention will be a first step in addressing the gaps in the literature. While these types of evaluation cannot provide direct evidence of effectiveness of the ergonomics education/training intervention, they may provide very useful insights to guide future intervention development and implementation. This in turn can actually keep the user engaged and sustain the behavior changes, since the intervention will be based on the requirements and preference of the participants. The rationale is also as per the paradigm of self-directed learning and demonstrate its power for proactive health behavior.

Purpose of the study

The purpose of this study is to explore the preferences of medium of ergonomic education and views about self-directed online training modules to prevent musculoskeletal disorders in computer professionals and understand their perspectives and experiences about online health information seeking. This will aid in garnering a greater understanding of the feasibility of the Internet to deliver intervention to prevent work-related musculoskeletal disorders. Since work-related musculoskeletal disorders are a leading cause of occupational morbidity, and lost productivity in the workplace, organizations would benefit from such preventive measures to reduce the incidence of WMSD.

Overview of the Literature

Work-related musculoskeletal disorders

Prevention and management of work-related musculoskeletal disorders (WMSD) in computer users is a common occupational health issue. Although the precise cause of WMSD is unclear, research suggests that it includes a number of factors and results from repeated micro trauma to tissues and through overload of the upper extremity, neck, shoulders and trunk in computer users (Bao et al., 2015). Computer use with sustained awkward postures and long duration of use lead to increased musculoskeletal discomfort (Gerr, Marcus & Monteilh, 2004). Carpal tunnel syndrome has been associated with increased use of computer mouse (Fan et al., 2015; Kumar, 2008).

Recognizing the risk factors and providing the training to the employees have been incorporated into the occupational health and safety programs of many businesses and organizations worldwide (NIOH, 1997; Splittstoesser et al., 2007). Musculoskeletal disorder risk prevention is an economic, social and moral need. Since MSDs have a progressive occurrence and development, every improvement and preventive measure at any level, will have a positive consequence on the risk (Kumar, 2008).

Thus in view of the high use of the computer and the resulting diseases, research and literature recommend prevention and educating employees to ensure better and more neutral postures of the body while working at the computer, requiring adequate work breaks, and exercising to strengthen the shoulder and for posture (Tiric-Campara et al., 2014).

Prevention strategies in the workplace

The main goals of ergonomics are comfort, and health and safety of workers, and to improve the interaction between people and their work environments (Kumar, 2008). An ergonomic training program that assists workers to develop ergonomic awareness, and avoid

musculoskeletal disorders causing situations helps to prevent MSDs from manifesting in the workforce (Carr et al., 2016). Much research has been conducted to measure ergonomic training effectiveness with different approaches of training including workstation assessment and intervention, education programs and multiple interventions in computer users, using didactic approach, participatory approach and web-based interventional approach (Bohr, 2000; Erdinc, 2011; Greene et al., 2005; Gerr et al., 2004; Ketola et al., 2002; Kreuzfeld et al., 2016; Shikdar et al., 2008; Tiric-Campara et al., 2014; Trujilo & Zeng, 2006; Waested et al., 2010; Wahlstrom, 2005).

Online Training

More employers are using technology as cost-effective methods to deliver safety training (Ellison, 2012; White, 2015). Online training to prevent MSD has been more effective at generating a greater change than the instructor delivered course in computer users, but there is minimal evidence on the user preference of online training (Rucker, 2004). In spite of the low cost and flexibility offered by web-based learning program of ergonomics, there are very few studies evaluating the efficacy and identifying the participant preference of an online ergonomic training program (Randolin et al., 2011; Splittsoesser et al., 2007). Similar use of self-directed online learning program has been used in other health related areas with good results (Cowie et al., 2014; Mancini, Cazzell, Kendong-Edren & Cason, 2009).

Online health promotion has been found to be an alternative to offering handouts or advice, as interactive websites can facilitate behavior change (Woolf, Krist, Johnson, Wilson, Rothemich, Norman & Dever, 2006). Online intervention also uses participatory and user generated features. Skinner, Maley & Norman (2006) recommend that it is relevant to consider

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participant preference when designing health behavior change intervention programs and to listen to the target population and understand their perspectives and needs and include content as per the different learning styles of the computer users. The popularity of web-based training programs can be illustrated by the number of online college degree programs being offered (Allen & Seaman, 2013). Safety training is similar, and this method allows for mass training without the need for instructor and employees to meet at the same time and place. Thus the ergonomic education and awareness program can be developed and delivered virtually. It transmits to lower costs, user flexibility, ease of updating course content and materials.

As new technology allows for a more virtual approach in health promotion and education, the Internet has provided unlimited information about health, awareness and lifestyle issues (Papen, 2012). This in turn has sparked an increase in health information seeking and learning about health and health issues (Papen, 2012). The Internet has thus emerged as a significant source of health information and lead to extensive studies that endeavors to understand user behavior.

Health information seeking behavior on Internet

With the advent of the Internet and online intervention for health promotion, there is growing evidence that online interventions for health behavior change outcomes are effective (Chow et al., 2013). However with the growing use of internet and mobile technology for seeking health information, it is important to understand user needs and behavior when implementing any technology in web-based patient education (O'Grady, Witteman & Wathen, 2008).

According to the Pew Internet and American Life Project, about 88 % of Americans have a cell phone, 58% have a desktop computer, 61 % have a laptop and 18% have a tablet computer. About 82 % of all adults in the United States use the Internet (Pew Internet and American Life Project). Integrating online health education and ergonomic awareness will help in reducing health care costs and enhancing employee health and prevent work-related musculoskeletal disorders (Ellison, 2012). Self-directed learning and education using Internet searches as a tool does lead to improved health outcomes (Rofles, 2013).

With the Internet as widely available as a source of health information it is important to study the health information seeking behavior of individuals (Papen, 2012). However, though computer users with work-related musculoskeletal disorders have effectively used web-based interventions (Splittoesser et al., 2007) and have preferred using web-based learning programs on ergonomics (Eerd et al., 2015; Randelin et al., 2011; Rucker, 2004), their preference for the online method of intervention and their health information seeking behavior on the Internet have not been studied so far.

Self-directed learning

This study is grounded in the theory of self-directed learning. Education has been identified as major determinant of health (UNESCO, 1999). Self-directed learning is also one of the attributes of a health- literate individual (U.S. Department of Health and Human Services, 2000).

Knowles (1975) describes the basic assumption for self-directed learning to include a problem centered approach requiring internal motivation and utilizing individual experiences as resources for learning with self-directness being an essential part of adult learners.

Building on the pioneering work of Houle (1926), Tough (1971, 1979) and Knowles (1970) which were more of descriptive in nature, research emerged providing more in-depth conceptual models of self-directed learning (Brockett & Hiemstra, 1991; Candy, 1991; Garrison, 1997; Grow, 1991; Gullielmino, 1997, Oddi, 1986; Spear, 1988; Valente, 2005). Valente (2005) studied the self-directed learning process of older adults who managed their own healthcare and concluded that older adults are motivated to take control of certain aspects of their healthcare, self-directed learning process is cyclical with interaction between the learner and their health professional and self-directed learning is perceived as positively affecting healthcare. Although Valente (2005) based her findings on a sample of older adults, she has recommended similar survey studies using different populations and sample. Valente (2005) has also identified the Internet as an important learning resource.

Technology has had a profound impact on self-directed learning. Use of technology in self-directed learning has been studied extensively. Researchers have linked a number of different variables with being self-directed in ones' learning, including readiness, educational levels, personality factors, learning style, health promotion and wellness, and health information seeking behavior (Merriam et al., 2005).

Papen (2012) has found in a qualitative study that when adults seek healthcare information on the Internet, they focus on specific tasks in response to particular needs, learning is through practice and often by trial and error and is fully embedded in the process of dealing with a health issue. In an auto ethnographic study, King (2014) identified self-directed learning strategies used in a chronic pain healthcare journey and has supported the paradigm of self-directed learning in promoting personal healthcare and behavior change.

Research Questions

While an ergonomics program is multi-faceted, this study will focus on the awareness and preventive aspects of training. Thus, this qualitative study focuses on the health information seeking behavior of computer professionals and explores their preferences for the method of ergonomic interventions to prevent work-related musculoskeletal disorders. The following questions will be addressed in the study.

1. What are the mediums of ergonomic education and information that are preferred by computer professionals to prevent and/or treat musculoskeletal disorders?

2. How do computer professionals view self-directed online ergonomic education?

3. What are the sources of health information that the computer professionals have experienced?

4. What health information do computer professionals seek from the Internet?

5. How has health information seeking on the Internet affected healthcare and behavior change?

6. What barriers do computer professionals experience when seeking online health information?

Definition of Terms

1. *Computer professionals/Information technology professionals*: Individuals who work in the Information Technology field.

2. *Musculoskeletal disorders:* Musculoskeletal disorders are an injury or disorder of the muscles, nerves, tendon or joints, not caused by slips or falls (Bureau of Labor Statistics).

3. *Online ergonomic and prevention training/ Online intervention*: Information modules of exercises, work-station adjustments and tasks related to computer use to prevent and reduce stress and disorders associated with overuse of muscles, bad posture and repeated tasks delivered online.

4. *Health information seeking behavior on the Internet*: The intentional active efforts to obtain specific health information on the Internet above and beyond the normal patterns of media exposure and use of interpersonal sources (Lambert & Loiselle, 2007).

5. *Self-directed learning:* The process in which individuals take initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning (Knowles, 1975).

Design and Methods

The purpose of this study is to garner a better understanding of the preferences and perspectives of IT professionals regarding ergonomic education awareness and medium of delivery of education including online approach to prevent musculoskeletal disorders. A qualitative inquiry was used to study this phenomenon, as currently there are no studies that explore both the preferences and health information behavior on the internet for computer professionals. This approach is apt to explore the research questions as they call for a rich and descriptive data. Informed by the theoretical perspective of constructivist approach and the interpretive process, the meaning-making process of each individual and their interaction with their realities within their context are emphasized. An exploratory case study was used in this inquiry. The focus of the case study is the process rather than the outcome, as here the goal is not to identify the effectiveness of any preventive strategy for WMSD, but to gain a deeper insight and understanding of the participant's views on online ergonomic education and preferences

about different mediums of delivery of training and health information seeking behavior (Creswell, 2003; Paul, 2005; Yin, 2009).

The participants in this study are the information technology professionals from a public organization in a mid-Atlantic state. Convenience sampling was used to identify the setting of the research study, and purposeful sampling method was used to select the participants for the interviews. A survey questionnaire was used as a recruitment tool to identify participants for the study. In-depth individual interview with standardized semi-structured questions was used to collect data. A pilot test was carried out with two participants.

Once the interviews were completed, they were transcribed and imported into Atlas-ti qualitative data analysis software, where the data was coded based on common patterns, themes and categories (Creswell, 2015; Maxwell, 2013; Miles & Huberman, 2002). The themes were organized based on the hierarchy of the codes and the relationships between the codes. The themes that emerged provided answers to the research questions and helps provide insights into understanding the perspectives of computer professionals' preference about ergonomic education and their experiences while seeking health information on the Internet.

Significance and Implications

Ergonomic training is part of the occupational safety training. In the United Sates employers have largely borne the increasing cost of healthcare (Lax, 2016). With work-related musculoskeletal disorders being a leading cause of occupational morbidity, and lost productivity in the workplace, organizations would benefit from preventive measures to reduce the incidence of WMSD (Bhattacharya, 2014; Silverstein & Evanoff, 2011). Online interventions providing ergonomic awareness and education are low-cost, and provide flexibility to the computer users,

at the same time being equally effective in the result (Ellison, 2012; Splittersoessor et al., 2007). Implementing ergonomic programs would reduce healthcare costs and employee costs and reduce absenteeism (Hedge, James & Pavlovic-Vselinovic, 2011). Identifying and assessing the computer users' health information seeking behavior on the Internet, and preference for the online mode of intervention or any other approach, have implications for the development for online training modules as the rates of Internet usage is high among American adults as it has been identified that the adherence and sustenance of an intervention depends on the user needs and preference. Thus it is useful for both the stakeholders- the employee and the employer.

This study will also add to the existing body of knowledge of health education in work-related musculoskeletal disorders in computer users, by filling the gap in the literature by identifying participant's preference for the mode of intervention, and also add to the knowledge on self-directed learning in relation to healthcare and related behavior. This study draws from a different population than the previous qualitative studies of health information seeking like older adults (Valente, 2005) and HIV positive women (Blackstock et al., 2015). This study focuses on health information seeking online in relation to ergonomics and work-related musculoskeletal disorders along with general healthcare in computer professionals. However heuristics described in this study may be of interest to researchers looking at other types of information seeking online. As a stand-alone qualitative study in this topic, this study may also be helpful to other researchers contemplating quantitative-based studies using experimental interventions or survey to develop questionnaires from this study's descriptions of contexts, constraints, and strategies related to online health information seeking.

Summary

Evidence in the literature suggests that computers users are at an increased risk of neck and upper extremity musculoskeletal disorders (Ketola et al., 2002; Greene et al., 2005; Shikdar, et al., 2008; Trujilo & Zeng, 2006; Wahlstrom, 2005). Some of the risk factors include awkward postures, repetitive motions and contact stressors and work-station alignment (Bao, 2015). Preventive strategies to address the growing number of work-related musculoskeletal disorders in computer users include ergonomic design of the workplace, and education/ training of the employees to develop ergonomic awareness and avoid MSD causing situations (Bohr, 2000; Wahlstrom, 2005). Most of the research focuses on the efficacy of the interventions while there is no study to identify computer users' preference of mode of intervention.

As per the Health Online - Pew Internet and American life Study, about 35 % of the U. S. adults have accessed the Internet to seek health information, with one in three American adults seeking information about a medical condition (Health Online, 2013). The motivation for seeking health information on the Internet usually is a health event (Rice, 2005; Valente, 2005). The purpose of this study is to explore the preferences of medium of ergonomic education and views about self-directed online training modules to prevent musculoskeletal disorders in computer professionals and to understand their perspectives and experiences about online health information seeking behavior. This study is grounded in the theory of self-directed learning. The chapter two reviews the relevant literature in the content areas of this study.

Chapter 2

Literature Review

Method for the Review of Literature

A comprehensive literature review was performed to investigate work-related musculoskeletal disorders in computer users, prevention of work-related musculoskeletal disorders, online training and education, health information seeking behavior on Internet and self-directed learning. Search terms included the following descriptors, used separately and in combination, without restricting publication dates: *Work-related musculoskeletal disorders in computer users, ergonomics in work-related musculoskeletal disorders, prevention of musculoskeletal disorders, online interventions for work-related musculoskeletal disorders, online ergonomic training, health information seeking behavior on Internet, health information seeking behavior of computer users, self-directed learning in healthcare,* and *self-directed learning for ergonomics. The scholarly literature included in this review was identified primarily using online Searches like VCU Libraries, Google Scholar and scholarly books.* The following databases provided access to the majority of the journal articles in this review*:* PubMed, MEDLINE, APA PsycNET, EBSCO, Taylor & Francis Journals, JSTOR, Springer Link, Academic Search Complete, CINAHL Complete, Science Direct and Google Scholar. Sources for the literature review were obtained using peer-reviewed articles, books, and doctoral dissertations.

This review of the literature involves several content areas and is comprised of six sections: 1) Work-related musculoskeletal disorders, 2) Prevention strategies in the workplace, 3) Online training,4) Health information seeking behavior on the Internet, 5) Self-directed learning and, 6) Impact of technology on self-directed learning. The articles chosen for this review of literature are directly relevant to this study.

Work-related musculoskeletal disorders

Musculoskeletal disorders are defined by the Bureau of Labor Statistics as an injury or disorder of the muscles, nerves, tendon, joints, cartilage, and spinal discs that do not include disorders caused by slips, falls, trips or any vehicular accidents (Bureau of Labor Statistics, 2015). While musculoskeletal disorders are multifactorial, with individual, social and organizational factors contributing to the outcome, the biomechanical demands of the work constitutes the most important risk factors (Kroemer, 2008). Work-related musculoskeletal disorders (WMSD) are very high throughout the industrially developed world, as the information age has led to more people using computers and longer periods of usage than in the past. Prevention and management of work-related musculoskeletal disorders (WMSD) in computer users is a common occupational health issue. Although the precise cause of WMSD is unclear, research suggests that it includes a number of factors and results from repeated micro trauma to tissues and through overload of the upper extremity, neck, shoulders and trunk in computer users (Bao, 2015; Korhan & Mackieh, 2010). Various epidemiologic and ergonomic studies of work-related upper extremity disorder in computer users have identified risk factors such as physical (typing duration and speed, work-rest cycle), and individual (gender, anthropometry) (Carr, Leonhard, Tucker, Fethke, Benzo & Gerr, 2016; Kumar, 2008). Past studies have shown that computer use with sustained awkward postures and long duration of use lead to increased

musculoskeletal discomfort and may lead to long term pain and disability (Bao, 2015; Gerr, Marcus & Monteilh, 2004). Carpal tunnel syndrome has been associated with increased use of computer mouse and keying (Fan et al., 2015; Kumar, 2000). Carpal tunnel syndrome is characterized by numbness, tingling, burning or pain in the thumb, index and middle fingers of the hand (Fan et al., 2015; Moore, 1992).

Many early studies on work-related musculoskeletal disorders have suggested that computer users are at increased risk of MSDs when compared to non-users with awkward postures being identified as an independent risk factor (Anderson, Fallentin, Thomson & Mikkelsen, 2011; Fagarasanu & Kumar, 2006; Gerr, Marcus, Ensor, Kleinbaum, Cohen, Edwards, Gentry, Ortiz & Monteilh, 2002; Gerr et al., 2004). Gerr et al. (2004) reported that posture was an independent risk factor for MSDs among computer users, along with long duration of keyboard use. The findings were based on a review of literature, and found that there was a significant association between daily or weekly hours of keyboard use and hand and arm MSD outcomes. Based on their review of literature, Gerr et al., (2004) thus, contend that lowering the height of the keyboard to or below the height of the elbow and resting the arms on the desk surface or chair armrests is associated with reduced risk of neck and shoulder MSDs. Bending the wrist and resting the thenar area (heel of the hand) on a hard edge as many computer users do, reduces the lumen of the carpal tunnel and increases the pressure on the tissues passing through it leading to carpal tunnel syndrome (Kumar, 2008). Similar findings regarding symptoms and disorders associated with longer duration on the computer have been reported by Turic-Campara, Krupic, Biscevic, Spalic, Maglajilija, Masic, Zunic & Masic (2014).

Anderson et al. (2011), in a systematic review of literature between 1999 and 2010 looked at upper extremity musculoskeletal disorders and carpal tunnel syndrome among

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computer users and the effect of intervention. Findings were that there was a moderate to high evidence indicating that there was an increased risk of acute or transient pain complaints among computer users. Anderson et al., (2011) concluded that usage of computer mouse intensively led to increased complaints, but only workstation adjustments without education was not helpful, and there was limited evidence that a combination of ergonomic training with workstation adjustment may be beneficial. This points to the involvement of the participants in the prevention program, as listening to the target population and then designing interventions based on their preferences leads to better outcomes (Skinner et al., 2006). Also, individual characteristics like age and gender may act as modifying factors (Kumar, 2008).

Erdinc (2011) explored the prevalence of WMSD focusing on upper extremity in computer users and the related work interference using The Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) in 45 participants. The study showed that there was a significant association between WMSD and work interference and added risk factors being of female gender, above the age of thirty one years and having being working on the computer for more than 10 years. Although the study signified the importance of preventive intervention to avoid WMSD, the study was limited to a smaller sample size based in Turkey.

The significant association between age and work-related musculoskeletal disorders in Erdinc's (2011) study was not found in a study with college students using computers (Noack-Cooper, Sommerich & Mirka, 2009) though similar patterns of musculoskeletal disorders were reported in the college students who use computer for longer duration in a day. 234 college students from three different universities in the United States were surveyed, using a web-based questionnaire concerning their computer using habits and physical discomfort. The study found that awkward postures was associated with physical discomfort which correlates to those of the

earlier studies (Gerr et al., 2002; Gerr et al., 2004; Kroemer, 2008). Students averaged 33.7 hours on the computer weekly, similar to the hours reported by computer professionals (Fan et al., 2015; Gerr et al., 2004; Noack-Cooper et al., 2009;Turic-Campara et al., 2014) signifying that the hours spent keying was an important risk factor for WMSD rather than age.

Organizations and businesses have recognized the risk factors and the consequent healthcare costs of work-related musculoskeletal disorders, and have been providing the training to the employees that have been incorporated into their occupational health and safety programs (NIOH, 1997; Splittstoesser et al., 2007). Research suggests that since MSDs have a progressive occurrence and development, every improvement and preventive measure at any level, will have a positive consequence on the risk factors, especially since the etiology is multi-faceted (Kumar, 2008). Historically employers have been providing health promotion and prevention programs to improve employee health and increase productivity. There is an additional business value from healthy workers by quantifying the combined effect on healthcare costs, absences and work productivity.

Thus in view of the high use of the computer in information technology and the resulting musculoskeletal disorders that are preventable, research and literature recommend prevention and educating employees. This will ensure better and more neutral postures of the body while working at the computer, and require adequate work breaks, exercises to strengthen the shoulder and for maintaining a neutral posture (Tiric-Campara et al., 2014).

Table 2.1

Work-Related Musculoskeletal Disorders in Computer Users

Risk Factors and MSD Conditions	Researchers
Typing Duration and Speed, Work-Rest	Noack-Cooper, Sommerich & Mirka (2009)

Cycle	Turic-Campara, Krupic, Biscevic, Spalic, Maglajilija, Masic, Zunic Masic (2014)
Gender, Anthropometry	Carr, Leonhard, Tucker, Fethke, Benzo & Gerr (2016) Erdnic (2011) Kumar (2008)
Awkward Postures	Anderson, Fallentin, Thomson & Mikkelsen, 2011 Bao (2015) Fagarasanu & Kumar (2006) Gerr, Marcus, Ensor, Kleinbaum, Cohen, Edwards, Gentry, Ortiz, & Monteilh (2002).
Carpal Tunnel Syndrome	Fan et al., (2015) Moore (1992)

Preventive strategies in the workplace

A wide range of evidence-based preventive approaches exists like ergonomic design of

the workplace, and education/ training of the employees to develop ergonomic awareness and

avoid MSD causing situations .The main goals of prevention strategies include using ergonomics

to improve the interaction between people and their work environments (Kumar, 2008) and

exercise and posture correction while working. In an office environment, training fosters self-

reliance so that employees can use basic scientific principles and office setup technique to

establish a workstation and prevention regime that reduces the risk of MSD development

(Baldwin & Ford, 1988; King, 1995). This allows the employees to work in an efficient manner

that is free of pain and discomfort, and increases productivity and reduces absenteeism. There are

a vast majority of research conducted to measure ergonomic training effectiveness with different

approaches of training including workstation assessment and intervention, education programs

and multiple interventions in computer users, using didactic approach, participatory approach

and web-based interventional approach (Bohr, 2000; Erdinc, 2011; Greene et al., 2005; Gerr et

al., 2004; Ketola et al., 2002; Kreuzfeld et al., 2016; Shikdar et al., 2008; Tiric-Campara et al., 2014; Trujilo & Zeng, 2006; Waested et al., 2010; Wahlstrom, 2005). Figure 1 illustrates the prevention and treatment strategies of work-related musculoskeletal disorders.
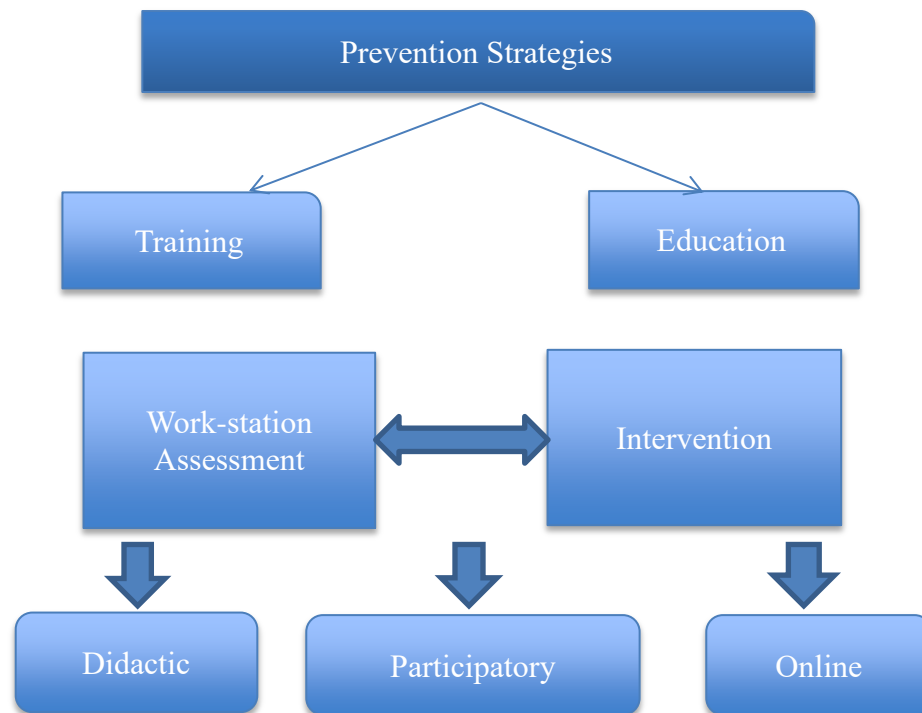
Figure1. Prevention and Treatment Strategies of Work-related Musculoskeletal Disorders

Work-station assessments may be conducted by ergonomists and modifications suggested (Conway & Hinds, 1998; Ketola et al., 2002), along with participant training for implementing prevention strategies. In a randomized controlled study comparing the effects of an intensive ergonomic approach, ergonomic education and reference, it was concluded that both the intensive hands-on ergonomic approach and education helped to reduce discomfort in computer users (Ketola et al., 2002). However it was also recommended that the best result would be achieved with cooperative planning including both the employees and the practitioners actively.

Participatory office ergonomic education intervention builds on the employee's unique knowledge and experience of work, thus involving them in identifying the workplace concerns

and solutions, and applies the principle of adult learning to the prevention of musculoskeletal injuries (Bohr, 2000). In order to investigate the efficacy of the worker education program in preventing musculoskeletal disorders in office employees using computers, the participants were divided into three groups- control, traditional education and participatory education. Bohr (2000) states that those who received education reported less pain/discomfort than those who did not receive education. The participants in the participatory group reported significantly better perception of their health status. Greene et al., (2005) reports similar findings in their randomized controlled study of eight-seven computer workers in an organization that worked for a minimum of 10 hours per week. The active ergonomic training intervention included didactic interaction, discussion and problem-based activities. Greene et al., (2005) found that intervention to develop skill in workstation analysis, and workers beliefs and awareness can improve work postures, work practices and risk factor exposure. Clearly, while the traditional approach was primarily didactic, there is evidence in the literature, that if the intervention is carried out with the active involvement of the employee, the interventions are more effective in certain cases (Greene et al., 2005; Wahlstrom, 2005; Tappin, Vitalis, & Bentley, 2016). However, there is no doubt that combining ergonomic facilities with awareness are better than providing either one (Shikder, Khadem & Al-Harthy, 2008). Implementing a participatory ergonomic awareness and training approach involves multiple stakeholders (Tappin, Vitalis & Bentley, 2016) and suggests better effectiveness based on tailoring of advice (Rothmore, Aylward & Karmon, 2014) since participatory change processes increase the acceptance and uptake of the changes implemented (Eerd, King, Keown, Slack, Cole, Irvin, Amicklll & Bigelow, 2015).

Although there have been several studies examining the various interventions for computer users, the effectiveness of ergonomic educational approaches has not been well

documented. In a study, evaluating and comparing the effectiveness of didactic and participatory methods of delivering ergonomic education, it was found that both didactic and participatory mode showed improvement relative to baseline on post-intervention measures of perception of ergonomic knowledge, self- reported workstation evaluation and adjustment behaviors, and the ability to set up the workstation to allow for working in neutral position (Johnson, 2008). Using a mixed methods design, forty seven employees from a health information contact center were assessed prior to intervention using self-reported questionnaire and workstation evaluation. Each participant attended an office ergonomics education for 60 minutes. The participants were retested after six weeks and workstation reanalyzed. This study also identified wide range of barriers to translating ergonomic knowledge into behavior and was influenced by the method of information delivery. Both the didactic and the participatory group showed improvement. However, this study was limited to a small sample size and no comparison group.

Prevention education and information delivery through computer based education programs have been designed, although understudied. In a study that evaluated computer break reminder program (Stop and Stretch Program) to prevent musculoskeletal disorders caused by prolonged usage at the workplace, it was found that user's opinion was satisfactory and that the program had sufficient usability and acceptance within a workplace setting (Trujillo & Zeng, 2006). Web-based ergonomic learning programs have been found to be sustainable and well accepted by users in promoting well-being at a low cost (Randelin, Saaranen, Naumanen & Louhevaara, 2011). Although online ergonomic training programs are low cost and reach a wider audience, there are very few studies evaluating their efficacy, especially in larger organizations (Rucker, 2004). In a study comparing the workstation adjustment made by computer users following web-based instruction and to those of an ergonomist, it was found that computer users

were able to adjust their workstation in a similar way as those made by an ergonomist (Splittstoessor et al., 2007). Twenty participants used a web-based tool to adjust their workstations, which was later adjusted by an ergonomist. It was found that the participant's and the ergonomist's adjustment more or less agreed with each other, reinforcing that computer users were able to make relevant changes to their workstation (Splittstoesser et al., 2007) resonating with Tough's (1970) ideas of the self-learner performing tasks effectively. An advantage of web-based tool is that the user can immediately interact with their workstation. The study provided evidence that web-based tools provide feedback and usage information, with the mode of information catering to the different learning styles of the computer users, thus accommodating the different ways in which people learn. However, though online ergonomic training programs provide the same benefit as hands-on intervention, with the additional benefit of being user-friendly and catering to the participant's needs, there is hardly any study exploring their feasibility. None of the existing literature has studied the adherence of any of the ergonomic interventions, and though the literature recommends utilizing participant's needs and acceptance (Cole, Rivilis, Eerd, Cullen, Irvin & Kammer, 2005; Eerd et al., 2015), no study has ever asked what the computer users preference as a mode of intervention, as it is seen that no matter how well-designed the information is, knowledge transfer is limited in that the delivery is didactic or instructor directed, and the information presented may not address the questions that interest the user (MaClean, Gray, Narod & Rosenbluth, 2004), since active participation is essential to the goal of both learning and applying information (Bohr, 2002). Still, most of the office ergonomics education programs described in the literature relies on lectures and didactic approaches, rather than trying to ascertain participant preference.

Online Training in adults

Employers are using technology as cost-effective methods to deliver safety training (Ellison, 2012; White, 2015). In a study comparing the efficacy of instructor and web-based training, it was reported that web-based ergonomics training was more effective at generating a greater change than the instructor delivered course (Rucker, 2004), but there is minimal evidence on the user preference of online training. In the study, the participants were from a high-tech semi-conductor research and development facility using computer. In response to preference of training delivery, the majority of participants who took the web-based training preferred it over the traditional classroom training. In spite of the low cost and flexibility offered by web-based learning program of ergonomics, there are very few studies evaluating the efficacy and identifying the participant preference of an online ergonomic training program (Randolin et al., 2011; Splittsoesser et al., 2007).

Similar use of web-based self-directed learning program has been used in other health related areas with good results. Testing whether patients were more likely to pursue healthy behavior by referring to a website, sponsored by a family practice, Woolf, Krist, Johnson, Wilson, Rothemich, Norman & Dever, (2006) found that tailored website on health promotion was an alternative to offering handouts or advice, as interactive websites can facilitate behavior change but that while there was improvement in health behavior in both the intervention and control groups, the intervention group reported greater improvement. However, the participants wished for more interaction with the clinicians. Woolf et al., (2006) sought to extend their outreach beyond the clinical offices, thus empowering the patients with the convenience of time and access to important information as and when they need it. Though there was increased interest in the website, there was no evidence of whether such websites improved health outcomes.

Over a period of time, similar use of web-based interventions has been used effectively not only to learn but also train professionals. For example, in order to develop effective communication in an obstetric event, effectiveness of a web-based learning resource, using videos were studied in ninety-five obstetric nurses (Cowie et al., 2014). The purpose of their study was to develop a web-based educational resource describing nursing skills, teamwork and communication in the event of a Cesarean birth under general anesthesia, and also to evaluate the outcome of training obstetrical nurses using this developed resource. The web-based resources included videos and links to library articles. The nurses were trained using the videos and had opportunity to view the self-directed videos after completion of the session. The nurses were administered with pre and post intervention questionnaire that consisted of 14 items that reflected knowledge of the various responsibilities and requirements that the nurses needed during an emergency Cesarean delivery. The study identified video-based learning resource to be valuable in improving knowledge and skills of the nurses, including teamwork and communication. Though this study was limited to the nursing faculty, similar web-based learning resources have been made available to other medical program (Cowie et al., 2014) and holds the promise for providing an opportunity for keeping the topic of learning current, and applying to continuous professional development.

Mancini, Cazzell, kendong-Edren & Cason (2009) had evaluated an online self-directed learning (SDL) kit for training in cardiopulmonary resuscitation (CPR) with results comparable to those obtained with traditional instructor-led courses. Learners in the SDL group independently completed the tutorial on CPR while the traditional classroom group completed the instructor-led course. The components of the self-directed learning course were web-based interactive simulations, and the learner could control the pace of watching and practicing the

demonstrated skills. Audio feedback was delivered with a click, while there was an online test assessed by instructor. The average time that the SDL course took to complete the learning was 1 hour, 15 minutes while the traditional in-classroom instruction took 4 hours, 30 minutes. Manicini et al., (2009) found that the percentage of learning with overall adequate performance was high for both groups. Having a self-directed learning module deals with the barrier of time away from work to complete training, learner discomfort over being in a classroom setting and is more time efficient and the SDL kit belongs to the learner and can be used at any time for practice.

Online interventions have the advantage to reach larger audiences with individually tailored design and relatively low costs. Rolfes (2013) in a multiple case study analysis has identified the efficacy of using internet-based home exercise program, as part of a treatment plan for patients suffering from common musculoskeletal injuries and conditions. The study was a randomized control trial, and data was collected from a multi-center project consisting of three clinics in North Carolina, Maryland and Washington D. C. The participants were randomized into two groups, one receiving a home exercise program delivered via the Internet and the other group receiving formal physical therapy. Both groups were asked to log weekly participation and administered pre and post participation questionnaire about their functional abilities and symptoms. The home exercise group also received videos and computer animated instructions. Rolfes (2014) reported that of the Internet-based home exercise program intervention was successful as patients who viewed them at office or at home reported an increased adherence to the program and demonstrated an improved outcome. The barrier that was reported was the initial access to the program, as many participants never accessed the program on their own. Rolfes (2014) stressed that since it was found that some patients did not access the home exercise

program, there was a challenge in evaluating the efficacy of the program, but points out that the participants must demonstrate some indications that they can be accountable for taking the initial steps in accessing the information available. This correlates with Knowles' (1970) assumptions about the adult learner, that they seek information based on their need and immediate application and adherence.

Studies of online engagement to assess participant engagement in health behavior intervention, has shown that greater engagement is associated with adherence and retention of participants (Couper, Alexander, Zhang, Little, Maddy, Nowak, McClune, Calvi, Rolnick, Stopponi & Johnson, 2010). Skinner, Maley & Norman (2006) recommend that it is relevant to consider participant preference when designing health behavior change intervention programs. They further suggest that care needs to be taken to listen to the target population and understand their perspectives and needs and include content as per the different learning styles of the computer users. Skinner et al., (2006) in their Spiral Technology Action Research model, describe the five cycles to guide the design, evaluation and ongoing improvement of any health education and health promotion using online technology. The five cycles are:

1. Cycle 1- Listen: To interact with the target community and population and identify their needs and understand how the community related to the technology. This cycle uses participatory and action research techniques.
2. Cycle 2- Plan: To develop a plan for addressing the identified community or population needs using technology by involving the target community.
3. Cycle 3- Do: To implement the plan by developing the website components with continuous interaction with the community to maintain relevance and engagement.

4. Cycle 4- Study: To review the website components with the community or the population before full implementation.

5. Cycle 5- Act: To launch the website after addressing the feedback obtained during the study phase, along with ensuring ongoing feedback from the community or population.

The model uses a participatory approach to assess the participant's needs and preferences. Skinner et al., (2006) state that through a process of continuous learning and improvement, pathways are created to enhance knowledge translation to various interested communities.

Chou, Prestin, Lyous & Wen, (2013) highlight that using web 2.0 tools for health promotion is related to the participatory environment, and the popularity of web-based training programs can be illustrated by the number of online college degree programs being offered (Allen & Seaman, 2013). Importance of designing and teaching good programs with space for learner's autonomy has evolved over the years in the interest of the learners (Moore, 1986). Online learning courses offered through these channels have the unique combination of information and feedback that is learner oriented and flexible. Adult learners find the flexibility of online education particularly attractive as it allows them to balance their multiple roles as working professionals, students, along with social roles with autonomy (Kasworm, 2011). Safety training is similar, as this method allows for mass training without the need for instructor and employees to meet at the same time and place. Thus the ergonomic education and awareness program can be developed and delivered virtually which in turn transmits to lower costs, user flexibility, ease of updating course content and materials. The computer user can take the course and view and apply it immediately whenever they wish to take it and at their own pace and can filter information at their own rate (Rucker, 2004).

Online training intervention, allowed the participants to immediately apply their learning, and though web-based ergonomic interventions have fared better when compared to didactic education intervention, their feasibility and participant preference and opinion in computer users have not been studied. As per Skinner et al., (2006), listening and identifying the preferences and opportunities within the target community will be possible by first interacting with the target population, identifying their needs and wants, and understanding how the community uses online technology for their health education. However, there is an emphasis on the self-diagnosis of the needs for learning through self-directed online training modules (Rolfes, 2014). This is in tandem with Knowles' (1970) andragogy. Online intervention in the case of these professionals will be tapping into their experience ensuring their active involvement. Thus as new technology allows for a more virtual approach in health promotion and education, the Internet has provided with unlimited information about health, awareness and lifestyle issues, sparking an increase in health information seeking and learning about health and health issues (Papen, 2012).

Table 2.2

Online Training in Healthcare

Researcher	Major Findings
Rucker (2004)	Online ergonomic training more effective than instructor led course.
Woolf et al., (2006)	Tailored website for health promotion effective, participants wanted more interaction with clinicians.
Cowie et al., (2014)	Online resource for developing nursing skills during Caesarean birth.
Mancini et al., (2009)	Online self-directed CPR kit as effective
Rolfes (2014)	Internet based home exercise program for treating musculoskeletal conditions was effective as formal physical therapy. However some patients did not access the program.

| Skinner et al., (2006) | STAR model with five cycles of Listen, Plan, Do, Study and Act. |

Health information seeking behavior on Internet

Computer users were able to adjust their workstations similar to that of an ergonomist following web-based instructions (Splittoesser et al., 2007). Participants in similar studies evaluating web-based instruction have expressed preference for online interventions (Eerd et al., 2015; Rucker, 2004). With the advent of the Internet age and web 2.0 tools and technology for health promotion, there is growing evidence that online intervention for health behavior change outcomes are effective (Chow et al., 2013). However with the growing use of internet and mobile technology for seeking health information behavior, it is important to understand user needs and behavior when implementing any technology in web-based patient education (O'Grady, Witteman & Wathen, 2008). According to the Pew Internet and American Life Project, majority of Americans have access to Internet and have accessed the Internet seeking health information either for themselves or for someone related to them (Fox & Duggan, 2013). The Pew report states that about 88 % of Americans have a cell phone, 58% have a desktop computer, 61 % have a laptop and 18% have a tablet computer and about 82 % of all adults in the United States use the Internet (Pew Internet and American Life Project). The Pew Internet and American Life Project is an initiative of the Pew Research center, and the survey was conducted by the Princeton Survey Research Associates International. Interviews were done in both English and Spanish in 2012. The key findings are- One in three American adults have accessed the internet for health issues information, and about 72 % started their inquiry at a search engine like Google, Yahoo or Bing (Fox & Duggan , 2013). The report further states that about 13% searched at a medical site like WebMD, about 2% searched Wikipedia and 1% at a social network like Facebook. WebMD,

Mayo Clinic, NIH and CDC are popular health websites, and the symptom Checker in WebMD is a consumer aid for self-diagnosis (Fox & Duggan, 2013). It was reported that most of the problems people searched were personal health issues, but at least 39% of the health information seekers were for someone related. People generally used search engines like Google, Yahoo or Bing to search for information. In many cases the internet users were asked to pay for the information (26%), and of those, 2% paid for the information, 83% tried to find the same information from somewhere else, while 13% gave up. This shows that most of the people try to find answers to their health questions themselves and made personal choices of consulting a healthcare provider. These findings indicate that the Internet is an added venue to search for health care related information (Fox & Duggan, 2013). Thus integrating online health education and ergonomic awareness will help in reducing health care costs and enhancing employee health and prevent work-related musculoskeletal disorders as self-directed learning and education using Internet searches as a tool does lead to improved health outcomes (Rofles, 2013).

Likewise, with the Internet as widely available as a source of health information it is important to study the health information seeking behavior of individuals (Papen, 2012). Many studies have assessed the health information seeking behavior in a variety of health scenarios, ranging from HIV positive women (Blackstock, Mangton, Gorner, Horvath, Norwood & Cunningham, 2015) to different demographics like socioeconomic status (Kim & Zhang, 2014) to older adults behavior (Chang & Im, 2014) and adults' educational status (Feinberg, Frijters, Johnson-Lawrence, Greenberg, Nightingale & Moodie, 2016).

Feinberg et al., (2016) used data from the 2012 Program for International Assessment of Adult Competencies (PIAAC), using the United States country specific background questionnaire with a sample of 5,010 adults between the age group of 16 and 65 years. The

PIAAC is an international survey conducted under the Organization of Economic Cooperation and Development (OECD). Each country was allowed to add questions to the questionnaire in which the Unites States added questions relating to health status, health information seeking behavior, and use of preventive health measures (Feinberg et al., 2016). They found that Internet use was related to better health status regardless of educational status, with people using different aspects of health information depending on their specific contexts and needs. Also, a key finding was that there was a strong association between digital literacy and health status regardless of educational status. Similar findings were also reported by Blackstock et al., (2015) in their survey of HIV positive women.

In their study describing patterns of Internet use for general and health-related purposes and to explore the differences between internet-using and non-using women, Blackstock et al., (2015) found that most of the participants (61%) had handheld devices like smartphones to access the Internet. The participants who viewed health related videos were high (58.7%), but only a small percentage of women were involved in interactive activities like asking questions or posting comments about health-related issues in an online discussion or blogs. Lack of access or skill was the barrier for non-internet usage. Thus both the studies indicated that digital literacy and access was the key to search the Internet for health information (Feinberg et al., 2016 & Blackstock et al., 2015). However Blackstock et al., (2015) also found that a majority of non-users (60%) were interested in accessing the internet. This indicates the popularity of the Internet for accessing health information, and has been widely used by those providing health services like hospitals, physicians, employers, insurance companies and wellness providers (Korda & Itari, 2013; Tague, Maeder, Vandelanotte, Kolt, Caperchione, Rosenkraniz, Savage & Van Itallie, 2014; Woolf, Krist, Johnson, Wilson, Rothemich, Norman, & Devers, 2006).

Further, it has been noted that though socio-economic status does have an impact on internet access, people accessed the internet for health-related topics using their smartphones (Kim & Zhang, 2014). The study was however limited to low socio-economic status Hispanics with no college degree. Kim & Zhang (2014) reported that smartphones were used because of lower costs, nevertheless, the study highlighted that the participants did access the internet for health information.

Similarly, in their study analyzing older adult's internet using behavior for health information, Chang and Im (2014) found that prior experience of using computers and internet, led to perceived ease of use and had a positive association with behavioral intention to use. However, this study had its limitation of sampling older adults.

This definitely suggests that computer professionals who are working in the Information Technology sector, possessing the skills and access will certainly benefit with online interventions for prevention of WMSD. Given the Internet's ability to reach beyond the clinical settings, it has the capacity of larger dissemination of knowledge. People of all demographics have adopted the innovative advances in internet communication and are using these for health-related information (Korda & Itari, 2013). Internet mediated wellness and prevention programs have been reported to be effective, with participant adherence and minimal attrition (Couper et al., 2010; Santoro, Castelnuxvo, Zoppis, Mauri& Sicurello, 2015; Woolf et al., 2006 & Wantland et al., 2004).

The motivation for participants to seek health information on the Internet has been a health event or a diagnosis or when they are deciding to change their diet or exercise habits (Rice, 2005). However, it has been noted in a few studies that many individuals also seek out

health-related information that promotes wellness (Weaver, Mays, Weaver, Hopkins, Eroghn & Bernhardt, 2010). It has also been noted that the proportion of American adults who seek health information on the internet do so for diet, exercise or fitness improvement, rather than only for specific illness (Fox & Jones, 2009). It has been found that an individual's behavior in seeking health information on the Internet is related to their demand for health care (Suziedelyte, 2012) and their individual preference for the source of health information (Zhang, Sun & Kim, 2016). The Internet has been found to be a complement to formal health care rather than a substitute for health services (Suziedelyte, 2012).

Given that such a large percentage of the population use Internet for seeking health information, many internet-based health interventions have been shown to be successful in prompting behavior change (Blackstock et al., 2015). However, though computer users with work-related musculoskeletal disorders have effectively used web-based interventions (Splittoesser et al., 2007) and have preferred using web-based learning programs on ergonomics (Eerd et al., 2015; Randelin et al., 2011; Rucker, 2004), there remains an opportunity to study their preference for the online method of intervention and their ergonomic awareness and education information seeking behavior on the Internet. Preference is the individual's choice of a medium of intervention over other alternatives (Brehm, 1956; Lichtenstein & Slovic, 2006). Most of the literature on health information seeking behavior has examined this behavior in certain illnesses like cancer, diabetes or in general population, and not specifically in people with work-related musculoskeletal disorders. The results of health information acquisition include knowledge change, attitude change and behavior change and maintenance (Lambert & Loiselle, 2007).

Self-Directed learning

Education has been identified as major determinant of health (UNESCO, 1999). Self-directed learning is also one of the attributes of a health- literate individual (U.S. Department of Health and Human Services, 2000). The concept of self-directed learning has been studied extensively in the literature. The following section provides a review of the most pertinent literature on self-directed learning in order to gain an understanding of the process and which is relevant for this study.

The concept of self-directedness in learning and the self-directed learner goes back to the work of Lindeman (1926). Lindeman (1926) observed that adults were motivated to learn based on their needs and interests and that, adults have a deep need to be self-directed. This assumption has been supported by the work of other researchers. Houle's (1961) typology of goal activity and learning orientation among adult learners was fundamental to those ideas expressed by Lindeman (1926). Houle's (1926) *The Inquiring mind: A study of the adult who continues to learn* reports the findings from his qualitative study that determines why adults participated in learning activities. Houle (1961) found that adults had three different orientations that motivated them to learn. One orientation was personal learning goals where the adults used education to accomplish their objectives. Another orientation was due to the attraction to the activity of learning rather than the content, while the learning oriented adult learners sought knowledge for its own sake. Although Houle's (1961) report provided a basic understanding of the self-directed learner, the findings were based on a sample of individuals who had engaged in formal learning activities, thereby not taking into account the vast amount of self-initiated and self-directed learning in an informal setting. This prompted much research on self-directed learning later.

Building on the work of Houle (1961), Tough (1967, 1971) provided the first operationalized description of self-directed learning activities and self-directed learner. Tough

(1971) found from his study of sixty-six adults in Ontario, Canada that over two-thirds (about 68 percent) of all learning activities were planned, implemented and evaluated primarily by the learners themselves and that it is a highly deliberate effort to gain certain knowledge or skill (Tough, 1971). He found that learners prefer to assume considerable responsibility for their learning activities, be it for planning or for directing (Tough, 1979). In his study of forty graduates who had conducted a self-teaching project, Tough (1967) found that self-learners could perform the tasks traditionally assumed to be performed by the teachers. This included activities like deciding a suitable place to learn, obtaining resources and the appropriate time. These significant findings supported the notion that many adults can teach themselves effectively and in turn initiated new research concepts.

Further continuing his research ideas on the self-directed learner Tough (1969) studied thirty adults on the reasons for beginning and continuing a learning project. The goal to accomplish something was identified as the primary reason with the need for knowledge or skill to attain the identified goal. Although his model was linear in nature, Tough's research on self-directed learning sparked numerous studies around the world.

Writing about the same time as Tough, Malcolm Knowles' (1975) formulation of the concept of andragogy stated that as a person matures, their learning characteristics change and provided a foundation for self-directed learning. Knowles (1975) defines self-directed learning in a broad sense as " a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating goals, and identifying human and material resources for learning, choosing and implementing appropriate learning strategies , and evaluating learning outcomes' (p.18). According to Knowles (1970), as a person matures, their experiences become a reservoir for additional learning, and their self-concept moves towards

self-directedness. Readiness to learn is dependent on their social roles and immediacy of application. Knowles (1975) also describes the basic assumption for self-directed learning to include a problem centered approach requiring internal motivation and utilizing individual experiences as resources for learning with self-directness being an essential part of adult learners. Although the work of Knowles is similar to that of Tough's, and has been criticized for being a liner model, their writings have resulted in research conceptualized in different process and models.

Building on the pioneering work of Houle (1926), Tough (1971, 1979) and Knowles (1970), which were more of descriptive in nature, research emerged providing more in-depth conceptual models of self-directed learning (Brockett & Hiemstra, 1991; Candy, 1991; Garrison, 1997; Grow, 1991; Gullielmino, 1997, Oddi, 1986; Spear, 1988; Valente, 2005). Merriam and Caffarella (2007) have reviewed the different aspects of self-directed learning literature and have identified various themes like interactive models focusing on different factors such as opportunities people find in their environments, personality characteristics of learners, cognitive processes, contexts of learning, specific characteristics or interests of a particular population and frameworks used in formal educational settings.

Spear (1988) suggested that self-directed learning generally did not occur in a linear fashion. He proposed that the process of self-directed learning had three major elements- knowledge, action and environment. Knowledge referred to the past or new knowledge, action referred to directed or exploratory action while the environment combined the human element and chance encounters found within the learning environment (Spear, 1988). As per his model, self-directed learning is accomplished by the ability of a person to engage in a number of relevant learning activities and making decisions on their importance and assembling them into a

coherent whole. Similar conclusions have been found in other's work like Candy (1991) as mentioned in Merriam and Caffarella (2007). Candy (1991) also emphasizes intentionality and refers to self-direction as the willingness and capacity to conduct one's own education, with the process being auto-didactic.

In an interactive model based on Knowles (1975) and Tough's (1979) work, along with the learner's intentionality to pursue learning or as Brockett & Hiemstra (1991) refer- learner's personal responsibility is combined with instructional processes. In this model called the Personal Responsibility Orientation (PRO) model, self-directed learning comprises of both instructional processes and the personality characteristics of the individual learner. Brockett and Hiemstra's (1991) model is different from others in that they recognize the context and the importance of situational factors in the self-directed learning process.

This insight that personal characteristics of the learner, his attitudes, abilities and values impact self-directed learning heightened the interest in this style of learning. Some of the investigations on characteristics and personality factors of individuals have led to the development of instruments that attempt to define the self-directed learner.

Guglielmino (1977) developed the most used self-directed learning instrument, the Self-Directed Learning Readiness Scale (SDLRS). This instrument has been extensively used for quantitative studies for examining the self-directed learning projects, life satisfaction, creativity and employment readiness (Merriam et al., 2007). Though there were concerns about the reliability and validity with SDLRS, that it does not reflect low literacy and higher levels of learning of adults, Guglielmino (1977) found that self-direction exists in learning along a continuum, and that it is present in each person to some degree, and ultimately the personal

characteristics of the learner, their attitudes, abilities and values are what determines whether self-directed learning will take place. Although the SDLR scale is perceived as mostly of personality characteristics, the instrument is geared mostly towards learning associated with learning through books and formal settings and does not measure the unintentional learning associated with daily activities (Brookfield, 1984). However, the SDLRS has been used for various studies examining relationships among self-directed learning, health promoting behavior and characteristics of the individual (Merriam et al., 2007).

In a study investigating the health behavior and self-directed learning readiness, high scores on the SDLRS were consistent for people who practiced health improving lifestyle behavior (Leeb, 1983). This study examined the relationship between   positive health behaviors in individuals and if they had the characteristics and attributes of self-directed learning readiness. Leeb (1983) sampled thirty five adults who were identified as actively involved in health promoting behaviors. All of them scored high on the SDLRS, showing that each of them had the characteristics of self-direction in learning. The study also found that all the participants desired control of their personal health decisions and activities. Leeb (1983) has recommended a framework for health enhancement through self-directed learning. However, since the sample only examined participants   who were already involved in health promoting behaviors, the questions remains as to how people not actively involved in health promoting activities would score on the SDLRS and would they change their behavior with direction from a health educator.

Another instrument was developed by Oddi (1986), the Oddi Continuing Learning Inventory (OCLI), using a 24 item Likert scale, to distinguish between personality characteristics of self-directed learners and the notion of self-instruction. Oddi (1986) described the personality characteristics of a self-directed continuing learner as one characterized by initiative and

persistence in learning over time through various learning modes and using many resources. Tough (1979) had already elaborated on the method used by those engaged in self-directed learning activities as emphasizing reliance on self, and other resources like computers, television, books and peers.

Hoot (1992) used the Oddi Continuing Learning Inventory (OCLI) along with other variables to better understand the characteristics of a self-directed learner and the degree to which they engage in health promoting behavior. Using a survey method, 575 subjects were sampled whose ages ranged from 22- 92 years of age. The study found that people in the older age group were more likely to be involved in health promoting behavior. The study also found educational level, past sources of knowledge, and self-care ratings to be predictors of self-directed continuing learning. Also, the measure of self-directed continuing learning was found to be a strong predictor of health promoting behavior for that sample, suggesting that people who engage in health promoting behavior also exhibit characteristics of self-directed learners. Hoot (1992) also states that people, who use frequent health promoting behaviors, view their health as their personal responsibility and have many sources of knowledge and have the characteristics of a self-directed learner. This was also in tandem with Tough's (1967) findings that self-learners can and do perform tasks traditionally assumed to be done by the teacher and can teach themselves. He also found that adults use a variety of sources for help in undertaking their self-planned learning activities.

Among the various researches that emerged on self-directed learning models, Garrison (1997) proposed a multidimensional and interactive model, where the dimensions include: self-management, self-monitoring and motivational for a meaningful and worthwhile approach. The learner takes control on a social milieu where he is interacting, and takes control and shapes the

contextual conditions to reach their goals. Self-monitoring enables the learner in decision-making, while the motivating dimension describes what influences and motivates people to embark on self-directed learning activity.

There have also been instructional models developed, prominent being the Staged Self-directed learning (SSDL) model by Grow (1991). This model provides a guide for teachers to help students advance towards self-direction. The model has four stages, where, in stage one, the learner is of low self-direction and needs assistance. Stage two levels of learners have a low level of self-direction, but they are motivated and confident, although they lack skills on the subjects to be learned. The stage three learners are intermediate self-direct learners and are ready to learn and explore with some assistance. The stage four learners possess high level of self-direction, and can plan, execute and evaluate their own learning with or without assistance. Grow's (1991) model provides guidance to the teachers based on the learner's stage.

There are a number of other interactive models of self-directed learning in the literature, some based on specific population or topics. Valente (2005) studied the self-directed learning process of older adults who managed their own healthcare, through a descriptive qualitative design using in-depth and semi-structured interviews for data collection. The model begins with a "health event" and once the health event is diagnosed, the cycle of self-directed learning begins. The findings were based on the data of 15 purposefully sample older adults between the ages of 65 and 89 years. The study found that self-directed learners controlled their health by acquiring and assessing information, choosing treatment options, monitoring treatment results, and managing adjustments in lifestyle and treatment. The conclusion that Valente (2005) drew are that older adults are motivated to take control of certain aspects of their healthcare, self-directed learning process is cyclical with interaction between the learner and their health

professional and self-directed learning is perceived as positively affecting healthcare. Valente's (2005) agrees with Knowles' (1975) assumptions that individuals take the initiative to learn and to diagnose their learning needs. The findings also coincide with Houle's (1984) theory that adults engage in learning because of some immediate need and related to their stage of life. Similar to Tough's (1971, 1979) ideas, Valente's (2005) model describes the deliberate steps taken by the learners and also includes the triggering event as the impetus for self-directed learning. Although Valente (2005) based her findings on a sample of older adults, she has recommended similar survey studies using different populations and sample. Valente (2005) has also identified the Internet as an important learning resource.

Table 2.3

Self-Directed Learning

Researcher	Contributions
Lindeman (1926)	Adults learn based on their needs and interests
Houle (1961)	Typology of goals- Personal learning goal, activity of learning, learning oriented..
Tough (1967, 1971)	First operationalized description of self-directed learning activities and self-directed learner. .
Knowles (1975)	Concept of Andragogy
Spear (1988)	Proposed model of SDL having three elements- knowledge, action and environment.
Candy (1991)	Emphasizes intentionality, auto-didactic process
Brockett & Hiemstra (1991)	Personal responsibility Orientation (PRO) model, emphasize instructional processes and personality characteristics of the learner.
Guglielmino (1977)	Developed the Self-directed Learning Readiness scale (SDLRS).
Oddi (1986)	Developed the Oddi Continuing Learning inventory

Garrison (1997)	Multi-dimensional interactive model-three dimensional, self-management, self-monitoring and motivational.
Valente (2005)	Self-directed learning model in healthcare

Impact of technology on self-directed learning

Technology has had a profound impact on self-directed learning. There is ongoing research and writing in self-directed learning where its applicability has been tested in human resource development, training and online learning, as it has been identified that there is considerable commercial and economical value in encouraging employees to be self-directed learners as then employees can master predetermined training material at their own pace, without the aid of an instructor (Merriam et al., 2007). Ellinger (2004) has examined the linkages between self-directed learning and human resource development and has suggested research examining the impact of technology on self-directed learning, with the prevalence of the Internet and web-based instructional strategies. Similar views are expressed by Merriam et al., (2005) as there is interest in research in online learning, as the need for self-direction has been identified on the part of the learners in an online environment. The technological shifts have impacted self-directed learning with the popularization of online learning, digital tools and Web 2 technologies, where the environment is convenient, interactive, non-linear leading to workplace changes affecting self-directed learning (Candy, 2004; Karakas & Mamisaligil, 2011).

Use of technology in self-directed learning has been studied extensively as researchers have linked a number of different variables with being self-directed in ones' learning, including readiness, educational levels, personality factors, learning style, health promotion and wellness, and health information seeking behavior (Merriam et al., 2005). Individuals use variety of

strategies for learning about health and wellness, including using the Internet and health books. Papen (2012) has found in a qualitative study that when adults seek healthcare information on the Internet, they focus on specific tasks in response to particular needs, learning is through practice and often by trial and error and is fully embedded in the process of dealing with a health issue. The use of Internet-based home exercise program for the treatment of musculoskeletal disorders has been found to be effective (Rolfer, 2013). Similar studies using the Internet has been conducted, where delivering the intervention through web-based interaction (Rucker, 2004) has been effective. Wright and Grabousky (2011) have recommended the role of adult educator in guiding the self-directed learner in seeking quality health information on the Internet, as about 82 % of American adults have sought health information on the Internet. King (2014) identified self-directed learning strategies used in a chronic pain healthcare journey and has supported the paradigm of self-directed learning in promoting personal healthcare and behavior change. Her study examined the healthcare experience within the lens of self-directed learning and demonstrated the power to change patient behavior and behave proactively.

Self-directed learning is the medium through which individuals take control of their healthcare (King, 2014; Valente, 2005) by accessing healthcare information through various sources including online source (Papen, 2012). The cyclical self-directed healthcare model is similar to the Health Belief Model (HBM) that is used in public health campaigns (Rosenstock, Strecher & Becker, 1988). The HBM is a psychological model that focuses on the attitudes and beliefs of individuals to explain and predict health-related behaviors. The HBM was designed with the idea that an individual's health-related behavior is based on two variables, both the desire to avoid illness or to get well and the belief that by taking health-related action the individual will prevent or reduce illness (Rosenstock, Strecher & Becker, 1988). Rosenstock

(1994) determined that the model consisted of four dimensions: perceived susceptibility, since it

is logical that when people believe that they are at risk for a certain disease or illness, they will

take the necessary precautions, perceived severity by the individual, perceived benefits based on

the individual's belief regarding the usefulness of the new behavior and perceived barriers. As

per the Centers for disease Control and Prevention (2004), in order for a new behavior to be

adopted, an individual needs to believe that the benefits will outweigh the consequences of

continuing the old behavior. Variables of the model include demographics, cues to action, and

self-efficacy (Rosenstock et al., 1988). Rosenstock et al., (1988) discussed cues to action in his

earlier work, noting that he believed some type of stimulus was required to start or trigger the

decision-making process.

Summary

This chapter reviewed the relevant literature in work-related musculoskeletal disorders,

their prevention strategies, online learning, and the health information seeking behavior on the

Internet. The literature on self-directed learning and the evidence of impact of technology on

self-directed learning provides support that it is a relevant lens to explore the preferences of the

computer professional regarding the medium of ergonomic delivery. Based on the

recommendations found in the literature on self-directed learning on healthcare models, and by

integrating technology, this study aims to explore the health information seeking behavior on the

Internet of computer professionals as the impetus for seeking health related information comes

from the individual based on their preference and needs (O'Grady et al., 2008) for adherence and

retention (Rolfes, 2014) and engagement in the learning (Couper et al., 2010). This study is

specifically targeted at computer professionals since they are at considerable risk of developing

musculoskeletal disorders (Bohr, 2000; Erdinc, 2011; Gerr, Marcus & Monteilh, 2004; Greene et

al., 2005; Ketola et al., 2002; Kreuzfeld et al., 2016; Shikdar et al., 2008; Trujilo & Zeng, 2006; Tiric-Campara et al., 2014; Waested et al., 2010; Wahlstrom, 2005). Employers would gain considerable economic value from the use of online preventive strategies that prevent work-related musculoskeletal disorders in their computer professionals, as this would integrate technology with self-directed learning with the benefits of online learning.

Chapter 3

Methodology

         This chapter describes the methodology for the current study on the health information

seeking behavior of information technology professionals in relation to musculoskeletal

disorders. The study explores and seeks to understand the participant's perspectives and

experiences regarding online ergonomic education. The purpose of this study is to garner a better

understanding of the preferences and perspectives of IT professionals regarding ergonomic

education awareness and medium of delivery of education to prevent musculoskeletal disorders

and their health information seeking behavior on the Internet. With work-related musculoskeletal

disorders being a leading cause of occupational morbidity and increased healthcare costs

(Bhattacharya, 2014; Silverstein & Evanoff, 2011), identifying and exploring the health

information seeking behavior on the Internet has implications for the development of online

training modules that will increase and maintain the adherence of an intervention since it will

depend on user needs and preference. The following sections include the research questions

guiding the study, design of the study, description of the participants and the context, data

collection, data analysis, pilot study, validity and reliability issues, ethical consideration,

researcher's biases and assumptions and the limitations and delimitations of this study.

Research Design

A qualitative inquiry was used to study this phenomenon, as currently there are no studies that explore the preferences of medium of delivery of ergonomic education and perceptions about self-directed online training modules to prevent musculoskeletal disorders in computer professionals and understand their perspectives and experiences about online health information seeking behavior. An exploratory case study was used in this inquiry. The case study approach was selected as it is the perfect method when exploring a phenomenon when it is linked to the context in which it occurs (Yin, 2009). The context of this study focuses on the work-related musculoskeletal disorders in computer users that can occur because of their particular occupation and related factors like gender and hours of working on the computer. The study also seeks to understand the participant's perspectives on online ergonomic education to prevent these musculoskeletal disorders and their preferences for the medium of delivery of intervention, so that there is maximum adherence of the behavior change. In this study, the bounded system was the musculoskeletal disorder risk associated with their work environment for each participant, along with individual characteristics like gender, hours of working on the computer in a week. The phenomenon studied was the health information seeking behavior on the internet and their perceptions about the mode of delivery of ergonomic interventions. This is especially important as previous research indicates that if there is no motivation and accountability from the participant's side, there is no knowledge transfer and behavior change, no matter how well the intervention is designed (Rolfes, 2014; Skinner et al., 2006). Thus, an understanding of the context is necessary for the in-depth exploration of the phenomenon as it answers the how and why questions (Creswell, 2015; Yin, 2009). The focus of the case study is the process rather than the outcome, as here the goal is not to identify the effectiveness of any preventive strategy for

WMSD, but to gain a deeper insight and understanding of the participant's views on online ergonomic education and their health information seeking behavior on the Internet. This approach is appropriate to explore the research questions as they call for a rich and descriptive data (Creswell, 2003; Paul, 2005).

Research Questions

1. What are the mediums of ergonomic education and information that are preferred by computer professionals to prevent and/or treat musculoskeletal disorders?

2. How do computer professionals view self-directed online ergonomic education?

3. What are the sources of health information that the computer professionals have experienced?

4. What health information do computer professionals seek from the Internet?

5. How has health information seeking on the Internet affected healthcare and behavior change?

6. What barriers do computer professionals experience when seeking online health information?

All the questions are grounded in the theory of self-directed learning. The answers to these questions will provide insights into understanding the perspectives of computer professionals' preference about ergonomic education and their experiences while seeking health information on the Internet. Online interventions providing ergonomic awareness and education are low-cost, and provide flexibility to the computer users, at the same time being equally effective in the result, thus being useful for both the stakeholders- the employee and the employer (Ellison, 2012; White, 2015). This study will also add to the existing body of knowledge of ergonomic

education in work-related musculoskeletal disorders in computer users on self-directed learning in relation to healthcare and related behavior.

Research Paradigm

The epistemological frame for this study is rooted in constructivist philosophy, with the intention to garner a better understanding of the health information seeking behavior and individual preferences for prevention of musculoskeletal disorders. According to Paul (2005), in the constructivist perspective, the meaning-making process of each individual and their interaction with the world are emphasized. Each participant's context, realities and values are given importance, along with the researcher's values to guide and generate constructions.

Informed by the theoretical perspective of constructivist approach and the interpretive process, the design of this study is a qualitative case study where the health information seeking behavior of each participant within an organization will be the case. Because of its philosophical assumptions, qualitative research provides for an ideal method for the study (Paul, 2005; Creswell, 2003). In qualitative research the meanings people have constructed from their worlds and realities are important (Lincoln & Guba, 2000). The assumption is based on the view that reality is constructed by individuals interacting within their social worlds, and in contrast to quantitative research which takes apart a phenomenon to examine a specific part, qualitative research examines the whole (Merriam, 1998). The resultant knowledge is dynamic within the context (Creswell, 2015).

The purpose of this study is to understand and delve deeper into the health information seeking behavior on the internet of computer professionals and identify their individual preferences, views and acceptance for the mode of delivery of intervention. Hence an

interpretivist perspective is identified, where each participant's meaning is probed, since the knowledge and the knower are linked (Paul, 2005).

The case study approach along with the constructivist and interpretivist paradigm will enable an in-depth exploration of individual perceptions in relation to health information seeking behavior on the Internet. For this study the participants will be considered as individual cases within the bounded entity of the information technology field in a public organization.

This process of inquiry is an inductive process where the researcher gathers data from the participant's setting to build concepts and data analysis inductively building themes, theories and the researcher making interpretations of the meaning of the data (Creswell, 2015). The strategy of inductive analysis allows the themes to emerge from the cases, the process being recursive (Maxwell, 2013). Also the product of a qualitative inquiry is richly descriptive, with the description provided from direct quotes, interviews and field notes to support the findings of the study (Creswell & Plano Clark, 2007; Merriam, 2002).

Another characteristic of qualitative research is that the researcher is the primary instrument for data collection and analysis (Creswell, 2015). Since the goal of qualitative research is to understand a particular phenomenon, the human instrument is the perfect tool that is immediately responsive and adaptive to collect and analyze data (Merriam 2002; Creswell, 2003). Since the researcher will be conducting the face-to-face interviews based on the interview protocol, she will be able to adapt and modify the questions and involvement based on the responses of the participant.

Role of Researcher and Researcher Identity

The inspiration and motivation for this study comes from my background as a physical therapist. As a clinical physical therapist, I have come across many patients who have been diagnosed with cervical spondylosis, carpal tunnel syndrome, or neck pain and back pain, primarily due to their work on the computer. I have treated patients with some debilitating symptoms that have affected their daily life. This was especially frustrating as the etiology of musculoskeletal disorders are multi-faceted with risk factors like long duration of working on the computer, keying for long hours, awkward postures, no break in between work and lack of stretching exercise. The phenomenon of WMSD is preventive with patient education in terms of health promotion and awareness; the musculoskeletal symptoms can be avoided. I used to wonder, why these people did not take adequate precautions and prevention strategies. I also saw that though in the acute phase of the discomfort, the patients took care of themselves; they reverted back to their old selves, in terms of risk factors of WMSD when they felt better.

It was only when I started my graduate studies again, and had to sit for prolonged period of time with extensive use of the keyboard and mouse, that I realized that I too was behaving in a similar fashion, in spite of being aware of the risk factors. I also noticed that I referred to the Internet, like Google search engine more than my medical books and the library for health information. There is an abundance of health information available online that provides consumers with greater and easy access. People are always searching the Internet for some relevant health or wellness information. But then I comprehend that an individual will access only that information that he or she needs immediately, and which is easily accessible and from a reliable source. If WMSD prevention information is provided online to people working in the IT field, that they can access anytime they need, it will promote wellness and reduce healthcare costs.

This study is an effort to explore how the people working in the information technology field, who need to work on the computer for many hours in a day, view online ergonomic education. Although there are several studies that examine the efficacy of various interventions to treat or prevent WMSD, user preference and their health information seeking behavior on the internet are not explored. This study will try to understand their perspectives and experiences.

My own biases and characteristics may influence the nature of the information collected (Maxwell, 2013). In an effort to reduce bias, I recorded my thoughts and feelings in a journal during interviews as a design strategy (Maxwell, 2013). The journal writings were not used in the data analysis, but they served as an important indicator or reminders of situations that needed to be considered while analyzing data to help prevent the researchers' own feelings from contaminating the interpretation of the data. This helped in being aware of reactivity (Maxwell, 2013). I asked different questions to different participants based on their characteristics. Thus, although it not possible to eliminate the threat of reactivity, by being aware and reflexive, I could acknowledge the way it influenced the interview responses (Finlay, 2002).

Setting and Participants

Setting

The setting is a public organization in a mid-Atlantic state that employs computer professionals who work in areas like System Development, IT Architecture, Information System Management, and Business Process enablement. The Information Technology professionals create software and set up and maintain the systems. The organization employs IT professionals, both as a permanent employee as well as hires them as contractors. The IT professionals are involved in project management, project requirement gathering, review and approval, design and

develop applications that will support the customers in the day to day operations of organization. Roles and responsibilities also include research and development of new technologies that could further increase the productivity of the organization and supporting the system, applications and other resource such as network and security of data and services. All the IT services offered by the organization require different type of IT professionals who can not only develop and deliver the software programs but also support those systems/applications. The organization does not have a wellness or ergonomic program as part of their human resources policy. Being a state organization, the permanent employees receive periodic information related to wellness sessions that are offered through the state department of human resource management. These sessions are not mandatory. Though there are no ergonomic training offered by the organization, ergonomic equipment like stand-up desk, ergonomic chair or keyboard was offered to many of the employees based on their request. The IT professionals were health conscious and were aware of the musculoskeletal disorders related to their work, mostly through their individual experience, and shared experiences. All the participants were keen to take precautionary measures and took proactive measures to prevent musculoskeletal conditions and maintain their fitness.

Participants

The target population for this study is the computer professionals in the Information technology (IT) sector who work on the computer for more than 6 hours in a day and have accessed Internet for health information. The participants in this study are the computer professionals from the identified organization.

Sampling and Recruitment Procedures

A convenience sampling method was used to identify the setting of the study. A convenience sample is the one that is easily accessible to the researcher (McMillan, 2011). The public organization was easily accessible for the researcher, and the population was the employees of this organization from which selected participants were purposefully sampled. Purposeful sampling is defined as selecting participants who are best suited to answer the research questions (Maxwell, 2013). Since qualitative research focuses on recruiting participants who have the most knowledge and the most experience with the phenomenon being studied (Lincoln & Guba, 2000), to begin purposeful sampling, the researcher has to determine the selection criteria that directly reflect the purpose of the study and also guide in the identification of information-rich cases (Creswell, 2003). Since the research questions asks about the experiences and preferences of computer professionals in utilizing online health information to prevent MSD, this study needs participants that are typical and represent the research questions (Maxwell, 2013). Thus, the participants are IT professionals who may or may not have MSD due to computer use and who also have used the Internet to find health information.

Selection Criteria

A demographic questionnaire (See Appendix B) was used as a recruitment tool to identify participants for the study. A survey was administered in- person after informed consent. Emails were requested in the survey to invite the selected potential participants for the in-depth face-to-face interview. Seventy four information technology professionals from the public organization completed the recruitment survey.

The demographic survey asked for the participants' demographic characteristics of age, gender, average number of hours they work on the computer in a week, number of years as a

computer professional, presence of chronic illness related to muscle or joints and history of pain related to any fall, slips or accident. The survey also asks whether the computer professionals have experienced any musculoskeletal discomfort like neck pain, shoulder pain or back pain in the last working week. Usage of Internet for seeking health information was also assessed. The framework adopted in this study for selection of participants requires some variance for organizing relationships among them, and is based on previous studies of work-related musculoskeletal disorders in computer users and health information seeking behavior on the Internet of general population.

In most studies, women were found to be at a higher risk than men in reporting musculoskeletal disorders among computer users, with suggestions that anthropometrics may cause women to work in more extreme postures or use higher relative muscle forces than men (Ekman, Andersson, Hagberg, 2000; Erdinc, 2011; Karlqvist, Wigaeus, Hagberg, 2002; Wahlstrom, 2005). At the same time Rice (2005) in a study on general U.S. population, demonstrated that being female, young, and highly educated contributed to increase in online health information seeking behavior.

The duration of working on a computer has been identified as a risk factor for MSDs in many studies, as the combination of repetitive movements of fingers and wrist, static loading on the thumb to grip the mouse, prolonged extension and ulnar deviation of the wrist for long duration may all contribute to the development of MSD (Bao, 2015; Carr, Leonhard, Tucker, Fethke, Benzo & Gerr, 2016; Kumar, 2008; Turic-Campara et al., 2014). The number of years working on computer has also been identified as one of the risk factors for developing WMSD (Erdinc, 2011; Fagarasanu & Kumar, 2006).

This study involved purposeful sampling of typical cases available, which met the above mentioned criteria for selection. Potential participants with or without musculoskeletal pain were invited to participate in the study. The same participants also need to access online health information and have been working in the IT field for at least a year, since the duration and the number of years working on the computer has been identified to cause injuries to the tissues and joints with increased risk for musculoskeletal disorders (Erdinc, 2011; Fagarasanu & Kumar, 2006). Participants were not selected if they have any chronic illness or symptom of musculoskeletal disorders that is caused by a fall, slip, accident or other pathological disease (Bureau of Labor Statistics; NIOH, 1999).

The demographic survey used as a recruitment tool was administered in person. The potential participants were approached after obtaining consent from the department heads of the organization. The department heads of the organization were contacted via email explaining the purpose of the study and requesting permission to contact the employees. Informal interest meetings were held in the workplace during lunch time. Four interest meetings were organized where the researcher explained the purpose of the study to the potential participants. It was emphasized that participation in the survey and the study was voluntary and was explicitly for research purposes and had no bearing towards their organization in any way. Official recruitment for the study was conducted after the approval from the Virginia Commonwealth University, Institutional Review Board.

Once the potential participants expressed interest for participating in the study, they were administered the survey. There was not any coercion. Only the researcher had the information of the participants at the time of the survey administration. The survey was administered in-person in small groups based on the convenience of each participant, so that if there is any doubt in the

question or procedures, the researcher could clarify. This method ensured maximum response for the study. In-person administration allowed immediate clarification of any doubts that the participants had. The survey was conducted via a paper and pencil form. Once the survey was completed, the responses were kept safe with the researcher in a locked cabinet with access to no one. The participants were assured once again that their participation was completely voluntary and their survey responses will be kept confidential.

The surveys took less than a minute to complete and care was taken to conduct them with minimal disruption to the workplace. Once the recruitment tool had been administered, participants who fit with the selection criteria of the study were contacted via email and invited to participate in the study. As there are no formalized rules dictating sample size in qualitative research (Creswell, 2015), efforts were to recruit at least 10-12 participants for this study.

Out of the 74 participants who completed the recruitment survey, 36 were found to meet the selection criteria. All the 36 survey respondents were contacted to participate in the interview. 17 respondents volunteered to participate in the interview. Since an appropriate sample size for qualitative research is guided by data saturation (Creswell, 2003), data was collected until a point of saturation was reached. This occurred after 15 interviews. The factors that influence the number of participants are the amount of data that the individual participants can provide including the depth and breadth of data (Creswell, 2015; Lincoln & Guba, 2000).

Research Relationships and Assumptions

I did not have relationships with the potential participants. However, I attempted to create a trustful relationship that was formal and courteous by reassuring participants about privacy and

confidentiality during and after the study. I also assured that that I would respect their decision to withdraw from the study if needed.

I had made several assumptions about the potential participants. I had assumed that the potential participants have more or less similar experiences and perceptions about seeking health information on the internet, and ergonomic education like those documented in the relevant literature, but I intended to listen more to their views and explanations. Secondly, I assumed that all the participants will be honest and candid during their interviews, and will trust me that there will not be any ethical breach from my side. I also reinforced that anonymity and confidentiality will be maintained throughout the research process and during dissemination of the results.

Data Collection

Data for this research were collected utilizing face-to-face interviews with open-ended questions (Maxwell, 2013) and observation of the work-station of the participants. Conducting personal in-depth interviews with the potential participants allows the researcher to become the primary instrument for data collection and analysis (Lincoln &Guba, 2000; Maxwell, 2013). In-depth individual interview with standardized semi-structured questions were used, with follow-up probing questions as needed (See Appendix E for Interview Protocol). Interviewing is useful and necessary when the behavior and feelings cannot be observed (Merriam, 1998). Interviews can be structured or unstructured. The semi-structured interview has a set of questions and sequence of themes to be covered, with an openness to change the sequence and order, so that follow-up probing questions can be asked (Merriam, 1998).

The interviews were conducted at a location that was convenient to the participant. Care was taken to minimally disrupt the working of the organization by scheduling the interviews at a

time that is feasible to the participant and does not interrupt their work. The interviews averaged from 20 minutes to 45 minutes. All interviews were conducted in person in a location convenient to the participants. Nine interviews were conducted in a private room in the participant's organization; one was conducted in the private office of the participant, three in the public library near the participant's home, one in the Starbucks café near the participant's office and one in the club house of the participant's apartment.

The research purpose guided the development of the interview questions. The research questions and the conceptual framework also helped in the development of the interview protocol. The interviews ultimately gathered information that was analyzed to provide description of the health information seeking behavior. The interview questions aimed to elicit opinions, experiences, feelings, knowledge and behavior. The interview protocol progresses from general questions to specific questions that address opinions and feelings. The interviews were audio-taped with permission and transcribed using the services of a professional transcriptionist.

Field notes were maintained based on the observations and my personal thoughts during the interviews. Throughout the process, I maintained memos and reflexive journals to be self-aware of my assumptions and thoughts.

Pilot Interviews

In order to obtain good data from interviewing and to test the usefulness of the interview protocol and the methods, a pilot test was carried out with two participants. The two participants were selected because they were identified as information-rich participants. Pilot interviews aid in finding redundancies in the interview protocol, and also determine the clarity of the questions (Merriam, 1998). It also provides insight into additional questions that may be needed and the

duration of the interview. Conducting pilot interviews gave the opportunity to practice and build rapport with the participants and helped in honing my interview skills.

The interview protocol was modified as a result of the pilot interviews. Some of the original questions were eliminated and modified. The interview protocol was modified to accommodate the findings of the pilot interviews.

Data Analysis

Data analysis is the process of making sense or meaning of the data and in qualitative research, data collection and analysis is a simultaneous activity (Merriam, 1998). Thus, it is a recursive process, as there is an overlap of data collection and analysis (Creswell, 2015). The data analysis process had three distinct components. The first part of the data analysis started with the interview of the participants as I asked probing and follow-up questions based on the answers of the participants. Field notes and journals were maintained during the interview, which were also be analyzed. The emerging insights or tentative ideas direct the next phase of the data collection, which in turn can lead to refinement of the research questions (Merriam, 1998).

Once the interviews were completed, the second part of the data analysis process continued. The interviews were transcribed and imported into Atlas-ti qualitative data analysis software. Field notes were also analyzed. A preliminary analysis was performed after each interview that included reading each transcript and member checks (Maxwell, 2013). For rigor in analysis data-driven and theory-driven analysis were done (Creswell, 2003; Miles & Huberman, 2002). Data were coded based on common patterns, themes and categories (Patton, 1990). A theory-driven approach was used to place the codes into themes and categories (Miles & Huberman, 2002) based on the concepts and the research questions. In the data-driven approach,

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codes were generated inductively from the data (Miles & Huberman, 2002). This process was achieved by reading each line of the transcription. This process minimized bias in the identification of codes. Based on the themes that started emerging, codes were given a prefix. For example, the sources of health information that the information technology professionals experienced were categorized as S- Sources, which was further divided into sub-categories based on the type and source of health information. Codes that related to Internet as source of health information was labelled with the prefix of Source, followed by "I" for Internet (SI), and those sources that related to organization were labelled as SO, for "Organization", and SMD, for sources form other media. Thus a hierarchy of codes was created as per the themes that emerged. The initial coding process generated 134 different individual codes. Following the initial coding process, I reread the fifteen transcripts, and examined the code book to see if there were overlapping codes. The main code that included various sub-groups was amended, and individual codes rearranged as per each individual theme. During this process, some of the initial codes from the 134 codes, needed to be merged or eliminated. Thus, each individual code fit into the larger code category. Each of the codes was given a definition. The final number of codes is 107, although not all the codes are in a group. The emerging patterns were used to create a hierarchy of codes. Care was taken to interpret the meaning of the data from the participant's perspective. Once this process was complete, network mapping was created using the Atlas ti to show the relationships between the codes. Based on the six research questions, I created a network map for the six main code group category (as related to the research questions), and identified the connections between the codes to develop the narrative analysis of the data and findings. I arranged these codes by the code category and content, and drew causes and relationships between them and finally interpreted the findings.

The third component of the data analysis process included synthesis and the connecting process (Maxwell, 2013). The descriptive and the interpretive codes and the network maps were used to generate a description of the participants, their working environment and experiences and perceptions. Once the network map was created, I started with the data analysis memo to clarify my thoughts and interpret the findings. Writing the participant profiles helped in understanding the meaning made them of the setting, their context and the relationships with other participants. This helped me in constructing a comprehensive individual narrative for each participant to capture their individual story and experiences. The interpretation was considered complete since no further themes or patterns could be drawn from the data. Writing the participant profiles and connecting the remaining data with the research questions helped in constructing an outline of the findings.

The resulting relationships between the themes helped to interpret the data by providing insight into the process of health information seeking behavior on the internet and the perspectives of the participants regarding online ergonomic education. Listening to the audio tapes and reading the transcripts aided in understanding the participant's meaning of the content for narrative analysis of the data. Analytical memos were developed that explained the network mapping of the relationships between the codes and the emergent themes. The process of theme construction continued throughout the data analysis until all data had been tentatively assigned to central themes. Cross-analysis between the participants were conducted that showed how one participant differed from the other, in turn leading to a thick analysis, and helped in understanding the relationship between the research questions and the data (Lincoln & Guba, 2000).

Strategies of Trustworthiness

In any research, there exist concerns about the truth, applicability, consistency and neutrality of the research design (Lincoln & Guba, 2000). In qualitative research, there is an assumption of multiple changing realities and that individuals have their own unique construction of reality (Maxwell, 2013). Credibility in qualitative research is that it accurately reflects the reality of the participants (Lincoln & Guba, 2000). There are several techniques for producing credible research. The first technique is collecting data in such a way that it is more likely that the data and the subsequent theorizing will in fact reflect the participant's construction of reality. The second technique is checking the study findings against the perception of the participants. For this, member checks with the participants was carried out (Lincoln & Guba, 2000; Maxwell, 2013; Rossman &Rallis, 2003) so that there is authenticity, and to determine that the findings are plausible and representative of their comments (Wolcott, 1990). Once the audio interviews are transcribed, they were shared with the participant for verification.

Dependability or reliability. In qualitative research, reliability is conceptualized as dependability or consistency, meaning that others will concur that given the data, the findings makes sense and are consistent (Merriam, 2002). As the researcher is the instrument for data collection and analysis, the researcher can become a more reliable instrument through practice (Rallis & Rossman, 2003). Documenting my feelings and thoughts during the study process will also aid in building dependability. By being self-aware, I was able to clarify the impact of my position as a physical therapist and someone who uses the internet for health information and who has occasional musculoskeletal   discomfort, on the questions that I asked and the response by the participants. I already had some assumptions and theories about the study before I started the research process. This bias could have posed a validity threat if not acknowledged as wrong interpretation of the data or imposing my interpretation on the participant's view will distort the

findings (Maxwell, 2013). I may also unconsciously represent only those data that fit with my preconceptions. In order to eliminate these threats, I ensured that I reported fully all data even if they do not corroborate with my assumptions (Wolcott, 1990). The participants may tend to give socially desirable responses. I tried not to reveal my personal responses and I endeavored to listen more and refrain from explicit personal revelation unless otherwise needed (Wolcott, 1990).

Also there will be a threat of reactivity, which may not be eliminated, but by being aware and reflexive, I was able to acknowledge the way it influences the interviewee's response (Finlay, 2002). Being aware of my assumptions and writing those down in a research journal helped in identifying my biases or prejudices (Linclon & Guba, 2000). Acknowledging the preconceptions was the first step in keeping them from distorting the data analysis (Merriam, 2002).

I used triangulation in data collection by recording interviews, and taking field notes and observation, and journaling to ensure consistency and dependability in the study. Authenticating the findings from the initial interview during member checks will increase the credibility. Member checks will thus help in establishing authenticity and credibility in the findings (Lincoln & Guba, 2000). Conducting the pilot test also helped in establishing trustworthiness where the interview protocol was revised based on the participant's feedback (Lincoln & Guba, 2000).

Transferability. In qualitative research, external validity refers to how the study is useful or transferable to other situations or similar situations (Creswell, 2003). Also, in qualitative research, the concept of user generalizability is on the readers (Lincoln & Guba, 2000). Thus, researchers need to provide a detailed description of the study's context and situations, so that

the readers can compare with their situations (Lincoln & Guba, 2000). In order to enhance the transferability or applicability of the findings, I have provided detailed and rich description of the data and the findings. I have utilized purposeful sampling and recruitment with diverse participants, to increase the potential for greater situational applications.

Ethical Consideration

This study was submitted to VCU IRB for an exempt review. After permission from the VCU IRB was obtained, data collection was initiated. The nature of the data collection warrants special precautions and considerations to protect the confidentiality and privacy of the participants. The identity of the participants was masked. Pseudonyms were used for each participant. The participants were approached through interest meetings that are informal in their workplace with the permission of their department head. Each of the participant was explained the purpose and the nature of the study. They were invited to participate in the study voluntarily and there was no coercion or incentives. The participants were informed about the risks and benefits of participating in this study and had the opportunity to not participate. The participants were handed the recruitment questionnaire with a brief explanation of the study prior to the survey items. Potential participant's doubts or queries or concerns were clarified immediately, both during the interest meetings and during the survey administration. Once the data collection was completed, only the researcher and the committee had access to the information. The participants were provided with the option to ask to stop the interview at any time or may withdraw if needed. The file containing the responses to the survey was kept in a secure location accessible only to the researcher. Attempts were made to collect the data with minimal or no disruptions to the participant's work or the organization. Pseudonyms were used once the data was collected and for transcription and reporting the findings.

Study Delimitation and limitations

The purpose of this study is to explore the preferences of the computer professionals regarding the medium of delivery of ergonomic education and online training to prevent work-related musculoskeletal disorders and to understand their perspectives and experiences about online health information seeking behavior. For this reason, this study's findings are delimited to the study's populations and the context in which the study occurred. This study has the limitation of convenience sampling that will limit the generalizability of the findings to the target population. The study is also be limited by the assumptions and experiences of the researcher as the motivation for this research has been the personal experiences of the researcher.

Perspectives gained from this study will add to the existing body of knowledge of health education in work-related musculoskeletal disorders in computer users. The findings have implications for the development for online training modules by organizations to reduce the impact of work-related musculoskeletal disorders in their employees, as the healthcare cost is usually borne by the employers.

Summary

This exploratory case study aims to understand each computer professional's preference of the medium of ergonomic education and their perspectives about online health information seeking. Each computer professional's experience and preference is considered as a case study within the bounded system of their individual working environment as context. Semi-structured interviews and observation were the mode of data collection. Data analysis consisted of deductive coding based on the concepts in this study and the research questions, while inductive

coding involved assignment of codes to the emergent themes form the data. Findings were

validated for trustworthiness, dependability and transferability.

Chapter 4

Results

This chapter presents the findings of this investigation designed to understand the experiences and perceptions of the information technology professionals with regard to health information seeking on the Internet and their preferences about the medium of ergonomic delivery to prevent work-related musculoskeletal disorders. This chapter is divided into two parts: Part One presents the profiles of the participants and Part Two presents the findings of each research question. The research questions that guided this study are-

1. What are the mediums of ergonomic education and information that are preferred by computer professionals to prevent and/or treat musculoskeletal disorders?

2. How do computer professionals view self-directed online ergonomic education?

3. What are the sources of health information that the computer professionals have experienced?

4. What health information do computer professionals seek from the Internet?

5. How has health information seeking on the Internet affected healthcare and behavior change?

6. What barriers do computer professionals experience when seeking online health information?

Part One: Participant Profiles

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The participants in this study worked in the information technology department of a state

organization in a mid- Atlantic state. Profiles of the participants are presented since, though the

focus of the study is to explore the common aspects of their perceptions and experiences, it is

important to understand the context of each participant and recognize the uniqueness of each

information technology professional's experience and preference. The context of this study

focuses on the work-related musculoskeletal disorders in computer users that can occur because

of their particular occupation and related factors like gender and hours of working on the

computer, as the bounded system in this case study is the musculoskeletal disorder risk

associated with their work environment for each participant. Fifteen information technology

professionals participated in this study. Pseudonyms have been assigned to each participant to

protect their identity. The profiles are presented in the order in which they were interviewed. The

participants ranged in age from 30 to 60 years. Eight are males and seven are females. Most of

them worked using computers for more than 40 hours a week while some worked between 30 to

40 hours on the computer. All of them used the Internet to search for health related information.

Some of them were permanent employees of the organization, while some were on contract or

temporary basis. Table 4.1 presents the demographic information of the participants. The

following sections will provide details about each of the participant.

Table 4.1

Participant Profile

Name	Age Group	Gender	Number of years working in IT field	Type of Employee
Nancy	Between 36-45 years	Female	15	Contract[*]
Susan	Between 46-55 years	Female	20	Contract
Barbara	Above 55 years	Female	34	Permanent
Aerial	Above 55 years	Female	45	Permanent

Rahul	Between 36-45 years	Male	15	Contract
Dave	Between 46-55 years	Male	20	Permanent
Samantha	Above 55 years	Female	2	Contract
Burt	Between 26-35 years	Male	9	Contract
Raj	Between 36-45 years	Male	16	Contract
Daisy	Between 46-55 years	Female	30	Permanent
Alana	Above 55 years	Female	38	Permanent
Carson	Above 55 years	Male	20	Permanent
George	Between 36-45 years	Male	14	Contract
Ned	Between 26-35 years	Male	7	Contract
Tom	Between 46-55 years	Male	29	Contract

Note *contract employee indicates temporary employee of the organization

Nancy

Nancy has been working as an information technology professional for 15 years, and puts in more than 40 hours of working on the computer. She is a business system analyst and spends a significant amount of time at her desk typing and writing on the computer. Her job involves testing, documentation of requirements, and technical specifications of the software. She is a contractor and not a permanent employee. Nancy sits continuously at her computer for about eight hours in a day, and has to remind herself to take a break. "I have to make myself get up to walk around or something because you sit there for so long typing…" is how she describes her breaks.

Although she does not have any severe issues of musculoskeletal discomfort, Nancy occasionally has some neck pain and shoulder pain, especially on the days when she needs to perform testing of the software that her team is waiting for her to deliver. At such times, she does not take breaks, though she may feel the need for it. "Its's kinda like I need to get it [testing] done and I need to get it done now…so it just depends on what's going on that day." According to Nancy, the musculoskeletal problems she faces while working is partly due to her stature. She said:

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I think I am kind of in the weird percentile because I am short, so it's hard to find the desk, chair, monitor level to be able to fit you. So a lot of times I either have to look up, so that does cause problems with strain on the neck.

Nancy has tried to be proactive, and is self-directed in finding her own solutions to the musculoskeletal and ergonomic problems. She has searched the Internet for tips and ways to adjust her work-station, with some success. She found some options to adjust the monitor and the chair, but faced the problem of her short stature again. She explained:

I do have the problem where I am short...so for me to lift my chair up high enough to where I am looking directly at the computer monitor like you are supposed to at eye level, then my feet doesn't touch the ground (Laughs)… and then I have the pain around the knees…

Nancy thus turns to her chiropractor for treatment and relief. "So a lot of times, I do have neck pain where I am kinda looking up, I go to the chiropractor because it's [neck] stiff and I can kinda tell with that." Nancy's chiropractor has recommended her stretching exercises, which she does follow and also attempts to maintain her posture while typing. She was also recommended a medicine ball to sit on while working on the computer, but as her work space is small, she didn't buy the ball. "So it's' like if I was to get the ball, it's either the ball or the chair." The solution Nancy has found is adjusting the monitor and chair as much as possible for her stature and since the work culture is flexible, taking breaks to stretch. Since the organization does not provide any preventive or wellness information, for Nancy, the Internet is always the first source of information.

Susan

Managing a family and career has kept Susan very busy and engaged throughout her life. She had worked as an administrative assistant and business analyst for many years. Presently she is a project manager in a contract position.

As a project manager, Susan has a very busy schedule. Her work entails communication, facilitating meetings and testing. She has been an IT professional for over 20 years and spends between 30-40 hours working on the computer in a week. Sometimes, she is so engrossed and focused in her work that she sits continuously for a couple of hours without break:

> I am pretty busy throughout the day, I have to track a lot of different things and planning the stages of different projects that I am working on, I got new ones that are getting ready to start and then I have some that are in the closure process. So I have projects in different phases, a lot of meetings with staff, with our customers that have projects. Also, testing, we are in the middle of UAT testing now…

Susan explains that "sometimes I have a lot of work that I need to do on the computer, so I am sitting for long periods of time focusing." Susan observes that when she spends a long time working in front of the computer, she gets severe neck pain and shoulder discomfort:

> If I sit for very long periods of time, I notice that I can feel something in my neck and shoulders. And it's been to the point of where it's so painful that I need to go to get a massage or put ice or heat on my neck.

Susan has taken treatment from her chiropractor and massage therapist, who tried acupuncture on her. She has also been advised stretching exercises by her chiropractor, which she feels she needs to do more often. One of the reasons for her severe musculoskeletal discomfort could be her posture, and the height of her desk, stated Susan. She also observed that

her posture is not good while sitting and working. "I am not sure my table is quite at the right height for my arms or maybe it's my chair. But I have a tendency, when I work, I kinda lean forward and I reach for my mouse." "And when I do a lot of work on the computer - it's usually something that hurts right up in my shoulders, the neck." She also feels it could be related to stress.

The strategies Susan resorted to alleviate the discomfort include intuitively adjusting the chair and the computer monitor, asking for suggestions from her co-workers, and looking up symptoms on the Internet. Susan shares her office with a co-worker, and has learned about ergonomic chair and she also intends to get a wireless mouse. She is very much aware of the imperfect height of the armrest. "...it's just I don't have the adequate desk space, and I am not sure if the difference in the height of the armrest may impact your neck." Susan is not aware of any ergonomic information available through her organization, but gets much of her solutions from her co-workers and the Internet. She tries to take breaks from her work often, but sometimes, "I get wrapped up in what I am doing so I don't think about things like that." She however attempts to be self-aware of her posture while working, and consults her chiropractor as the last option. "The chiropractor is the last ditch effort of when I have just given up, you know what I mean... I know that I am hurting and it's not getting better and then that's when I would go to him."

Barbara

Barbara describes herself as a workaholic, out of necessity. She is in management at the organization and is a permanent employee. For 34 years she has been in the field of information technology, starting as a data entry operator, when she was 18 years old. Barbara puts in more

than 40 hours of work in a week, all of which involves working with the computer. Sometimes she works for 10 hours a day, and continues the work at home on her laptop. "I am in management, so I feel more responsibility [manager]," she explained:

A lot of times with having people that work for me on my team, I feel responsible for making sure they have the pieces they need to do their job, which puts more pressure on me because they might be waiting on something from me...I am a workaholic not because I want to, I think it's because I am in management.

Barbara feels that her workload has taken its toll on her health. She realizes that although she has a good posture, she has a tendency to lean forward when she is engrossed and involved, which happens when she is working in front of the computer. "A lot of times when I get involved in things I will actually be sitting there [at her workstation] for hours at a time,…I lean forward too much, so my head goes forward and I don't even realize it.'

Some of the health issues that Barbara faces are neck pain and related migraines. She takes treatment from her chiropractor every two weeks. "…my chiropractor told me , when he did an X-ray- he said that working at the computer and not doing the correct things, and not taking enough breaks has put a lot of stress on my neck." Barbara also feels that the migraine attacks she has to bear may be related to her posture and work. "From what I have done all these years, I actually had migraines real regularly and I really wonder if that doesn't have something to do with unfortunately not paying attention all these years to my posture."

Barbara has resorted to many solutions to alleviate some of the problems. She researched on the Internet and found information about the stand-up desk. She requested an ergonomic chair and stand-up desk from the office, which has helped in alleviating some of the discomfort.

Accessing people and co-workers to find solutions also helped her with suggestions like sitting

on a tennis ball, repositioning herself, keeping a box under her desk to prop her feet. Barbara felt

that all of these solutions did help, and stressed that if she was aware of the occupational hazards

of working at the computer, she would have been more proactive and taken care of her health:

> I was still sitting at a computer typing for 40 years, and nobody really stressing to me that
>
> you have to take a break, you have to have adjustments. Now, I have adjusted and tried to
>
> make sure my eye level is at the right place where it is supposed to be on the monitor.

Barbara feels that the organization should take the initiative to educate their employees

about the right way to sit, take breaks before its too late. "…by the time I went to the

chiropractor, the damage was already done." The organization's HR department is small and

only has few resources. Much of the information that Barbara utilizes to help solve these

problems are from her chiropractor, her co-workers and the Internet. She feels that management

needs to emphasize the importance of being proactive to avoid such disorders:

> This is important, I think it needs to come from the top down. You need to let your
>
> employees know, and if you have managers, you must let them know, and make sure this
>
> information is passed along and there are available resources, make sure that they know
>
> that this is a hazard potentially of IT professionals and these are the sort of things that can
>
> happen…make sure you don't end up falling victim of some of these things that can
>
> happen to you.

Aerial

Aerial works as a security administrator in the organization and is a permanent employee.

Her job involves interacting with the customers and provides access to the various applications

of the organization. She acts as a coordinator of the security administration of the organization. Most of the times she needs to stay in the office, and works more than 40 hours on the computer in a week. Aerial has been working in the IT field for 45 years.

She is proactively managing her health in collaboration with her healthcare provider and her self-directed strategies. She has adjusted her work-station and made it comfortable based on her experience over the years and looking up strategies online. "I go online periodically, as needed, something that I hear on TV or radio, I say let me go look that up," is how she explained her strategies.

Aerial also relies on external sources like the periodic wellness program provided by the department of human resources of the state. Being a permanent employee of the state, she receives emails regarding sessions about health and wellness. "It's something I do myself, its voluntary, when someone comes from the state HR, I always go to those sessions." Aerial likes to be well-informed about her health, and health options and relies significantly on all available sources of information including her healthcare providers, the Internet, seminars and people.

Rahul

Rahul has been working as an IT professional for 15 years, and spends about 30-40 hours every week working in front of the computer. He is a database administrator in the organization, where most of the work that he does entails using the computer for coding, managing the database within his team. He works on a contract basis with the organization.

Rahul is proactive in taking care of his health and always refers to the Internet as his first source of information. He has conducted extensive researches on the Internet for a wide range of health topics, like diet, exercise, and strength training. He is not sure whether his office desk and

chair are the right height for him; however, he regularly takes breaks from work and stretches. "I guess, yes, or probably I got used to it, or after so many years if this was different chair or table, then I might feel different," is how he put it.

Much of the self-directed learning that he indulges is based on his immediate need or symptoms. "Unless you have a discomfort, you don't do anything about it [musculoskeletal discomfort]…but I will read about it [health information]." Though he is proactive in managing his health, Rahul wants succinct information in response to immediate need. He explains that he may not access the health information available if it does not pertain to his immediate need. "...depends on what it [health information] is actually, outside the routine I won't do it. Sometimes I will be curious or if I have a problem I will think-oh yeah, they [employer] gave me this and I will use."

Dave

Being proactive in taking care of his health and preventing musculoskeletal discomfort because of his work in front of the computer has helped Dave in maintaining his health as he advances in age. Dave is a web developer in the organization and a permanent employee of the state. His job entails developing codes for software applications for the organization's intranet. He has been in the IT field for 20 years and works for more than 40 hours in a week on the computer. Depending on the project he is working on and the priority it demands, he sits for about two and a half hours at a stretch. However, he has found intuitive ways to avoid any pain or stress on his joints or body.

> I sit from somewhere between 9:45 am and 12:00, so its's a good couple of hours and a
> lot of it is typing and reading, so I typically got to find a way to keep my wrist on the

edge of the table in a comfortable way, you know that kind of thing for ergonomic purposes.

He is also aware of his posture while sitting but sometimes tends to sit in an awkward position. "…sometimes I will turn a little bit to the right and my left leg will have some pain, so I will turn to the left, and I think it happens mostly later in the day." Dave thinks that it could be because of his awkward posture. "So maybe there's some pressure on the hip joint or something," he explains.

Dave maintains that since the past few years, he has tried to be proactive in preventing the pain and discomfort. He spends time reading and searching online for information about ergonomics and office sitting, and also gaining information from his coworkers. "I have read about ergonomics and office sitting, read generically and generally about these kinds of issues, and about how it's good to get up and walk really." Dave explains that most of the information that he collects is proactive. He explained:

> I really wasn't experiencing any symptoms or issues; it's just as a way to be proactive and health smart. It's not like I am 25 anymore, I am 50 years old now, so you know, your body is not as resilient, so I think about these issues more than I used to.

Along with stretching and walking around the cube space in his office, Dave observes his coworkers and receives information from them. "My boss got a kneeling chair; it could be a proactive kind of thing." He also attempted putting books under the computer monitor to raise it to eye level. "I have seen other people do that and so it's in my mind, because the person before me left them there…and that was a help."

Dave admitted he liked having sufficient knowledge about health, and searched the Internet often for health related information. "I guess to begin with when you work with a PC in front of you, you are used to just typing into Google any questions that you have," he laughed.

Although his organization provides some wellness information through the state website, he hopes there will be definite guidelines in their intranet regarding localized information about ergonomics. "Everybody is sitting at their desk all day, so these are some tips, you know, we don't want everybody to have all these health problems, through the year, so this will be something good for everybody," he stated. He further explained, if such information was available on their website, it will put some emphasis on it:

> ..It's helpful to have the organization include in their website as opposed to people themselves having to search for, on their own, because people need to have this information prominent in their mind, because it's something that everybody is going to be subject to possibly.

Samantha

Samantha has been working as an IT professional for two years and has to spend almost all of her working time in front of the computer. She works as a support analyst, supporting the applications of the software and interacting with the users in the organization. Samantha works for about 30-40 hours on the computer in a week. She had an episode of neck and shoulder pain about 10 years back, where it had reached a point of intense distress. The treatment she underwent included cervical traction and exercises.

Hence, when about four weeks back, Samantha had similar symptoms, she resolved to be proactive. She is seeking professional help from her massage therapist and stretching along with

reminding herself to take breaks between her work. "My doctor said, it didn't just happen like this all of a sudden, over a period of time, you have let this [neck pain] instead of taking care…..So this time I am going to be proactive," she explained. Samantha has also requested for a chair that would be better suited to her body. "Right now, I have a chair that's probably not the best, because I realized my feet aren't flat on the floor…and I have bad sitting habits," she remarked. She has resolved to retrain herself in being aware of her posture; however laments that she rarely takes a break between her work:

> I will get to my office before seven, so I will start, and basically I am there…I don't leave, I eat at my desk, I mean I keep working…except maybe for going to the restroom, until I leave at 3:15.

Although Samantha had severe musculoskeletal problems 10 years back because of her work on the computer, she stopped taking preventive measures and exercise when the symptoms of pain declined. "And so now I have had to go back, stand up doing the stretches and things I have been given, but I didn't start doing it, until I started having problems.(Laughs)." Although she is contract employee, she remembers going to wellness programs organized by the state, where they gave tips about staying healthy. But now, she relies on her coworkers for information and discusses with her boss who also has similar issues.

Samantha uses the Internet for seeking health information and prefers watching short videos. "I love *YouTube* for learning things, I am a visual person, and I am one of those always looking at something [information], whether it's diet or exercising." Samantha said that she uses the Internet as a motivator for exercising. "I think because I get bored with exercises and different things, I will go online and okay, what can I do different this week? …Because I have

to be motivated to exercise." Samantha has used the Internet for checking about ergonomics and tries applying it to her work. She emphasized that before the internet; she was used to going to the library [health information] for her self-directed learning resources, but prefers the Internet now. "Now with the Internet, I am just more comfortable going on the Internet, because I can do it at night, I can do early morning, yeah, it's not a nine to five," is how she put it. She calls the Internet her "little reminder buddy" to keep her motivated.

Burt

> I use computers a whole lot, it hasn't been a problem recently but on occasions I found that I was getting soreness in my right wrist. And I thought, I wonder what the symptoms of carpal tunnel are, and what is going on there? I looked online, and I was pretty sure it was just the way I was resting my arms on the desk. I was cutting off circulation or something. So I changed my seat posture and it went away.

Burt can be described as someone who is proactive in taking care of his health and is extremely self-directed in pursuing information to prevent illness and maintain his health. Burt is a business analyst and has been an IT professional for nine years. His work involves being a liaison between the organization users and the web developers. He collects the requirements, creates requirement documents and provides the input to the developers. Most of his work involves the computer and spends more than 40 hours on it in a week. Occasionally he needs to do field work.

Burt is very much aware of his posture when he is working in front of the computer, and adjusts the chair height. "On occasions I do adjust my chair, I don't know if the chair changes over time or if it's just trying to be adaptive, but I usually try to sit with a straight back and get to

the level so my arms are horizontal," he said. Having heard of musculoskeletal disorders from his colleagues and having read about the hazards of sitting for long, Burt has made it a routine to take breaks every hour form his work. "I try and make a point of getting up and moving at least once an hour, its preventative, and I looked at various studies on the differences between sitting for most of your day versus standing for most of your day," emphasized Burt. "And I didn't ultimately come to any conclusion, but I did decide that I was going to make sure, I at least got up and stretched, that's just part of my routine," he stressed.

Burt has worked in a call center during his college days, and was aware of the environment. He attributes his proactive and self-directed attitude in maintaining his health to his parents. He explained:

> I want to make sure that I am able to just be active, and healthy for as long as possible. It's just always something that my parents instilled in me, that I need to take care of myself now, so that I don't have to deal with major problems later, so it's preventative maintenance in a way, and that's something I try to make part of my lifestyle.

Raj

Raj is a developer and has been working as an IT professional for 16 years. He works more than 40 hours per week. Raj is proactive and endeavors to take preventive measures to avoid any musculoskeletal discomforts. Having run many marathons, Raj is aware of the need to maintain his posture, and stretching his muscles. He makes sure he takes breaks between his work to stretch and get up and move every hour:

> Every hour I will make sure, I stretch my neck. Because what happens is two things-one, I work on a computer, my posture needs to be straight. In the same way when you run, it

needs to be straight. So for both of them, it's working for me. Because unnecessarily, you don't want to hurt any muscle right?

But, Raj agrees that he tends to *slide down* in his chair while typing. He knows that may not be the best posture for his body, but he prefers that position, as he is most comfortable in it. He also looks up to the monitor, rather than looking straight. "I put books under the computer monitor; I slide down and sit low, since I type fast, so it is less stress on your hands. That's comfortable for me since a long time, for maybe 15 or 16 years I have been doing that." When the office had offered him an ergonomic chair, he researched about it on the Internet, but didn't feel comfortable on it [ergonomic chair]. He had also heard about ergonomic keyboard from his coworkers, but preferred his regular keyboard.

Raj is very health conscious and searches the Internet for healthy organic food suggestions every day. "Normally, I don't take any pills, so I just want to use either stretches, or food as medicine," explained Raj. He does have occasional back pain which he deals with stretching exercises and frequently getting up from his chair.

Daisy

Daisy is a project manager in the organization and has been working in the IT field for 30 years. She spends between 30-40 hours working on her computer in a week. Her job involves organizing, scheduling, meetings, most of which is on the PC. Daisy suffers from pain in her shoulders and her wrist.

In order to remind herself to take breaks between work, Daisy marks off every hour on the day on the whiteboard in her office, "it would make me get up and walk around, and check that hour off, and then the next hour. But I would have to write that down or else you get so

involved in what you are doing with work, its three hours later…,"she said. She has also discussed with her colleagues about her problems, and on their recommendation has switched to ergonomic keyboard. "When I had a standard keyboard, I would go home and my wrist would hurt. I got one of those ergonomic keyboards and its made a ton of difference for me," she expressed.

Daisy also purchased a medicine ball online, based on her colleague's reference, but it did not help her much. "So I think I needed a little bit more direction of exactly what kind of ball to get," she stated. Based on talks with her coworkers, Daisy searches the Internet for more information, but prefers to have some credible information. She always made it a point to attend any wellness sessions organized by the state HR. In explaining her preference, Daisy said, "I like to be active and I like to take care of myself and I like to have fun too. So anything that can break that up of just sitting in front of the computer – yeah, I am up for it."

Daisy realizes that her work as a manager needs to be on the computer, and being busy with many projects at the same time, she has to take some preventive measures. "…I use my keyboard every day, that in six months, the letters wear off them. So I am on it all day and, I hardly have any of the letters on the keys anymore, I just know where they are."

Alana

Alana has always been proactive in maintaining her health. She is a dancer, loves aerobics, and is regular with her Pilates and exercises. She is a database analyst in the organization, working more than 40 hours in a week. Alana has been in the IT field for 38 years, and is very driven. Although the work culture is flexible in the organization, it depends on the urgency of the project. Alana described:

Over the course of time, it just depends on the urgency, we can't be down. So when we are upgrading, moving systems, developing, going into production, giving it to the user, we have to make absolutely sure that things are as perfect as we humans can possibly present it.

Being conscious about her wellbeing, Alana makes it a point to take breaks and unwind. She explains, "I take regular breaks, especially when there is something intensely stressful or difficult, it helps me to get up, back away from it for a minute, and come back…If we have a production problem, if we are doing installs, something very intense I can sit for 12 hours..."

During such times Alana suffers neck and shoulder discomfort, for which she receives massage and stretching exercises. "I believe in exercise, I trust in exercise first," she stressed. She maintains that she has a good posture while working, which she attributes to her years of dancing. She has made changes in her work-station, like adjusting the height of her chair intuitively based on her comfort. Alana explained:

> I know what feels good for me. I know that I need to be able to set my feet firmly on the floor when I sit. My knees are usually shoulder width apart, and when I pull up to my desk, I don't lean my elbows or wrists or forearms on the desk. I work basically with my hands only on the desk.

However, Alana does experience some wrist and finger stress, which she attributes to her being a gardener and her keyboard. She explains that, "my problems are in my hands, my fingers, my thumb joints. I am a gardener. So between the keyboard and gardening, I do have some pain." Exercises have been her solution. Alana does interact with her colleagues regarding the issues and looks up on the Internet, any suggestions put forth by them. She also likes to

attend the wellness sessions, organized by the state HR, and prefers interacting with the presenters. In order to follow a healthy lifestyle, Alana goes online to search for tips. "You know, I will do those things that are noninvasive. I am just a curious IT person," said Alana.

Carson

Google has helped Carson solve the problem of his backache. He feels that from the time he bought a "kneeling chair" after researching it online, not only has his posture improved, but his backache disappeared too. Carson is a software developer in the organization and has been working as an IT professional for 20 years. He works for more than 40 hours working on the computer.

Over the years, Carson has set up a good routine of taking breaks in between his work and being self-aware of his posture. He likes the flexible atmosphere of his office, and explained that, "It's actually one of the things that I like about my workplace. They don't stand over me and push me hard, and I am more of a self-motivated person and so that environment works well for me."

Carson did experience some musculoskeletal problems early in his career. He had pain in his elbow, which his colleague suggested could be due to using the mouse. He searched the Internet for some solutions, and found a keyboard with a track ball.

> ...I was getting a pain in my elbow; my colleague said it was tennis elbow from using the mouse. It was a traditional mouse. So, at that time, I got a keyboard with a trackball. So, between the kneeling chair, the track ball, and just kind of being careful about my posture, I don't have any problems.

Carson also believes his training in wind instruments as a high school student and singing in choirs, got him into the habit of holding the music stand high, which he applies to his work by raising the computer monitor high enough for him. He explained:

> …the rule when you are singing in a choir or playing a musical instrument is to make sure your stand is nice and high. So you are bringing the music to you rather than contorting your body to see the music. I got in the habit of that...so the same principle applies as far as I am concerned.

George

George is a developer, and has been working in the IT field for 14 years. He is a contractor in the organization. George works between 30-40 hours on the computer in a week. He always makes it a point to take breaks. Having a habit to *slouch* has given him low backpain. George realizes the hazards of his bad posture and tries to improve it. "My natural tendency is kind of a hunched over position but I am constantly trying to sit up and improve my posture," he said.

George has searched the Internet to look for videos on exercises to improve his posture and relieve backache, but never got around to actually do it. According to him the duration of the exercise session was the deterrent. "I have some nagging lower back issues; I definitely feel that part of it is related to sitting for a long period of the day, but also sitting with poor posture. I notice a difference when I am more conscious about having better posture," explained George. He researched on the Internet, "but I never did anything with it, but it was more time consuming than I was expecting. I mean I would like to do it," said George.

George liked the idea of his employer providing information about ergonomics and exercises, but stressed that it was necessary that they follow-up. "I think that would be the most effective thing if someone actually came in and said, okay, you are six one, this is what size your chair should be and this is how tall your desk should be…" he said. George felt that since he was tall, individual solution would make a great difference. Although he liked the video that he found on his own, he would have been more ready to do it if it was short.

Ned

Ned has been working as a web developer for 7 years and is a contractor in the organization. He has to work between six and seven hours at the computer in a day and puts in more than 40 hours in a week.

Ned stated that he has a bad posture while sitting and suffers from low back pain. He tries to take a break every half hour during work. He has also tried using a medicine ball while sitting following his colleagues' recommendation. Ned agreed that sitting on a medicine ball helped him in aligning his posture, and consequently relieved his low back pain. He explained:

> I have a pretty poor posture, and I have used that blow up medicine balls. It just forced me to have more correct posture and then I would use it and do a couple of stretches with it while I was sitting at my desk.

Though he had back pain, Ned did not consult a doctor, but tried other self-directed strategies like asking his colleagues and searching resources on the Internet. He found that when he paid attention to his posture and did exercises, his back pain was better:

My poor posture and all day sitting at the desk caused my back pain, but I never went to the doctor or anything. I would just stretch at home and started working out regularly, and the back pain went away.

Though his organization had offered him a standing desk, Ned never did follow up on it. He relies on his wife who searches the Internet for health information for their family. Ned has also quit smoking based on the information that he got from the Internet.

Tom

Tom is a senior software engineer and developer in the organization. He has been working as an IT professional for 29 years and works for more than 40 hours in a week on the computer. He is self-directed in finding information that he deems relevant in maintaining his health. He generally uses the Internet to find out more information and considers himself very capable in extracting whatever he needs. Tom attributes his increased personal awareness of health management and searching abilities to his experience of working in the army as an intelligence analyst.

"I know several stretching exercises that I learned in the army, for the back and how to stretch within the office," Tom stated. "I have been using the internet and the World Wide Web since it existed, I have learned how to filter out reliable sources and be very picky about my sources," affirmed Tom. However, the problem Tom had faced at his work-station was of his stature. He is very tall. Tom explained:

I do slouch, part of my problem is that I am six foot eight and the world is designed for people that are about a foot smaller than me…so the desk are at the wrong level, the

chairs are a bit small, the keyboards are small, but I have been doing this since 1988, so I have kind of learned to adapt.

Tom said that his organization has been helpful in providing him a bigger chair; however he does not use the ergonomic keyboard. "They have been really good about getting a chair for me, that was made for people my size, so that's helped a bit," agreed Tom. He said that instead of using a special keyboard he takes frequent breaks. "I type very quickly so I can get things done very quickly then take what I call a micro break. I go do something else for a few minutes, so that my wrist isn't in that position for an extended period of time," stressed Tom. He also explained that by talking and discussing with his friends and colleagues who had suffered from carpal tunnel syndrome, he got as much information about the ailment and followed up online for prevention strategies:

> Watching my friends go through the wrist braces and surgery and all that…they would tell us what the doctor told them. Sort of second hand knowledge on how to avoid it, and once the Internet became a thing, I could actually do more research on my own to find out what is carpal tunnel exactly. How do I avoid it, what type of position do I need to avoid, and since I am on a keyboard and mouse all day, that one was a key for me.

However, Tom is very vigilant about the Internet sites that he visits and trusts only credible sites. He wishes for the employer to provide a list of credible sources that the employees can look up and follow.

Part Two: Findings

This section details the findings of the research questions in order to understand the health information seeking behavior of computer professionals on the Internet, and also their

preferences regarding the mode of delivery of ergonomic education to prevent work-related musculoskeletal disorders. Several themes emerged from this study. Common themes and elements were found in the participant's response to the interview questions. These will be presented as well as those themes for which no common patterns were found. Based on the data two prominent findings emerged: (a) the preferences for the mode of delivery of ergonomic education depends on the individual attitude and on the perceived attributes of the particular mode of delivery; and (b) information technology professionals in this study are self-directed in their healthcare and seek out various resources of health information for both wellness and illness management, and perceived their health information seeking on the Internet as positively affecting their healthcare.

R.Q.1. What are the mediums of ergonomic education and information that are preferred by computer professionals to prevent and/or treat musculoskeletal disorders?

This research question aimed to understand the preferences of the computer professionals regarding the medium of delivery of ergonomic education and training. Four themes emerged from the analysis of the data-

1) Participatory approach
2) Self-directed online delivery
3) Combination of delivery approaches and
4) Preferred follow up

Table 4.2 illustrates the themes and the data collection method of this research question.

Table 4.2

Preferences of Medium of Ergonomic Education

Themes	Data Collection Methods
Participatory Approach	Semi-Structured Interviews,
Self-Directed Online Delivery	Field Notes,
Combination of Delivery Approaches	Memos
Preferred Follow-Up	

Participatory Approach

Preference for a participatory approach for the delivery of ergonomic education emerged as a theme after analysis of the interview data. Eleven participants preferred being involved in their work-station assessment and adjustment. Participants wanted the expert advice of ergonomic professionals and also wanted to be involved in the identification of problems not only of their work space, but also related to their individual factors like posture, awkward positions and the correct biomechanical way of functioning with the computer. Both Burt and Dave expressed their first preference for having an expert to assess their work-station and advising based on that. Burt explained:

> The idea of a therapist coming in and evaluating the personal work space seems like the best option, because then its someone who is a subject matter expert being able to say, hey, here is something you might not have thought of that will really improve your level of comfort in this work space.

Dave resonates this by expressing that, "it would be nice to have a professional who understands this better, to assess, you know the work environment, so they can identify, "Oh, this is going hurt your … if you don't have your monitor this high, it is going to hurt such and such..", and tell me what I need to look out for… how do I do it? How can I make sure it stays the way it is supposed to be?" These views were echoed by Ned, Samantha and George too.

Providing individual feedback and obtaining their input, was considered to be an important factor to prevent musculoskeletal disorders by the participants. Nancy explains, "So it would be nice if somebody was there to say, no, this is the proper position, your knee should be bent here..." Tom too felt that individual participatory approach would be the best scenario.

The participants stated that the participatory nature of the session would be the most helpful in adopting new strategies. Daisy described the combined approach of having information presented and then demonstrating the strategies immediately in the workplace will be beneficial in adopting the new strategies. 'I think that it should be someone that can demonstrate what some of the exercises are and everybody gets up and moves," she expressed.

The benefit of having a professional evaluate the work-station and interact with the individual employee was identified by the participants as a great facilitator to change their behavior. Both Aerial and Alana preferred the idea of interacting with the professional regarding their problems and solutions. "I like to interact with the presenter," said Aerial. For Alana, having a demonstration was valuable, "because we use the internet so much for problem solving, I think it's refreshing when we get someone to come in for a demonstration. When you see a person there, you have more respect for the information that's presented. When you don't see that person, it's like where did this come from?" she said.

The expertise of an ergonomist to explore alternate strategies while interacting with the employees was seen as a benefit and perceived to benefit the change. This was very well put forth by Barbara, the manager." I think maybe you have a couple of additional experts, that can work with people individually after you talk about it, then they can work with them one on one if they want extra help."

Self-directed Online Delivery

Online videos and online mode of delivery of education emerged as a theme based on the interview analysis. Nine participants preferred to learn the strategies of ergonomic education through self-directed online modules. Flexibility and convenience was cited as the primary reason for this preference. Although participatory mode of delivery was preferred by Burt, he also preferred the online approach and explained that, "I prefer online courses too because I can do it when it's convenient for me, I can focus the level I want," he said. Burt explained:

> If you have a video series, it could be an hour long, but broken up into 10 segments, where –it's on chair height, this is on desk…I feel like I know I am guilty of this, everyone's patience for sitting and listening has declined. So how can I get the information most directly? And the nice thing about the online teaching tools is that it can be structured so that you can have a table of contents so to speak for the lecture and direct it.

Carson too voted for online mode of delivery, "they would provide the greatest flexibility." Although Dave liked the idea of having an expert assessing his work-station and coming up with solutions together, he liked the idea of having online sources. "Videos could be helpful because it would show the motion." Ned too expressed the same thought as though he preferred having a professional assessing his work-station, he preferred online mode too, since it would be convenient for him. "Yeah, online would probably be good, just so you could then get to it on your schedule," he explained.

Rahul and Nancy too expressed their preference for an online delivery of information. "...give me a link to somewhere on the Internet," she stressed. Susan remarked that she always prefers the online mode of delivery. "I like to look stuff up online, so I would probably do that."

Samantha loves YouTube videos. She is always looking up exercise videos and would prefer to have the training through short online modules. "I am a visual person, I like short videos." Tom wished there was a single source of online resources that was credible and provided by the employer. Barbara felt that, "I think that if they have an exact website, that would be nice." Carson remarked, "I prefer it because in my mind it's more concise and quicker, because I don't have to go anywhere and sit down and do any waiting."

Combination of Delivery Approaches

Combining two or more delivery approaches emerged as a theme for preference of mode of delivery of ergonomic education. Four of the participants highlighted the benefits of having a participatory approach followed by self-directed online modules, wherein they can avail of the expertise of the professional as well as be self-directed in the application of the strategies. Alana expressed her preference as, "I think having someone do the presentation in an environment like this, and giving you the opportunity to reference things online would be the best of both worlds for me." Though she likes online information, she felt that if it was validated by an expert personally, it would be more credible. "You have these sites that are valid, coupled with the introduction with a lab person; I think that's very important. Because then you take it seriously," she asserted.

Having one- on-one sessions with an ergonomist in assessing their work-station, and having online resources that they can use to refer back and follow-up was cited as a preferred

mode of training and self-care responsibility in the workplace. Dave remarked that the online videos could complement whatever was shown personally. "If I can have someone to help me set up the environment and then some videos that teach me on the general principles involved in that, I think it would be perfect. That would be all that would be necessary." Raj echoed the same response. "Basically if you ask me that I will probably prefer the combination one, both video tutorial and the specialist coming to measure the desk and my height, if everything is right..." he explained.

Barbara prefers a combination of a participatory approach, didactic training and online videos. According to her, a basic classroom presentation on ergonomics and the strategies should be followed by one-on-one application with the professional and the employee. The employees should then be given online links or websites for follow-up. "I think a combination of all the modes of delivery is needed, it should come from the HR department to the managers to say and for your own health, you need to go out there and make sure you read over it…and kind of list for people that are just coming into the field."

Preferred Follow-up

Participants expressed the need for a follow-up on the part of the professionals and the organization, to ensure that the employees have understood the work-station adjustment techniques and ergonomic strategies to improve the health outcomes. The participants expected their employer to offer solutions that actually make an impact on their health. George remarked that, "It will be great as long as it was tied to some action on the part of the employer, so meaning if it was just informational, then no, I guess I would like to see, okay, here's the

information. Go to this website or this link, watch this video, and after you watch that video, here are the things that we can actually do to change, to help you if you need to make a change."

Barbara expressed the need for a follow-up online after the initial intervention. Daisy mentioned the need for a follow-up since everybody may not be able to be actually present for the participatory or the didactic intervention. "Because you can't always make the classes," she said.

For a behavior change and positive outcome, and for the intervention to be successful, the employees need to be engaged and adhere to the recommended strategies. This was described by Nancy, "but I think it would only really help us if they would actually do something to follow-up to help the person, not just give the information. Like okay, so these are the options, we can offer these better chairs, or we can try to help..." Nancy further suggested that positive benefits and sustenance of the strategies would depend on the employer involvement:

> We are gonna show you proper sitting technique, and if you want a better chair with
> lumbar support, this is what we can offer you, or we have the things that you can put on
> the back of the chair, that helps you reach the goal.

She also expressed that after the initial intervention by the professional, a follow-up after few months will heighten their awareness and enables the employee to adhere to the ergonomic strategies. "Just send a quick check, they don't have to come and see, just even an email, just saying –did you get anything out of it? What can we do? Stuff like that..."

In summary, participants preferred a combination of delivery approaches with a participatory approach followed by an online delivery. Some of the participants preferred more interaction with the participatory approach, while others preferred the convenience and flexibility

of online modules. Follow-up by the healthcare professionals and the organization was preferred for more effectiveness of any of the intervention strategy.

R.Q.2. How do computer professionals view self-directed online ergonomic education?

This research question aimed to elicit response about the perceptions of the participants in regards to ergonomic education through self-directed online modules by their organization to prevent or treat work-related musculoskeletal disorders. The main themes that emerged from the analysis were based on the perceived benefits and perceived negative attributes of the online channel of education by the participants. They perceived that the self-directed online ergonomic education would make them –

1) Feel empowered

2) Be relevant and trustworthy and

3) Role of individual personal attributes.

Table 4.3 illustrates the themes and the data collection method of this research question.

Table 4.3

Perceptions about Self-Directed Online Ergonomic Education

Themes	Data Collection Methods
Feel Empowered	Semi-Structured Interviews,
Be Relevant and Trustworthy	Field Notes,
Role of Personal Attributes	Memos

Feel Empowered

Data revealed that participants feel more in charge of their own health and were able to self-manage based on individual requirements. The main benefits of self-directed online

ergonomic education were related to convenience, flexibility, immediate information availability, self-paced and ease of information seeking and selective learning.

Convenience. Most of the participants cited convenience and flexibility of the online resources as an advantage in their busy schedule. Burt, Carson, Dave and Ned observed that when there is a formal intervention, there may be conflict with their work schedules, and online channel will be empowering since it would be "on demand" for them. The fact that it would be according to their schedule makes it convenient. The flexibility provided by the online resource allows the participants to choose the timing of the training delivery so that it fits their schedule. Nancy and Samantha shared this feeling. "I think it's accessibility to when you have the time to do that, because we all have such varying schedules," remarked Samantha. Raj too perceived it in a similar fashion. "It's convenience, time, you can watch whenever you want, it's not like now you have to go there at specific time, right? If its classroom learning, you have to go there specifically, I don't want it, so it's my convenience, you can watch it on the bus, right?"

Immediate accessibility. Burt also described the immediate accessibility of the online resources as attractive. "Everyone's patience for sitting and listening has declined, so we really wanna say, how can I get the information most directly?" he contended. This feature of the online resources aided in their immediate need. Carson describes it as quick with no waiting time. "It's gonna be quick and concise, because I don't have to go anywhere and sit down and do any waiting."

Self-paced. The ease of getting the online information at one's own time and pace, and the ready availability was an important positive attribute that empowered the participants. It

allowed them to filter the information at their own rate and helps them in focusing on topics that they might not fully understand or go back again.

Raj expressed that, "You can watch it as many times as you want." He felt that they could immediately apply whatever they learned and go back to check any doubts. "Sometimes when you are adjusting your chair, you feel it is not right, so you want to go back to the video tutorial again and watch it again and you want to make sure it is right," explained Raj. Dave, Ned and Barbara also expressed similar perceptions. "The fact that you can revisit it, whereas if someone came in and gave a presentation, if you are not paying that much attention, or two months from then, you were trying to remember what they said about this or that...if you have online, it's always there. So you could refer to it again and again. So that, combined with doing it on your own time I guess would be the two big advantages to doing it online," described Ned.

Selective learning. The participants were interested in learning about those things that directly related to their individual situations, and did not want to learn everything about ergonomics, but rather what they needed at the time. Their self-directed learning is targeted to meet those immediate needs and may change over time. Burt described:

I might not feel like there's any problem with my chair, so I don't want to sit through the 10 to 15 minutes of lecture about chairs. But I am concerned about where my keyboard is, or desk height, so I want to focus on that and learn that. And having an online resource with sort of those organizational tools, that's what I think makes it really effective and helpful.

Ned also liked targeted learning based on their immediate need. "So I would probably just try to get information on specific problems I am having which at the time is none, but yeah, a few months ago, it was a different case."

Relevant and Trustworthy

The participants had the view that if their organization provided them an online resource about ergonomics, it would be both relevant and trustworthy. They were interested in a resource provided to them by an informed source like an ergonomist through their organization, which was particularly tailored towards their needs. They generally trusted websites that were from professional sources, and thus having a resource through their HR department was considered very useful and valuable. "I would consider the organization providing care and assistance to its employees, would be valuable," said Alana.

Dave preferred to have the resources on the organization's intranet since it would then give them localized tips. Barbara views having a localized website, with relevant information to be apt for new as well as the old employees. "They have something where you go through a list of things that needs to be done." She observed that if it was through their organization, the information would be considered credible and important, "and they need to make sure this information is passed along and that these are available resources, because I think for one, it would make the employees feel like they are cared about," she contended. "And it's focused on exactly what you want to do," she continued. Barbara wanted to make the online ergonomic training mandatory, so that the employees would be aware of their occupational hazard and take adequate precautions. She felt that if it was not mandatory, the employees may ignore the resource. "And if it's only ten minutes, have your boss require that you have gone through it, and maybe have a list of other sites because it might peak somebody's interest. I have a tendency not to make myself a priority or to look out for these things, unless for one, someone says I have to do," she explained.

Burt felt that short video series would be great for learning ergonomic strategies online. "If you have a video series where it could be the same hour long lecture broken up into 10 segments where its- this is the segment on chair, height..," he said. Many participants shared Barbara's view of the HR department's involvement. "I think it would have to come from the HR department to the managers." Dave suggested having localized information will be useful and relevant to what they experience, "because people need to, sometimes have this information prominent in their mind, it's helpful to have the organization include this on their website as opposed to people themselves having to search for on their own," he explained.

Just having information was not sufficient according to the participants. Along with relevant information, they also hoped for action and solutions form the organization's side.

Online ergonomic resources from the organization also elicited trust. Participants considered the information to be credible, "because it's coming from the state," said Aerial. Tom expressed that, "If a trusted source said for additional information, check these sites that would be very helpful."

Nancy felt that the online resources will be more relevant if it was updated. "I think it also needs to be updated as new studies or new things have been found."

Role of Personal Attributes

The negative attributes that the participants perceived about self-directed online education included related to the personal attributes of each employee. The factors that impact negatively are the lack of time, procrastination, personal attitude and personal preference.

Lack of time and procrastination was suggested to be an impediment in accessing and learning the online resources. "I think you may have good intention, but I think sometimes we get too busy and we read about it and at the time we say, I need to do that, but we don't follow through," said Barbara. George too shared similar views. Nancy explains that she tends to procrastinate, but may never actually get to learn and do it. "You just visit it once and sometimes you just kind of forget about it." Barbara thus suggests enforcing the online course through the HR department.

Assessing and utilizing online resources requires initiation from the participant's side. Participant's attitude may not be of initiating self-help in certain cases. Burt expressed that, "It does require more initiation on the part of the people, so I think that's the downside there."

Participant's preference for the medium of delivery may also serve as a barrier to self-directed online education. Alana prefers personal interaction when undergoing training. However she expresses that she likes the combination of online "coupled with the introduction by a lab person," to be effective.

The personal attitude of the participant can either help or be a barrier. Although many participants preferred online mode of delivery, and were self- motivated in maintaining their health, some of them preferred feedback and interaction. Alana described, "You get the opportunity to ask questions without having to look at the frequently asked questions and whatever is presented on the site." Carson, Dave and Samantha too stressed about feedback, "sometimes it's good to get feedback." Participant's attitude will also decide on how much engaged they will be in learning from online resources. As Burt explained, "Some people just don't engage well with online materials."

In summary, the self-directed online education was viewed as giving empowerment through its convenience, flexibility, self-paced immediate accessibility and selected learning. Because the resource would be through the organization, it is considered relevant and trustworthy. However, personal attributes like preference, attitudes, lack of time and procrastination were considered to negatively impact the effectiveness of the online resources.

R.Q.3. What are the sources of health information that the computer professionals have experienced?

This research question is aimed to explore the sources of health information accessed by the computer professionals. All the participants were self-motivated and self-directed in seeking out health information. The motivation for seeking out health information was preventive, wellness and illness reasons. Three sources emerged from the analysis-

1) Internet and other media

2) Individuals

3) Workplace initiatives

All of the participants used multiple sources for their information. Table 4.4 illustrates the sources and the data collection method of this research question.

Table 4.4

Sources of Health Information Experienced by Information Technology Professional

Sources	Data Collection Methods
Internet and other media	Semi- Structured Interviews,
Individuals	Field Notes,
Workplace initiatives	Memos

Internet and Other Media

Internet

Searching the Internet was mentioned as a major resource for finding health related information by the fifteen participants. Since they work using the computer, the participants reported that the Internet had become their typical information source for their health problems. "The knowledge is at your fingertips. I can't even imagine as a matter of fact, what we would do without the Internet," was how Barbara expressed her sentiments about the internet. Her views were echoed by all the other participants. Burt said that the Internet was his first option, "But I did my first level search on the Internet, and that's what I feel like I do for almost everything," while Samantha considers the Internet, her buddy. "It always keeps me rejuvenated to just to continue to exercise, or to improve, so it's like my little reminder buddy to keep motivated," she expressed.

When asked how they search on the Internet, almost all the participants responded that the starting point was always the search engine Google, and going to specific sites.

Search engine, Google. All the participants reported starting with Google using specific key words. Based on their immediate need for information, the participants said that they typed the search words in Google, and followed up the results that came up. Burt explained, "Well, I start with Google, and I would do a Google search of generic terms and key words." Dave also explained the accessibility of the Internet, as a reason for using it. He said, "I guess to begin with, when you work with a PC in front of you, you are used to just typing into Google any questions that you have." Carson stated that, "I found the kneeling chair by Googling."

Barbara also refers to Google for more information about health related problems or for solutions. When asked for an example, she said, "So I went out there and looked on the Internet, Google for this chair that the people were talking about." Ned elaborated his search strategies that, "I pretty much just use Google, and then If I recognize some of the results, I might be more likely to visit them." When in need for more information about her shoulder injury, Nancy explains that Google is her solution. "I have been doing a lot of Google for medical information searches," said Nancy.

According to Raj, Google is the first source before his doctor. He stated that, " I went to Google and searched...I didn't go to a doctor; I felt that it needs to make more sense when I am going to a doctor, if I have to go."

"We Google for anything health related," said Carson. He used the search engine, Bing occasionally.

Hospital websites, **Mayo Clinic.** Hospital websites like Mayo Clinic emerged as a major source of health information for the computer professionals. Seven participants cited the Mayo Clinic website as a legitimate source for getting information about health-related topics. Tom stated, "I end up on things like Mayo Clinic that seems to be more reputable." Barbara, Burt, Dave and Alana also attested the Mayo Clinic website for its health information. "I found tangentially relatable article on the Mayo Clinic website that looked like it had detailed information, that was irrefutable," he explained.

WebMD. One of the common themes for sources of online health information was the medical website- WebMD. Twelve participants reported accessing WebMD for their health information. The participants were attracted by its features like symptom checker, ease of use,

popularity and functionality. It was also considered as "one of the top 10 medical websites," as per Alana. Barbara considered WebMD to be a valid site. Ned too considers it to be a trusted site. "I use WebMD since I recognize it, and visit them...I have checked it several times in the past for some things and then checking references is always a big one." Rahul too echoed this sentiment. "There is WebMD where I check out, if I have a cold, you don't know if there is an infection or allergy. I used it to check about it, what it is actually..." said Rahul. Many participants pointed out that they used WebMD as a symptom checker. Susan explained that, "it's cool, you say where you are feeling pain and you can point on a body figure." However, Daisy expressed that she didn't like WebMD. "If you have a symptom and you look it up, it could be 110 different things, I won't go to WebMD again," she remarked.

YouTube. Nine of the participants viewed YouTube as a source of health information. Apart from viewing exercises for general fitness, YouTube was also used as a resource for specific exercises related to their specific medical conditions. George had used YouTube for back exercises. He elaborated that, "I have looked up how to do stretches for back pain and things like that..." Watching the demonstrations also helped the participants in understanding how to do the actual exercises. According to Ned, "Watching someone else do the same exercises was useful." Dave also used YouTube for learning the techniques of doing exercises. He explains that, "I look up on the YouTube for exercises, like with Kettle bells; I try to learn techniques on how to exercise with them. So that I don't hurt myself and I do them in the right way." Rahul too accessed YouTube for similar reason. The videos and the demonstration appealed to many of the participants. "I will try YouTube just because they will show the video of how somebody does something," remarked Nancy. Samantha too agreed. She had used YouTube to learn to adjust her work-station ergonomically, while Susan found weight-loss

regimes on YouTube. "I have looked at YouTube for wright-loss," she confirmed. Barbara too had searched the YouTube for ergonomic adjustment of her work-station.

Government health websites. Health websites like NIH and CDC which were government endorsed emerged as a source of health information among the computer professionals. Many of them visited these sites directly or when it came up in the initials search results, because they trusted them. "If it's an organization like the CDC, I will trust them," remarked Ned. Burt explained that the NIH had a detailed information page. "The NIH had some information that was a little more detailed. They had a page that was patient oriented and a page that was professional oriented, and I looked at both of those," he said. Tom explained that the government institutions were "credible sources" for searching health information.

Wikipedia. Another source of health information used by three participants was Wikipedia. All of them were aware that it was not an official medical site, but did refer to it for health information. "Often times I would just go directly to Wikipedia, I think it's a pretty good source for information," Dave commented. Tom resonated with this view. "I might stop at Wikipedia, because it often gives an overview of something along with links to credible sources in their document. And then I will go spider through those." Although Wikipedia was not an official site, participants liked to use it. "I trust Wikipedia maybe more than I should. Wikipedia won't necessarily give you tips, they will just tell you about the thing, like if you wanted to look at the spine, they will show you the skeleton and then they will show you the muscle, that kind of thing," Dave explained.

Insurance company website. Another theme that emerged from the data was the use of insurance company websites of the participants as a source of health information. Some of the

participants commented that they used it to track their healthcare and for reviewing preventive measures. Alana and Dave both have checked for wellness information provided by their insurance company. Susan too mentioned using them for health suggestions and information. "They also offer health suggestions and how to stay healthy..." she said. Burt checks up and decides about using specific health benefits. He explains that, "checking up on my health insurance and keeping an eye on that, and decide how I want to utilize those benefits." Dave says that if used, he can reduce his health insurance costs. "There is some wellness stuff there, there is a program where if they track your biometric numbers that you can cut dollars," he commented.

Reference websites. Accessing reference sites for health information was one of the sub-categories of the theme. Four participants mentioned using journal articles sites, and reference sites to search for health information. Barbara stated that, "There's something in the Britannica Encyclopedia, where it is more legitimate and has good information." Burt explained that in searching for a standing desk for his office, he even looked up various studies. "And I looked at various options for that and tried to look for some studies on the differences between sitting for most of the day versus standing for most of the day," Burt explained.

Blogs. Two of the participants referred to blogs on the Internet as a source of health information. Samantha found some blogs with useful health information, but was also careful about relying too much on them. She explained that, "I might come across blogs when I am on the Internet, and some of them have been really helpful and interesting," whereas Rahul uses the experience of other blog users for solving his own problems. According to him, "When I had surgery, I see how it's progressing, what happens after first week? What do people think...there is a blog where we write about it. First week what they had said, I commented on it. In the 10th week if I have pain, is it common to everybody..."

Raj also utilizes podcasts and Amazon reviews for health information. He runs marathons and has an avid interest in the information regarding running. He expressed his interest by stating, "They have ultrarunner.com and menshealth, talk about issues and in general. So I listen in bus, I will make sure I listen."

Other Media

Media like television, radio and print advertisement and health magazine emerged as a source of health information. Four participants, Barbara, Daisy, Dave and Samantha mentioned accessing health magazines as a source of health information. Samantha referred to a British magazine geared towards women. "I get it once a month, it is wonderful, it is called *Psychologies*, but it is geared for women, and its total health."

Daisy refers to a nutrition magazine for healthy recipes and diet. Barbara suffers from migraines due to her work on the computer. In the course of her search for solution, she came across the Cefaly device for migraines in a health magazine, which prompted her to look up in detail on the internet. "So I have used from the magazine to the Internet to look the device up, and then I went to the doctor, got a prescription for it, and now I use it. I have used it for the last two years, every night like clockwork, because I know it helps." Barbara explained.

When Ariel hears about some information on TV or radio, she searches for it online. "If I hear about something on TV or radio, I say let me go look that up…," She explains. Samantha uses the fitness information and modules provided by her cable operator. Alana obtains health information from flyers from her health food store.

<center>**Individuals**</center>

The participants identified other individuals as a source of health information. Four

primary sources were identified- healthcare providers, family, friends and colleagues.

Healthcare Providers

Healthcare providers were a significant source of information and also a factor in their

self-directed learning about their health care. Several types of healthcare providers were the

source of information for the participants including doctors, chiropractors, physical therapist and

massage therapist.

Doctors. For Burt, his physician is the source to go for any real concerns regarding his

health and for information. "I have a general practitioner; they are usually my go to, when I have

a real deep question. And they are our family's general practitioner for a while, so we are on

emailing basis." Carson also found the doctor's suggestions as useful. Similar views were

expressed by Alana, Aerial and Rahul.

After searching the Internet for health information, if the results did not yield any

satisfactory conclusions, Dave usually consulted his doctor. "I will search a few more times and

then maybe give up and then see a doctor," he explained. Nancy said that she tries to confirm the

information that she read on the Internet with the doctor. "And then, if I happen to go to my

doctor, I will be like, all right look, so I read this, but this one says this, what do you suggest?"

Nancy further stated that she goes to the doctor if the problem she has is serious.

Based on the suggestions from her doctor, Samantha has been motivated to further search on the Internet for posture exercises. 'The doctor said okay, make sure you do this, I need to go back, I have got into some bad sitting habits again," she said.

The doctor was also a source of information regarding trusted Internet sites for some of the participants. Barbara explained that, "My thyroid doctor actually gave specific sites. He says don't go to any other sites. These are the sites that are legitimate," whereas Dave doesn't get much information from his doctor, which prompts him to search the Internet for more detailed health information.

Chiropractor. Four of the participants get much of the health information they need from their chiropractor. Barbara regularly sees a chiropractor for her neck. Nancy, Susan and Carson also shared similar views about their chiropractor. Barbara explained:

…one of the things that he told me when he did an X-ray, is from working at the computer and not doing the correct things, he gave me a sheet of things...neck exercises that would help strengthen because of the way my neck was out of position, and he said it's really hard after you have done the damage to get it back to where it's in alignment again.

Physical therapist. Another source of health information that some of the participants identified were their physical therapist. George, Nancy, Daisy and Samantha had been to their physical therapist at various times, and still follow the instruction and the information that they received. Samantha explained that, "...the physical therapist went through them (exercises) physically if I was doing them correctly or not..," while George reiterated the same. When daisy

was asked if she sought any information on the Internet, she replied that," Because I got exercises from my physical therapist, he would give me ones to do, so probably not."

Massage therapist. Two of the participants also identified their massage therapist as a source of information. Both Samantha and Susan take treatment form their massage therapist periodically for their musculoskeletal disorders. "I have also gone to massage therapist that's told me things I can do to help improve with the stretching," stated Susan.

Family

Family also emerged as a source of health information for the computer professionals. Some of the participants whose wives or parents were knowledgeable about health issues were cited as health information sources that the participants rely on.

Ned describes his wife's and his instinct to consult their parents along with the doctor regarding any health issues of their children, for which they need more information. "I will ask our parents, since we know that they have raised children, and probably saw a lot of the similar things we did," elaborated Ned.

Carson relies on his wife for health information. He claims that she usually researches the Internet, magazines or discusses with her friends. "My wife because she spends more time looking at magazines and talking to her friends," he said.

Friends

Friends emerged as a theme to look for and share health related information for the participants. In addition, some participants described that they often obtained health information from their friends who are health professionals like doctors and physical therapists. Alana said,

"My friends that are doctors in medical field, I get free advice from them," while Nancy had friends who were physical therapists. She said, "they are in another state, so normally I will Facebook message them..." Samantha's friend is a personal trainer who refers her to relevant health information. "I have a friend who is a personal trainer and sometimes he might give some interesting sites to kind of check."

Both Susan and Tom talked to their friends about their musculoskeletal disorders, and were given information based on their experience. "A lot of it was talking to people who suffer from carpal tunnel syndrome." Raj uses his runner's group to discuss about immediate and relevant health topics. He states, "whenever I go for a long run with friends, I try to talk to them.' Friends share information about their experiences with treatments, or other health options, and their interaction with healthcare professionals.

Colleagues

Based on the findings from the data, colleagues of the computer professionals played a significant role as a source of health information. Samantha talks about discussing her musculoskeletal disorders with her boss, who also suffers from similar problems, and mentions sharing resources. Samantha expressed:

> Well my boss and I talk a lot and so talking about stretching and different things with neck…and so yeah, between her and I, so she is my supervisor, so she's very understanding and that's why she says, okay we need to get a different chair.

Barbara also got an ergonomic chair based on the recommendation of her colleague. "It's because someone told me it makes your back straight," she said. Daisy too changed her keyboard after discussing with her colleagues. "I was just talking to somebody here and they said, well

maybe you need a different kind of keyboard and I tried it, and immediately I felt relief," exclaimed Daisy. She further said that most of the health information she is got is from "talking to people." She also continues her search online, once it is recommended by her colleagues. Burt and Dave too have used information provided by their colleagues regarding health. Dave had made some adjustments in his work-station based on his co-worker's suggestion. "I have seen others doing it, it's in my mind, especially my boss," quoted Dave.

Ned used a medicine ball to sit to relive his back pain borrowed from his co-worker. "I was talking to someone here and their wife was pregnant and had used it." Nancy used her colleague's input in finding healthcare professionals. "A lot of times I will do word of mouth- I will ask, hey who do you go to or whatever," said Nancy. Talking to people in their office helped in finding and gathering health information for Tom and Susan. Tom explained his case about learning about carpal tunnel syndrome, "I watched them go through the wrist brace and surgery and all that, and they would tell us what the doctors told them, s=-0ort of second hand knowledge on how to avoid it."

Workplace Initiatives

Although not all the participants were permanent employees of the organization and were not acquainted with the health information provided by the state organization's human resource department, the workplace of the participants emerged as a source of health information.

Human resource department of the organization

The participants' organization emerged as a source of health information for some of the participants. Although their organization does not have an official wellness program or ergonomic program in place, being a state organization, the permanent employees receive

periodic information regarding wellness sessions that they are invited to attend. Most of the permanent employees among the participants preferred to attend the sessions although it was not mandatory. Ariel and Alana always attend such sessions to interact with the presenter and gather more information. "They have wellness program from the DHRM, down in the conference room, they have someone coming in to talk to you". Daisy also likes to attend the sessions, she explained that "… where you bring your lunch and you go into the conference room and you sit for an hour and somebody does a presentation on a topic." The HR department sends emails about these sessions. Daisy also mentioned that the organization encourages the employees to walk and track their miles. "..Last year there was a walk around the state or something… They encourage you to track your miles every day for a month..." and they have several wellness topics that we have discussed."

The organization had offered ergonomic chairs to those who requested it. "A couple of people in our office have standing desk, and ergonomic chair, "explained Ned, and "that it was offered to anyone who wanted one." Although the organization had such occasional wellness sessions, only the permanent employees were aware of it.

In summary, the sources that the computer professionals used for obtaining health information included the Internet, other individuals, their workplace and other media. These participants used multiple sources, and complemented or supplemented the information obtained from one source with other sources. All of the participants were self-directed and motivated in obtaining health information for their immediate needs. Figure 2 illustrates the health information sources experienced by the computer professionals.
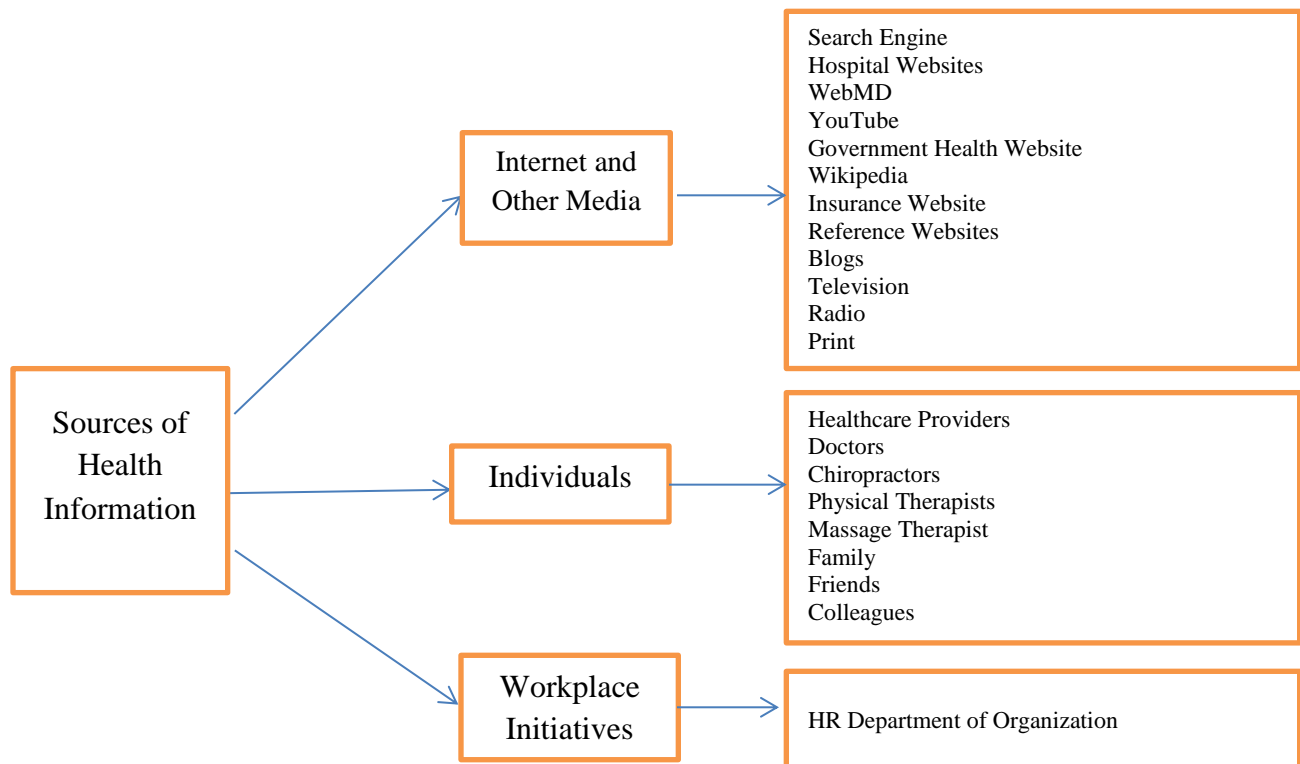
Figure 2 *Sources of Health Information of Computer Professionals*

R.Q. 4.What health information do computer professionals seek from the Internet?

The themes that emerged from the interview data regarding the type of health information

that the IT professionals sought from the internet are-

1) Wellness and prevention information

2) Information to self-educate about medical conditions and

3) Information to decide their treatment options.

Table 4.5 illustrates the themes and the data collection method of this research question.

Table 4.5

Types of Health Information Sought on the Internet

Themes	Data Collection Methods
Wellness and Prevention Information	Semi-Structured Interviews,
Information to Self-Educate about Medical Conditions	Field Notes,
Information to Decide treatment Options	Memos

Wellness and Prevention Information

All the participants recognized the importance of maintaining their health and considered the Internet a reliable source for disease prevention and health promotion. As part of the wellness and prevention information, the main categories that emerged were fitness, prevention of musculoskeletal disorders, and information to maintain a healthy lifestyle.

Fitness. Many of the participants accessed the Internet to search for the correct technique to perform exercises to maintain their fitness. Dave uses kettle bells, and finds the videos on YouTube as a valuable source for learning the technique. "I look up on YouTube for various exercises. Like with kettle bells, I try to learn techniques on how to exercise with them, so that I don't hurt myself, so I use them in the right way," he explained. Rahul too utilizes demonstrations on YouTube. "I used to lift weights in a particular way; you might end up having a sprain, and I did have a sprain, so I checked YouTube videos," he remarked. Rahul described that he maintained his wellness by following the advice on the Internet. "Earlier I used to run. According to the Internet if you run more than 6.5 miles per hour you are less prone to get heart disease. From then I run more," he explained. Samantha likes the fact that the exercises are demonstrated in videos. She likes using different videos for her daily routine of exercise.

Raj uses the Internet for learning about different kinds of stretches, and stressed that he extensively uses the internet for prevention and learning new regimes of stretching. "If I feel pain after running, and it's not going away with regular stretches, so I just want to make sure what other kinds of stretches are there," he explained.

For Ned, his gym instructor refers him to videos on YouTube that regularly he follows. "I use it regularly because of the classes I take at the gym. They often incorporate new exercises and they like you to familiarize yourself with them before you come to the class. So I will use YouTube a lot to watch the particular exercises that we are gonna be doing in class that day."

Prevention of musculoskeletal disorders. Techniques and strategies to adjust their work-station based on ergonomics to prevent musculoskeletal disorders was one of the types of information that the participants sought from the internet. Both Nancy and Samantha had made changes in their work-station based on information they sourced from the Internet. "If I could set up my desk a little bit better, what's the proper way? I have done some research on that and I have found some things that I should do. They have these little foot things for your feet, so I found some options," Nancy described. She was particularly happy for locating these solutions, as she had musculoskeletal issues due to her short stature. "I never did realize that your monitor should be eye level. And so I didn't realize that's causing severe pain in my neck with my spine, because I am constantly looking up than where I should be looking straight, so I would say checking on there helped me," while Samantha too had checked on YouTube for making changes on her chair height. "I did check on about your desk, chair and I know what you are supposed to be doing."

Aerial had also adjusted her chair as per the instructions she found on the Internet, and so had Burt. All of them recognized the importance of having an ergonomically designed work-station to prevent and treat musculoskeletal disorders. "I have done research on the pros and cons of having a standing desk," said Burt. Based on the experiences of his colleagues Dave checked for an ergonomic chair online. Barbara and Carson went ahead and got it. "I went out there on the Internet to research for this chair and got it last week," she explained. Carson found information about the kneeling chair from the internet that helped him relieve his back pain. To find more information about carpal tunnel syndrome, Tom researched the internet to find ways to prevent the onset of the symptoms. "I could actually do more research on my own to find out what is carpal tunnel exactly. How do I avoid it, what type of positions do I need to avoid."

The participants also recognized the importance of maintaining a good posture to prevent musculoskeletal disorders. The internet provided most of them with information regarding posture. "..and it was really about how to improve posture, including while sitting, and how to reverse the situation like mine, where your natural tendency is to kind of hunch over," remarked George. George found the stretches to be very helpful, "and usually if there is a video that demonstrates that, it's helpful," he stressed. Raj resonated with this view, as it helped him with his back pain.

Information to maintain a healthy lifestyle. Information to maintain a healthy lifestyle and prevent diseases emerged as one of the themes. Many participants relied on the internet for information such as diet, nutrition, natural products, organic products, weight loss, vitamin and supplements and home remedies to attain and maintain physical health and wellness. Participants also searched for specific dietary supplements and for a disease or annihilating symptoms.

Alana described her searches for maintaining her health and good nutrition, "I get health related information, diabetes, high blood pressure, cholesterol, eating right, importance of exercise and importance of good nutrition." Carson echoed the same thought. "Just searching for ideas of how to improve things, anything health related, is how I respond to a problem."

Eating healthy and organic food was the prompt that sent Raj to search the Internet for more information. "A lot more of examples of eating healthy habits, and organic products are there," said Raj. He also searched for supplements. Healthy eating was cited by Alana, who loved to search the internet for natural food. "What oils can I use? How does olive oil help?" described Alana. Ned described his family's search for healthy food for his children.

Rahul, Susan and Tom looked up low fat food. Tom described his search was for low carbohydrate food to reduce weight. Rahul explains, "I look for fat free, how much and why? What kind of breakfast you need to eat?"

Carson, Daisy and Raj need information about recipes that helps them maintain a healthy lifestyle. "I do a lot of searching for healthy food recipes," says Daisy. Enhancing health and wellbeing prompted Raj to search for vitamins supplements and organic foods. "I searched for supplements, and then I started taking these vitamin D supplements, I never used to take that," he claimed. Ned described his search regarding his smoking. "I have seen enough information online, to scare me into not smoking anymore."

Information to self-educate about medical conditions

The participants described their information needs when experiencing symptoms of ailments that affected their health for which they needed immediate solutions, from easily accessible information source. They needed information to make sense of what was wrong with

them or their family, understand the medical conditions, understand the likely treatment solutions and their effects and outcomes, learn how to prevent further illness and improve their understanding of the condition so that they can better communicate with their healthcare professionals.

Symptoms. Information regarding any symptoms that the participants experienced was cited as a need to search the Internet. As Barbara describes, "this particular flu, or if I have got the flu, I had some symptoms of allergies and the flu, and I went out and said, what is the difference between a cold and the flu?" She checked for reasons for increase in the heart rate to reasons for pain. "So now I wanted to go out there and find out, what if your heart rate keeps changing?" Symptoms of pain drove both Daisy and George to the Internet to gather more information.

Nancy looks up the symptoms on the Internet and then discusses them with her chiropractor. "If I am hurting I will try to Google my symptoms, and then if I go to my chiropractor, so this is saying that this...and I will kind of talk to him about it," she explained. Susan and Burt also experienced physical symptoms of pain that prompted them to search online. "I used the Internet to try to determine, do the symptoms that I have match the symptoms of carpal tunnel, is that something I need to be worried about or mindful off?"

Medical conditions. Many of the participants reported searching the internet for gaining more information regarding any medical condition that they have been diagnosed or may have. Barbara gathers as much information about thyroid since she has Hashimoto. "I have Hashimoto for my thyroid. So I go out there and learn more about thyroid."

Some participants searched the internet for information regarding specific medical conditions and treatment that their family member's needs. Tom describes that he needed to educate himself about a diagnosis that the doctor gave his mother. He explained:

My mother has orthostatic hypertension, but I had to educate myself on orthostatic hypertension, so that when the doctor asks questions and I was talking to the doctor on my mother's behalf, I know enough about the condition, the treatment, to ask questions intelligently like, have you tried this or these type of medications...so I was able to educate myself on the condition itself, what causes it. What different people are trying for treatments, and then have that conversation with the doctor, to sort through what might be internet rubbish, or what might be the doctor just overlooked.

Participants also reported seeking health information online related to the medications and treatment prescribed by their health professionals. Common reasons were to be more informed. As Ned describes his experience of his son's ear procedure, "one of our son's had tubes, so we did lot of research when he had that pain, he had ear infection, so they basically poke a hole in your eardrum so that they drain faster…we weren't really familiar with it and they recommended the tube. We did a lot of research just to see how dangerous the surgery was,"

Similarly, Tom explained his need to be familiar with chemotherapy as his mom may need it. "My dad had chemotherapy in the 1990s for mesothelioma, and we have to reeducate ourselves on chemo, since it changed since 1989."

When Rahul needed to undergo knee ligament repair surgery, he described turning to the internet for information and gaining from other's experience. "When I had surgery, I checked what the people think, there is a blog where they write about it," he explained.

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Gaining information about medicines and their side-effects was another reason cited by some of the participants. "Any type of medicine the doctor gives me, I am going out there, I am always looking up what the medicine does, for the side-effects," explained Barbara. She also found information about medical devices for her migraine, and relayed her findings to her healthcare provider. "I went up to the Internet to look at the reviews, how it works, if it helps control the migraines," said Barbara.

Communication with healthcare professional. Participants reported that they were likely to need health information from the Internet before or after consultation with their healthcare professional. Many viewed the internet as a tool for enhancing their knowledge about the medical conditions and its treatment and consequently enhance the communication with their healthcare providers. They prepared for their doctor's appointment, to actively participate in the discussion regarding their treatment. "Sometimes when I have to go to the doctor, I look up before I have the appointment, if I have the questions to ask, or sometimes following the appointments," said Aerial. Searching the internet following an appointment was to learn more about what the doctor prescribed them or about a diagnosis. Carson, Barbara and Dave expressed similar views. "Before I go to a doctor, I do like to do my research ahead and so I know what the doctor is saying before I see them," said Dave.

Nancy and Samantha discuss with their healthcare providers whatever information they have gleaned from their search. "Because, I am like, what do you think about this, what is your opinion?" remarked Samantha.

Information to Decide Treatment Options

Participants sought information from the Internet to help them make decision about their treatment option, and to decide whether they should seek treatment from their healthcare professional in the first place. Barbara contends, "So I recently went out there and looked up, before I went to the doctor, I wanted to know, and should I even go to the doctor? So it helps to make a decision." Dave too finds information to make sure if he needs the doctor. Raj explained that he used the Internet to self-diagnose and decide whether to consult a professional:

> I had a muscle pull; I went to Google and searched about what kind of things we have to do. I didn't go to the doctor; I felt that it needs to make sense when I am going to the doctor, if I have to go.

In summary, the participants searched the internet for information regarding wellness and prevention to maintain fitness, prevent musculoskeletal disorders, and maintain healthy lifestyle. They also sought information to self-educate themselves about their symptoms, medical conditions and for communication with their healthcare professionals. Finally, information needed to decide their treatment options was also searched.

R.Q. 5. How has health information seeking on the Internet affected healthcare and behavior change?

This research question seeks to detail the outcomes of health information seeking on the internet on the healthcare of the IT professionals. Five themes emerged from the analysis of the interview transcripts of the participants. They were-

1) Being proactive in fitness
2) Modifying contextual factors
3) Making lifestyle modifications

4) Being more confident in their treatment decisions and

5) Better management of health conditions.

Table 4.6 illustrates the themes and the data collection method of the fifth research question.

Table 4.6

Impact of Health Information Seeking on the Internet on Healthcare and Behavior

Themes	Data Collection Methods
Being Proactive in Fitness	Semi-Structured Interviews,
Modifying Contextual Factors	Observation,
Making Lifestyle Modifications	Field Notes,
Being More Confident in Treatment Decisions	Memos
Better Management of Health Conditions	

Being Proactive in Fitness

The internet provided an effective channel for health promotion and disease prevention activities by encouraging the participants to be more proactive. The participants believe that they can self- manage their health, and were self-directed in accessing appropriate resources from the internet. The data indicated that most of the participants were able to actively apply the health information regarding exercises and fitness to their daily self-care regimes in different situations.

Ned has incorporated the exercises that his gym instructor refers to him on YouTube into his daily exercise routine. "It's a mix of circuit training, some stretching, some cardio, some weight lifting."

Nancy recalled how she was able to rectify the way she was doing an exercise, and says that health information that she searches on the internet definitely has a positive impact on her self-health management. She explained:

It's definitely helped. There were times when I have gone on there and looked for exercises, and I was able to see how they do them. And so I was able to either correct the way that I was doing it or add something new to the way that I was doing.

Among the positive outcomes that emerged was the use of alternative ways to stretch. Raj explains that he usually found alternative solutions to stretching using, "self-massaging, like foam roller and sticks, so I see how I can use them." Rahul explained that he found information to keep his heart healthy. He said:

I learned from the internet that your heartrate should not go more than 170 per minute for a particular age. It should not go beyond that, otherwise you will end up with a heart attack; I make sure it doesn't go beyond that. I mostly go according to whatever I read on the internet.

Modifying Contextual Factors

The contextual factors that the IT professionals modified in their environment, related to two categories, ergonomic adjustments strategies and posture correction, to treat and prevent musculoskeletal disorders that most of them suffered due to their occupation.

Ergonomic adjustment. Nine of the participants suffered from musculoskeletal disorders because of prolonged sitting working in front of their computer, and because their work-station was not ergonomically aligned with their bodies. Participants informed that they were able to make informed ergonomic adjustments and alterations either to their seating arrangements or their work-station. When asked if Aerial felt whether the height of her chair and monitor was comfortable for her, she said, "Yes, the arms have to be comfortable for you and I

found the information online." Barbara had searched the internet for solutions to alleviate her neck pain. She described:

> But yes, for 30 years plus, I have been doing the same sort of thing, where I have been at a desk, in front of a computer for a long time. So yes, I am definitely doing that sort of things to kind of help alleviate – like the stand-up desk that I found after researching on the internet.

She also had learned to adjust the computer monitor. She also searched about ergonomic chairs on the Internet, and based on her search bought one to keep her back straight. Carson too shared his positive experience after using the kneeling chair that he credits to the Internet. Based on the symptoms that he experienced, Burt tried to determine, if he suffered from carpal tunnel syndrome after researching on the Internet. He explained:

> I used the Internet to try to determine, do the symptoms that I have match the symptoms of carpal tunnel...I found that I could attribute to the chair getting lower, so instead of resting my arms horizontal on the desk, it was resting at an angle, so I corrected that.

As Nancy was short in stature, she faces particular difficulty in adjusting her work-station to her body. She has tried all possible solutions known to her and is getting treatment from her chiropractor. Researching on the internet helped her inform about better options to ergonomically adjust her computer monitor. "Never did I realize that your monitor should be eye level…so I didn't realize that's causing some pain in my neck because I am constantly looking up than where I should be looking straight. I found some options," she described. Similar experiences were shared by Samantha who was aware of the need for ergonomic interventions.

Postural adjustments. The need to maintain a correct posture while sitting and working in front of the computer to prevent musculoskeletal disorders was recognized by all the participants. Many of the participants thought that they had a good posture, and took proactive measures to prevent MSD. All of the participants were self-directed in finding solutions to maintain a straight posture and motivated to align their posture because of their years of experience in the IT field.

Barbara is in a management position and felt that the directions should come from the top. She took all precautions to maintain a good posture, as she has neck pain due to her occupation. The participants were aware of the impact of a good posture, either because of existing MSD or to prevent MSD, and reported that their health information helped them in achieving a positive outcome. Burt reiterates his decision to take breaks. Dave also explained that the exercises that he did based on the internet information were for prevention. "I would say proactive. I really wasn't experiencing any symptoms or issues. It's just as a way to be proactive and health smart." George stresses the importance of maintaining a good posture and refers to the exercise he learned from the internet.

Making Lifestyle Modifications

Preventing diseases by making lifestyle modifications such as practicing good nutrition and diet management, overcoming negative habits were cited as an important outcome of seeking health information from the internet. Ned explicitly credited the internet for helping him cease the habit of smoking:

> I smoked for a couple of years and after reading the ingredients in cigarettes and getting
> more information than just like the commercial that you will see that says smoking is

bad...but I have gotten enough information online and seen pictures of cancerous lungs, so it was enough to scare me into not smoking anymore. Yeah, there have definitely been some drastic effects, I guess, to a point where I was, I am not gonna smoke anymore.

He continued, "Yeah, it took more than just hearing from people that smoking is bad once I actually did some research on it. That was enough for me to walk away."

Tom and Raj made significant changes in their dietary habits based on information from the internet. They explained that they applied the obtained information to change their eating habits and behaviors. Raj explains that as he runs, he found his performance to decline. He researched the internet and found solutions that he applied with good results. Raj explained:

I was taking protein, and it was not helping me. So then I found that you have to take Vitamin D supplements because it makes your bone strength and muscle mass, that I followed and it helped me. From other websites I found you have to take flaxseed oil. So I take flaxseed powder through smoothies.

Raj also described his experience of using organic products after reading about them online. "Once you start, the results of these organic produce, you realize it's beneficial for you. So all this I learned from the internet."

Similar instances were described by Alana, Carson, Daisy, Ned, Rahul, Samantha and Susan. "I use internet for weight loss and diet," said Susan. Tom said, "I do a lot of research on what the diet should be and it does make me change my diet."

Being More Confident in their Treatment Options

The participants reported that searching online for health information often helped them to make decisions about treatment options, and also to decide whether to seek professional treatment. Many participants identified that the self-directed learning that they employed in searching health information, gave them more confidence in deciding their options, and also identified this as the purpose of their learning.

When Barbara felt that her heart rate was not going back to normal after some physical exertion, she did some research about her thyroid medicine on the internet and brought it to the attention of her cardiologist. She described:

> I was running. My heart rate was high, which was okay, but then when I went back to my car, it never went down. My Apple watch tells me what my heart rate is and I can feel it. It's jumping around from 120 back to 80 and then 90 and then 130 and then 121. And I am like, that's not good, even if you get palpitation, typically it will stay at the same rate. So I looked up in WebMD. It said if I have too much thyroid medicine, it gives palpitations. I wanted to see if it's kind of valid for me to go to the cardiologist, so I learned from there. So I called the cardiologist.

She was able to convince her cardiologist to lower her dose of the thyroid medicine and the palpitation went away.

Sometimes the participants reported that they self-diagnosed their condition, but most of the times, whatever information they found needed to be confirmed by their healthcare professional. As Burt explains, "I would say if I found something on the internet, if I was worried about specifically and I found something on the Internet to confirm my suspicion –at this point I need to talk to a professional."

Tom uses whatever he learns from the internet to educate himself, and to have as much confidence as possible in the choices he was making and thus he uses his learning to participate in the decisions made regarding his treatments. He explained:

> I go there on the internet and then I go to the doctor, because doctors are humans too and they might forget something. Maybe unware of some new treatment or they may be able to dispel something that I see, where this expert may say it's great, this expert may say-no that treatment is awful...I can at least educate myself to have that discussion.

Several participants decide whether to consult a healthcare professional; based on what they have learned online. "A lot of times I will read certain things and it will impact whether I make an appointment with the doctor, or it will make me more aware of what I should do," counters Barbara. Burt too shared similar opinion. He said:

> I think it's a stepping stone, and maybe it's a good way to start pin pointing issues or narrow down what could be wrong, and then going to a professional, or gauging a sense of is this really something to be worried about.

Dave and George also cited confidence in their treatment choices and decisions as one of the outcomes of learning. "I definitely changed my routine and sometimes I might decide not to go to a doctor based on what I read online," explained George. Raj said, "If you have minor issues and you want to try out solutions from the internet before you go to the doctor, it helps you with unnecessary visits." Nancy cited that the internet helped in deciding to choose the correct doctor for health shoulder injury by looking up on the reviews on the websites.

Better Management of Health Conditions

The participants reported that their self-directed learning through online information helped in self-educating themselves about their symptoms and specific medical conditions. Participants reported that the main aim in learning was gaining maximum knowledge about their specific conditions, and set of treatments which in turn improved their ability to discuss with their healthcare professionals and also aided in having a feeling of control over their health. Their outcomes also included getting more information or double-checking or clarifying the information provided by the healthcare professionals, and thus better manages their condition.

Aerial, Alana and Barbara explained that their objective in accessing information was to derive more knowledge about their medical condition and treatment. Barbara explained:

The first thing I do is to go out there and find out what it is...because a lot of times doctors don't tell you anything. They will give you something and they don't tell you why they are giving it to you.

One of the goals was also to get second opinions from the internet, so that they were reassured about the management of their health condition. Tom described his outcome as:

I will go to a site, if I see something that doesn't look correct; I will go to other sites that get those same hits that I trust, to see if perhaps I am wrong or perhaps the site is wrong. And I will look to see what type of consensus there is and I will look for three or four opinions from trusted sites.

The participants do this sometimes to confirm what the doctor said. Aerial says, "I check the internet even though I went to the doctor."

Better informed to better manage their health needs was the outcome of health information search. "I take everything with a grain of salt, but at least I have an idea." said Aerial. "Yeah, it does change my approach because I have learned so much," remarked Dave.

Aerial, Barbara, Dave, Burt and Carson felt more in control of their healthcare and were better able to communicate with their healthcare providers based on the knowledge they obtained. "I want their [healthcare professionals] feedback, but I did my first level search on the Internet," said Burt.

In summary, the IT professionals were self-directed in seeking health information on the Internet in order to be proactive in maintaining their health and were consequently more confident in choosing their treatment options and were able to better manage their health condition. They were able to modify their contextual factors pertaining to their workplace environment and also for making lifestyle modifications. Figure 3 illustrates the outcomes of self-directed learning in online health information seeking behavior.
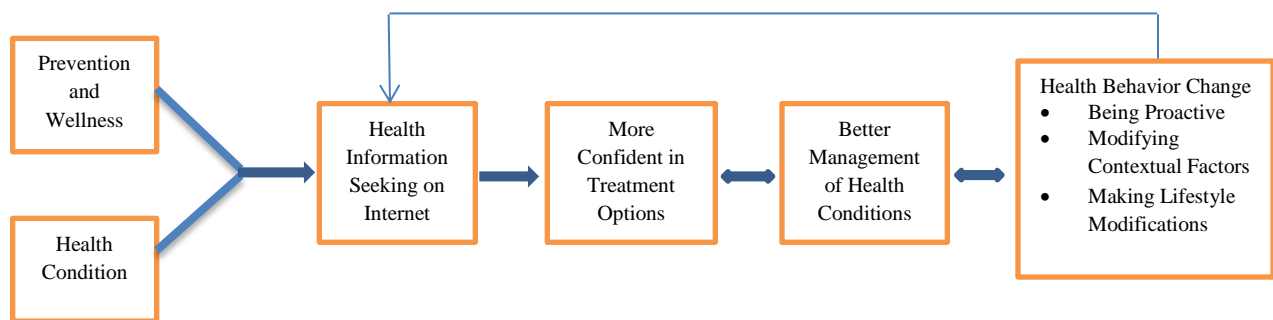

Figure 3

Self-directed Learning in Online Health Information Seeking Behavior

R.Q.6. What barriers do computer professionals experience when seeking online health information?

The factors that emerged as barriers to seeking health information on the Internet are-

1) Issues of trust

2) Volume of information and

3) Distractions

Table 4.7 illustrates the themes and the data collection method of the sixth research question.

Table 4.7

Barriers Experienced in Health Information Seeking on the Internet

Themes	Data Collection Methods
Issues of Trust	Semi-Structured Interviews,
Volume of Information	Field Notes,
Distractions	Memos

Issues of Trust

Throughout the interviews, the issue of trust emerged as a significant factor associated with online health information seeking behavior of the computer professionals. It was evident that they viewed the internet information with caution and trusted government or known medical websites. Although the participants trusted their healthcare professional's advice and opinions, they confirmed it through online information. However, despite these trust issues, participants still searched the internet for health information. The barriers they faced included finding legitimate sites, finding credible sources and quality of content.

Because of concern for quality and credibility official sites are considered trustworthy. "I usually am more prone to trust official sites, like official WebMD, but even then I am cautiously optimistic. I will refer to my doctor," said Alana. Barbara and Burt trust NIH and Mayo Clinic sites. "I feel the hardest part of it is figuring out whom to trust, that's why I look at the Mayo Clinic or the NIH or other medical professional institutions," remarked Burt.

Participants mentioned using blogs with caution or not using at all. "Some of the blogs that I found are not necessarily credible. I would rather go to more of an official credible site than some blogs where people are giving you their opinions," said Barbara.

Similar views were shared by other participants like Ned, Samantha, Raj and Tom. "The internet is a great resource with just being cautious of understanding that not everything out there is completely accurate," remarked Ned. As Burt puts it, "The biggest issue is determining what's trustworthy."

Finding legitimate site is thus cited a barrier for sourcing reliable health information. "We have to look at the source where it's coming from," said Samantha. "Mostly just finding the legitimate site is a challenge. I have clicked on a link, and then you will go to something where somebody will talk about conditions they have had and they have the most ridiculous answers," said Barbara.

Volume of Information

Although the participants relied on the internet for health information and referred to it as their first option, they reported at times being overwhelmed with the volume of the information. This in turn causes difficulty in finding specific and relevant answers. Participants informed that due to the vast amount of information, they have to change their search strategies and at times

found it inefficient. Most of the participants were looking for relevant, succinct information, and found the overload of information a detriment in keeping them engaged. Nancy said, "If I have to sit there and read a huge two page document or something, I am not going to. I need quick, to the point… the best ones because that's what gets you drawn."

Rahul describes his frustration by stating, "Sometimes, you try to get something, and then it shows 1000 pages, and you go first page, second page, third page and still you don't find it!"

Daisy felt that she was not using the right search words. "I don't always use the best search words, which becomes frustrating and I am not finding what I want because there's just so much information out there," she said.

Participants were looking for concise, credible information. "Mostly I want a paragraph, not like the page or two pages," remarked Rahul, while Nancy said bullet points helped her. "If there are bullet points of this, and this, and then there's information below it, that's great. But if it's where I have keep scrolling down and reading this huge article, and then trying to find what I need just out of that, I am just gonna abandon it."

Alana also suggested that having less knowledge about medical terminology may be a barrier. "Going online, I think you need to have a bit of medical knowledge yourself."

Distractions

Participants reported getting distracted by the advertisements that pop up while they are searching or reading relevant information. Commercial content emerged as one of the main irritant.

Describing the benefits of using YouTube, Nancy expressed that the advertisements that come up annoys her. "It's a little annoying because you got to sit there and wait for the ad and all that," she said. Raj too reported similar views. "Then these annoying malwares, adware issues..." he further said, "Mostly ads, there are a lot more ads. Yeah, obviously they want to gain something, but that gets annoying." Pop up advertisements were cited as an irritation. Daisy describes, "I am not interested in the products that I checked yesterday (Laughs)."

In summary, finding legitimate and credible trustworthy sites were considered as a barrier related to trust in searching for health information on the internet. The volume of information available on the internet, created barriers to find relevant and engaging information based on their immediate needs. Finally, the presence of commercial content was an irritation.

Summary of Findings

` The purpose of this study was to explore the preference of mediums of delivery of ergonomic education to prevent musculoskeletal disorders in information technology professionals and to understand their perspectives and experiences about online health information seeking behavior. Figure 4 represents a model for prevention of work-related musculoskeletal disorders. Fifteen computer professionals participated in this study. Some of the participants suffered from musculoskeletal disorders due to awkward postures while working on the computer for long duration. Many of the participants made adjustments to their work-station to align their work environment as per their body. They sourced this information from different sources like their colleagues and from the Internet. All the participants referred to multiple sources for health information along with the Internet. These included, their healthcare providers like doctors, chiropractors, physical therapists and massage therapists, and their friends and

family. Some of them referred to other media like television, and print media for health information.

The computer professionals were aware of the risk factors of musculoskeletal disorders due to their work, and were keen to learn the preventive strategies. Many of them preferred to be trained by a participatory approach for ergonomic education, while few of them preferred the online medium of delivery. Majority of the participants wanted a combination of these two delivery approaches. Follow-up after the intervention was identified as a critical aspect for the success of the intervention.

Participants perceived the online medium of ergonomic delivery to be very flexible and convenient and felt that it offered them empowerment. Online ergonomic education offered by their organization is perceived as more relevant and focused and trustworthy. However, not all the participants preferred online medium of delivery. The preference depends on individual attitudes and preferences and also on the attributes of the medium of delivery since each medium have its own advantages and deficits.

The information technology professionals in this study were self-motivated and self-directed in finding resources for filling their knowledge gap. Internet was their first source of reference, which they utilized for different types of information like wellness and prevention information to help them keep fit and maintain a healthy lifestyle. Participants also searched for information to help alleviate and prevent work-related musculoskeletal disorders on the Internet. Finding more about their symptoms and medical conditions helped to keep them more informed about their health conditions and treatment options and better interact with their healthcare providers.

The outcome of this self-directed learning about their healthcare on the Internet was that the computer professionals were able to be proactive in their fitness and by making modifications in their individual contextual factors like ergonomic adjustments in their work-station and being more aware of a good posture while working on the computer. They were able to make significant lifestyle modifications including their diet, nutrition and habits based on the information they gained on the Internet. The need for knowledge about their health conditions and related treatment prompted them to search the Internet for more knowledge that in turn made them more confident in their treatment options and better manage their healthcare.

Learners did experience some barriers while searching health information on the Internet. These challenges were due to the volume of information that was available on the Internet, issues of trust and credibility and distractions that they faced like advertisements. Although the participants faced these barriers, they were able to overcome them by being cautious in trusting the sources of information and double checking them with their healthcare providers. Table 4.8 summarizes the findings of the research questions.

Table 4.8

Findings of Research Questions

Objectives	Findings
Preferences of medium of ergonomic education of information technology professionals	- Participatory approach - Self-directed online delivery - Combination of delivery approaches - Preferred follow up
Perceptions of Self-directed online ergonomic education	- Feel empowered - Be relevant and trustworthy - Role of personal attributes
Sources of health information experienced by information technology professionals	- Internet and other media - Individuals - Workplace initiatives

| Type of health information sought from the Internet	- Wellness and prevention information - Information to self-educate about medical conditions - Information to decide their treatment options
Impact of health information seeking on the Internet on healthcare and behavior	- Being proactive in fitness - Modifying contextual factors - Making lifestyle modifications - Being more confident in their treatment decisions - Better management of health conditions
Barriers experienced in health information seeking on the Internet	- Issues of trust - Volume of information - Distractions
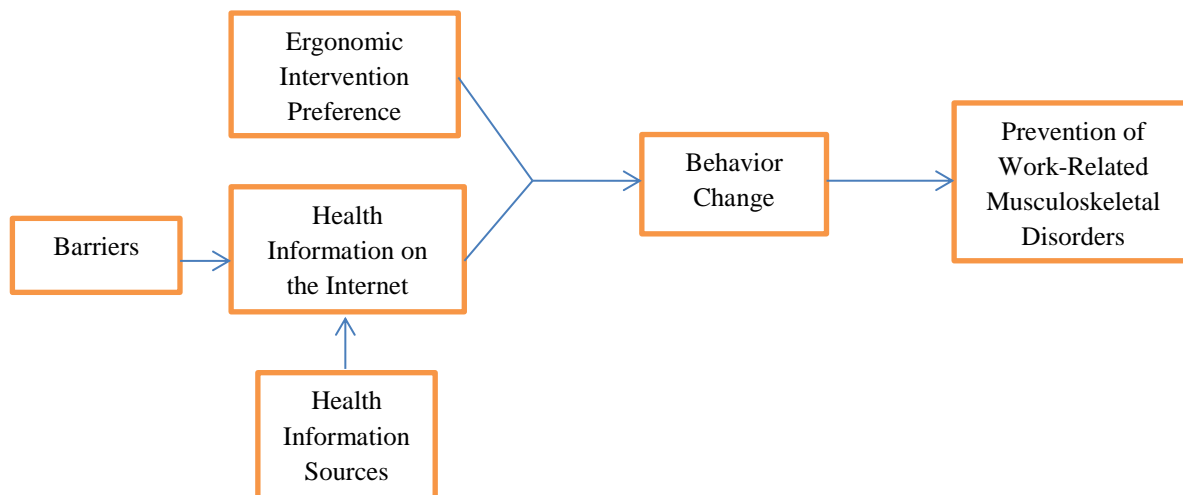
Figure 4

Framework for Ergonomic Intervention Preference and Health Information Seeking on the Internet to Prevent WMSD as Applied to IT Professionals

Chapter 5

Discussion, Conclusions, Implications and Recommendations

The purpose of this study was to explore the preferences of computer professionals regarding the medium of delivery of ergonomic education and their views about self-directed online ergonomic training and to understand their experiences and perceptions about online health information seeking behavior. The research questions guiding this study are:

1. What are the mediums of ergonomic education and information that are preferred by computer professionals to prevent and/or treat musculoskeletal disorders?

2. How do computer professionals view self-directed online ergonomic education?

3. What are the sources of health information that the computer professionals have experienced?

4. What health information do computer professionals seek from the Internet?

5. How has health information seeking on the Internet affected healthcare and behavior change?

6. What barriers do computer professionals experience when seeking online health information?

A qualitative case study design was used to explore these questions. The case study approach was selected as it is the perfect method when exploring a phenomenon when it is linked to the context in which it occurs (Yin, 2009). The context of this study focused on the work-

related musculoskeletal disorders in computer users that can occur because of their particular occupation. This chapter will discuss the conclusions based on the findings of the research questions in relation to the past literature and discuss the implications for policy, research and practice. This chapter will offer a model of self-directed learning in healthcare in the Internet era, explore the limitations of this study and propose several areas of future research suggested by the findings.

Findings from this study echoed some findings from prior literature. However, this study also uncovered important findings and trends that prior literature has not examined. Some of the findings expand and extend the research on online health information seeking behavior and work- related musculoskeletal disorders in computer users. By integrating the findings of these two areas, explored in this study, the results offer new insights into prevention of work-related musculoskeletal disorders and health promotion.

Discussion

Based on the results of the research questions, this study arrived at two findings: 1) the preferences for the mode of delivery of ergonomic education depends on the individual attitude and on the perceived attributes of the particular mode of delivery based on research questions one and two, and 2) information technology professionals in this study are self-directed in their healthcare and seek out various resources of health information for both wellness and illness management, and perceived their health information seeking on the Internet as positively affecting their healthcare, based on research questions three, four, five and six. Following sections present the discussion of the conclusions.

Finding One: Preference for the mode of delivery of ergonomic education depends on individual attitudes and on the perceived attributes of the particular mode of delivery.

This study uncovered that although the information technology professionals preferred some guidance from health professionals through a participatory approach in their self-care for prevention of WMSD, they also liked self-directed online mode of delivery or a combination of these approaches in addition to follow-up, because of the feeling of empowerment it offered and perceived it to be relevant and trustworthy. Their choices were largely based on their personal attitudes and the attributes of the delivery approach. These findings have been validated in themes in past literature in relationship to preventive strategies of work-related musculoskeletal disorders (Greene et al., 2005; Tappin, Vitalis, & Bentley, 2016; Wahlstrom, 2005).

The success of any prevention strategy including ergonomic intervention depends on the attitudes, preferences and willingness to change the behavior of the employees (Bohr, 2000: Haslam, 2002). The participants of this study were self-directed in finding resources based on their immediate need to either adjust their work-station and/or make lifestyle modifications. Their organization does not provide a formal ergonomic training or awareness education although there are some wellness programs available for permanent employees, and ergonomic work furniture was available to everyone who asked. The data provided by this study is the first step in identifying the preferences of the employees, since participant's preferences will dictate the adherence in any health promotion program (Hoot, 1992). For positive outcome and behavior change to be achieved, adherence over time is needed. Most of the participants in this study were willing to follow the ergonomic training program if provided by their organization and make the adequate behavior change, and considered their health and well-being as their personal responsibility. As noted by Hoot (1992), people who view health as a personal responsibility and

engage in a variety of health promoting behavior using a variety of sources are most often also self-directed learners.

Some of the participants preferred a participatory ergonomic intervention, while others preferred an online approach. Most of the participants valued a combination of delivery approaches. This preference for the mode of instruction corresponds to Brockett and Hiemstra's (1991) Personal Responsibility Orientation (PRO) model, where they recognize that self-directed learning comprises of both the instructional processes and the personality characteristics of the individual learner. The participants preferred different modes of learning based on their situational factors, personal attitudes and immediate context. For example, Alana preferred interaction and wanted a participatory approach for ergonomic training, since "they spend all their time working on the computer, in IT," while Susan preferred the online mode. Barbara preferred to have a combination of approaches and wanted the organization to make the training mandatory; as she was afraid she would procrastinate if it was not required. This preference based on individual attitudes, corresponds with Brockett and Hiemstra's (1991) PRO model, as they recognize the context and the importance of situational factors in the self-directed learning process. In their model, the instructional method focuses on the learner's responsibility for their learning, but may be facilitated by an educational agent or resource. The second dimension of their model centered on the individual's preference or personality aspects for learning. In this study, the various approaches to learning ergonomic awareness are the instructional methods.

Numerous studies have reported that participatory ergonomics, where the employees are actively involved along with the professional in identifying and solving problems, are suitable for achieving the best results in prevention of WMSD (Ketola et al., 2002; Greene et al., 2005; Tappin et al., 2016). Since participatory office ergonomic education intervention builds on the

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employee's unique knowledge and concerns, there is a greater chance of correctly designing

solutions (Bohr, 2000). Many of the participants in this study reflected similar views. Almost all

of them preferred to have an ergonomist or physical therapist to assess their work-station and

advise them on their individual issues. The views expressed by the participants could be summed

in Nancy's and Tom's concerns. Nancy was of short stature while Tom was very tall. Both of

them had felt that since their work-station was designed for adults of average height, it was

imperative that they be involved in the intervention for it to be most effective (Wahlstrom,

2005). Anthropometry or gender differences in body are often cited as a risk factor for MSD in

computer users (Kumar, 2008). Because of their height, employees may resort to awkward

postures that are an additional risk factor for MSD (Bao, 2015; Carr et al., 2016).

It is noted in the literature that web-based interventions have been successfully

implemented in many areas including health (Ellison, 2012; Splittoesser et al., 2007; Trujillo &

Zeng, 2006; White, 2015). The online training transmits to low cost and flexibility (Ellison,

2012), however it also depends on the participant's needs and acceptance (Eerd et al., 2015). The

participants in this study were very agreeable in utilizing the self-directed online ergonomic

training, primarily because of the convenience and flexibility it offered. Though most of them

gave their first preference as a participatory approach, their busy schedules and time constraints

favored the online approach. Similar views have been expressed by participants in previous

studies (Rucker, 2004). It was found that flexibility, filtering information at the participant's own

rate, ability to refer back any time and immediate application were the features that attracted the

participants in past studies (Randelin et al., 2011; Rucker, 2004; Splittoessor et al., 2007). The

participants in this study also aligned with these viewpoints, however some felt that after initial

guidance from the professional, they would be ready to set up their work-station by referring to online information. Dave mentioned that:

> A professional, somebody who is, who understands this better, to assess, you know, the environment, the work environment…That way, I know where I am sacrificing and what I can change. As long as I am taught originally, what I need to look out for and things like that. How do I do it? How can I make sure it stays the way it's supposed to be? Yeah, if I can have someone to help me set up the environment and then some videos that teach me on the general principles involved in that. I think it would be perfect. That would be all that would be necessary.

This was in contradiction to the findings by Splittoessor et al., (2007) where they found that computer users were confident in adjusting their work-station in a similar way as those made by an ergonomist, following an online intervention. Perhaps, this was because, some of the participants were not familiar with any formal instruction on ergonomics, and whatever knowledge they had was entirely based on the information they had sourced from their colleagues and the Internet.

The empowerment offered by the online resources is very well documented in the literature (Cowie et al., 2014; Mancini et al., 2009; Rolfes, 2013; Woolf et al., 2006). The participants in this study explained that having a self-directed learning module dealt with the barrier of time, and allowed them the privilege of selective learning based on their immediate need. They could diagnose their learning needs, identify human and material resources for learning, choose and implement strategies and evaluate the outcomes (Knowles, 1975). Houle (1984) had suggested that adults engage in learning because they have some immediate reasons

in their present stage of life. Evidence from this study, suggests that participants were interested in learning those parts of ergonomics that they needed at the particular time. For example, Ned suggested utilizing only those videos that were relevant to him.

The fact that the self-directed online modules would be provided by their organization, gave it more relevance and credibility as per the participants. Past literature has stressed the importance that individuals attribute to information from trustworthy sources, especially since they are exposed to a huge volume of knowledge on the internet (Fox & Duggan, 2013; Woolf et al., 2006). Tailored websites on health promotion were used by a family practice as an alternative to offering handouts (Woolf et al., 2006). The information in the interactive website was perceived to be more trustworthy and relevant by the patients, in that study and also empowered them with convenience of time and access to information whenever they needed it (Woolf et al., 2006). Similar views were documented in this study, where the participants perceived the online ergonomic training to be more localized and focused on them as information technology professionals and credible as it was offered by the state human resource management. One of the participants also expressed that the information should also be updated periodically for more relevance.

Personal attributes and attitudes have been known to impact the self-directed learning (Brockett & Hiemstra, 1991; Garrison, 1997). The model by Brockett and Hiemstra (1991) takes into consideration the personality characteristics of the individual, while Garrison (1997) integrates the dimensions of self-management, self-monitoring and motivation in the process of self-directed learning. Some of the participants in this study, identified themselves as preferring personal interaction with healthcare professionals, and depended on feedback, while others were content with online resources. Alana wanted the opportunity to interact with her healthcare

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professional, while Carson, Dave and Samantha needed feedback. Barbara and Nancy expressed that they were prone to procrastinate, thus would prefer enforcement of the training by the organization. Similar views had been expressed by the participants in the Woolf et al., (2006) study. In their study, although the group of participants who were delivered the interventions via the Internet reported improvement in their outcome, the participants wished for more interaction with the clinicians.

Rolfes (2014) had found that in delivering internet – based home exercise programs for the treatment of common musculoskeletal injuries and conditions, some of the patients did not access the home exercise program at all. Their study thus stressed that participants need to be accountable for taking the initial step in accessing the information available. Similar views were expressed by some of the participants in this study. One of the participants, Burt, had expressed that the online resource may not be accessed by some people at all.

It was also interesting to note that some of the participants in -spite of working in the IT field did not want to undergo online training. This was contradictory to many previous studies, where the notion that computer users are more at ease, and more digitally literate would perceive online delivery approach as more attractive (Blackstock et al., 2015; Chang & Im, 2014; Feinberg et al., 2016; Rucker, 2004) while in this study, many of the computer professionals preferred participatory approach over online approach.

Research has documented that ergonomic intervention utilizing a didactic approach and participatory approach leads to a better outcome in the effectiveness of the intervention (Erdnic, 2011; Kreuzfeld et al., 2016; Shikdar et al., 2008; Trinic-Canpara et al., 2014; Wahlstrom, 2005). Past literature revealed that interventions comprising of modifying work-station with employee

involvement, in combination with feedback from the employees and individual training focusing on working technique would have a better outcome. Management support and active involvement has also been pointed out as important factors when designing interventions (Shikdar et al., 2008; Trinic- Campara et al., 2014). The participants in the present study shared similar views and preferences regarding management involvement and mode of delivery. Many of them felt that rather than a single delivery approach, a combination of lecture, with practical involvement and assessment would provide them with individual solutions.

A major theme that came out of this study was the need for a follow-up post intervention. Many of the participants identified that a follow-up by the healthcare professionals or the organization would endure adherence and sustenance in the intervention program. This new insight has not been documented by any of the past literature and provides a solid reason for the successful implementation of any MSD prevention strategy. Management support throughout the program and even after the delivery was considered as adding value and credibility to the intervention program, thereby improving self-care since long-term commitment would lead to sustained effectiveness of the preventive measures.

Finding Two: Information technology professionals in this study are self-directed in their healthcare and seek out various resources of health information for both wellness and illness management, and perceived their health information seeking on the Internet as positively affecting their healthcare.

The findings of this study revealed that self-directed learning is the medium through which the participants identified and used information and resources to overcome perceived barriers and achieved benefits of the health information seeking process on the Internet for the

management of their healthcare. Much of the information seeking was informal, self-directed and self-managed (Papen, 2012). Knowles (1975) stated that self-directed learning was the ability to learn on one's own. This was clearly demonstrated by each of the participant in this study. All the participants used multiple sources of information to inform their healthcare choices and decisions, ranging from information from the Internet, other media, their workplace or discussion with other individuals. The predominant source of information was the Internet, where the participants sought wellness and prevention information as well as information related to specific medical conditions and treatment options. The participants felt empowered in their information seeking on the Internet and were able to be proactive and modify their lifestyle and contextual factors, and thus were more confident in their options for treatment and better manage their health. The participants were able to overcome the barriers of trust, volume of information and distractions by making good decisions based on their experience (Knowles, 1975). These findings support Candy's (1991) view that self-directed learning is motivated by the need to make a good decision, and also reflected their immediate need (Knowles, 1975).

The nature of the information seeking on the Internet of the participants reflected the characteristics of the self-directed learner as suggested in the literature. Apart from taking the initiative to learn, the learning was task or goal oriented (Houle, 1984; Knowles, 1975). The participants were involved in diagnosing their learning needs, formulating goals, identified resources including people and media, chose the appropriate strategy based on their context and evaluated their outcomes (Knowles, 1975). Just as Tough (1969) described the impetus to learn was to achieve a particular goal or skill, the participants of this study had a definite goal that they needed to fulfill- in their case, learning more about prevention strategies for musculoskeletal disorders, any specific health conditions or an aim to lead a better lifestyle. Valente (2005)

documented that change in the health status was the triggering event for a learning episode in older adults. However, in this study, the findings revealed that along with a specific health event, learning was also triggered by the motivation to prevent illness and to maintain a healthy lifestyle.

As seen in earlier research, the participants in this study consulted a variety of sources for their self-directed learning in health information including the Internet, other media like television, magazines and other people like their healthcare professionals, friends and family, and their colleagues and organization (Papen, 2012; Tough, 1979; Valente, 2005; Wright & Grakowsky, 2011). Although the participants used multiple sources for health information, for many the Internet was the primary source of information. It is interesting to note that all the participants valued the health information provided by the internet, even after interaction with their healthcare providers.

As previous research suggests, the participants most often searched the internet for health information using search engines with specific key words (Chang & Im, 2014; Fox & Duggan, 2013; Kim & Zhang, 2014). Also, participants judged the information to be more credible when they found it on multiple websites. Participants in this study shared similarities with previous studies in choosing websites they trust (Fox & Duggan, 2013). Generally official medical websites like WebMD was trusted more, along with government sites like NIH and CDC. One reason for the popularity of WebMD among health information seekers may be its ability to cater to a wider audience. Other websites like Mayo Clinic also emerged as popular sites. Among other popular sites were Wikipedia, YouTube videos and insurance company websites. Two of the participants referred to blogs for health information, although they were aware of the credibility of such information.

Similar to earlier research, the participant's source of health information was not limited to the Internet (Valente, 2005). Interpersonal communication for health information occurred not only with their healthcare providers but also with friends and family. This study confirmed that the self-directed learners utilized all available avenues to source health information. They not only discussed their healthcare options with their healthcare providers, but also discussed the information that they obtained from the internet with their healthcare providers. This helped in learning and controlling their healthcare. One of the participants, Barbara discussed the medical device that she needed for her migraine- she found about the device in a health magazine, researched it further on the Internet, and then convinced her doctor to prescribe it for her.

Consistent with past research, family and friends helped facilitate the participant's self-directed learning process (Papen, 2012; Valente, 2005). Most of the participants discussed with their family and friends who helped them in providing references from which they could begin assessing their own health. Few of the participants had friends who were in the healthcare profession that further helped them in sourcing credible health information. One of the participants Tom found much of information about carpal tunnel syndrome by talking to his friends and learning from their experiences.

Most of the information related to the participant's working environment was gleaned through their interaction in their workplace, including their colleagues and information sessions provided by their organization. Being a state organization, the permanent employees received periodic information regarding wellness sessions through the state department of human resource management. However, this information was not available to the contract employees. Information related to prevention of MSD was discussed among their colleagues, as many of them suffered from WMSD. For example, two of the participants, Barbara and Samantha often

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discussed possible solutions for their MSD. Barbara was also keen to help educate other colleagues about the hazards of their occupation. Knowles (1975) described these traits, identifying them as self-directed learning that is problem-centered in approach and requires internal motivation and utilizes individual experiences as resources. Spear (1988) had also suggested that the process involves three elements, knowledge, action and environment, which could be seen here as being utilized by the participants of this study. Spear (1988) referred to the past or new knowledge of the participants, action referred to their directed or exploratory action within their workplace-their environment. The participants were able to engage in a number of learning activities and make decisions based on their importance (Spear, 1988).

Contrary to previous research (Valente, 2005), only a few of the participants in this study referred to other media like television, radio, print advertisement, brochures and magazines for their health information. Most of the participants used multiple sources for their health information, with the most prominent being the internet. This may be because they are computer professionals who have constant access to the Internet. The information from each source however, was either complemented or supplemented or verified by other sources.

Type of health information sought on the Internet

This study discovered considerable variability in the type of information sought on the Internet. Both wellness and illness related information was searched. Most of the participants mentioned using the Internet for behavior modification in terms of lifestyle and maintain their fitness. As previous research had suggested (Blackstock et al., 2015; Feinberg et al., 2016; Fox & Duggan, 2013; Kim & Zhang, 2014), the study participants searched the Internet for health information on fitness regimes, diet, exercises, alternative treatments and specific diseases and

treatments. The participants reported searching for preventive care and healthy lifestyle choices including diet, nutrition, vitamin supplements and organic food in consistence with previous research (Rice, 2005; Weaver et al., 2010). Additionally some of the participants searched for ergonomic videos to help them set up their office work-station and posture correction exercises. Some of the participants also searched online to make a self-diagnosis, satisfy their curiosity and gain more knowledge about certain medical conditions, and monitor developments in their disease management. The search on the Internet was for themselves as well as for their family members.

Findings were similar to earlier studies that reported that online health information seekers search for health conditions and treatment (Fox & Jones, 2009; Fox & Duggan, 2013; Suziedelyte, 2012; Zhang et al., 2016). Participants in this study searched for health information based on their symptoms and medical conditions. Their search was also before and after consultation with their healthcare professional. This indicates that these participants were very much self-motivated and wanted more say and control of their personal health and wellness. When participants described the reasons why they searched the Internet for particular health information, it was revealed that all of them wanted to be well-informed about their medical condition; it's symptoms, and the available treatment options, so that they could be involved in the decision of the treatment along with their healthcare providers and agreed that searching the internet for health information had a positive effect on their overall healthcare.

Findings that relate to the outcome of health information seeking on the Internet are consistent with previous research (Fox & Jones, 2009; Rice, 2005; Suziedelyte, 2012; Weaver et al., 2010; Zhang et al., 2016). The resultant information has led to knowledge change, attitude change and behavior change and maintenance (Lambert & Loiselle, 2007) for the participants of

this study. Many of the participants have remained proactive in maintaining their fitness and exercise regimes. One of the participants had made a life changing behavior change. Ned credits the Internet to help to stop smoking.

Participants were also more confident in the available treatment options. Similar to previous research (Fox & Duggan, 2013), some of the participants in this study self-diagnosed their symptoms while some deliberated their options whether to consult their healthcare provider. All of the participants felt that they could better manage their health condition, with the help of the Internet, and considered the Internet to complement their formal healthcare (Suziedelyte, 2012).

This study specifically found that participants were able to make modifications in their contextual factors. Many of the participants suffered from WMSD, which propelled them to search for feasible modification of their work-station. Many participants made changes based on ergonomics to their desk, chair or computer monitors, based on the information that they obtained from various sources on the Internet. Participants used these modifying options both to treat as well as prevent MSD. Some of the participants also used YouTube videos to learn postural correction exercises. This was specifically mentioned by the participants who were aware that they went into awkward postures while working on the computer. Participants like Nancy and Tom who were not of average height, found modifications and solutions to alter or modify their work-stations on the Internet. One of the participants Samantha used the Internet as an exercise buddy. "I live alone, so I need it for motivation."

The data collected during this study suggested in creating a model of self-directed learning in healthcare based on the impact of technology on self-directed learning, (Figure 3).

The impact of technology has been emphasized by several researchers in the past (Candy, 2004; Karakas & Mamisaligel, 2011; Merriam et al., 2005; Valente, 2005). The model seen in Figure 3, is a summary of the process and outcome of self-directed learning described by Knowles (1975), Tough (1971, 19790, Brockett and Hiemstra (1991), Garrison (1997) and Valente (2005), but specific to self-directed learning in healthcare in the technological era.

The model in Figure 3 assumes that an individual has the knowledge, attitudes and belief that are antecedents to searching and could influence their search behavior, based on their prior life experiences, their interactions with their friends, family, healthcare providers, or colleagues in their workplace. This model assumes that the individuals are prompted to search for health information either because of their health condition or for the need for prevention or wellness. In each case, the self-directed learner decides that she has a need for information and seeks to fill that gap by engaging in self-directed learning activities. Because of the profound impact of technology in every aspect of the individual's life, the search usually starts with health information seeking on the Internet. In some cases, it may be that this search is initiated by interaction with other people in their lives or their individual context. In this cycle, the self-directed learner becomes more confident in their treatment options, and is consequently better able to manage their health by making modifications in the lifestyle or contextual factors or by being proactive.

In the literature on self-directed learning various models have been suggested. Some of them have been linear while others have been interactive to describe the process of self-directed learning. Knowles' (1975) assumptions about the self-directed learner provided a foundation for self-directed learning. Knowles' (1975) description of self-directed learning as a process in which the learner takes the initiative, with or without the help of others, diagnoses their learning

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needs, formulates goals, identifies human and material resources for learning, chooses and implements appropriate learning strategies, and evaluates the learning outcomes. The proposed model mirrors Knowles' (1975) model, since the self-directed learning on the internet could be triggered by a health condition or for a need for wellness. However, this model is cyclical, and goes back and forth, depending on the individual's evaluation of the outcome.

Similarly, Houle's (1961) view that adults may be motivated to learn to achieve a personal learning goal, forms the basis for this model. However, where Houle (1961) spoke about formal learning, the proposed model encompasses informal learning. Tough's (1967, 1979) discussion that self-directed learning stems from a highly deliberate effort to gain certain knowledge or skill also underlies this model. Although Tough's (1967, 1979) model, had many steps, and was linear in nature, this model is a summary of the process and outcome of self-directed learning in healthcare.

Brockett and Hiemstra's PRO (1991) interactive model provided a framework where factors like the personal characteristics of the individual learner and the opportunities found in the environment or the instructional processes were included. In the instructional processes, learners assumed the responsibility in choosing the learning methods, either facilitated by an external source or not facilitated, while the personal characteristics of the learner like her attitudes, preferences and abilities were considered. Brockett and Hiemstra's (1991) model was considered different to the other models as they recognized the context and importance of situational factor in the self-directed learning process. This model developed based on the finding of this study holds many similarities with Brockett and Hiemstra's (1991) model. The context of the individual is considered, as well as the preferences and attitudes of the individual are valued. The context may be different for each learner depending on their preferences and

attitudes. The trigger for self-directed learning may thus be either their health condition or their need for prevention and wellness, depending on individual factors.

Garrison (1997) has expanded on Brockett and Hiemstra's (1991) Personal Responsibility Orientation (PRO) model, and added broader psychological dimension. In Garrison's (1997) model "self-management" includes goal management, learning methods, support and outcomes or the external control. In this study, the learning methods were searching the internet for health information based on their own will and need and also in response to interaction with other people. Thus, self-management involved the learner taking control of their contextual conditions to reach their respective goals and objectives.

Self-monitoring according to Garrison's model is where the learner construes personal meaning, including both reflective and critical thinking. The proposed model is similar as here the individuals take appropriate decision in either modifying contextual factors or lifestyles and in choosing treatment options. The motivation aspect of Garrison's (1997) model reflects the motivation to pursue self-directed learning and to stay on the task. In this model, the motivation could be either be a need for wellness and prevention or a health condition.

Valente's (2005) cyclical model on self-directed learning begins with a health event, and goes into cyclical process where the learner acquires and assesses information, chooses treatment options, monitor and reflects on the treatment results and manages adjustments in lifestyle and treatment. This model was based on self-directed learning of older adults. The process of self-directed learning is triggered by a health event and health care professional. The proposed model is similar to Valente's (2005) model as both are summaries of the process of self-directed learning. Both of these models feature the learner's actions when faced with a health condition.

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However, this model has the trigger of need for prevention and wellness along with a health condition as the motivation for self-directed learning. Valente's (2005) model begins only after consultation with healthcare provider, while this model begins with the need for information that is perused on the Internet. This can occur before, while or after consultation with healthcare providers or other people. The elements of Valente's model (2005) go in a unidirectional flow, while the elements in the proposed model go back and forth, depending on individual context. The proposed model incorporates the prime role of the Internet in the self-directed learning process of an individual.

The proposed model in Figure 3, contributes to the literature on adult education and self-directed learning in healthcare as it incorporates and validates the role of technology on human life. This new model is based on the learning experiences of information technology professionals related to their health information seeking behavior on the internet. This research identified the internet as playing a significant role in self-directed learning. Recent literature has provided evidence on the use of the internet for health and wellness (Ellinger, 2004; King, 2014; Merriam et al., 2007; Papen, 2012; Wright & Grabousky, 2011). This model provides new insight into the self-directed learning as it related to healthcare from the perspective of the information technology professionals, as it looks into the unique dimension of the internet. The model provides the components of the process along with outcomes as summary.

The components within this model, involves a set of activities that are also the outcomes of the process. The self-directed learning on the internet is triggered by a health condition or prevention or wellness need. Based on the health information seeking on the internet, the learner could make decisions related to their immediate need by being proactive, modifying contextual factors, making lifestyle modifications, and being more confident in choosing treatment options

and better managing their healthcare. The learner may go back and forth between the activities, based on their individual need or input from other external sources in their environment, and start their learning on the internet again.

Barriers to seeking health information on Internet

Findings from this study echoed those themes that have been predominant in literature on online health information seeking. (Fox & Jones, 2009; Fox & Duggan, 2013). The themes of trust, volume of information and commercial content were identified as the main barriers. All of the participants were cautious in their use of internet for health information, and used reputed websites as credible sources. A common evaluation technique identified was to judge the credibility of the source. Thus, medical organizations and government websites like NIH, CDH, and Mayo Clinic were viewed by many participants as trustworthy. Blogs were viewed with less trust. These findings suggest that participants were conscious of the sources of online information from websites belonging to reputable institutions as well as those recommended by their healthcare provider or friends.

Though the participants were drawn to the internet because of its easy availability and convenience, they were aware of the various sources of health information, and their authenticity. The participants chose WebMD because of its high credibility. It was found that the participants shared the knowledge that they found on the internet in their personal circles, including colleagues and also with their healthcare providers. Commercial content was discarded immediately, and participants reported their vigilance about the source of information. Researchers recommend that collaborative activities need to be embedded in online learning and design of the online course was also a significant factor for engagement with online resources

(Chakraborty & Muyia Nafukho, 2014; Ivankova, 2014; Salazar, 2010). The participants in this shared similar views, and related engagement with content and design of the online information. With the increasing availability of health information online, it is important to be able to access trustworthy and reliable information.

Limitations of the Study

The purpose of this study is to explore the preferences of the computer professionals regarding the medium of delivery of ergonomic education to prevent work-related musculoskeletal disorders and understand their perspectives and experiences about online health information seeking. The nature of the context and its participants were studied using a case study design, thus would limit the generalizability of the findings. The setting was selected through convenience sampling while the participants were purposefully selected. The participant's willingness may represent specific attitudes and beliefs that may have influenced the study findings. The sample of fifteen participants may not represent the entire population of information technology professionals. The study is also limited by the assumptions and experiences of the researcher as the motivation for this research has been the personal and professional experiences of the researcher.

Perspectives gained from this study will add to the existing body of knowledge of self-directed learning in healthcare and health education. Findings also provide new insight into health promotion to prevent work-related musculoskeletal disorders in computer users. The findings have implications for the development for online training modules by organizations to reduce the impact of work-related musculoskeletal disorders in their employees, as the healthcare cost is usually borne by the employers.

Implications to Practice

The results of this study provide practical implications for organizations and their human resource managers, public health professionals and adult educators as they all are engaged in providing learning opportunities to the information technology professionals. While more research is needed to confirm these results, it is evident that these findings have important implications in terms of impacting behavior modifications.

1) **Implications for Employer**

Results of this study have significant implications for the employer. Past research suggests that organizations have recognized the risk factors and associated healthcare costs of work-related musculoskeletal disorders in their employees (NIOSH, 1997). This study provides information for employers regarding employee preference when selecting training media to use for office ergonomics. In this study, the goal was to listen to the employees, since interacting with the target community and population will help in identifying their needs and understand how they would relate to the mode of delivery (Skinner, 2006). Practitioners should investigate the participant preference prior to delivery, as limited evidence is available for ergonomics for computer users, although there abounds much research on the various types of ergonomic interventions. This study suggests that employee demographics, working conditions, work-station design, training delivery method and content and follow-up after training are the key factors for the success of any intervention to reduce the morbidity associated with WMSD.

Each training delivery has its own strength and weaknesses. The success of the delivery method not only depends on its content and desired training objectives, but also on the employee's preferences, attitudes and learning styles along with their prior knowledge and skills.

The findings from this study suggest that ergonomic awareness training can be delivered via the organization intranet after an initial introduction by the ergonomist. Online modules allow for training flexibility, at the location of their work and provide the employees opportunity for selective training. The employees can go back to the videos as many times as they want, and it can be self-paced. The findings of this study also suggest that health officials and the employer need to update the information on their intranet, and respond to any queries and provide feedback. Results also suggest that a periodic follow-up is imperative for the effectiveness of the intervention, and also for the employees to remain engaged in the program. This would ensure adherence, and sustain the behavior change. These are critical factors for the success of the ergonomic training program.

With the advancement in technology, interactive tools can be used to create short videos modules that are localized and provide to the point information. Findings from this study points to a need for reliable and credible information that the employees can trust. Employees are looking for short succinct information based on their immediate need. When the employer provides that information, it saves time and reduces frustration of the employees, when they search for these on the internet. Many of the participants have hoped for a reliable source of information on ergonomics through their office intranet. One of the participants Tom hoped:

> Probably be nice if there was someplace I could go to get a list of reliable sources... that can be trusted. So if a trusted source said for additional information, check these sites, that'd be very helpful. Something online that would give us options. So it's like if I can't get an ergonomic keyboard, what can I do? If I have what I think might be carpal tunnel, what are things I can do to alleviate the stress and pain and make it not worse. That type of thing would be handy.

Findings of this study also point out the importance of making ergonomic training mandatory for computer professionals. Many of the participants tend to procrastinate or not follow the simple preventive techniques until they are faced with musculoskeletal disorders. As suggested by the manager Barbara, if the training were in short modules, and were required by the human resource department, this would force all the employees, especially those who are entering the field to be aware of the potential occupational hazard associated with long duration of working in front of the computer. If self-directed online modules are available on the intranet of the organization, employees should be encouraged to refer for their resources based on individual need. Periodic assessment of the training mode along with feedback from the employees will ensure the efficacy of these programs.

Management involvement will ensure successful prevention approach, since success of any ergonomic project depends on the willingness on the part of the employee, manager and the team to adopt and change their behavior. Thus based on the results of this study, it is recommended that employers and the human resource department consider the range of ergonomic delivery approaches to prevent WMSD and consider the employee preference for the mode of delivery. Management support and involvement will contribute to a feeling of trust and cooperation. Following the intervention, human resource professionals should follow-up and identify any obstacles from the employees' side and attempt to provide solutions. The results of this study may help in building better communication through the organization's intranet, and in serving the employee's health as priority. When the organization adopts a proactive response to deal with WMSD in computer professionals, it gives an emphasis on prevention strategies. This would lead to education and awareness, and changes in attitudes and behavior. Participants of this study were provided with ergonomic chairs or stand-up desks. Such practices need not

represent large expenditure but would definitely improve the working condition of the employee. Also, in alliance with insurance providers, organizations can initiate ergonomic awareness programs, that would be beneficial to all the stakeholders, the employee, the insurance provider and the employer. When the employee participates in a worksite wellness program like ergonomic awareness, they experience positive outcomes like reduced healthcare cost, less absenteeism and improving the health and productivity. Thus, providing ergonomic awareness program based on the preference of the employees will be cost effective to promote a healthy lifestyle in their employees. The significance of this study extends not only to computer professionals in the information technology field, but to all the people who use computers in their work for a significant amount of time. Awareness of musculoskeletal disorders and preventive strategies can yield a healthier population.

2) Implications for Public Health Professionals

The findings of this study that participants seek health information online to take actions and to collaborate with their healthcare professionals and actively contribute to their medical health decisions, underscores a valuable opportunity for healthcare providers and public health officials to become more proactive by providing their patients with quality health information outside their office through the internet by referring them to credible website sources. Results of this study cited concerns in finding trustworthy websites, and difficulty in finding relevant information from the vast amount of the information on the Internet. Participants were using the knowledge from the internet with caution. By referring them to credible sources healthcare providers can ensure that people have access to reliable information.

Public health officials can provide people with factual information in their reputed websites, so that people will trust the source without hesitation. Based on the findings of this study, participants have changed their negative habits like ceasing smoking and incorporated healthy lifestyle changes of diet, nutrition and exercises. Using the internet to promote positive attitude may predict a specific positive behavior in certain cases.

Tailored health messages can be delivered via the internet. Past research (Bennett & Glasgow, 2009) suggests that providing individual messages can out preform traditional and linear health information strategies. From the findings of this study, we can assume that tailored health messages can be provided based on individual characteristics like age, gender, self-efficacy, preferences and attitudes. Since many of the participants referred to the internet for reliable sources for making lifestyle modifications, and were using their own discretion and caution in trusting websites, when such information is provided by public officials tailored for specific characteristics, people will perceive it as credible and act on them. Thus, keeping in mind the characteristics of the self-directed learner indicated in this study, their preferences and attitudes, health professionals could use a framework of health promotion that considers the participant's self-directed learning to promote wellness.

Based on the findings of this study, public health officials need to keep the content engaging and short, so that the learners are kept engaged. Online resources allow for a wider reach at a relatively low cost and aide in transfer of information and health education. Public health professionals could benefit from a better understanding of the needs of the computer professionals, the barriers they face while seeking health information online, the strategies they use to overcome them, as well as preferences of the participants regarding ergonomic awareness. The study results present important implications for the future development of more effective

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prevention programs that will empower computer users to maintain their health and be proactive in preventing MSD. The negative health aspects of WMSD represent a costly expense to the employee, organization and broader society. By promoting an awareness of the potential problems and reviewing the prevention strategies, the healthcare costs can be reduced. The results are also useful for informing the development of assessment instrument to evaluate the outcome of ergonomic interventions in the workplace for computer users.

3) Implications for Adult Educators/Health Educators

Results from this study point to critical health promotion educational considerations that adult educators or health educators need to consider when developing and delivering educational training programs in the workplace. Based on their health information seeking behavior on the internet, and the perceived barriers that the participants faced, if educators provide credible information in short, succinct videos, it would keep the employees more engaged in the training program. Also, given the complexity and the range of ergonomic delivery approaches in the workplace, educators need to assess the preferences of the individual employee. This study highlighted that each employee was able to identify the barriers and facilitators related to application of ergonomic strategies. Thus, it would be valuable in the education process to use a participatory approach and involve the employees in the process.

Adult educators/health educators should direct internet users for health information to reliable sources that are authenticated by health professionals. Self-health management should be promoted as a lifelong endeavor. This study indicates that the self-directed learners are motivated users of health information online, and this provides the perfect opportunity to promote the importance of healthy lifestyle choices. Some of the participants of this study considered

themselves ineffective searchers, and felt that they needed more medical knowledge to garner

benefit from the tremendous amount of information on the internet. It is important for adult

educators to help the learners evaluate online information and help them in identifying quality

sources. Thus, these recommendations illustrate that the field of adult education and health

education are interconnected, with the adult educators playing a role in developing collaborative

relationships with health professionals (Wright & Grabousky, 2011).

Recommendations for Future Research

The results of this study contribute to the field of adult education and ergonomics to

prevent work-related musculoskeletal disorders in the workplace. The findings of this qualitative

case study support the need for future research into establishing strategies to prevent MSD in

computer users, and the health information seeking behavior on the internet. Further studies will

allow health educators and public health officials to better deliver information that has better

adherence and sustenance. Based on the findings of this study, the following recommendations

are suggested for future research.

The findings demonstrate that the participants preferred a participatory delivery approach

followed by online videos for ergonomic education. Larger studies, such as randomized

controlled trials would be necessary to support these results. The results of this study also

provide a baseline for future survey research design on the facilitators, barriers and treatment

strategies in online delivery of intervention. Results may vary based on the demographics of the

sample. The results of this study cannot be generalized across populations or with employees

with or without musculoskeletal disorders. Future research could follow Skinner's second and

third stage of the STAR model (2006), which is the "Plan" and "Do" stage respectively. Plan an

intervention based on the identified community need and follow by doing it. Based on the preference for online delivery approach in this study, interventional studies using interactive online tools like videos, wikis and blogs for ergonomic awareness and strategies can be studied with a larger sample size. Participant and ergonomist/healthcare provider interactions through virtual collaboration can be assessed through a qualitative design.

As the findings of this study suggests, providing an online module as an instructional tool for preventing or treating MSD, in addition to individual interaction may prove to assist the employee's understanding of the condition. Providing access to training and education online, that the employee is able to access again any time, may result in more successful outcomes and increased accountability. Future studies should also include evaluating the outcomes of such a program, as a longitudinal study using both quantitative and qualitative inquiry. A more heterogeneous group of larger sample of employee participants with varying levels of work experience, awareness and incidence of musculoskeletal disorders may yield different results.

Future research should also focus on developing additional evaluation tools. Employee self-efficacy should be evaluated in future studies. Self-efficacy measures may be added to both the quantitative as well as qualitative questions. A survey study could be undertaken to determine the extent and the nature of ergonomic problems that affect the employees.

Since the present study was conducted in a state organization, with some employees being on a permanent basis awhile some on contract basis, comparative studies in private organizations may reveal different challenges as workplace ergonomics may be affected by the organizational considerations. This may also reveal innovative solutions to prevent WMSD in the workplace. Future studies involving more managers are suggested. Based on the suggestions

put forth by the managers in this study, using a community based participatory approach will be useful in initiating a plan to identify potential challenges and develop solutions that impact organizational policy is recommended.

Based on the results of this study, survey study is recommended to analyze the positive effects of searching online health information with a larger sample and varying demographics. Studies to determine the type and extent of tailored health message to the population is also recommended. The perceptions and experiences of healthcare professionals like doctors, physical therapists and chiropractors, who are one of the sources of health information for the participants of this study, should also be explored to gather additional information about the impact of health information seeking behavior online.

Additional research using the characteristics of the self-directed learner in healthcare may include exploring the similarities and differences of participant experiences of self-directed learning in online health information seeking are recommended. Conducting larger studies to determine patterns across various demographics, personality or learning styles is also suggested. Replication of this study in other geographic areas with different participant characteristics would contribute additional information on self-directed learning in information technology professionals.

Summary and Conclusion

This study explored the preferences of fifteen information technology professionals regarding the medium of delivery of ergonomic education and their perceptions and experiences of seeking online health information using the lens of self-directed learning. This study led to two findings, that the preferences for the mode of delivery of ergonomic education depended on

the individual attitude and on the perceived attributes of the particular mode of delivery, and information technology professionals are self-directed in their healthcare and seek out various resources of health information for both wellness and illness management, and perceived their health information seeking on the Internet as positively affecting their healthcare.

The information technology professionals obtained health information from multiple sources including the Internet, other people, their workplace and other media and complemented or supplemented the information obtained from one source with other sources, since they were aware about the credibility of information from the internet, they used it with caution. Individuals utilizing self-directed learning to gather healthcare information, from any source, and using it to make informed decisions have the potential to be more in control of their healthcare. The computer professionals were self-directed in seeking preventive strategies to help alleviate their musculoskeletal disorders. This study offered new insights into the preferences and needs of the computer professionals for maintaining a healthy workforce. The use of technology and easy availability of health information on the internet has made the self-directed learners more informed, and better capable of interacting with the healthcare system, make modifications to their lifestyle or contextual factors, be proactive and manage their own health with the impetus to learn being their health condition or a need for prevention and wellness. These findings have led to preliminary recommendations for organizations, public health officials and the adult educators, when offering ergonomic awareness training for computer professionals, with a goal of reducing work-related musculoskeletal disorders and to create a healthier, productive and more engaged employee.

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Appendix A

Interview Information

RESEARCH SUBJECT INFORMATION AND CONSENT FORM

STUDY'S TITLE: Internet-based behavior of IT professionals: Implications for online ergonomic education to prevent work-related musculoskeletal disorders

This consent form may contain words that you do not understand. Please ask researcher Priya P. to explain any words that you do not clearly understand.

PURPOSE OF THE STUDY

The purpose of this study is to explore the preference of self-directed online training modules in computer professionals and understand their perspectives and experiences about online health information seeking behavior to prevent musculoskeletal disorders

DESCRIPTION OF THE STUDY AND YOUR INVOLVEMENT

This study will assess your health information seeking behavior on the Internet and your preference for the method of delivery of ergonomic intervention for preventing musculoskeletal discomfort like neck pain and wrist pain when you work on the computer through face-to-face interviews. The interviews will be audio recorded. After the interviews the researcher may contact you for verifying the data.

RISKS AND DISCOMFORTS

It is unlikely that you will experience any risks or discomforts from your participation in this study. However if you are uncomfortable answering any of the questions or prefer not to be part of the survey, you may skip at any time should you choose to do so.

BENEFITS TO YOU AND OTHERS

There is no direct benefit to the participants.

COSTS

There are no costs for participating in this study other than the time you will spend answering the survey questions.

CONFIDENTIALITY

Data is being collected only for research purposes. Access to all data will be limited to the researcher and dissertation committee. No personal data will be asked. The audio data will not be identifiable. Pseudonyms will be used in the transcriptions.

VOLUNTARY PARTICIPATION AND WITHDRAWAL

You do not have to participate in this study. If you choose to participate, you may stop at any time without any penalty. You may also choose not to answer particular questions that are asked in the study.

Your participation in this study is strictly voluntary. Your individual responses will be shared with the committee of the dissertation.

QUESTIONS

If you have any questions, complaints, or concerns about the research, now or in the future contact:

Priyadarshini Pattath

pattathpk@vcu.edu

I have been given the chance to read this information sheet. I understand the information about this study. Questions that I wanted to ask about the study have been answered and I agree to be in this study.

Appendix B

Recruitment Survey

This survey is intended for collecting data for dissertation research. The purpose of this study is to assess the preference of computer professionals about online ergonomic education and training and prevention strategies to prevent work-related musculoskeletal symptoms like neck pain, shoulder, and upper and lower back, arms, hand, wrist of lower limbs, and also to assess the health information seeking behavior on the Internet.

Participation in this study is strictly voluntary. You may choose not to join the study or may leave the study any time. If you meet the study requirements, you may be contacted again to schedule to face-to-face interviews. Any personal information that is used will be coded to protect your privacy and confidentiality. Any identifying information will be destroyed at the end of the study.

The following questions are required before participation in the research study. Your answers will assist the researcher in determining if this is a suitable study for you.

1.   What is your age? (Please Check)

   a) Under 25 years_____
   b) Between 26- 35 years_____
   c) Between 36- 45 years_____
   d) Between 46-55 years_____
   e) Above 55 years_____

2. Gender _____Male_____ Female

3. How long have you been working as a computer professional? _____Years

4. How many hours do you work on the computer in a week?
   a) Under 30 hours_____
   b) Between 30- 40 hours_____
   c) More than 40 hours_____

5. Are you currently receiving treatment for any muscle or joint problem?
   _____Yes_____ No

6. During the last work week, when using the computer or after using it did you experience any ache, pain, numbness or discomfort in any body part (neck, shoulder, back, wrist)?
   a) Yes_____
   b) No_____

7. Have you looked for information online about certain health or medical issues, either for yourself or someone else? In the last 12 months, have you looked online for information about...

   a) A specific disease or medical problem
   b) A certain medical treatment or procedure
   c) How to lose weight or how to control your weight
   d) How to reduce your health care costs
   e) A drug you saw advertised
   f) Exercise and stretching for computer users
      a. Yes,_____
      b. No, _____

8. In the last 12 months, have you personally?
   a) Faced a serious medical emergency or crisis
   b) Had a fall, slip or accident

      a. Yes_____
      b. No_____

Email: _____

Thank you

Appendix C

Interview Protocol

1. Briefly describe a typical day of work?
   Prompt: Do you sit continuously or work on the computer without a break?
2. Do you experience any pain or discomfort when you sit and work? What do you do then?
   Prompt: Stretch, take a break, exercise, or continue working
3. Do you know of any exercises of stretches that you can do, and about the right way to sit, height of the desk?
   a) From where do you get the information? Office or any other source?
4. What is it like to work here? How busy are you?
   Prompt: work culture, work environment?
5. Suppose your office was to provide training and education awareness to prevent neck pain, shoulder and back pain that invariably can occur while working, which would be your preferred way to learn the techniques and exercises? And why?
   Prompt: - Classroom training with PowerPoint
   - Handouts
   - Ergonomist or physical therapist personally teaches
   - Online videos and websites
6. What is your view about online training using videos and websites for ergonomic education?
   a. Will you access the information if provided?
   b. Will you make any health improvements or changes based on the information?
   c. If yes, what do you feel is the advantage of such online information?
   d. What in your view are the disadvantages?
7. How often do you use the internet to find health information?
8. What motivates you to search for health information online and what wouldn't you search online?
   Prompts: - Symptoms like pain
   - A diagnosis
   - Doctor's visit
   - Any new medications
   - Conversation with colleagues/friends/family
9. What sources of information on the internet do you use for exercise or ergonomic education?
   a. Do you use search engines like Google, Bing, etc.?
   b. Do you use a health website?
   c. When would you use a health website and when would you use a search engine?

10. Have you used videos sites like YouTube or read or comment on Blogs?
    a. Can you describe your experience?
    b. Was the information helpful?
    c. Did it help answering your problems and did you act on it?
11. Besides the Internet, where do you get health information?
    Prompts: - Mass media like television, radio, newspapers, and magazines like Prevention
        - Interpersonal like friends, family or healthcare professionals
12. When do you search the internet versus going to other sources of information?
13. Tell me about a time, something you learned from the internet that had a positive impact on your healthcare?
14. Describe your perceptions about the impact of searching online health information on your general healthcare? Has it been advantageous or have there been problems?
15. When you use a search engine, how do you decide what part of the search results are relevant?
    a. Are there any sites you automatically trust? Why?
    b. Are there any sites you automatically reject? Why?
16. If you find information online that does not support what you know about the disease/illness, what do you do?
17. What kind of barriers or challenges do you experience when searching online health information?
18. Have you ever abandoned a search before you found your results? Could you describe what you were looking for and what frustrated the search?
19. Has online searching for health information in relation to exercise and ergonomics or otherwise affected your healthcare routine?
    Prompt: - Affected a decision about how to treat a condition
        - Changed your overall approach to maintain your health
        - Led you to ask a doctor new questions, or to get a second opinion
20. What else would you like to share about your health related learning on internet?

Thank you for taking the time to participate in this interview. I may contact you to check if the transcriptions and interpretations from this interview are consistent with what you intended to communicate. Please do not hesitate to contact if you have any questions or concerns regarding this interview.

Appendix D

List of Codes

Code Family "Context"

Codes	Brief Description
CWS	Workstation design
CWA	Adjustment made to workstation
CMSD	Presence of musculoskeletal discomfort
C_IWSMSD	Influence of work-station on MSD
C_PC	Physical characteristics
C_IPCMSD	Influence of physical characteristics on MSD
C_TMSD	Treatment for MSD
C_TE	Type of employee
C_WC	Work culture
C_TD	Typical day in organization
C_EP	Employee perspectives about work culture
C_HISBI	Health information seeking behavior on the internet
C_HISBM	Motivation for seeking health information
C_IO	Health information form organization
C_P	Attitude regarding prevention strategies

Code Family "Sources"

S	Sources of health information that the computer professionals have experienced
SI	Internet as a source of health information
SIGHW_CDC	Source of health information from Government health website, CDC
SIGHW_NIH	Source of health information from Government health website, NIH
SIHW_MC	Source of health information as Hospital website, Mayo Clinic
SIIC	Sources of health information from Insurance provider
SIJA	Sources of health information from Internet, Journal articles
SIOW_B	Source of health information on Internet, Other websites, Blogs

| SIRW | Source of health information from Internet as Reference website |
| SISE_G | Source of health information as Search Engine, Google |

Code Family "Sources"

Codes	Brief Description
SISE_B	Source of health information, search engine, Bing
SIU	Source of health information on Internet, Medical University website
SIWP	Source of health information on the Internet, Wikipedia
SIYT	Source of health information as YouTube
S_F	Source of health information as Friends
SC	Source of health information as Colleagues
SF	Source of health information as Family
SF_W	Source of health information as Family, wife
SH_C	Sources of health information from healthcare provider, chiropractor
SH_D	Sources of health information from healthcare provider like doctor
SH_MT	Source of health information, Healthcare Provider, Massage Therapist
SH_PT	Source of health information from healthcare provider Physical Therapist
SM	Source of health information as Health magazines
SMD	Sources of health information from media
SO	Health information from the organization

Code Family "Preferences"

PDA	Preference for a didactic mode of ergonomic education delivery
PDPO	Preference for a combination of didactic, participatory and online follow-up
PPA	Preference for a participatory approach for ergonomic education delivery
PPA_R	Reason for preference for participatory approach
PDA_R	Reason for the preference of didactic class
PPAO	Preference for a combination of participatory and online delivery approach
PPAO_R	Reason for preferring combination of participatory and online delivery
PSDO	Preference for an self-directed online delivery

| PSDO_R | Reason for the preference of online mode of delivery |
| FUP | Need for follow-up after delivery |

Code Family "Type of Health Information"

Codes	Brief Description
HL_D	Search for diet to improve health
HL_F	Search for right way to do exercises for fitness
HL_HR	Search for Home remedies
HL_N	Search for natural products and living
HL_O	Healthy lifestyle, organic food
HL_P	Healthy lifestyle and prevention of diseases
HL_S	Healthy lifestyle, supplements
HL_W	Healthy lifestyle for weight loss
IHP	To find information about doctor, find correct healthcare professional
LFM_D	Lifestyle modification for diet
M_AGD	After going to doctor
M	Medical
M_BGD	Before going to doctor
M_BR	Medical condition, follow-up on information, from doctor's office
MEDCON	Search about a medical condition
MEDCON_S	Search about symptoms of medical conditions
TR	Search for treatment for specific condition
TR_IM	Search for information about medicine, side-effects
TR_MD	Search for information about medical devices used for treatment of specific condition

Code Family "Effect of online health information"

Codes	Brief Description
CON	To decide whether to consult doctor
CT	Being more confident in their treatment
MCF	Modifying contextual factors-ergonomic adjustment of work space
MHC	Manage health conditions
MHC_D	For discussion with health professional
MHC_K	For More knowledge
HL	Healthy lifestyle
LFM	Lifestyle modification

Codes	Brief Description
HP_E	Health promotion, exercises
HP_PR	Health promotion, being proactive to prevent MSD

Code Family "View about online resources"

Codes	Brief Description
V_A	Views about SD ergonomic education, Adherence
V_C	Views about self-directed online courses, convenient
V_E	Views of SD ergonomic education, Negative attributes, No engagement
V_EGB	Views- SD ergonomic education, can go back to it anytime
V_ER	Views of SD ergonomic ed. At own rate
V_FU	View about self-directed ergonomic education, Website for Follow-up
V_HR	View about self-directed online ergonomic education, should come from HR of organization
V_IA	Views about SD ergonomic education, Immediate access or availability
V_NI	View about self-directed ergonomic education, No personal interaction
V_PMIP	View about self-directed ergonomic education, procrastination
V_PMIPA	Views of SD ergonomic education , Negative attributes, Personal attitude
V_PMIT	View about self-directed ergonomic education, personal issues, lack of time
V_R	View about self-directed online ergonomic education, Relevant and helpful by the organization
V_RI	Views - requires initiative
V_RRC	View about self-directed online ergonomic education, make it relevant and required course for IT
V_S	View of SD ergonomic education, short videos
V_SL	Views about self-directed ergonomic education, selective learning
V_T	View about online self-directed ergonomic education, trusted information
V_TR	View about self-directed ergonomic education, tailored website
V_UP	Views about SD ergonomic education, has to be updated

Code Family "Barriers"

Codes	Brief Description
B_A	Barrier, Advertisement
B_CLS	Barrier, finding legitimate sites
B_CT	Barrier of trust
B_ISE	Barrier. Inefficient search strategies
B_MK	Barrier, need for medical knowledge
B_R	Barrier, relevance
B_RES	Barriers, difficulty in finding specific answer
B_V	Barrier, Volume of information

VITA

[redacted]