UNIVERSITY OF MANITOBA

FACULTY OF GRADUATE STUDIES

THESIS

COMPARISON OF THE EFFECTIVENESS OF PARTICIPATORY AND DIDACTIC OFFICE ERGONOMICS EDUCATION PROGRAMS

Submitted by

LESLIE ANN STRATTON JOHNSON

Submitted to the Faculty of Graduate Studies at the University of Manitoba

In partial fulfillment of the requirements of the degree of

MASTER OF SCIENCE

THE UNIVERSITY OF MANITOBA

FACULTY OF GRADUATE STUDIES

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ABSTRACT

Work-related musculoskeletal disorders of computer users represent a growing, costly burden on employees, the workplace, the health care system, and society. Office ergonomic educational strategies, using a variety of approaches, have been developed and implemented to address this concern. The effectiveness of ergonomic educational approaches has not been well documented, nor have employees' perceptions of barriers or facilitators to making changes been explored.

This study evaluated and compared the effectiveness of two office ergonomics educational methods (didactic and participatory) when delivering office ergonomics education. A mixed method design was used, utilizing a sequential exploratory strategy. Forty seven employees from a health information contact centre work environment were assigned according to their work schedule to either a Participatory or a Didactic Ergonomics Education Group. Prior to participating in an educational intervention, participants completed a demographic profile, the Workstyle Questionnaire, a self report pain questionnaire, the Ergonomics Knowledge Self-measurement Scale and the Workstation Evaluation and Adjustment Questionnaire. In addition, the researcher visited each participants' workstation while the employee was working and completed a workstation analysis which addressed equipment placement and work practices. Subsequently each participant attended an office ergonomic education session for 60 minutes. Six weeks after delivery of the education session, participants were retested on quantitative measures, and the researcher returned to each participant's workstation to complete an additional workstation analysis. The researcher also met with each participant to ask a series of open ended questions regarding perceived barriers and

facilitators to implementing workstation and work practice changes.

Both the Didactic and the Participatory Education intervention groups demonstrated quantitative improvements relative to baseline on post-intervention measures of perception of ergonomic knowledge, self reported workstation evaluation and adjustment behaviours, and the ability to set up the workstation to allow for working in neutral positions. There was not, however, a significant difference between the two treatment groups.

The qualitative findings provided context to the workers' experience of employing ergonomic strategies in their work environment. Participants identified a wide range of barriers and facilitators to translating ergonomic knowledge into safe behaviours in the workplace. These barriers and facilitators were influenced by the method of information delivery. These findings provide valuable insight into the factors that affect knowledge uptake and behavioural changes in the work environment.

In summary, both methods of educational intervention were effective in creating positive workstation changes and safer workplace behaviours. The participants' perceptions of the barriers and facilitators which influence these changes may inform understanding of the complex process of translating knowledge into practice in the workplace.

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It is not possible to teach others anything;

one can only help them discover it.

Galileo

I dedicate this work with love to my family -

thanks for helping me discover so much.

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1. 0 INTRODUCTION

1.1 Statement of the problem

The astounding increase in computer use in the last decade is paralleled by a rise of work-related discomfort experienced by office workers and associated costs (Bohr, 2000; Rempel et al., 2006; Robertson & O'Neill, 2003; Wilkens, 2003). These discomforts include headaches, eye strain, and a number of work-related musculoskeletal disorders (WRMD) which affect the neck, back, shoulder, arm, and hand (Bettendorf, 1999). Marcus et al. (2002) found that more than 50% of computer users reported musculoskeletal symptoms and disorders during the first year after starting a job that requires computer use.

Work-related musculoskeletal disorders represent a growing and costly burden on the employee, the workplace, the health care system, and society; they are the single largest cause of lost time injuries in Canada (Cole & Wells, 2002). According to a report from Statistics Canada, 10 percent of Canadian adults report having an upper extremity WRMD at some point in the past year based on the Canadian Community Health Survey (Statistics Canada, 2003). In the workplace, the economic impact includes claim and risk management costs, lost productivity, overtime associated with compensating for injured workers, work-site modifications, and human resources costs for managing injuries (Amell & Kumar, 2001; Green, DeJoy, & Olejnik, 2005). In addition, the emotional, psychological, and financial burden placed on the employee and families are important considerations (Amell & Kumar, 2001).

The etiology of musculoskeletal disorders and symptoms in computer users is complex and controversial (Greene, DeJoy, & Olejnik, 2005). Although the precise

cause of WRMD remains unclear, the literature suggests that it includes a number of factors and results from repeated micro trauma to tissues and through overload of the upper extremities, neck, shoulders and trunk (Street, Kramer, Harburn, Hansen, & MacDermid, 2003). Epidemiologic and ergonomic studies of work-related upper extremity disorders in office settings have identified risk factors such as physical (typing duration and speed, work-rest cycles), individual (gender, anthropometry), work organizational (job stress, control over work decisions) and psychosocial (supervisory and peer relationships) (Tittirana, Burastero, & Rempel, 1999). Computer use with sustained awkward postures, long duration of use, and work organizational factors demonstrate the most consistent relationship to musculoskeletal discomfort. Increased prevalence of upper extremity musculoskeletal symptoms has also been associated with increased computer mouse use (Wahlstrom, 2005). A large epidemiologic study found that a high proportion of computer users worked in non-neutral positions that place them at risk for developing musculoskeletal pain (Gerr et al., 2002). Additional causal factors include poor workstation design, improper office lighting, and inadequate rest periods (Aaras, Horgan, Bjorset, Ro, & Thoresen, 1998; Buckle & Devereux, 2002; Demure et al., 2000).

Contact or call centres are work environments in which business or information exchange is conducted via telephone while simultaneously using a computer, represent a rapidly expanding sector of the work world (Norman, 2005). Contact centre workers are commonly employed in one of five sectors: customer sales and service, telemarketing and fundraising, market research and survey, financial services and medical services (Putnam, Fenety, & Loppie, 2000). Along with the rapid growth of these environments, alarming

concerns are emerging related to the impact of job characteristics and the work environments on employees' physical and psychosocial health. High rates of upper extremity musculoskeletal symptoms have been reported among contact centre employees (Karlquvist et al., 2002). These symptoms relate to physical and psychosocial exposure risks in the work environment (Norman, 2005). Factors of concern in the contact centre environment include a static workload, repetitive movements, minimal tasks variety, and high demands and low control (Sprigg, Smith, & Jackson, 2003).

In the workplace, a variety of preventive strategies has evolved over the past two decades to address the growing concern of office-related musculoskeletal disorders (Bettendorf, 1999; Brewer, Ven Eerd, Amick, Irvin, Daum, Gerr et al., 2006; Moore, 1997; Street et al., 2003). As work environments increasingly emphasize accountability and fiscal restraint, questions regarding the effectiveness of these strategies have arisen. The literature evaluating prevention programs is sparse; researchers are just beginning to focus on determining whether workplace office ergonomic strategies are effective in improving safety and comfort in the work environment.

1.2 Significance of the Study

This study will compare the effectiveness of two educational delivery methods promoted in the literature to address office ergonomics: didactic and participatory. The goal of the education intervention is to assist participants to evaluate and adjust workplace set-up to achieve optimal neutral work postures, and improve work behaviours to reduce the physical ergonomic exposures in a physically challenging work environment. Since employers and health and safety educators are increasingly concerned about accountability and fiscal restraint, effectiveness studies are imperative to ensure that injury prevention and

health promotion programs contribute to optimal workplace health.

The employees' experience of participating in educational activities and subsequently translation of information into action in the workplace has not been explored in the literature. This study will address employees' perceived barriers and facilitators to making workplace change. This exploration is planned to better understand the complex process of knowledge uptake. Findings of this study will inform best practices regarding office ergonomic education intervention in the workplace for several key stakeholders: the employee, the educator, and the employer.

2.0 LITERATURE REVIEW

2.1 Ergonomics in the Workplace

Ergonomics is a concept that has drawn increasing interest in the workplace health and safety literature (Haines & Wilson, 1998). Derived from a combination of its Greek linguistic roots, "ergo" (meaning work) and "nomos" (meaning law), ergonomics literally means the laws of work. When applied, the goal of ergonomics is to improve the interaction between people and their work environments. Broadly stated, it attempts to create a fit of the job to the person, rather than the person to the job (Haines & Wilson, 1998). Traditionally the fit is achieved by making workplace and work practice adjustments, based on the input of an expert.

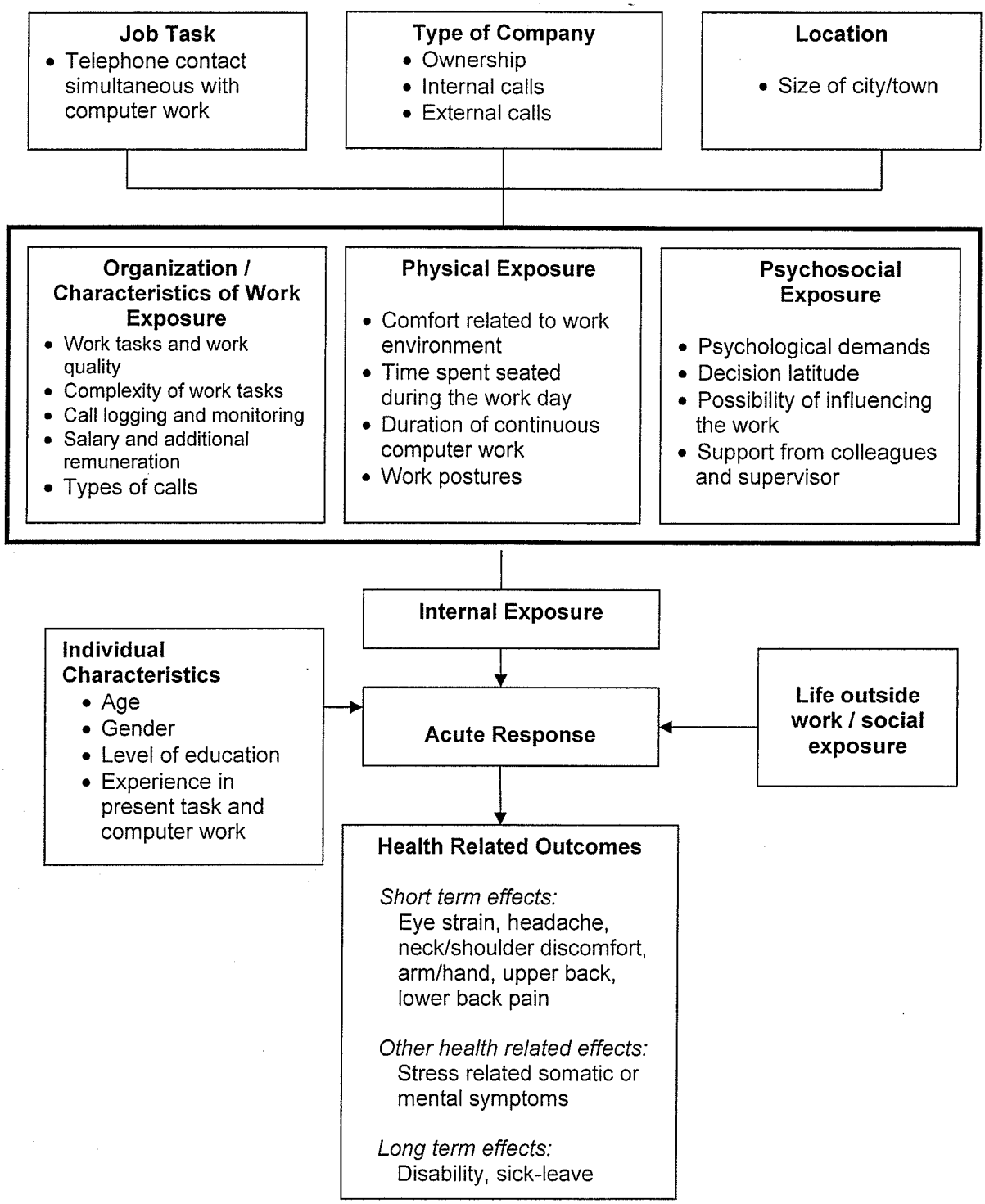
Ergonomic intervention is viewed as a key element to improving employee safety, health and productivity, particularly related to preventing back injuries (King, Fisher, & Garg, 1996). More recently, ergonomics strategies to address upper extremity WRMD have emerged. These prevention and intervention strategies have included design or re-design of the office environment, employee selection and placement, proactive medical management, and education and training of workers (Brewer et al., 2006; Saunders & Shultz, 1998).

Models of ergonomics have emerged for specific work environments, including contact centres. Norman (2005) modified a model initially proposed by Winkel and Mathiassen (1994) to describe work at a contact centre according to an ergonomic multifactor risk perspective. The work-related exposures to stressors in the workplace are categorized as organizational characteristics of work (e.g. work tasks, work quantity, complexity of work tasks), physical exposures (e.g. comfort in the work environment,

length of time spent seated, work postures) and psychosocial exposures (e.g. emotional and cognitive demands, decision latitude, support from colleagues and supervisor). These internal exposures are postulated to collectively influence the body's adjustment, identified as the acute response, and may lead to muscular fatigue, metabolic changes, or altered muscle blood flow. Norman (2005) recognized that the influence of life outside of work/social exposure, including physical demands, and support from family and friends, affects the intensity of the body's acute response. Individual characteristics, including age and gender may act as modifying factors for the exposures as well. If the ergonomic exposures are not addressed, Norman suggested that the acute response may further lead to negative short or long term health related outcomes. The Ergonomic Exposure Effect Model, as related to a contact centre environment, is summarized on Figure 1.

This model serves as a useful framework to understand the many factors that contribute to ergonomic challenges in the contact centre environment. The primary intent of ergonomic education in the contact centres has been to teach and encourage employees to adopt self care strategies which will lower the physical exposure. It is integral to recognize, however that this intervention takes place in the context of a variety of additional ergonomic exposures as well. These exposures affect each other and ultimately the worker.

Figure 1. Ergonomic Exposure Effect Model as Applied to a Contact Centre



From "Call centre work characteristics, physical, and psychosocial exposure and health related outcomes". K. Norman, National Institute for Working Life, p. 6.

2.2 Participatory Ergonomics

Participatory ergonomics is defined as "the involvement of people in planning and controlling a significant amount of their work activities, with sufficient knowledge and power to influence both the processes and outcomes in order to achieve desirable goals" (Wilson, 1995, p.1070). Ergonomic intervention nearly always involves worker participation, however, this involvement can be considered on a continuum. Worker involvement takes on a more identifiable and intentional form in participatory ergonomics approaches (St. Vincent, Bellemare, Toulouse, & Tellier, 2006).

The growth of interest in participatory ergonomics over the past two decades is important to understand both within the ergonomics delivery context, as well as the historical, social and organizational context (Haines & Wilson, 1998). The earliest "tool designs" were participatory by definition – they involved individuals understanding their own environment and needs and then creating their own tools. For example, in the Stone Age hunters designed their own spear points to enhance their survival. The user's own needs were the explicit design goals and the "expert user" was intimately involved in the process; this is the earliest example of a user-centred design (MacLeod, 2003; McNeese, Zaff, Citera, Brown, & Whitaker, 1995).

Over the subsequent centuries, the connection between the designer and the user has grown apart. During the industrial revolution, the production of tools shifted from the user to specialized workers. The purpose of design shifted from being for one self to being for another. This created many workplace and worker mismatches as well as challenges for designing for safety and productivity; the field of ergonomics emerged to address this issue (Haines & Wilson, 1998).

There has been an interesting shift over the past two decades to participatory ergonomics; this essentially returns the "user" to a role of active participant in the design process. The focus of ergonomic intervention has moved from expert-produced solutions, with minimal worker involvement, to worker-produced solutions with high levels of worker involvement (Imada, 1991; McNeese et al., 1995).

A number of factors have led to the growth and interest in the shift to participatory ergonomics. First, management structures and approaches have changed profoundly over the past 50 years. Recognition that employee motivation and performance are complex issues has created interest in changing work environments to develop a more educated, involved, and responsible workforce (Haines & Wilson, 1998). Increasingly there is more emphasis in workplaces on developing empowered workers where teamwork is encouraged (Karasek & Theorell, 1990). The emphasis in many work environments on attributes of quality, flexibility and customer service rather than on productivity alone has also supported the interest in greater workforce participation (Karasek & Theorell, 1990). Participative management that includes action groups and quality circles, though not without criticism, has been introduced as a process to effect workplace improvement (Maciel, 1998). These initiatives are in keeping with the goals and structures of participatory ergonomics.

As well, since the 1970's there has been increasing evidence expressed in the ergonomic, health and organizational literature linking exposure to adverse organizational characteristics to stress and illness (Hanse & Forsman, 2001). Based on the framework of the Demand-Control model (Karasek, 1979), a number of authors have demonstrated that the combination of high psychological job demands with low worker

control is particularly detrimental to worker health (Imada & Nagamachi, 1995; Karasek & Theorell, 1990).

Warren (2001) separated ergonomic risk factors into three categories: physical, psychosocial, and organizational. Norman (2005) built on this framework in the Ergonomic Exposure Effect Model. The body of evidence which links psychosocial factors and musculoskeletal disorders has received increasing attention (Bohr & Barrett, 1997; Warren, 2001) and suggests that the psychological value of participation is very important. Participatory ergonomics has been identified as a strategy that has the capacity to address the physical, psychosocial and organizational factors in the work environment (Haims & Carayon, 1998). Karasek and Theorell (1990) and Warren (2001) emphasized that participatory work combines increasing social interaction and support with greater opportunities for information exchange, participation in decision making and control over one's work activities. These are seen to be important elements of a healthy work environment.

In addition, within the domain of occupational health and safety practice there has been increasing effort to include workers in the identification and resolution of workplace issues (Haines & Wilson, 1998). Canada, the United Kingdom, the United States and Australia are examples of countries which have introduced legislative directives that employers work with employees to address workplace health and safety issues. For many organizations, this has extended to establishment of joint labour/management ergonomic committees that have, in turn, adopted various aspects on the continuum of the participatory ergonomics approach (Haines & Wilson, 1998).

Finally, as organizations and workplaces begin to understand and appreciate the benefits

of applying ergonomic principles to the design of workplaces and jobs, they are coming to terms with a compelling practical issue: ergonomics consultants cannot be hired to address every ergonomic issue due to economic limitations. It has been suggested that "outside experts" may be of limited value as they may be too isolated from the core work and safety culture of a company (Haines & Wilson, 1998). Both of these considerations make the approach of participatory ergonomics appealing, as it draws primarily on existing human resources and expertise in the workplace.

The participatory ergonomics process has been applied in a variety of work environments and with a range of workers including meatpackers (Gjessing, Schoenborn, & Cohen, 1994; Moore & Garg, 1996), installation workers (DeJong & Vink, 2002), newpaper production workers (Rosencrance & Cook, 2000), material handlers (Yeung, Genaidy, Deddens, Shoaf, & Leung, 2003) and health care workers (Carrivick, Lee, & Yaum, 2002; Bohr, Evanoff, & Wolf, 1997). The Occupational Health and Safety Research Institute reviewed 11 ergonomic studies carried out in Québec using a participatory ergonomic approach that aimed to provide company personnel with the skills to analyze and correct hazardous workstations in relation to musculoskeletal disorders (St. Vincent, Bellemare, Toulouse, & Tellier, 2006). They concluded that the participatory process was successful in implementing changes to reduce workplace risks.

Within the office environment, the participatory ergonomics process has been applied to keyboard design (Lindgaard & Caple, 2001), and to process reorganization (Hanse & Forsman, 2001; Vink & Kompier, 1997). The application of participatory ergonomic principles to the return-to-work process has also been promoted and evaluated (Anema et al., 2003; Loisel et al., 2001). A "blue print" for organizations to use to apply the participatory ergonomics process has been outlined by Wells et al. (2003).

A systematic review of the effectiveness of participatory ergonomics interventions for improving health outcomes was completed by the Institute of Work and Health (Cole et al., 2005). Despite research methods and reporting that differed widely across the studies reviewed, the review team found partial evidence that participatory ergonomic interventions had a positive impact on controlling musculoskeletal symptoms, and reducing injuries and compensation claims, including days lost from work. Recommendations for further research and evaluations were provided. These included documenting the level of participation of stakeholders within the process, using comparison groups when possible, paying attention to the presence of co-interventions and potential confounders, and completing a systematic review of participatory ergonomic process evaluation by a team which includes qualitative researchers (Cole et al., 2005).

2.3 The Effectiveness of Office Ergonomics Interventions

Determining the effectiveness of office ergonomics intervention strategies is integral to reducing and managing the incidence and impact of work-related musculoskeletal disorders (Brewer et al., 2006; Street et al., 2003). Effectiveness has not been well documented; a limited number of formal intervention studies have been published. Research to date has focused on three intervention strategies: workstation assessment and intervention, educational programs, and combined methods.

2.3.1 Workstation Assessment and Intervention

Worksite assessments generally involve an expert visiting the workstation, completing an assessment, and recommending changes to the employee and employer. This is frequently promoted as an effective strategy; however, only one formal evaluation of the process was found in the literature. Demure et al. (2000) investigated the effects of

an individualized worksite assessment program on musculoskeletal discomfort using a non-controlled design in a cohort of 118 computer users in several offices of a large administrative department. Recommendations for improvements included both on-the-spot adjustments, as well as more substantial modifications including acquisition of new furniture. Interventions were completed by ergonomic specialists and tailored to the individual workstations. Data was gathered one year following the intervention.

Compliance with the intervention was reported to be at 75% at follow up. In spite of this finding, the authors were not able to correlate reductions in employee discomfort to the ergonomic interventions (Demure et al., 2000). This study was likely affected by two factors which the authors were unable to control during the study period: a major administrative reorganization, and the introduction of and/or increased use of the mouse by many employees due to altered task demands. These factors illustrate the complexity of completing workplace-based research. A no-treatment control group might have clarified these findings.

2.3.2 Education Programs

Office ergonomics education as an intervention has been implemented in several ways. The didactic educational method is driven by the educator, who determines the participants' needs and delivers relevant content, generally using a lecture format. A question and answer period may be provided at the conclusion of a didactic educational program (Bohr, 2002). Some studies have utilized didactic content delivery strategies using a number of media resources to illustrate and reinforce the content (Marcoux, Krause, & Nieuwenhuijsen, 2000; Wilkens, 2003). Other studies have utilized a more learner-engaged participatory educational method. This method allows the group to

determine their learning needs, includes active engagement between the educator and the participant, and focuses on application of the content by way of case studies and problem solving exercises (Bohr, 2002; Greene et al., 2005; King, 1995; Robertson & O'Neill, 2003; Vink & Kompier, 1997). Computer based educational programs have also been designed and evaluated according to the needs of specific users (Harrington & Walker, 2004). Ergonomics education training programs have focused on a number of outcomes including knowledge increase, and behavioural changes in the workplace. Little attention has been directed to understanding the translation of this knowledge into behavioural changes into the workplace, or the antecedents to behavioural change (Greene et al., 2005).

2.3.2.1 Didactic Office Ergonomics Education Intervention

Although there is a range of resources available to assist delivery of didactic office ergonomic education interventions, the literature review revealed only one study which examined the effectiveness of didactic education techniques. A pilot project reported by Marcoux et al. (2000) and Nieuwenhuijsen (2004) assessed the effectiveness of an intervention to increase knowledge and reduce risky work behaviours related to cumulative trauma disorders. Based on the Health Belief Model (Rosenstock, Stretcher, & Becker, 1988), the interventions were designed to include a variety of educational methods to meet the needs of people with various learning styles. The one-year long intervention period incorporated a variety of didactic delivery methods including e-mail tips, posters, a 45-minute workshop, and an information booklet. Participants completed a 156-item survey designed by the researchers. The survey gathered information related to demographics, work history, health history, the ability to perform job tasks,

occupational stress, and health knowledge and beliefs. The survey was completed prior to and following the one year intervention period. The authors found that there was a statistically significant improvement in the participants' knowledge and behaviours related to assuming safe work postures for the hand/wrist and neck/shoulders; workplace behaviour adjustments were identified by the participants' report. There was sizable attrition reported in this study. Initially there were 84 participants; at the post-test, there were 40 participants. This study was further limited by a lack of a comparison group and reliance on self-report regarding work postures.

2.3.2.2 Participatory Office Ergonomics Education Intervention

Some investigators have focused on providing and evaluating educational programs that use participatory delivery methods. These methods build on the philosophy that employees have unique knowledge and experience of work, therefore their involvement to identify workplace concerns and generate solutions is essential (Haines & Wilson, 1998). This method of delivery, which applies adult learning concepts to the prevention of musculoskeletal injuries, has been promoted by health care professionals; however, it is largely untested (Bohr, 2002).

One study that examined a participatory ergonomic intervention was completed at Laval University by Brisson et al. (1999). A sample of 627 workers were randomly allocated by their geographical location and administrative responsibilities to either the first year (experimental group) or second year (reference group) of the program. The ergonomic training program was developed based on the PRECEDE (predisposing, reinforcing and enabling causes in educational diagnosis evaluation) model of Green and Kreuter (1999). The program targeted three behaviours: adjusting the postural

components of the workstation correctly, adjusting the visual components of the workstation correctly, and organizing work activities in a preventative manner. The program included two teaching sessions, each three hours in duration, with a two-week interval between sessions. The sessions included demonstrations, simulations, discussions, and lectures. As well, participants completed a self-diagnosis of their workstation using a photograph taken prior to the commencement of the program. Brisson et al. (1999) suggested that the two-week interval between teaching sessions allowed the participants to apply new knowledge and skills to their learning situation and return to the second session with experiences and questions.

The measurements for the Laval University program were collected two weeks prior to and six months after the training. They included direct observation of workers at their workstation; an observational tool was designed for the project and pre-tested at 30 workstations prior to the study to insure the validity of the observation and inter-observer reliability. Evaluators using the tool received training from the authors of the study; no additional information about the evaluators' credentials was provided. A self-administered questionnaire of musculoskeletal symptoms, also designed by the study authors, sought information on the prevalence of musculoskeletal pain, intensity of the pain using a visual analogue scale, the psychological job demands, job-decision latitude, and lifestyle factors. The only questionnaire component which had been standardized and found to be valid and reliable was the job decision latitude scale (Brisson et al., 1998). The physical examination was completed by occupational therapists blinded to the participant's assigned group.

The authors reported that six months after the training program, improvements in

postural stressors and workstation components occurred more frequently in the experimental group (Brisson et al., 1999). A strength of the study was its design which included both objective and self-reported measures as well as longitudinal data collection. However, measurement tools were not standardized. The authors indicated that contamination between the intervention and control group likely occurred and accordingly, they may have underestimated the true intervention effect. The effect of history as a threat to internal validity should also be considered in this study as administrative and organizational changes in the second year may have affected the results.

A comparison between what the author described as the "traditional approach" to office ergonomic education (primarily didactic) and the participatory method was evaluated by Bohr (2000; 2002). A sample of 102 agents at a contact centre responsible for co-ordinating transportation reservations was randomly assigned to one of three groups: a traditional education group, a participatory education group, and a control group. The content provided in the two intervention groups was similar. Participants in the traditional group attended a one-hour didactic education session; content was reinforced by providing take-home informational handouts. Participants in the participatory education group met for two hours. The first part of the participatory educational sessions included hands-on demonstration of workstation evaluation and modification, case study, and an active problem solving approach to recognizing ergonomic issues and recommending solutions. The second portion of the session paired participants and required them to return to their workstations to evaluate and modify it according to the information delivered during the first portion of the session. The course

instructor was present to ensure that the newly arranged work areas were consistent with the principles taught in the class. Data collection was completed with a self-report survey and observational checklist; data was collected prior to the intervention and at 3, 6, and 12 months post-intervention. The author noted that data collection instruments were developed for this study using expert consultation; however, the reliability and validity of the tools were not reported.

Both the traditional and participatory intervention groups reported less pain and work stress following the intervention than did participants who did not receive the training. However, there was no evidence that participatory methods were more effective than didactic methods for office ergonomics education (Bohr, 2002). This finding may have been due to lack of sensitivity of the measurement instruments used or lack of power for size of effect. As well, this study was completed at a single site; this allowed for control in matching the design of work areas and equipment used, however, it may have led to cross contamination as workers in all groups worked in close proximity (Bohr, 2000).

Applying the participatory education approach to university students Robertson et al. (2002) completed an exploratory study with a goal to reduce upper extremity symptoms related to extensive computer use. The interactive educational approach promoted student participation either on the training design team, as a co-facilitator, or as a student trainee. The authors reported that this approach was successful in increasing students' knowledge and accuracy in conducting peer reviews of computer workstations, and creating a sense of ownership among the student participants as determined through their self-reports during a post-intervention debriefing. This pilot study had recruitment

problems, resulting in a small sample. There was no control group and the instruments were not standardized (Robertson et al., 2002). The results were inconclusive and limited in their generalizability; however, the careful documentation of the participatory education process is useful to others trying to operationalize the principles.

Street et al. (2003) described a pilot study with 36 participants carried out in a banking call-centre to determine if changes in postural risk and general health were impacted by a brief ergonomics participatory education intervention (one 60-minute small group session plus a 15-minute individualized follow-up). Two measurement tools were used: the Short Form 36 Health Survey (SF – 36) (Ware, Snow, Kosinski, & Gandek, 1993), and a 30 minute videotaped work session which was analyzed using the Postural and Repetitive Risk Factor Index (PRRI) (James, Harburn, & Krammer, 1997). Data were collected before and 5 weeks following the intervention. At the follow-up point, this intervention was associated with a reduction in postural risk (determined by a video taped analyses of the PRRI scores), but not with general health scores. The strength of this study was that rather than relying on self report or the therapist's visual assessment to determine behaviour change, the PPRI offered an objective, valid and reliable evaluation (Krammer, Potter, Harburn, Speechly, Rollman, & Evans, 2001). The limitations of this study included a small sample size and no control group. The question of long-term effectiveness of these strategies was not addressed. The use of the SF-36, a census tool that was designed to measure health in the general population, was also limiting in that it was likely not sensitive enough to detect change within the time frame (five weeks) for this study group.

The effects of the *Active Ergonomics Training* (AET) program with computer

users at a large state university in the United States was conducted by Greene et al., (2005). The training lasted for six hours and included a combination of didactic content delivery, group discussions, and problem-based activities. The AET program emphasized workstation adjustments, exercise, work organization and micro breaks. This prospective two-group experimental design with delayed intervention for the control group was completed with 87 employees. A number of measures were used prior to the training program including the Rapid Upper Limb Assessment, an observational tool which assesses risk factor exposure at the computer workstation (McAtamney & Corlett, 1993), a symptom survey, a pain intensity scale, an ergonomic knowledge questionnaire, a self efficacy questionnaire, and outcome expectation questionnaire. Data were collected at one week prior to and three weeks following the educational intervention. Post-intervention assessments were repeated one year later. Results showed that the majority of the participants benefited from the intervention. Participants who were initially at higher risk for musculoskeletal injury had the greatest benefit. While this finding makes intuitive sense, no other ergonomic training studies have assessed or reported a similar finding. The authors note that the practical application of these results are that workstation assessments can be an effective method of identifying high risk employees and ergonomic education intervention can be targeted accordingly. At the one year follow-up data collection point, a re-evaluation of the workstation set-up and assessment of the participant's neutral positioning was not repeated (Greene et al., 2005). This is a limitation, as the study did not address the issue of maintenance of safe work behaviours. While there are many strengths of this project that may be replicated in subsequent studies, the intervention dose period (six hours) was extensive, and thus

costly. This feature may require modification in other work organizations that are unable to support employees' absence from the workplace for six hours for educational intervention.

2.3.2.3 Computer Based Office Ergonomics Education

Educational programs have been designed for and evaluated according to the needs of specific office workers. Harrington and Walker (2004) focused on education for 50 employees that worked by telecommuting. They reported on the effectiveness of a home office ergonomics training program delivered via a 45 minute computer-based training module. The program provided an introduction to ergonomics and musculoskeletal disorders, tips on evaluating the home office, and stretching exercises. One hundred and two (102) participants were recruited by way of an e-mail list and randomly assigned to a treatment or control group; each group completed a pre and post test which consisted of 26 ergonomic knowledge, practice or attitude statements, to which respondents indicated their level of agreement. The treatment group was sent the training module and given three weeks to complete it prior to writing the post test. The attrition rate for this study was high (51%). Harrington and Walker (2004) reported that the treatment group had statistically significantly increased scores between the pre and post test on each subtest (knowledge, attitudes and practices); there was not a significant difference for the control group. Again, the determination of work behaviour change was based on self-assessment only; this is a major limitation of this study. The attrition rate was also a concern; the authors identified that this was likely related to the short time frame allowed to review the materials and complete the test, and the timing of the study in the month of June that likely conflicted with vacation commitments.

2.3.3 Multiple Interventions

Interventions that use multiple strategies are often suggested to address the range of issues, learning styles and organizational hurdles found in the workplace. Aaras et al. (1998) and Aaras, Horgen, Bjorsset, Ro, and Walsoe (2001) reported on a prospective, parallel group design with three groups of computer users: two intervention groups and a control group. Intervention strategies included adding a new lighting system, installing new workstations, providing optometric examinations and vision correction if needed, and encouraging participants to support their arms on the work surface during mouse use. Participants reported a significant reduction in shoulder and back pain six years after the intervention. Statistically significant improvements were reported related to visual discomfort and shoulder pain. These results are promising; however, the impact of potentially confounding factors and threats to internal validity due to history and maturation were not determined (Aaras et al., 2001).

Vink and Kompier (1997) described a participative ergonomic study completed in a department where repetitive keyboard tasks were required. Employees were divided into two groups: one group participated in workplace instruction only; the other group was engaged in a participatory program in which they created their own "ideal workplace" with additional furniture and ergonomic enhancements. The participatory group reported objective and subjective improvements in workplace comfort compared to the instruction-only group. The validity and reliability of the measurement instruments was not addressed. The authors concluded that the participatory process can be viewed as a positive change agent (Vink & Kompier, 1997). However, there is poor evidence in this paper to support this conclusion, given the small sample size resulting low statistical

power and limited information regarding the measurement tools. As well, the financial costs of this study were not presented; this may be an important consideration in implementation.

The effect of an office ergonomics workplace and training intervention on knowledge and self-reported musculoskeletal pain and discomfort was investigated by Robertson and O'Neill (2003). The researchers began with a sample of 1135 participants. Three groups were included in the study: those who participated in ergonomic training and had workstation equipment changes, those who received workstation equipment changes only, and a no-intervention control group. Two methods of electronic data collection were employed; the work environment survey and ergonomic knowledge test were distributed by e-mail. The validity and reliability of these instruments was not indicated. Data were collected before and after the intervention however there was significant attrition using the electronic data collection method; the return rate on the forms for the combined group of participants was 37% pre-intervention and 31% post intervention. Only the matched samples (pre and post) for the experimental and control group were used, reducing the participant group to 633. Following the intervention, there was a statistically significant increase in workers' office ergonomics self reported knowledge and awareness. The workstation plus training group reported a significant reduction in muscle discomfort. The intervention group that had only workstation equipment changes reported greater reduction in work-related discomfort than the control group, however the reductions in both intervention groups were not significant. Limitations of this study were that group sizes were unequal, training was administered to a small group (N= 45) relative to the total participant group

(N=633) due to limitations of time and resources. The methods and timing of information gathering for this study were not clearly described and all results were based on self-report.

A study designed to examine the effect of office ergonomic intervention in reducing musculoskeletal pain levels with 168 employees of a state department was reported by Amick et al. (2003). The effect of an adjustable chair and office ergonomics training on ergonomic knowledge, postural behaviour, health and productivity was assessed. Participants were assigned to one of three study groups: a group receiving an adjustable chair with office ergonomics training, a training-only group, and a control group that received training at the end of the study. Data were collected prior to the intervention, and two, six and twelve months post-intervention. Workers who received the adjustable chair and office ergonomics training had statistically significant reduced pain symptoms over the course of a workday compared to the control group. No significant reduction in symptoms reported over the workday was found for the training-only group compared to the control group. These results suggest that unless workers are provided with the appropriate tools (in this case a chair) to apply the knowledge gained through training, the full benefits will not be achieved (Amick et al., 2003). Study limitations were that participants were not randomly assigned to the study groups; assignment was guided by geographical separation of the three groups to control for cross contamination. As well, the observed chair group effect may be partially attributed to the workers' perception of the chair's value (Amick et al., 2003).

A pilot study to assess the effectiveness of the combined approaches of education, workstation redesign, and task modification as a comprehensive work injury prevention

program offered to 16 office workers for one hour per week for four weeks was reported by Martin, Irvine, Fluharty and Gatty (2003). Participants reported a high level of satisfaction with the intervention process. The researchers reported a high level of compliance for all injury prevention strategies; compliance with the use of ergonomic equipment was found to be higher than with either modified job tasks or the use of stretches. This study had a number of limitations, including a small sample size that limits the generalizability of the findings, use of non-standardized instruments, and a lack of objective evaluation of compliance.

May, Reed, Schwoerer and Potter (2004) examined the impact of an office ergonomics intervention program, and explored specifically whether older workers reacted differently than younger workers to office ergonomics improvements. A sample of 87 employees participated in an educational workshop that provided information on the physical needs of a healthy body, the physical and emotional load placed on computer operators, risk factors for cumulative trauma disorders, intervention strategies and self-assessment of computer workstations. The instructor then met with participants to review the self-assessment and provide recommendations for ergonomic enhancements as necessary. Employees in the treatment group had an ergonomic enhancement; those who did not were in the control group. Measures included workstation ergonomic characteristics, pain reports, eyestrain, workstation satisfaction, age, and length of time completing the job. This study reported support for the effectiveness of an ergonomically focused office workstation redesign effort. Workstation improvements were linked to decreased upper back pain and greater workstation satisfaction. Younger workers' workstation perceptions were influenced more by improvements than older workers'

perceptions but did not influence the relationship between workstation changes and the physical discomfort-related outcomes (May et al., 2004). The authors acknowledged that this study may have been influenced by the Hawthorne effect.

A one year randomized controlled intervention trial evaluated the effects of a wide forearm support surface and a trackball on upper body pain severity and musculoskeletal disorders among 182 call center employees in a large health care company (Rempel et al., 2006). Participants were randomized into one of four groups: ergonomics training only, ergonomics training plus a trackball, ergonomics training plus a forearm support, or ergonomics training plus a trackball and forearm support. Outcome measures were weekly pain scores and the diagnosis of incident musculoskeletal disorders via physical examination performed by a physician blinded to the intervention. The study demonstrated that providing a large forearm support combined with ergonomic training was an effective intervention to prevent upper body musculoskeletal disorders and reduce upper body pain associated with computer work among call centre employees. This ergonomic device allowed employees to work in supported neutral positions. Along with the recommendation that forearm supports be installed in the study location, the authors used a return-on-investment model to predict a full return on the equipment and installation costs in 10.5 months at the study site (Rempel et al., 2006). The economic cost of the workplace ergonomic changes is rarely addressed in intervention literature and is a helpful inclusion. However, the cost of the employee education was not considered in the calculation. This is a critical consideration since researchers have found that if ergonomic training is not provided when ergonomic equipment is made available, the benefits of equipment use are substantially reduced (Amick et al., 2003; Robertson &

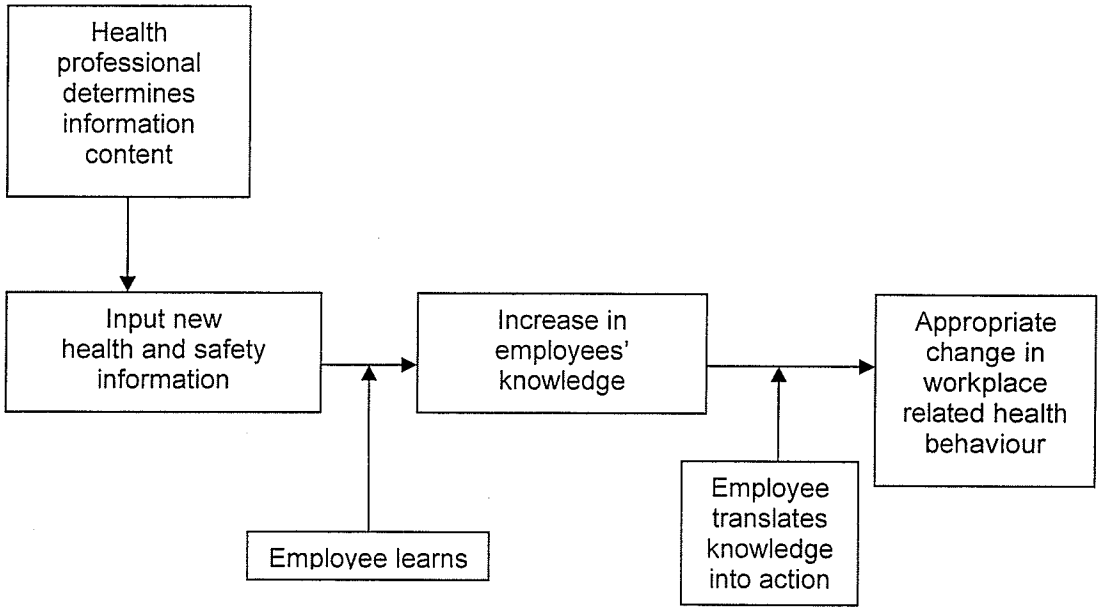
O'Neill, 2003; Wahlstrom, 2005).

2.4 Theoretical Issues Related to Workplace Safety Education

The effectiveness of health promotion education aimed at preventing musculoskeletal injuries and promoting workplace safety has been discussed historically in the literature related to back injury prevention (Innes, 1997; King, 1995; Marcoux et al., 2000); more recently it has been discussed related to upper extremity injury prevention in office ergonomics education programs (Bohr, 2002; Nieuwenhuijsen, 2004). However, theoretical concepts have been largely untested in the context of worker education programs designed to prevent work-related injuries (Bohr, 2002). One group of researchers initiated testing of the Health Belief Model in order to understand knowledge uptake and behaviour change among office workers (Leonard, 2000; Marcoux et al., 2000). Greene (2005) adopted two constructs from social-cognitive theory to provide a more comprehensive assessment of the factors that influence behavioural change.

More typically, workplace-based safety education is designed to improve the workers' ability to identify risk factors that lead to injury in order to control these factors to prevent injury (King, 1995). While often not clearly articulated, the inherent assumptions of workplace-based education is that if workers are trained in safe and effective techniques, they will use this knowledge to change behaviours, which in turn will prevent work-related pain and injury (King, 1995). Innes (1997) summarized this process as noted on Figure 2.

Figure 2. Workplace education process assumption



From "Education and training programs for the prevention of work injuries: do they work?" by E. Innes, Work, 1997, 9, 221 – 232.

Innes (1997) emphasized two complicated assumptions in this model that are not clearly understood: employee learning (knowledge uptake) and translating knowledge into action (knowledge translation). Given that putting new knowledge into practice is a complicated process, clinicians and health educators have questioned the simplicity of this model.

The process of translating ideas into behaviour change was identified as a relevant concept of interest in the past decade. Prior to the 1990s, the literature related to the flow of knowledge was referred as *knowledge transfer* (Maclean, Gray, Narod, & Rosenbluth, 2004). This term describes the one-way flow of knowledge from expert to potential users of the knowledge (Maclean et al., 2004); the expert was responsible for imparting the

information. The methods of knowledge transfer were both active and passive, depending on the transfer goals (Maclean et al., 2004). It has now been well established that the more participatory and targeted the transfer activity, the more likely it is to result in application (Grimshaw et al., 2001; Lavis, Robertson, Woodside, McLeod, & Ableson, 2003).

There are concerns regarding the possibility of limited knowledge uptake in the knowledge transfer process; this is often attributed to the reality that researchers, policy makers, and clinicians inhabit "different worlds" (Lavis et al., 2003; Lomas, 1993). This concept is known as the "two-communities" theory (Caplan, 1979). In other words, simply receiving knowledge does not necessarily lead to using it, especially if the parties do not share the same focus, language, culture or research agenda (Jacobson, Butterhill, & Goering, 2003; King, Hawe, & Wise, 1998). The "two community theory" may be applied to health professional educators and workers as well.

To move toward more effective knowledge transfer, strategies to promote knowledge uptake have been suggested by Maclean et al (2004), building on the work of Lavis et al. (2003). The following components and strategies have been suggested to promote knowledge uptake:

- ensure messages are clear and concise;
- "fine tune" the message to the target audience and the related environment;
- ensure that the messenger has credibility;
- strive for face-to-face exchanges as these are most effective; and
- build in performance measures that are audience specific and appropriate to the context.

However, no matter how well packaged the information is, knowledge transfer is limited in that the delivery is top-down (Maclean et al., 2004). It follows that the information presented may not address the questions that interest the user, or, in the case of workplace-based education, the worker.

More recently, the term *knowledge translation* has emerged to describe a broader concept which includes all the steps between the creation of knowledge and its application. Rather than beginning at the point at which a message is to be delivered (as knowledge transfer most often does), knowledge translation describes an active, multi-directional flow of information which begins at project inception. Partnerships, which are integral in knowledge translation, are encouraged among researchers (within and across disciplines), policy makers and managers, health care providers, and health care users (Crosswaite & Curtice, 1994). Interactions and exchanges occur before, during, and after a project with the goal of developing research questions, setting a research agenda, and then determining the answer (Jacobson et al., 2003).

The Canadian Institutes of Health Research (CIHR) has put forward the following definition of knowledge translation:

> "knowledge translation is the exchange, synthesis and ethically-sound application of knowledge – within a complex system of interactions among researchers and users – to accelerate the capture of the benefits of research for Canadians through improved health, more effective services and products and a strengthened health care system" (CIHR, 2004).

Although there is increasing interest in enhancing opportunities for knowledge translation, this area remains poorly understood. To promote the process of putting

knowledge into practice in the workplace, some authors have stressed that active participation is essential to the goal of both learning and applying information (Bohr, 2002; Zalk, 2002). Still, many of the office ergonomics education programs described in the literature rely on lectures and content exams to measure comprehension of material, rather than on observable change in the workplace, or the participants' perception of new knowledge acquisition and their confidence and demonstrated ability to apply it (Innes, 1997; King et al., 1996; Marcoux et al., 2000). Greene, De Joy and Olejnik (2006) also noted that little attention has been given to the antecedents to behaviour change, such as self efficacy and outcome expectations. Clearly more work on the development and testing of a theoretical framework to support interventions that address the multi-step process of knowledge translation is in order.

2.5 Summary of the Current Literature

Positive trends related to the impact of office ergonomics interventions have been noted; however, there are a number of concerns and difficulties with the existing literature. Even though office ergonomics interventions are routinely promoted for the management of workplace health and safety, literature related to the effectiveness of these efforts is relatively sparse. In part, this is because the design and execution of intervention studies in the workplace are complex and challenging (Wilkens, 2003; Zwerling et al., 1997). The potential is great for these studies to be confounded by unexpected changes related to the dynamic nature of market economies, of public policy, and of workplace culture (Zwerling et al., 1997).

A number of strategies aimed at increasing workers' knowledge have been offered; these efforts are generally based on the assumption that training increases

awareness which leads to self responsibility and positive behaviour change (King, 1995). Other studies have focused on strategies which will enhance self-efficacy which in turn is expected to improve work postures, work habits, and reduce risk factor exposure (Greene et al., 2005). However, the links between increasing workers' knowledge and observed work-place improvements are rarely evaluated.

The need for office ergonomics intervention programs to be formally evaluated is clear, however there are a number of methodology challenges in the area of office ergonomics intervention research (Brisson et al., 1999). Methods for evaluating effectiveness are not well defined; variables for measuring success range from absenteeism, incidence of injury, physical measures of disability and educational compliance, number and duration of recurrences, and physical examination results (Bohr, 2000). Without agreement on what to measure and the use of standardized tools, it is difficult to know if failures to replicate results represent different findings or merely differences in measurement (Zwerling et al., 2001). The effectiveness of prevention programs cannot be determined without adequately defined parameters, and standardized methods of data collection and analyses (Bohr & Barrett, 1997) and this must include objective evaluations of behaviour change (Wahlstrom, 2005). Study designs which use existing valid and reliable evaluation tools are essential to allow for repeated measures and follow-up studies. As well, additional evaluation tools which are more sensitive to the specific intervention parameters should be developed (Amick et al., 2003).

It is commonly assumed that ergonomic interventions will show savings in terms of improved productivity related to fewer musculoskeletal symptoms; however, the cost-effectiveness of ergonomics programs is seldom addressed (Westgaard, 2000). Studies

which have focused on this issue cite significant limitations to the research process related to employees' willingness to report, and the difficulty of factoring the indirect costs of workplace discomfort and disability such as administrative costs and reduced productivity (Lewis, Krawiec, Confer, Agopsowicz, & Crandall, 2002).

Leonard (2000) suggested that more long-term prospective studies which assess the effectiveness of an intervention over a period from 6 months to one year post-intervention would add to the body of knowledge.

A number of strategies have been suggested to improve the quality of occupational injury prevention studies (Zwerling et al.1997; Westgaard, 2000). Making wider use of qualitative research methods, such as interviewing, observation and focus groups to provide a better understanding of how interventions are perceived and received in the workplace has been encouraged. It is postulated that qualitative methods may begin to address the employees' perception of what method was most meaningful, and how to implement useful interventions (Cole et al., 2005). Qualitative methods have been identified as essential to determine the programs and resources that may address ergonomic challenges. However, no published studies that use qualitative methods were found during the literature review.

Worker compliance with ergonomic interventions is often reported in the literature. However, there has been little attention focused on determining the barriers or facilitators to compliance. Further attention to an action research paradigm that would include participation with workers and management in the design of the intervention and determination of appropriate outcome measures has been encouraged (Zwerling et al., 1997). This is in keeping with the participatory ergonomics process and has exciting

potential.

A systematic review of workplace interventions to prevent musculoskeletal and visual symptoms and disorders among computer users was completed (Brewer et al., 2006). The reviewers noted that the office ergonomic intervention literature is heterogeneous in the interventions tested, the study designs employed, and the outcomes measured. There was no evidence that office ergonomic intervention had a negative effect on musculoskeletal or visual health. However, given the range of single studies, the evidence was insufficient to conclude that exercise training, stress management training, educational interventions or alternate equipment had positive effects on workers' musculoskeletal health. The team summarized that the current state of peer-reviewed literature provides relatively few high quality studies on the positive effects of office ergonomics interventions on musculoskeletal health (Brewer et al., 2006).

Based on the literature review presented, echoed by the recent systematic review, it is apparent that office workers, particularly contact centre workers, are at risk of developing pain and disability in the workplace. Although there has been a range of suggested educational interventions, there have been significant gaps and inconsistencies in the evaluation of these strategies.

Accordingly, the following study was planned and carried out to compare didactic with participatory office ergonomics education intervention. It was determined that the success of the program would be determined not by a measure of the participants' ergonomics knowledge, but rather by determining whether participants were able to put "knowledge into action", as evidenced by making workstation changes which were in line with ergonomic principles addressed during the education session. Repeated

measures were used to determine if changes occurred related to intensity of pain, perception of ergonomics knowledge, and frequency of evaluating and adjusting the workstation. When available, standardized tools which have been shown to be valid and reliable were used.

Heeding recommendations from the literature to explore the knowledge uptake process using qualitative measures, the study was also designed to explore participants' perceptions of the barriers and facilitators related to implementing workstation changes. The goal of this component of the study was to understand the participants' perspective of the change process with a goal of improving the effectiveness of worker education approaches.

3.0 OVERVIEW OF THE STUDY

3.1 Purpose of the Study

The purpose of this study was to evaluate and compare the effectiveness of office ergonomics education delivered in a contact centre environment using two methods: didactic and participatory. The *didactic method* involved participants attending a lecture style education session followed by an opportunity to ask questions. The *participatory method* involved active learning strategies incorporating case studies and problem solving exercises to promote the application of the principles to the work environment.

3.2 Objectives of the Study

The following were objectives of the study:

1. To evaluate whether a participatory office ergonomics education intervention had a greater effect on the employees' behaviour of adjusting/improving their workstation than a didactic office ergonomics educational intervention.
2. To explore what employees perceived as barriers and facilitators to implementing workstation and work behaviour changes and whether these barriers and facilitators varied with the intervention.

3.3 Hypotheses

This study tested the following hypotheses:

Hypothesis 1: There will be no difference in the two groups prior to the educational intervention on demographic variables such as age, gender, length of employment, equivalent full time status (EFT), role, workstyle responses, location and intensity of pain.

Hypothesis 2: There will be a difference in the two groups following the

intervention on study measures related to ergonomic knowledge, self reported behaviours, objective workstation evaluations and pain scores.

Hypothesis 3: There will be a difference in the two groups related to satisfaction with the education experience.

Hypothesis 4: There will be a difference in the two groups related to the reported facilitators and barriers when implementing ergonomic recommendations.

3.4 Limitations

The design of this study was limited by several factors. Due to limited resources, the researcher was not blinded as to which educational group the participants were assigned, therefore the objectivity of the Workstation Analysis observations may be questioned; potential researcher bias was addressed in part by using an observational tool which forced dichotomous (yes/no) responses.

The Hawthorne Effect was likely a factor when the workstation observations were being completed. That is, employees might have been more likely to demonstrate ergonomically supported postures while the observer/researcher was present. However, this effect would be equal in both groups.

The sample size was small which resulted in low statistical power. Again, this was due to resource limitations.

While this study design was strengthened by the fact that both groups were located in the same workplace with similar conditions and demands, this situation allowed for potential contamination. Employees from different groups may have had an opportunity to discuss the intervention approaches which may have led to an underestimation of the true effect. Attempts to control for the contamination threat to internal validity included requesting that

employees not discuss their participation prior to the conclusion of the study period, and assigning the participant groups based on their work shift in order to minimize interaction in the workplace.

This study did not include a control group of participants who did not receive education intervention since the available study group size was already small and creating a third group would have further reduced the statistical power of the quantitative aspects of the study.

3.5 Delimitations

This study was limited to contact centre employees of a single and specialized organization: Health Links – Info Santé, Winnipeg. Participants in the provincial health contact centre have specialized training and equipment, potentially limiting the generalizability of the findings to other contact centres or telemarketing workers. No control mechanisms were in place for the potential variability between participants (e.g. age, gender, length of employment, full or part-time job status, musculoskeletal concerns prior to the study).

4.0 METHODOLOGY

4.1 Research Design

A mixed methods design was used, utilizing a sequential exploratory strategy (Creswell, 2003). Phase one of the study focused on collecting quantitative data before and after participation in one of two education intervention methods: didactic or participatory. Participants were randomly assigned to an education group based on their shift schedule at the time of the education session delivery.

Phase two of the study employed semi-structured participant interviews to collect qualitative data regarding the participants' perceived barriers and facilitators to implementing workstation and work practice changes. The data were reviewed and collated into themes using an iterative strategy. The qualitative data was used to help interpret and explain the quantitative results (Creswell, 2003).

4.2 Ethics Processes

Ethics approval for the research was granted from the University of Manitoba Health Research Ethics Board in December 2005 (Appendix A), the Winnipeg Regional Health Authority Research Review Committee in January 2006 (Appendix B) and the Misericordia Research Review Committee in January 2006 (Appendix C).

The employer, Health Links – Info Santé, Winnipeg Regional Health Authority was supportive of the project (see Appendix D). It was determined that if the study demonstrated that one intervention was more effective than another, the group that did not have the opportunity to participate in the more effective ergonomic education method would have the option of participating in further training.

The recruitment protocol in the workplace was designed to ensure that employees were

supported to participate in the study by the employer, but not coerced. The employer agreed to allow educational sessions to be conducted during the participants' paid work hours. Employees were assured that participation in this study would not be linked to performance management.

4.3 Research Site

The research project took place within the provincial health care contact centre work environment, Health Links – Info Santé. Health Links – Info Santé is a 24 hour per day, 7 days per week, telephone information and referral service. The call handlers in this service (nurses and service navigators) manage incoming calls from across the province. Most Health Links – Info Santé employees work at the Misericordia Hospital site; there is also a satellite location at St. Boniface Hospital. Both hospitals are located in Winnipeg, Manitoba.

Employees at the contact centre work in cubicles which are equipped with a computer and telephone. Employees are not assigned a specific workstation; they choose a workstation when they arrive for their shift. The workstation set-up is consistent across the centre; each has a fully adjustable keyboard tray, standard profile keyboard and mouse. Employees have their own telephone headset which they plug into the workstation when their shift begins. There are additional ergonomic supports and devices in the work environment including monitor risers, foot rests, keyboard and mouse wrist rests, anti-glare screens, alternate pointing devices, and alternate keyboards. Ergonomic equipment is available in the storage room or left behind in cubicles circulating in the work environment. Considerable attention was given to workplace design, environmental considerations and selection of ergonomic supports for the workplace when the contact centre location was established several years ago. The manager indicated that less attention had been devoted to ergonomic issues in recent times.

4.4 Participants

Employees in the facility include registered nurses with additional specialized training, service navigators (non-clinical employees who provide health resource information), business analysts, receptionists, and managers. Nurses and service navigators work rotating shifts (ranging from 4 to 12 hours); the business analysts, receptionists and managers work during the business day shift (i.e. 8:00 a.m. until 5:00 p.m.). All employees who were in the workplace at the time of recruitment (i.e. not away from the workplace due to medical or parental leave) were invited to participate in the project. During the planning stages, the target number of participants was 40. In fact, 47 employees volunteered to participate. Volunteer participants were randomly assigned by coin toss to either the Participatory or Didactic Education Group.

4.5 Instrumentation

Several variables were explored in this study. Accordingly, the following tools were used to collect data: Demographic Profile, Workstyle Questionnaire, Visual Analogue Scale for Pain, Symptom Drawing, Ergonomics Knowledge Self Measurement Scale, Workstation Evaluation and Adjustment Questionnaire, Education Satisfaction Survey, Workstation Analysis, and interview questions. These tools are identified on Table 1 and subsequently reviewed in detail.

Table 1 Summary of Instruments

VARIABLE	INSTRUMENT
Demographic • Age • Length of employment • EFT • Gender • Role	Demographic Profile
Workstyle	Workstyle Short Form Questionnaire (Dane et al., 2002)
Pain	Visual Analogue Scale for Pain (Huskisson, 1983) Pain Symptom Drawing (Ransford, Cairns, & Mooney, 1979)
Workstation assessment and adjustments	Workstation Self Evaluation & Adjustment Questionnaire
Perception of ergonomic knowledge	Ergonomic Knowledge and Self Measurement Scale
Ergonomic risk exposure	Workstation Analysis (State of Washington Department of Labor and Industries, 1997)
Education satisfaction	Education Satisfaction Survey
Perception of barriers and facilitators	Guided interview questions

4.5.1 Demographic Profile (Appendix E)

A data collection tool was designed to gather information about age, gender, status of employment (full time or part-time) and length of time employed at Health Links – Info Santé.

4.5.2 Workstyle Questionnaire Short Form (Appendix F)

The Workstyle Questionnaire Short Form (WQ – SH) (Dane et al., 2002) is a 32

item pencil and paper questionnaire which comprises ten subscales that the authors propose underlie the construct of workstyle. Workstyle is defined as one's behavioural, cognitive and physiological response to increased work demands; it has been proposed to explain the link between ergonomic and psychosocial factors in work-related upper extremity symptoms (Dane et al., 2002). The subscales of the WQ-SH address the individual's response to working through pain, social reactivity, workplace support, deadlines, self-imposed work pace, breaks, mood, pain, autonomic response, and numbness and tingling. The minimum (most optimal) score on this tool is 0. The maximum (least optimal) score on this tool is 104. A Total Workstyle Short Form score is considered to be "at risk" if the individual's score is ≥ 28. The tool has demonstrated acceptable psychometric properties in terms of high internal consistency within the subscales and test-retest reliability (Dane et al., 2002).

The WQ-SH tool was selected for this study because it captures relevant individual data regarding employees' perceived psychosocial and physical risk factors in the work environment.

4.5.3 Visual Analogue Scale for Pain (Appendix G)

The Visual Analogue Scale for Pain (VAS- Pain) requires participants to indicate his/her experience of pain a 100 mm line anchored at one end with "no pain" and on the other end with "pain as bad as it could be" (Huskisson, 1983). The minimum (most optimal) score on this tool is 0; the maximum (least optimal) score on this tool is 100. The VAS - Pain was chosen for this study as it offered an efficient pain reporting system before and after the intervention program. This measure has been determined as a valid and reliable measure of an individual's perception of pain (Huskisson, 1983).

4.5.4 Symptom Drawing (Appendix G)

To determine the location of a primary and secondary area of a pain, indicated up to two areas of discomfort on a body drawing (Ransford, Cairnes & Mooney, 1979).

4.5.5 Workstation Self-Evaluation and Adjustment Questionnaire (Appendix H)

The Workstation Assessment and Adjustment Questionnaire is a two-item pencil and paper tool that requests participants to indicate the frequency with which they complete two key behaviours: assessing their workstation components and adjusting the workstation components at the beginning of the shift. The minimum (most optimal) score is two; the maximum (least optimal) score is eight. This tool was created as the literature supports that employees using multi-user workstations benefit from adjusting the workstation to match their needs (Demure et al., 2000). A published tool was not available which captures this workplace behaviour.

4.5.6 Ergonomics Knowledge Self Measurement Scale (Appendix I)

The Ergonomics Knowledge Self Measurement (EKSM) is a pencil and paper questionnaire which requires participants to rate their current level of ergonomics knowledge in five key content areas. These include the principles of neutral body positions, workstation set-up and adjustments to promote working in neutral positions, the benefits of regular position changes and workstation breaks, and the use of ergonomic tools to improve comfort at the workstation. These content areas match the principles that have been identified as relevant in the literature (Bettendorf, 1999; Gatty, 2004); information related to the content areas was presented to both intervention groups. Five statements were provided; participants were requested to rate their response on a 7 point Likert scale anchored at one end with "strongly disagree"(1) and on the other end with "strongly agree"(7). The minimum (least

optimal score) is five; the maximum (most optimal) score is 35.

The EKSM was developed for this study as the literature supports that employees' perception of their knowledge is predictive of their likelihood of feeling empowered to make workplace changes (Karasek & Theorell, 1990), however a published tool that captured this information was not available.

4.5.7 Workstation Analysis (Appendix J)

The Workstation Analysis tool determines the participants' ergonomic risk exposures. The checklist guides the investigator's observations of individual workstation in seven main areas: keyboard, input devices, monitor, other office equipment, chair, and workspace (State of Washington Department of Labor and Industries, 1997). In each category, the investigator responds to a set of dichotomous questions that determine if optimal ergonomic workstations conditions are achieved. Each "no" response is recorded as a "workstation ergonomic risk"; the tool is scored by adding the number of risks identified in all areas. The minimum (optimal) score is zero; the maximum (least optimal) score is 37. This is not a standardized tool; however, it was chosen as it has been used in related studies (Dane et al., 2002). Prior to initiating the project, the tool was piloted by the investigator and found to be a thorough assessment of relevant workstation ergonomics risk exposures in the contact centre environment.

4.4.8 Education Satisfaction Survey (Appendix K)

The Education Satisfaction Survey tool was created to gather participant feedback regarding satisfaction with the education intervention; a published tool was not available. Two statements were provided; participants were requested to rate their response on a 7 point Likert scale anchored at one end with "strongly disagree" (1) and on the other end with

"strongly agree" (7). The minimum (least optimal) score is 2; the maximum (optimal) score is 14.

The statements were:

1. This education session addressed my specific ergonomic education needs.
2. This session provided me with information to help me improve my safety and comfort at work.

As well, employees were encouraged to provide additional feedback with the following two open ended prompts:

1. What I liked best about this education session:
2. What I would have preferred in this education session:

4.5.9 Semi-Structured Interview Guiding Questions (Appendix L)

After the individual follow-up quantitative data collection, a semi structured interview was conducted by the researcher with each participant to answer questions related to whether participants felt that they had made work station adjustments or work process changes, and what factors participants identified as barriers and facilitators to making these changes. The following guiding questions were used:

- Did you make any adjustments to your workstation based on the ergonomics education session in which you participated?
- Did you make any adjustments to your work processes based on the ergonomics education session in which you participated?
- If you made changes, what were the factors that assisted you to make the changes?
- If you did not make changes, what were the factors that stood in the way?

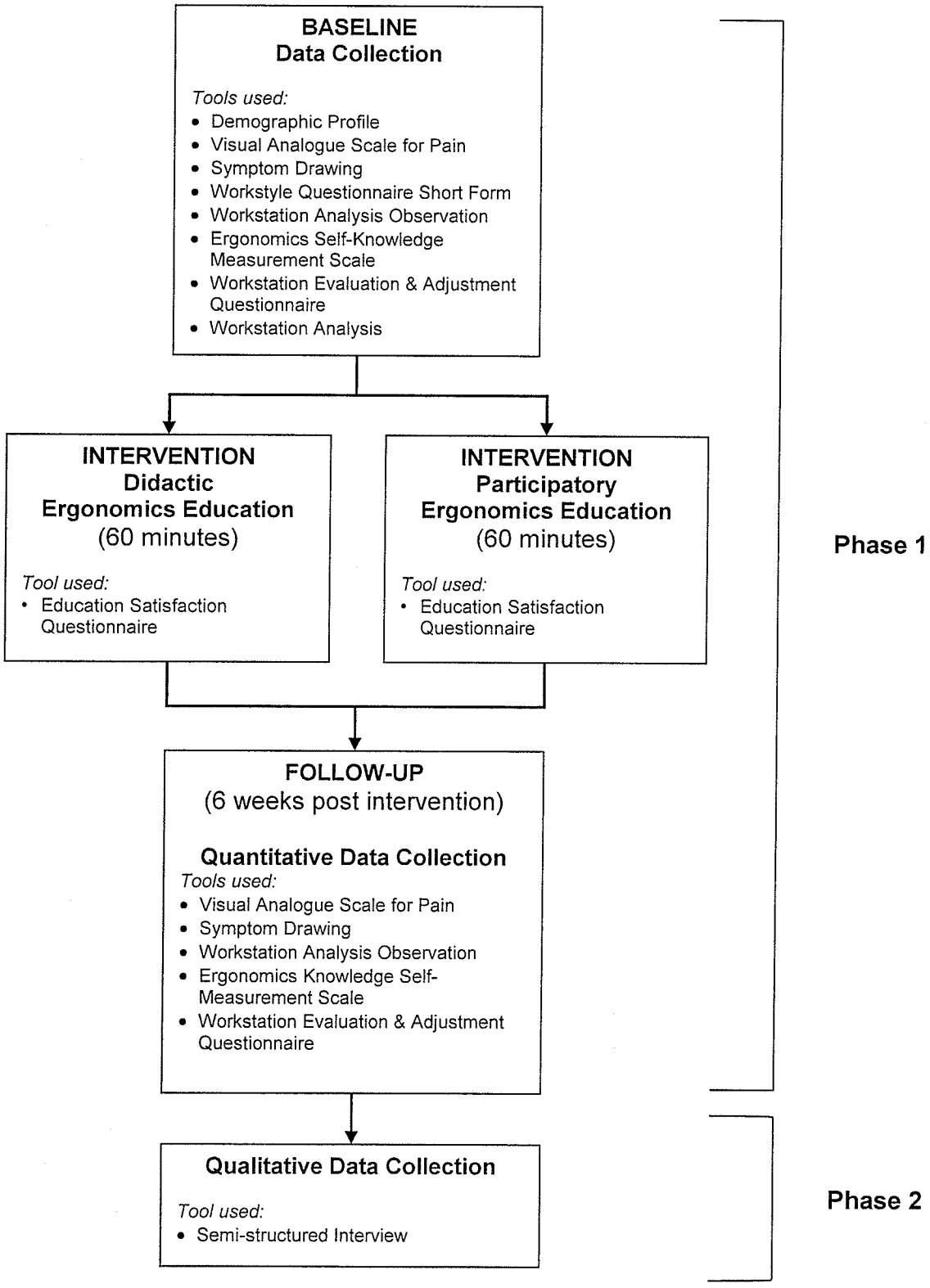
4.6 Procedure

A detailed protocol of the procedure used in the study is included in Appendix M and summarized in Figure 3. The investigator provided the Clinical and Project Manager of Health Links – Info Santé with a recruitment notice which invited all employees to participate in the study (Appendix N). A tear-off response was returned to the Clinical and Project Manager in a sealed envelope. The investigator met with all employees who indicated their interest to provide an overview of the purpose of the research study and explain the protocol. The investigator provided a copy of the Information and Consent Form to each potential participant to read and consider (Appendix O).

If employees indicated that they were willing to participate in the study, the investigator requested that the participant sign the Information and Consent Form. A Participant Summary Sheet was completed for each participant (Appendix P). Participants were requested to complete the following pre-intervention assessments: demographic profile, Workstyle Short Form Questionnaire, Visual Analogue Scale for Pain, Symptom Drawing, Ergonomic Knowledge Self Measurement Scale and the Workstation Evaluation & Adjustment Questionnaire. The investigator met with each participant at his/her assigned workstation and observed him/her completing standard work activities for approximately 15 minutes. Based on the observations, the investigator completed the Workstation Analysis observational tool.

The investigator met with the Clinical and Project Manager at Health Links – Info Santé to review the work schedule and assign participants to education groups by a coin toss. To minimize disruption to the operation of the Health Links – Info Santé service, the sessions were provided during the first or final hour of the employees' assigned shift.

Figure 3. Study Procedure



The investigator delivered the education sessions in the board room of Health Links – Info Santé or the contact centre at Health Links – Info Santé Satellite clinic at St. Boniface Hospital. Educational groups ranged in size from 2 to 7 employees. Each session was 60 minutes in duration and was delivered according to the educational outlines provided in Appendix Q. In the initial planning of this project, the intent was to provide 90-minute education sessions. This was determined to be too much time loss in the workplace; the education session plan was revised to 60-minute sessions. Content across both the Didactic and Participatory educational sessions covered the ergonomic principles including neutral work postures, workplace set-up, chair fit and adjustments, work practices, ergonomic tools and the environment as these principles are well defined in the literature (Greene et al., 2005; Martin et al., 2003; Saunders & Shultz, 1998). These concepts were also considered to be relevant in this work environment based on the ergonomic site review completed by the researcher/educator when the study was developed.

The *didactic educational session* was primarily lecture style. PowerPoint slides were used to demonstrate and reinforce the principles. At the conclusion of the session, participants were invited to ask questions or clarify the concepts. Participants were encouraged to use the content presented to make safe and positive changes related to their workstation set-up and work behaviours at Health Links – Info Santé.

During the *participatory educational session,* the content focus was a review of ergonomics principles, with an emphasis on the participants' application of these principles to their workstation. During the classroom session, interactive educational strategies were employed to engage participants in identifying ergonomic issues in their workplace, and proposing change strategies. At the conclusion of the classroom session (approximately 45

minutes), participants were instructed to return to their workstations in pairs or groups of three to review their current workstation set up and assist each other to make changes as required. The investigator functioned as a facilitator and reviewed the proposed changes with employees in the workplace. The investigator confirmed whether the changes matched the ergonomic principles reviewed in the session; the investigator did not complete the changes for the participants.

Six weeks after the educational intervention, the investigator was scheduled to meet individually with each participant at his/her workstation. This timing was determined in consultation with models in the literature for evaluating educational interventions (Street et al., 2003). The investigator observed the participant during work activities for a period of 15 minutes and completed the Workstation Analysis form. As well, follow-up measures were gathered: Visual Analogue Scale for Pain, Symptom Drawing, Ergonomics Knowledge Self Measurement Scale, and Workstation Evaluation and Adjustment Questionnaire. The investigator then met with each participant in a private room in the facility to complete a semi-structured interview using the guiding questions. Interviews were audio taped.

To ensure anonymity and confidentiality of the data collected, each participant was assigned a unique study number. Findings were anonymized to ensure that identifying information was not on reports or records that left the study site.

Raw data, tapes and transcriptions were stored in a locked, secure filing cabinet in R126, School of Medical Rehabilitation, University of Manitoba. After five years, the raw data forms and transcriptions will be shredded in the School of Medical Rehabilitation confidential shredding system; audiotapes and computer discs will be destroyed.

4.7 Data Management

4.7.1 Quantitative Data

Data collection forms were completed during the Baseline, Intervention and Follow-up components of the study. Participants were assigned a unique research number which was used on all forms. A master list of study participants was maintained. All quantitative data was entered into an Excel spreadsheet. The spreadsheet data were checked twice against the assessment forms to confirm accuracy of the data. Data was transferred to Statistical Package for the Social Sciences (SPSS) Version 14 for further analysis. All data collection forms were filed in a locked cupboard in a locked office.

4.7.2 Qualitative Data

The audio-taped interviews were transcribed verbatim into word processed, participant specific transcripts. These transcripts were transferred into the NVivo 7 qualitative analysis program for content analysis (QSR, 2006).

4.8 Data Analyses Plan

4.8.1 Quantitative Data Analyses Plan

The statistical analyses of the quantitative data was planned to include the procedures outlined on Table 2.

Table 2. Data Analysis and Statistical Procedures Plan

RESEARCH HYPOTHESIS	DATA USED	PROPOSED STATISTICAL PROCEDURE (alpha $p \leq 0.05$)
1. There will be no difference in the two groups prior to educational intervention on demographic variables such as age, gender, length of employment, equivalent full time status (EFT), role, workstyle response, location and intensity of pain.	**Demographic variables:** - age - length of employment - EFT *(interval data)*	Unpaired t-test, 2 tailed
	- gender - role - pain location *(nominal data)*	Chi-square test
	- Visual Analogue Scale for Pain *(interval data)*	Unpaired t-test, 2 tailed
	- Workstyle Short Form Questionnaire *(ordinal data)*	Mann-Whitney rank-sum test
2. There will be a difference in the two groups following the intervention on study measures related to ergonomic knowledge, self reported behaviours, and objective workstation evaluations, and pain scores.	**Pre-post change on:** - Ergonomic Knowledge and Self Measurement Scale - Workstation Self Evaluation & Adjustment Questionnaire - Workstation Analysis *(ordinal data)*	Two Way Repeated Measures ANOVA test
	-Visual Analogue Scale for Pain *(interval data)*	
3. There will be a difference in the two groups related to satisfaction with the education experience.	**Post Intervention data:** - Education Satisfaction Survey *(ordinal data)*	Mann-Whitney rank-sum test
4. There will be a difference in the two groups related to the reported facilitators and barriers when implementing ergonomic recommendations.	- Facilitators and barriers data *(nominal data)*	Chi-square test

4.8.2 Qualitative Analysis

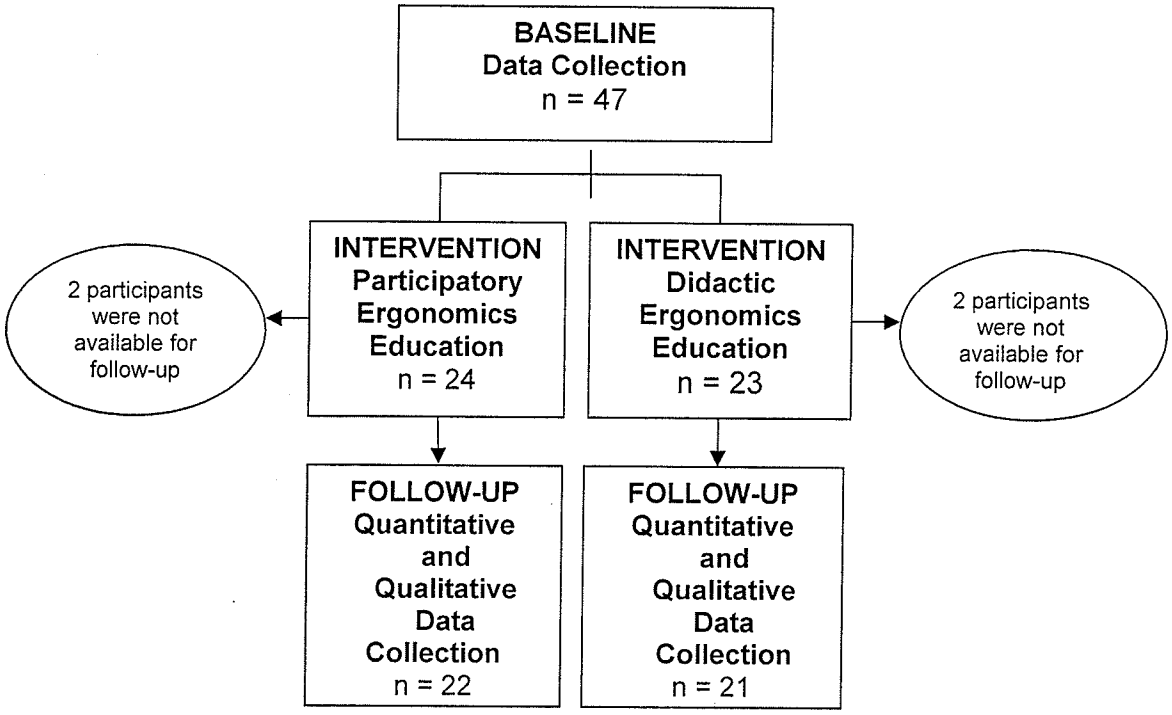
Qualitative data collected from the semi-structured interview in Phase 2 of the study were organized in four main areas: workstation set-up changes, work practice changes, barriers to implementing ergonomic strategies in the workplace, and facilitators to implementing ergonomic strategies in the workplace. Content analysis included organizing, preparing and coding data (Portney & Watkins, 2000). Themes were extracted for interpretation (Creswell, 2003). The qualitative information was used to interpret and explain the quantitative analysis, and to provide insight into the barriers and facilitators to employing ergonomic changes in this workplace.

5.0 RESULTS AND DISCUSSION

5.1 Study Participants

At the outset of the study, 47 employees of the provincial contact centre enrolled and participated in the baseline data collection and intervention. At the follow-up data collection point, four participants were not available. One participant was on maternity leave and three participants were no longer working at Health Links - Info Santé. Two of the non-completers were from the Didactic Education Group, and two were from the Participatory Education Group. The results section will present the data of the 43 participants who completed Phases 1 and 2 of the study as outlined in Figure 4.

Figure 4. Study Participants



5.2 Quantitative Results

5.2.1 Hypothesis 1

There will be no difference in the two groups prior to the educational intervention on demographic variables such as age, gender, length of employment, equivalent full time status (EFT), role, workstyle responses, location and intensity of pain.

5.2.1.1 Demographic Profile of Participants

Table 3. Demographic Data

	All Participants N = 43	Didactic Education Group N = 22	Participatory Education Group N = 21
Age			
Mean ± SD	48.6 ± 7.6 years	48.6 ± 7.3 years	48.5 ± 8.0 years
Range	26 - 60 years	26 - 59 years	35 - 60 years
Gender			
Female	40 (93%)	21 (95%)	19 (90%)
Male	3 (7%)	1 (5%)	2 (10%)
Length of Employment Mean ± SD	43.8 ± 35.3 months	44.7 ± 38.4 months	42.7 ± 32.4 months
EFT Mean ± SD	.682 ± .26	.645 ± .27	.719 ± .25
Role			
Nurse	38	20	18
Service Navigator *	2	1	1
Business Analyst	1	1	0
Receptionist	1	0	1
Manager	1	0	1

* non-clinical employees who provide health resource information over the telephone

As shown in Table 2, there was a similarity in the composition of the two groups. The mean age of the Didactic Education Group did not differ significantly from that of the Participatory Education Group ($t(41)=.09$,ns). The proportion of men and women in the two Groups was similar and the mean length of employment at Health Links – Info Santé across the two groups was also very similar, $t(39)=.18$,ns. The Equivalent Full Time (EFT) status of the Didactic Education Group did not differ significantly from that of the Participatory Education Group, (t(41)=-.93. The employment status of the Didactic Education Group did not differ significantly from that of the Participatory Education Group, $t(40)=-.92$, ns. in the workplace. Participants were employed in five work roles in the environment: nurse, service navigator, business analyst, receptionist and manager. Again, the distribution of roles was similar across the two groups and statistical testing was not completed due to size limitations

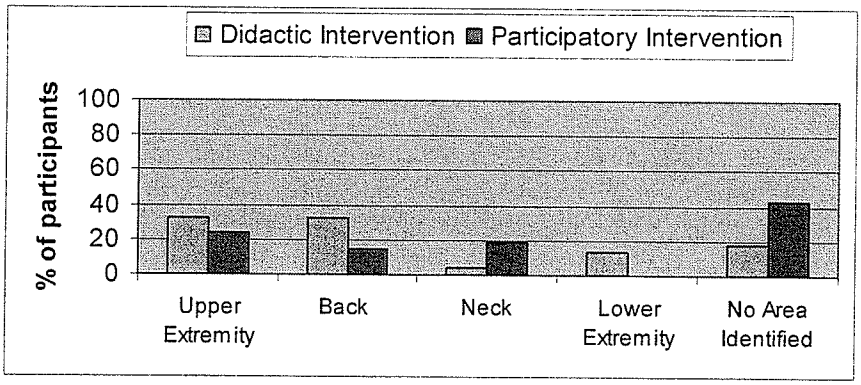
5.2.1.2 Location of Pain

Participants were requested to indicate what pain they are most aware of in the workplace by shading an area of a body drawing. They were instructed to identify their primary site of discomfort and secondary site of site of discomfort, if relevant. This data was coded initially according to the site indicated by the participant. To simplify the analyses, the categories were subsequently collapsed and the data was re-coded. Recoding was checked by an independent evaluator. The data analysis below represents the re-coded data.

When identifying the primary site of pain at the baseline data collection point, 31 of the 43 (72.1%) participants indicated that they currently had pain; 12 (27.9%) participants indicated that they did not currently have pain. Although slightly more

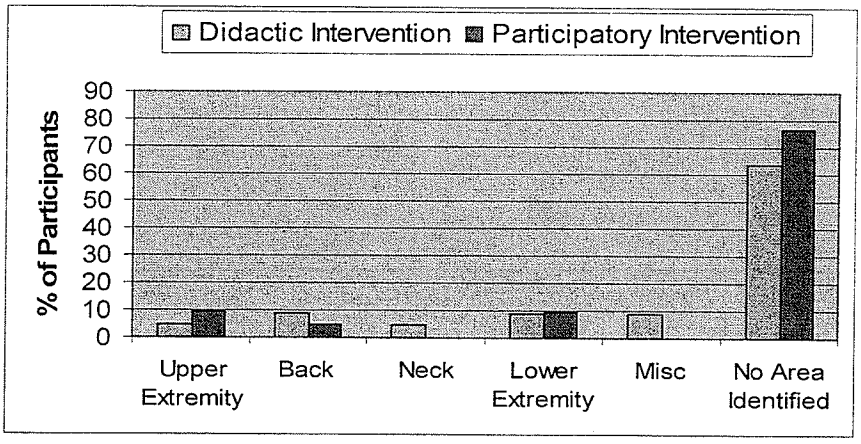
participants in the Didactic Education Group reported pain relative to the Participatory Education Group (18 vs. 13), this was not statistically significant, $\chi^2(1, N = 43) = 2.12$ as noted on Figure 5.

Figure 5. Primary Pain Site at Baseline



When identifying the secondary site of pain at the baseline data collection point, 14 of the 43 (32.6%) participants indicated that they had a secondary site of pain. Of this group, 8 were in the Didactic Education Group, and 6 were in the Participatory Education Group. This difference was not statistically significant, $\chi^2(1, N = 43) = .3$. At baseline, 29 (67.4%) participants indicated that they did not currently have a secondary site of pain. The secondary site distribution is noted on Figure 6

Figure 6. Secondary Pain Site at Baseline

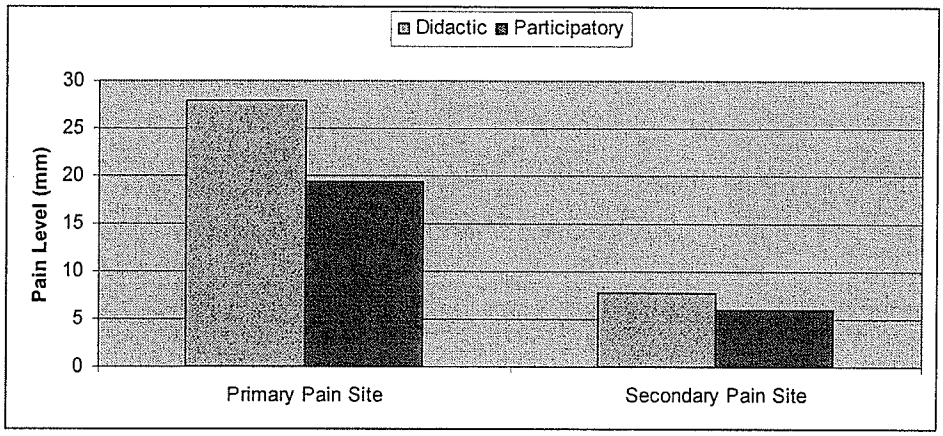


The distribution of primary and secondary pain sites was similar in both the Didactic and Participatory Education Groups. The small numbers within specific sites precludes statistical comparison of the groups.

5.2.1.3 Intensity of Pain

To complete the Visual Analogue Scale for Pain, participants are requested to mark their experience of pain on a 100 mm line which is anchored at one end with "no pain" and on the other end with "pain as bad as it could be" (Huskisson,1983). Participants were instructed to identify the intensity of their pain at the primary site of discomfort and secondary site of site of discomfort, if relevant. This is noted on Figure 7.

Figure 7. Visual Analogue Scale for Pain at Baseline



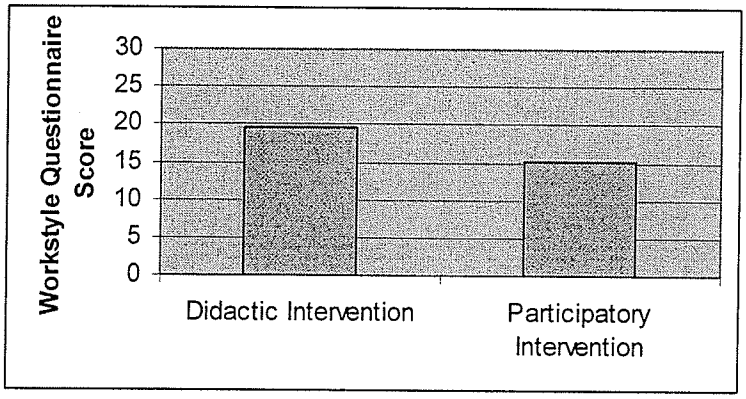
The Didactic Education Group reported a higher level of pain than the Participatory Education Group at both the primary and the secondary sites, however the difference was not statically significant in either the primary or secondary site. At the primary site, $t(41) = 1.23$, n.s.; at the secondary site, $t(41) = 0.42$, n.s.

5.2.1.4 Workstyle Questionnaire Short Form

The Workstyle Questionnaire Short Form was used as a baseline measure of the participants' behavioural, cognitive and physiological response to work demands.

The overall score of the test was compared between the groups. Neither the Didactic nor the Participatory Education Group had an overall median score that exceeded the threshold defined by the test as an indication of perceived psychosocial and physical risk in the work environment, that is, scores equal to or greater than 28 (Dane at al, 2002). The difference between the total score of each group was not significant. Mann-Whitney $U = -1.19$, n.s. Figure 8 illustrates these findings.

Figure 8. Workstyle Questionnaire Short Form Results



5.2.1.5 Discussion of Hypothesis 1

The demographic composition of the two treatment groups was very similar in terms of age, gender, length of employment and EFT status and role. There was a non-significant difference in the group scores on the Workstyle Questionnaire; however, neither group exceeded the threshold determined to indicate psychosocial and physical risk in the work environment.

The location and intensity of pain reported at baseline demonstrated some minor, non-significant variability between the two treatment groups. Upper extremity, back pain and neck were most often noted as the sites of pain. This is consistent with the literature which identifies increasing incidence of musculoskeletal disorders of the upper

extremities (Wilkens, 2003), neck (Norman, 2005), and back (Greene et al., 2005) among computer users.

The prevalence of symptoms for different occupational groups, including contact centre employees has been reported. Karlqvist et al. (2002) reported that 57% of the men and 72% of the women working in contact centres reported symptoms in the neck/shoulder during the previous month; this was higher when compared with other groups of professional computer users (35% of the men, and 54% of the women). Health Links-Info Santé participants reported similar frequencies of pain as the contact centre-specific data listed for women above. Given that women made up 93% of the participants in this study, this is not surprising.

It is impossible to link all the reported musculoskeletal concerns of Health Links – Info Santé participants with the current work environment and task. Of note, frequently the nurse participants at Health Links – Info Santé shared anecdotally that prior to working at the contact centre, they had participated in previous physically challenging worker roles such as on heavy nursing wards or in the emergency room. Some participants indicated that they sought out employment in the contact centre environment as they perceived it as a safer alternative to "physically demanding nursing roles", or in some cases, as a form of job accommodation following musculoskeletal injuries. The presence of pre-existing musculoskeletal concerns and work history was not gathered for this study. In future research, this may be a useful addition.

5.2.2 Hypothesis 2

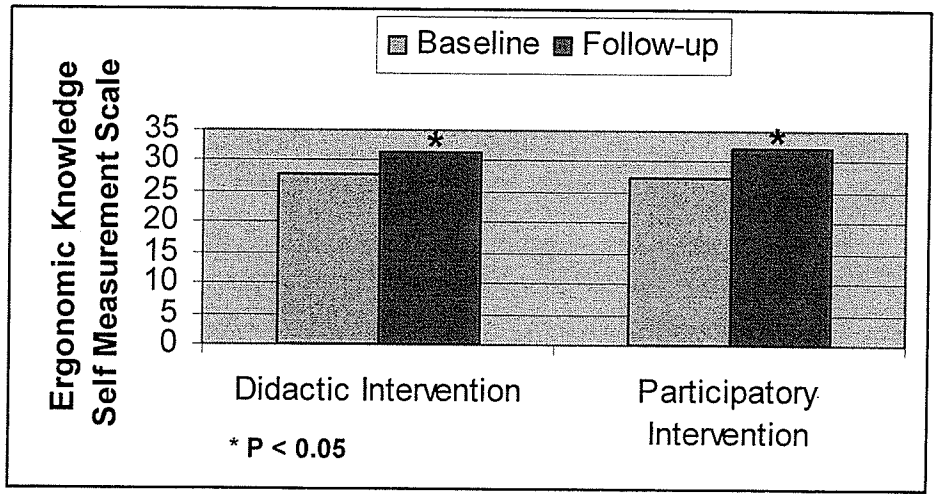
There will be a difference in the two groups following the intervention on study measures related to ergonomic knowledge, self reported behaviours, objective workstation

evaluations and pain scores.

5.2.2.1 Ergonomic Knowledge Self Measurement Scale

On the Ergonomics Knowledge Self Measurement Scale (EKSMS), participants rated their knowledge of five key ergonomic content areas measures, using a Likert Scale anchored at one end with "strongly disagree" (1) and on the other end with "strongly agree" (7). The lowest possible total score (5) indicates the participants' perception of having limited ergonomic knowledge; the highest possible score (35), indicates the participants' perception of having knowledge related to all of the ergonomic principles identified. As noted on Figure 9, at Baseline, the EKSMS scores did not differ significantly between the Didactic and the Participatory Education Groups. Following the educational interventions, participants in both groups reported significantly increased perception of ergonomic knowledge.

Figure 9. Ergonomic Knowledge Self Measurement Scale



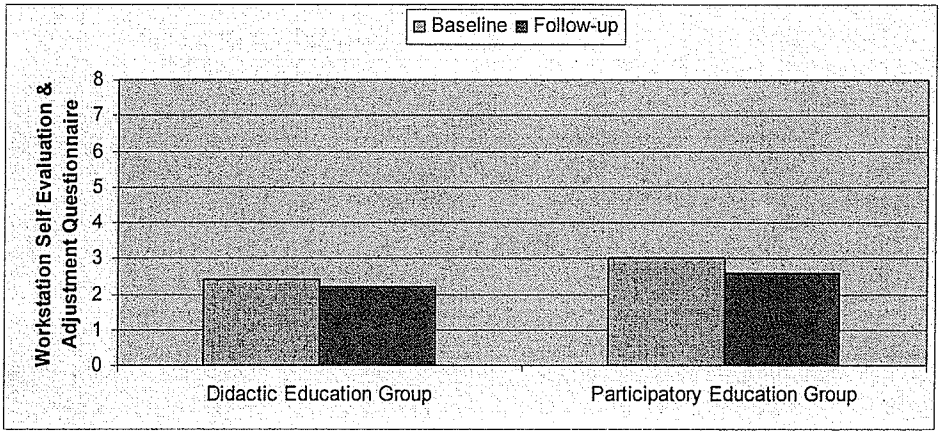
The Repeated Measures Analysis of Variance showed that there was a significant within group difference from baseline to follow-up $F(1, 41) = 43.62$, $p < 0.001$. However, the group by time interaction was not significant $F(1, 41) = 0.842$, ns. Thus, the

improvement displayed from baseline to follow-up did not differ between the groups.

5.2.2.2 Workstation Self Evaluation and Adjustment Questionnaire

The Workstation Assessment and Adjustment Questionnaire was completed at Baseline and Follow-up. Participants reported their perception of the frequency of two specific behaviours: evaluating the workstation and adjusting the workstation. The optimal performance score on this measure (2) indicates frequent evaluation and adjustment (i.e. at the beginning of each shift); the least optimal score on this measure is eight (8), indicating the participant never evaluates or adjusts their workstation. The mean scores at baseline indicated that participants in both groups perceived that they frequently evaluate and adjust the workstation. When the measure was repeated at the Follow-up data collection point, scores improved slightly, indicating increased frequency of use of these safe work behaviours. Results are noted in Figure 10.

Figure 10. Workstation Self Evaluation & Adjustment Questionnaire



The Repeated Measures Analysis of Variance showed that there was no significant within group difference from baseline to follow-up $F(1, 41) = 2.909$, ns. As well, the group by time interaction was not significant $F(1, 41) = 0.475$, ns. Thus, while the follow-up scores showed improvement, this was not significant, and this did not differ

between the groups.

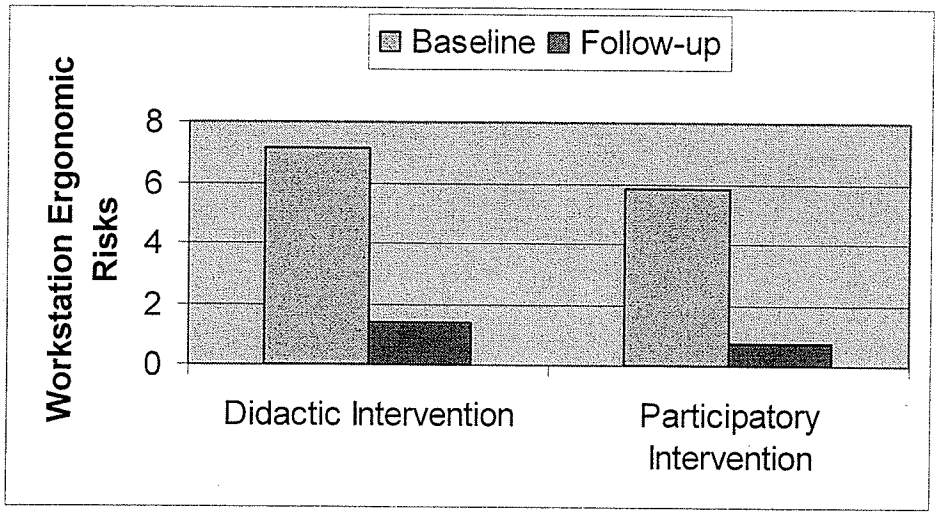
5.2.2.3 Workstation Analysis

The Workstation Analysis observation tool was used to determine participants' ergonomic risk exposure. The following aspects of an individual's workstation were evaluated: keyboard, input devices, monitor, other office equipment, paper documents, chair, and workspace. A checklist guided the investigator's observations (via dichotomous responses to optimal and neutral workstation set-up concepts); the sum of ergonomic risks noted for each participant was determined. The most frequent ergonomic risks in each intervention group were related to:

- Keyboard position (e.g. not positioning the keyboard to promote neutral upper extremity posture; "hiking" shoulders when using the keyboard)
- Monitor position (e.g. monitor too high or too low, requiring the neck to be sustained in a non-neutral position)
- Chair use (e.g. improper chair size relative to the stature of the participant, backrest not properly positioned, feet not adequately supported on the floor or footrest, less than optimal seat pan depth, poorly positioned armrests)

Following the intervention, both the Didactic and Participatory Education Groups demonstrated improvement, in that they more frequently set themselves up in neutral positions with a reduction in the ergonomic risk. This is summarized in Figure 11.

Figure 11. Workstation Ergonomic Risks

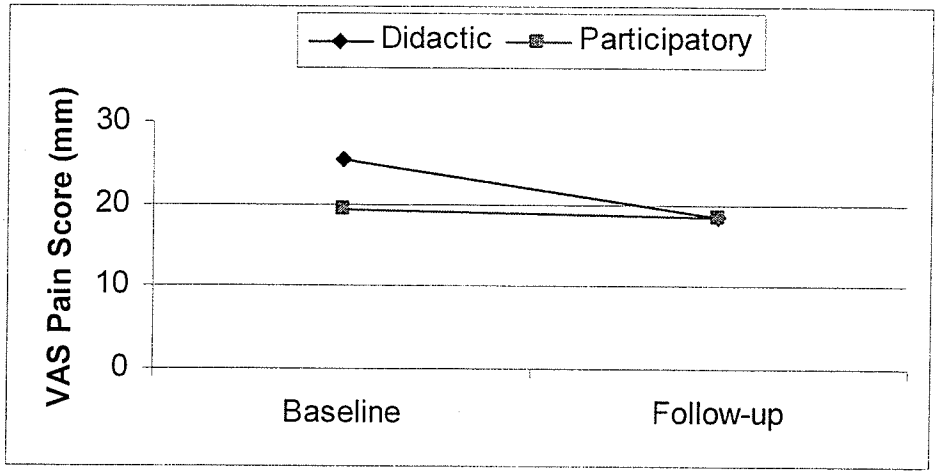


Six weeks following the educational intervention, both groups had significantly improved scores. The Repeated Measures Analysis of Variance showed that there was a significant within group difference from baseline to follow-up $F(1, 41) = 150.21$, $p < 0.001$. However, the group by time interaction was not significant $F(1, 41) = 0.46$, ns. Thus, the improvement displayed from baseline to follow-up did not differ between the groups.

5.2.2.4 Visual Analogue Scale for Pain

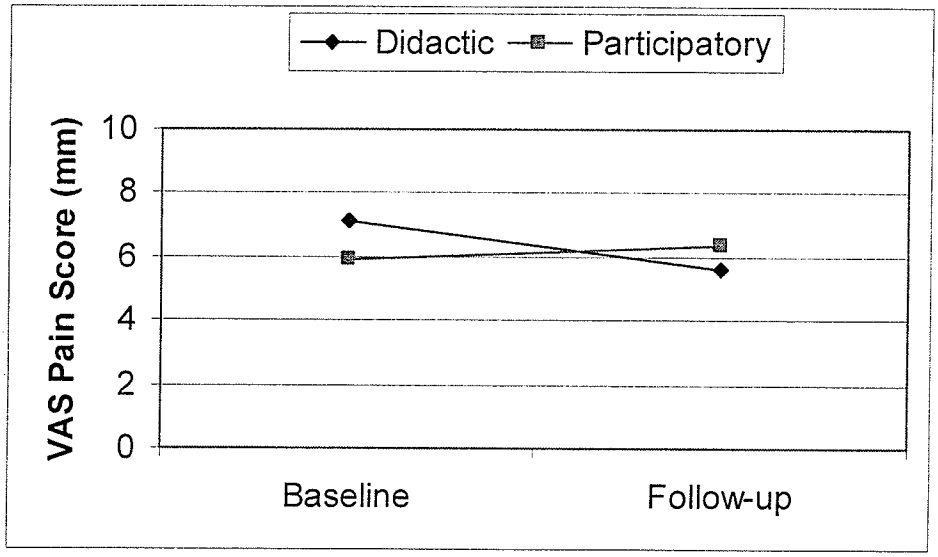
The Visual Analogue Scale for Pain was re-administered at the Follow-up data collection point. Participants were instructed to identify the intensity of their pain at the primary site of discomfort and secondary site of site of discomfort, if relevant. These findings are summarized in Figure 12 and 13.

Figure 12. Primary Pain at Baseline and Follow-up



The Repeated Measures Analysis of Variance showed that there was no significant within group difference from baseline to follow-up $F(1, 41) = .40$, ns. As well, the group by time interaction was not significant $F(1, 41) = 0.91$, ns. Thus, the follow-up scores showed no improvement, and this did not differ between the groups.

Figure 13. Secondary Pain at Baseline and Follow-up



The Repeated Measures Analysis of Variance showed that there was no significant within group difference from baseline to follow-up $F(1, 41) = .01$, ns. As well, the group by

time interaction was not significant F (1, 41) = .01, ns. Thus, the follow-up scores showed no improvement, and this did not differ between the groups.

5.2.2.5 Discussion of Hypothesis 2

While it was anticipated that the Participatory Education Group would show significantly greater improvements than the Didactic Education Group on a number of measures; this was not so. However, the results provided evidence that ergonomic education intervention, regardless of the style of delivery, had a positive effect on the worker's perception of ergonomic knowledge, adoption of safe work strategies, and use of more neutral alignment workstation set-up strategies.

This finding is consistent with a study reported by Bohr (2002) who tested these two educational styles at a reservation call centre. Those who took part in the participatory education intervention reported a significantly better perception of their health status than those in the control group or traditional (didactic) education group; however, in other measures, there were no significant differences between the participatory and the traditional educational groups.

The current study built on a number of the features of Bohr's work. One important difference in the methodology was the length of the educational intervention. Bohr (2002) delivered the traditional education session in 60 minutes; the participatory intervention was delivered in 120 minutes. Since educational interventions are offered in work environments where the "bottom line" is a consideration, this difference may have unfairly influenced decision-making. As the Bohr (2002) study did not demonstrate differences in measures related to participants' work area configuration or work postures, the conclusion of some stakeholders might be to provide the most cost effective intervention; according to Bohr

(2002), this would be didactic educational methods. If Bohr's study had demonstrated significant differences, it would not have been possible to determine whether the dose or the method was the change factor. The current study modified the method to ensure that the educational programs were delivered for the same time (60 minutes).

The workstation analysis measurement was a central evaluation component of the current study and a number of previous workplace intervention studies (Bohr, 2002; Greene et al., 2005; Brisson et al., 1999; Rempel, 2006). Authors have noted that it is not enough for employees to simply use "ergonomically designed workstations"; rather employees must adjust their environment to ensure that they are in good alignment at their workstation and use safe work practices in order to have low risk for injury (Greene et al., 2005). In the current study, given that the worksite and work tasks did not change between the Baseline and Follow-up measures of this study, the improvements (i.e. less ergonomic errors noted in both groups) that were noted can be attributed to changes in work behaviour.

The change in the pain scores (primary and secondary), reported by both intervention groups in this study was not significant. While a number of intervention studies have demonstrated significant changes in the intensity of musculoskeletal symptoms following ergonomic training (Brisson et al., 1999; Ketola et al., Greene et al., 2005), the baseline pain profile of participants in the studies cited exceeded the baseline pain profile of the participants in the current study resulting in less room for improvement in pain scores.

5.2.3 Hypothesis 3

There will be a difference in the two groups related to satisfaction with the education experience.

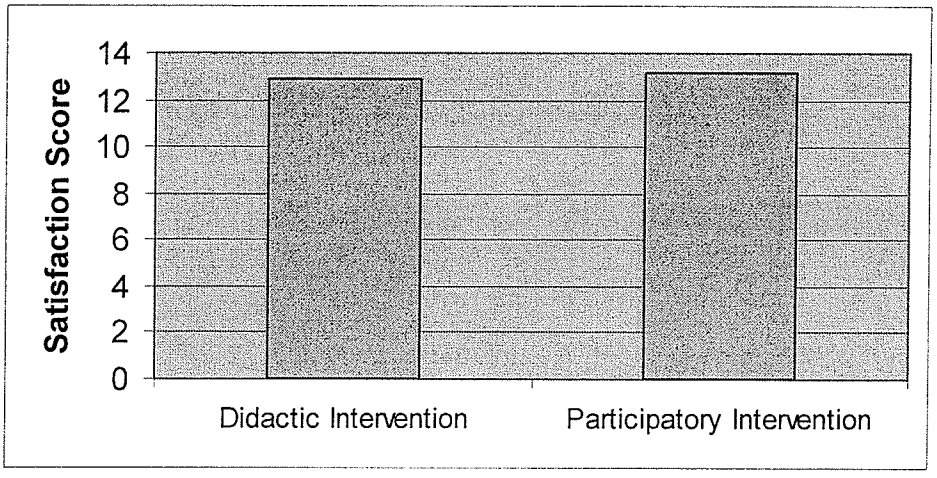
5.2.3.1 Education Satisfaction Survey

Participant feedback on the educational sessions was collected using the Educational Satisfaction Survey. Participants rated two statements on a seven-point Likert scale from 1 (indicating "strongly disagree") to 7 (indicating "strongly agree"). The statements were:

1. This education session addressed my specific ergonomic education needs.
2. This session provided me with information to help me improve my safety and comfort at work.

Participants in both the Didactic and the Participatory Educational Groups reported a very high level of satisfaction with the sessions; the Participatory Education reported a slightly higher level of satisfaction than the Didactic Education Group; however, there was no significant difference between these scores, $t(40) = .0.38$, n.s. The results are represented in Figure 14 where the highest level of satisfaction is 14.

Figure 14. Education Satisfaction Survey



In addition to the quantitative responses requested following each educational session, participants were encouraged to provide written feedback to two open ended

prompts on the Educational Satisfaction Survey. The two prompts were: *"what I liked best about this education session"* and *"what I would have preferred in this education session"*.

Didactic Education Group

When responding to the prompt "*What I liked best about this education session*", responses from participants in this group were captured in two themes:

- *Presentation Style*: "friendly manner that the information was provided", "personable presenter", "good rapport with presenter", "auditory and visual presentation allowed for discussion and questions", "informal", "interactive" and "relaxed atmosphere".
- *Helpful information:* "relevant to current work", "reinforced my knowledge of proper ergonomics", "overall good review and good suggestions", "seemed quite comprehensive about workstation basics" and "very thorough and informative".

When responding to the prompt: "*What I would have preferred in this education session"* responses from participants in the didactic group, 7 respondents (33%) indicated that in addition to having the general principles outlines, they would have preferred further interaction, demonstration and practice. These comments included:

- Individual assessment, addressing problems at the workstation and ways to improve
- That the instructor would have shown me how to make the changes
- Reviewing our specific needs i.e. set-up assessed and what changes should be implemented
- Demonstrating at an actual workstation while learning proper posture, technique

etc

- Maybe small Group education sessions to have an opportunity to share questions and/or experiences, practices.
- Some adjustment in front of a computer, as well as overhead learning
- Hands on set-up of my workstation to get a neutral position

Participatory Education Group

When responding to the prompt "*What I liked best about this education session*", responses from participants in this Group were captured in two themes:

- *Interactive & "Hands-on" presentation format*: "hands on observation and adjustment with colleagues", "it was very hands-on", "opportunity to custom design my workstation", "enjoyed help with proper set-up with the workstation", "individualized", "very practical" and "lots of fun"
- *Relevant information:* "reminder of neutral postures", "relates to my environment", "good ideas to help with our workstations", and "updated my knowledge of computer ergonomics".

When responding to the prompt: "*What I would have preferred in this education session"* responses from the Participatory Education Group consistently reiterated that they were very satisfied. In addition, suggestions included utilizing:

- Pictures to demonstrate different positions to try; and
- More "hands on" learning strategies.

5.2.3.2 Discussion of Hypothesis 3

Regarding satisfaction with the educational sessions, both the Didactic and the Participatory Education Groups rated their experience very positively. When

considering the participants' response to the open ended prompts, more distinctions between the groups' experiences were apparent.

When the Didactic Education Group was asked to identify what was positive about the session, comments focused on the presenter's style and the comprehensiveness of the information delivered. Participants did not explicitly address how or if they would apply the concepts to which they had been exposed. When asked to suggest what else they would prefer in the educational process, many respondents (33%) in the Didactic Education Group identified more interactive and hands-on learning strategies, including demonstrating and adjusting at the worksite and small group interactive learning.

When the Participatory Education Group was asked to identify what was positive about the session, comments were related to how the method of delivering the information led to hands-on practice at workstation adjustments. The Participatory education sessions were reported to be very practical; respondents noted that it promoted their confidence in their ability to adjust to a "proper set-up" of their workstation. Fewer participants in this group (2), provided a response to the prompt regarding what would be preferred in the education session.

While the positive educational satisfaction responses are heartening, the process of collecting this data may have been problematic. Participants completed the survey directly following the educational session. The researcher/educator distributed the survey and requested the participants to complete it and place it in an envelope that was located at the back of the room. Given the researcher's proximity, and the small size of the education groups, the participants may have been concerned that their

comments and ratings could be linked to them individually. As well, at the point that the Satisfaction Survey data was collected, the researcher/educator had spent considerable time at the worksite collecting the pre-intervention data. Familiarity with the researcher may have altered the participants comfort with providing constructive criticism of the educational process.

In future studies, consideration may given to re-sequencing the Satisfaction Survey. In the current study, respondents initially responded to the two Likert scaled questions, and then reported on what they liked about the session, and what they would have preferred. If this order had been reversed, and respondents considered the open-ended questions first, this might have affected their responses to the Likert scaled questions. As well, given that a number of the comments related to the participants' perception of self-efficacy to apply the information in the workplace, this construct could be incorporated as an additional probe on the Satisfaction Survey. Satisfaction Survey data has not been reported by other education intervention research to date; these findings therefore add a new perspective to the literature but cannot be related to other studies.

5.2.4 Hypothesis 4

There will be a difference in the two groups related to the reported facilitators and barriers when implementing ergonomic recommendations.

5.2.4.1 Barriers and Facilitators of Implementing Ergonomic Changes

Barriers and facilitators of implementing ergonomic changes that were identified during the participant interviews were coded and counted. In addition to the qualitative analysis that will be reported in the following section, the number of reported facilitators and barriers was

compared quantitatively across the two educational groups as noted on Tables 4 and 5.

Table 4. Barriers to Implementing Ergonomic Changes

Barriers	**Didactic Intervention**	**Participatory Intervention**
Workplace, Pace and Performance Demands		
• Pace of work	6	2
• Management focus on performance	4	1
• Employee concerns re: time/speed	1	3
• Equipment issues: availability and proximity	4	3
• Job allows for minimal movement	6	3
Total	*21 (64%)*	*12 (46%)*
Knowledge Limitations		
• Not sure how to make change	2	1
Total	*2 (66%)*	*1 (33%)*
Pain		
• Ergonomic changes caused pain	3	1
Total	*3 (75%)*	*1 (25%)*
Barriers Total:	**26 (65%)**	**14 (35%)**

Table 5. Facilitators to Implementing Ergonomic Changes

Facilitators	Didactic Intervention	Participatory Intervention
Information		
• New information	9	9
• Reinforcing information/raising awareness	7	8
• Participatory nature education session	5	6
• Interacting with peers	2	7
• Interacting with facilitator	2	6
Total	*25 (41%)*	*36 (59%)*
Workplace Factors		
• Management Support	5	2
• Equipment: availability and proximity	4	5
• Readiness to learn due to job demands	3	2
• Co-workers using alternate workstation set-up	2	0
Total	*14 (61%)*	*9 (39%)*
Comfort		
• Comfort improved with ergonomic changes	3	3
Total	*3 (50%)*	*1 (50%)*
Facilitators Total:	**42 (48 %)**	**46 (52%)**

The Chi-Squared Test of Association showed that there was no association between the proportion of barriers and facilitators mentioned and the educational group $\chi^2(1, N = 43) = 2.57$, n.s.

5.2.4.2 Discussion of Hypothesis 4

Although the differences between the two groups in the frequency of reported barriers and facilitators did not meet the test of significance, there was a slight trend toward the Participatory Education Group having a greater emphasis on identifying facilitators relative to barriers than the Didactic Education Group.

5.3 Qualitative Analyses

5.3.1 Interview Themes

Participants' responses during the semi-structured interview were summarized in four general theme areas, which correspond to the four guiding questions used in the interviews. Participants discussed the changes that they made with respect to setting up their physical environment (workstation) in the contact centre at the beginning of each shift. They identified new work practices that they employed while working subsequent to participating in the ergonomic education intervention. The participants identified the factors that interfered with adopting safe ergonomic strategies and workplace behaviours. Finally, participants identified facilitators that they felt enhanced their adoption of safe ergonomic strategies and work behaviours. The framework for reporting this information is provided in Table 6

Table 6. Interview Themes

- Workstation set-up changes
- Work practice changes
- Barriers to adopting ergonomic strategies
- Facilitators to adopting ergonomic strategies

5.3.1.1 Work Station Set-Up Changes

Participants in both the Didactic and Participatory educational intervention groups

indicated that they made changes in four major set-up component areas. These included changing the location and/or orientation of the keyboard, chair/seating, monitor, and lighting. These workstation components changes will be reviewed in detail.

Keyboard

Keyboard adjustments were the most frequently identified changes reported among the participants when adjusting their workstation to promote upper extremity neutral postures at the outset of a shift. Overall, more than half the participants reported making an adjustment to keyboard positioning, however the Participatory Education Group more frequently adopted and maintained this change.

In both the Didactic and Participatory Education Groups, participants reported changing the way they position the keyboard, specifically indicating that they had adjusted their keyboard to use a negative tilt alignment. This option was introduced during the education session as an option that promotes safe, neutral positioning of the upper extremities. Such positioning was possible since all workstations at Health Links - Info Santé have fully adjustable keyboard platforms. This was an intentional design feature; however prior to the educational sessions, only one participant was noted to be using the feature to promote neutral upper extremity positioning. Some participants found negative tilt alignment an effective strategy and reported that they continue to use it:

22D: ok . . . the keyboard – I tilted it down and found that a lot better.

43D: I tilted the keyboard down, and I actually found that a lot better. Some of the other nurses said they didn't, but I found that the position helps, and I am doing that no matter where I am sitting now - tilting down by ten degrees.

20P: I think the big change for me was using the keyboard - slanting the keyboard downward and adjusting my arm so this it was in a more neutral position. It is so much more comfortable for me. Before, I was continuously up and down, the table up and down, changing my chair and arms rest - and now, I go through the whole shift and I am not fidgeting and uncomfortable.

9P: I am adjusting the keyboard into that downward tilt – of everything, that has been helpful.

29P: The other thing that I am doing consistently since you shared information with me is changing where my keyboard is. Like we talked about putting it in the negative tilt - so yeah, I find that helps a lot. So, thank you!

Participants in each group also noted that they had lowered the keyboard feet to reduce the angle of extension at the wrist required while keyboarding. This also allowed the participants to work in more neutral wrist positions:

25D: I think I tend to check what I am doing . . . and one of the things I do make sure of is that I drop the feet [that angle the keyboard "up"] from my keyboard now. I tended to have them up, now I drop them.

15 P: I changed the angle that I work with – by lowering the feet on my keyboard.

Chair/Seating

Participants in both the Didactic and Participatory Education Groups also reported that following the educational intervention they made changes in the way that they adjusted their chair in the work environment at the beginning of the shift:

42D: I adjust my chair better - I think that I might have been a little more aware of evaluating or taking a look at, is the workstation in a comfortable position?

When discussing chair adjustments, Participatory Education Group participants appeared to be more intentional than the Didactic Education Group as they related changes that they made relative to ergonomic principles:

2P: Just that I am aware that we have to adjust the chair . . . like this one is no good for me right now. I have to sit right and try and keep my spine in a neutral position . . . those kinds of things, so I am aware.

As well, Participatory Education Group participants discussed how they were able to apply their knowledge to making specific chair adjustments:

45P: It made it easier and like the chair, I knew how to lift it up and down, but I didn't know how to adjust the back.

Participatory Education Group participants indicated that they were more selective about choosing a chair at the beginning of the shift that matched their stature:

47P: Absolutely, the other chair that I started using - the smaller chair made a big difference, big difference.

38P: I am more conscious of finding a chair with a good seat and with the shoulder pads [high back].

Participants in the Didactic Education Group indicated that they were intentionally trying to achieve a safe and comfortable seated position by using a footrest:

4D: I use the footrest now - like I try to do it first - as I come on shift - instead of everything else, I get comfortable.

13D: Sometimes if my back is really bad I will use a footstool. I'm terrible, I cross my legs all the time, I know.

Participants in the Participatory Education Group indicated that they altered the position of their armrests to achieve more support:

36P: Well, I did raise the armrests so that was a better position but other than that, I think the height was ok.

Monitor

Nearly one quarter of the participants, representing both the Didactic and Participatory Education Groups, reported that they had made changes to how they

position their computer monitor at the outset of a shift to ensure that the monitor allows for neutral neck alignment:

5D: I try to put my monitor lower.

44P: Well, like I said, when [another nurse] uses my workstation, then I know how important it is to bring it right back down to the right level for me.

43D: I am making sure the monitor screen is correct - I am paying attention to that as well, so that the level, the eye level is, you know, correct.

Lighting

Lighting adjustments were reported by two participants, both from the Participatory Education Group. They referred to regularly seeking out and using the devices used to control for the glare generated by natural and florescent light in the work environment:

12P: I have started to use a glare guard after our session. I have used it for a little while - it took some time to get used to it - once you are used to it, you don't notice that it just doesn't feel weird anymore.

29P: Yeah, I find the glare guard helps a lot . . . I always preferred it, but I didn't go out of my way to get one, but now I go out of my way to get one - now it's a "must", it is part of my setting up my workstation for the shift.

5.3.1.2 Work Practice Changes

Participants identified four areas in which they had made changes to how they complete their work. These included:

- evaluating and adjusting the workstation
- changing positions more frequently
- being more aware of work positions during the shift
- stretching

"Checking it out": Evaluating and adjusting the workstation

Participants in each educational group indicated that they were now more

attentive to evaluating and adjusting their workstation at the beginning of the shift:

31D: I am certainly more conscious of how I set up.

34P: I was much more conscious of it.

The descriptions provided by participants in the Participatory Education Group showed that they adopted active and intentional strategies for evaluating and adjusting their workstation:

29P: I would say I am fine tuning my set-up. I'm sure that part of it is that I am more conscious and the set up is becoming more automatic . . . I come to work a little early and make sure I have everything like in order to be efficient and comfortable.

15P: Just when I come in – I make sure that the platform is pointed in the direction that I like . . . and I've got my mouse and keyboard set up, and the chair is adjusted . . . I am much more aware of doing that at the beginning of my shift, every shift.

"I do move around more": Changing positions more frequently

Participants in both educational groups reported that they were trying to creatively change their work position frequently throughout their shift by standing during or between calls, reaching out of the seated position to retrieve frequently used work items, and walking around the workplace:

24D: . . . I make a point of getting up quite often throughout the shift, even for two minutes. I drink a lot of water, so of course then you use the bathroom a lot . . . now make a point of standing up, doing the stretch and a walk around my station, looking out the window – instead of sitting planted in the chair the whole time.

33D: I do [move around] a lot, in between calls . . . It's been busy today, so I haven't got up as much but like, even between calls, it's quiet I try to stand up just to do my little pirouettes!

29P: . . . You gave us tips, since it is such a sedentary type of job, to keep some items out of reach . . . so I'll stand to grab my water bottle while I am waiting for my screen to close out, before I start the next call . . .

38P: That's the one thing that I am doing now that I wasn't doing before. I'll walk over to the window and adjust the blinds or something . . . and I didn't used to do that – I would sit planted - so now I am more cognizant that sometimes I just need to stand up.

8P: I do move around more.

"Paying attention": Awareness of work positions

Participants in both educational groups indicated that following the office ergonomic education sessions, they were more attentive to the work positions that they assume during the workday:

19D: I think that I am more cautious when I am at the filing cabinet because we are back and forth all day long . . . and it is so low to the ground and so, having reviewed some of the ergonomics, I'm trying to be more careful with what I do with my knees, and my lower back, and my neck.

33D: I try to be aware, you know, like making sure that I am sitting properly, making sure the screen is at the right level, that kind of stuff you know, trying to make things better . . . so I make a conscious effort of making sure that I am sitting properly, that I am not slouched over, you know, and that makes a difference.

36P: I try to be more conscious of when I am multitasking - writing and looking at files - I try to be more conscious of being in a good position.

"Stretching"

A few participants in both educational groups reported that they were more frequently and consciously stretching during their shift. This was reported as primarily occurring between calls.

37D: Other times during the call, you know, depending on the call, I kind of move a little bit or you know, stretch with my legs. During a call, really we don't have the ability to move around as much, but in between calls we do.

42 D: ... doing some stretches, getting up even if not going for a walk but doing some stretches and that – more often . . .

45P: I used to stretch, but maybe it would be every two to three calls - and now I do it more.

Most often, stretching was a strategy that workers reportedly employed independently, although some workers (in the Didactic Education Group) indicated that they sought out opportunities in the work environment to do a stretching routine together:

> *21D: I think I am more conscious of getting up and stretching, depending on who's on, you know, some of us tend to do a set of stretches together when we are working together. . .*

5.3.1.3 Barriers to Implementing Ergonomic Changes

Participants indicated that there were barriers to implementing some of the ergonomic changes that were suggested during the Office Ergonomics Education intervention. Barriers were divided into several theme areas as: workplace, pace and performance; knowledge limitations; pain. Each of these themes was further divided into sub-categories that will be reviewed below:

Workplace, Pace and Performance Expectations

Pace of the calls: "The calls are non-stop!"

Participants in both groups reflected that the work environment and job demands allow for very little worker control, however this idea was presented more frequently and vigorously in the comments from the Didactic Education Group. Specifically, Didactic Education Group participants referred to the unpredictable volume of the calls to the contact centre. Some participants perceived that their only viable opportunity to move out of the seated position to stretch or alter positions was when there is a "pause" in the pace of the calls:

> *D3: Well, I guess it's just the kind of work that we do, you know, its actually not conducive to a lot of time away from the phone. I mean, having said that though, we can get up, as long as it's not really busy, so I think if the calls come in and we*

have thirty seconds between call, if we can stand up and sort of do whatever, but there are times that the calls are <u>non-stop</u> [participant emphasis] and so you kind of have to take one after the other and that makes it difficult.

D37: Yeah, so it's kind of that, and you are, you know, going to get within a call time, right, where we've got, we're supposed to do calls in under ten minutes. There are supposed to be five to six calls an hour, so and then the calls are coming in which we don't have control over, so there is three big things that we don't really have control – we feel our injuries are related to that.

D4: Usually there is a break [in the calls] in the morning – I would get up and do, you know, I would rotate my shoulder. But today because it was, when I came on, it was quite steady and then other things, you know, you read the memos and everything it sort of slipped my mind . . . but other than that, no . . . I think the pace of the calls gets in the way.

Participants in both educational groups noted that the pace of the calls limited their ability to try out alternate strategies since they would take some time to adjust; the pace of the calls would not allow for this adjustment:

19D: I tried with the tipped keyboard and I just couldn't or wouldn't work for me. Maybe if I was able to have time where I wasn't taking calls I could practice with it, but I remember the day that I set it up, I just gave up.

2P: Well, I was willing to try the tipped keyboard, when I was told it is a good thing, especially to prevent the carpal tunnel thing . . . but with my vision, or it's just my glasses - it would take me an hour to just not have a call to get used to it. I haven't chosen to come in an hour early to play with that.

Emphasis on Performance: "Mixed Message from Management"

Participants frequently acknowledged that in general, the physical environment of the workplace was designed for comfort and that there are messages from the management to employ safe and healthy strategies at the contact centre. However, the pressure of performance, with respect to achieving time-related performance targets during each shift, was seen to present an opposing and conflicting message.

This reflection was much more frequently and intensely described by participants in the Didactic Education Group:

> *22D: Sometimes though, we get two messages – one is be careful, be safe, be sure to stretch – the other message is take more calls. It's hard to know.*
>
> *25D: well, they do want you to take call after call, right? They don't want you to stop – so in a way, that would be nice if they said, ok, you've less calls but you need to stretch – but they watch the time that you aren't available to take calls . . . it's an expectation to take calls as much as you can within the hours that you are working.*
>
> *3D: oh yeah, for sure time, time is always one of the things in the back of your mind.*
>
> *43 D: I usually get up and walk to the washroom or something – just log out. I mean, they encourage us to get up and do that, on the other hand, when there's lots of calls on the queue, there's also pressure to get it.*
>
> *P34: I do stretch and move more, obviously when the phones are quiet, especially what I noticed is that if we have a really busy day, all my good intentions go out the window.*
> *Interviewer: so, it's hard to take care of yourself if it is busy?*
>
> *P34: yeah, the message is "go, go, go"*

Equipment Issues

Participants in both the Didactic and Participatory Education Groups indicated that their ability to follow through on some of the ergonomic strategies presented in the educational sessions was limited because the equipment required to promote good positioning in the contact centre was not available:

> *37D: So there again, you know, if you are wanting to have the ability to stand up and keep working, we really don't have the right equipment for that. I know it is out there [in the marketplace], but it's likely very expensive.*
>
> *17P: I had talked to you about how I would really like to try using a mouse bridge, because I'll find I always feel a bit of strain in my arm just from having to reach over there and mouse, but I obviously have not tried one because there doesn't seem to be one available.*

Another participant indicated that the amount of equipment that was available in the contact centre was not adequate for the number of potential users of the equipment. In addition, the question of the functionality of the ergonomic equipment was raised:

> *9P: There aren't enough of them [footrests] and about half, some of the ones that are there, are broken too.*

> *9P: We've only got a couple of those experimental mouse devices. Well, there are a couple of us that like that same station, so if she's there first and you know, there is only two of them [alternate style mouse device].*

Participants in both education groups indicated that the proximity of the equipment could be a barrier to setting up the workstation safely and employing safe strategies throughout the shift. They noted that if the required equipment was not close to their chosen workstation at the beginning of the shift, they were unlikely to use the equipment to promote optimal positioning. This was because either participants were unlikely to think about the strategy, or because they perceive that they do not have sufficient time and support in the workplace to seek out the appropriate equipment prior to logging onto the system and starting their shift:

> *1D: You know getting the right equipment means that I don't get logged in until eight minutes after because I have to find it and push it all back. I may be here on time to start my shift, but since no one sets up their workstation like I need it, it takes a bit of time.*

> *9P: I also use a footrest if it is at my workstation . . . if it's not there, I tend to go without, unless there is one right over there, or right over there.*

> *46P: Yeah, it's just that I don't remember all the time to go and get the equipment. We have a couple in the workplace, so they are not always right close by.*

"Attached to the Desk": Work restricts movement

Participants in both groups indicated that the nature of their work at the contact

centre, including the physical challenge of sitting for extended periods and feeling "attached to the desk" by the headset, was detrimental and got in the way of employing safe ergonomic self care strategies:

> *33D: which is too bad, because they set it up very nice, like the desks are a nice height and stuff, but I find that being "attached" is a real pain – I wish we weren't, as much . . .*
>
> *15P: there is nothing that you can control – nothing I can think of . . . I wish I didn't have to sit as long . . . it's kind of restrictive – but you are able to go up and down and move a little bit . . . it's just part of the job.*
>
> *8P: Well, they are supportive around here – but within limits – we are still attached to our desks with this cord [points to telephone headset]*
>
> *9P: I think having a shorter shift would be better than ten or twelve hours. I mean the sitting is so detrimental.*

Knowledge Limitations

"I'm not sure how to make changes"

A few participants in both groups indicated that there were some gaps in their own understanding regarding making changes in the workplace that was a barrier to their ability to work safely and comfortably:

> *43D: sometimes I'm not sure if I am understanding about how to lower the armrest, sometimes, it seems to me that I can't lower them enough to roll in as much as I would like to . . . or maybe I am rolling in too much . . . but I do like armrests. I don't want to get a chair with no armrests . . . but other than that, I think the equipment is fairly good and, you know, I can find a chair that suits my body type.*

"Ouch" – Ergonomic Changes Caused Pain

Some participants indicated that they tried new office ergonomic strategies which were suggested in the educational session, however abandoned these efforts and practices when they did not find the changes to be comfortable. This was reported in

both education groups; the theme however appeared to be more prevalent in the Didactic Educational Group:

1D: I did try tipping my tray or whatever . . . I didn't like the way it felt on my wrists, so I quit that. . . but I did try it for two or three days . . . maybe it was just a point of getting everything straight.

27D: The negative tilt was something new to me, but I can't use that. Yeah, for some reason I am just not comfortable typing like that.

28P: I had my keyboard tilted forward and had my hands curved up over the keyboard and I really liked that - but then one evening I was having some pain in my wrist and then my elbow and then all the way up my arm, and I've had tennis elbow before, so I know that was coming . . . so I just automatically went back to the way that they set up my station before because I have been doing this since 1999 and I've done ergonomics before, so I know sort of what I need to do . . . well, I really liked the new set-up - but not if I was getting a repetitive strain injury - I can't afford that.

5.3.1.4 Facilitators of Ergonomic Changes

Participants indicated that there were facilitators to implementing the ergonomic changes that were suggested during the Office Ergonomics Education Interventions. Facilitators were divided into several theme areas: information factors, workplace factors and comfort and pain. Each of these themes was further divided into sub-categories which will be reviewed below.

Information Factors

New Information: "Information enlightened me"

Many participants in both groups reported that the most significant factor to promote adopting new ergonomic strategies was being presented with current ergonomic information:

5D: number one, it was very informative

42D: Well, I guess it was partly the information – because I always felt that how I was doing it was the good position and that, I didn't realize that it wasn't,

because it wasn't uncomfortable and that.

38P: Well, the information that you gave me definitely.

29P: . . . certainly your information enlightened me, if you will. I knew the basics, but I found that certainly you expanded my knowledge in that area.

"Educational reminder heightened my awareness"

Participants in both groups acknowledged that while the office ergonomic education session did not necessarily provide new information, it did offer a reminder of strategies that had been suggested and promoted previously at the contact centre. They noted that the attention to the topic was a useful review and heightened their awareness regarding safety and self-care responsibilities in the workplace:

19D: I think the reminder, the educational reminder, that those are things that you can do to help yourself and I think after awhile, you just get busy and you forget to watch for those things.

16D: I don't know if that really changed, because that was something, because I think it was sometimes like we were always aware of those kinds of things and we'd have a little reminders once in a while.

44P: the heightened awareness that day had a ripple effect

45P: because of the instruction and the information and the discussion you gave us, I think. You made us aware of what we could do for ourselves

"Hands-on helps": The participatory nature of the session

Participants in the Participatory Educational Group most frequently noted the participatory nature of the session as the most helpful facilitator related to adopting new strategies. One participant acknowledged that the information in the session was very similar to the information presented on an educational notice posted in the contact centre, however, since the participatory method of delivering the office ergonomic information was more in keeping with the participant's preferred learning

style, he noted that he was more attentive to learning and implementing the information:

> *39 P: Right there is information [gesture toward a posted educational handout with office ergonomics tips]- but I have never looked at it. It's right there – afterward I saw the similarities in the things that we reviewed together, but I never looked at it before. . . . Yeah I come from a culture which is all . . . we tell things to people . . . the way for me to learn is "hands on" and oral.*

Another participant described the combined approaches of having information presented and then trying strategies immediately in the workplace as beneficial to adopting new strategies:

> *45P: I think it is nice to have practice, like hands on, and that is what you gave us, like doing different things and then we came to ourselves and there was a co-worker to help us if we aren't too sure which knobs were going to do what, so having "hands-on", I think was probably the complete teaching in the sense that you see, then you know.*

"We're all in this together": Interacting with peers

Participants in the Participatory Education Group also identified the value of learning and trying new strategies together as a facilitator to adopting alternate strategies:

> *44P: Well, I think the teaching session and the group dynamics, you know, "we're all in this together", have fun with it, and it will be better for us in the long run . . .*
>
> *46P: I'm glad that we did that – because we discussed it and encouraged each other, and you know.*

"You said it!": Interacting with the educator

The benefit of having an educator who was perceived by the participants to have expertise in the area of office ergonomics was identified by some participants as a facilitator to making changes in their workplace set-up or work strategies. The

encouragement of a knowledgeable educator to explore alternate strategies while interacting in the classroom and within the contact centre was seen to be a facilitator of adopting changes. This was identified by participants in both education groups; however it appeared to be much stronger theme in the Participatory Education Group:

26D: You suggested it, like why not try it out; you know what you are talking about!

45P: Because of the instruction and information and the discussion you gave us, I think. You made us aware of what we could do for ourselves.

40P: Yeah, I think that fact that you were here, present and can say, "well try this, try that or adjust this or adjust that", made it, you know, if you were to say to me tilt it up in the classroom, I would sort of think about that, I might forget it. The fact that we talked about how to adjust my workstation, that I could see on the screen where it was there, and I would actually perform those changes while I was doing them, was obviously helpful in making that happen.

46P: The things that you showed to us and then we tried it and we liked it. Like, we didn't know it was best to do it that way before, but you showed it to us and we tried it and we liked it. So, I think it's just showing it to us and the different things we can do even with the chair, you told us.

Workplace Factors

Management support

Participants in both the Participatory and Didactic Education groups identified the encouraging communications with the managers at the contact centre regarding ergonomic strategies to be a facilitator to their comfort with exploring and adopting of alternate workstation and work practice strategies:

1D: one of the team leaders . . . she said that you have [emphasis] to get up between calls

42D: Well certainly, with some of the team leaders, and with the nurse manager – with things, and trying to find what will be good, what will be helpful, and you know, to try.

29P: The team leaders, you know, certainly are very supportive and ergonomic

and making sure your workstation is ergonomically safe and because they certainly understand and have appreciation of the type of work that it is – sedentary – and you know, with the phone and computer and I think there is that . . .

8P: Well they are supportive around here – but within limits – we are still attached to our desk with this cord [headset].

"We've got it": Equipment availability and proximity

Some participants in both education groups noted that their efforts to adopt new ergonomic strategies were supported by the equipment that was both available and close at hand in the contact centre environment:

45P: I think right now we have just about everything.

26D: well the foot rest that you were talking about – but then we looked around and found that we had them.

12P: Also, the equipment was around here, which really helped me make the change

22D: Well, we do have flexible equipment around here. That helps.

"I was ready!": Openness to new learning due to job demands

A number of participants indicated that they were feeling *ready* to hear about and adopt ergonomic strategies in the workplace given their awareness of the challenges of their work environment, demands of the job and their interest in protecting themselves in the workplace:

5D: . . . I think I was ready to hear the information because this job is so hard, it is too long to sit in front of a computer . . . . I was looking for strategies.

16D: Well, even though I wasn't having any symptoms, I thought, well, I am again . . . so I am trying to take advantage of everything I can, and that is sometimes difficult . . . like, I guess it would have been just as easy to say "oh well, I don't need to do that because I am not having any problems, but I thought, well, because you spend long hours, it is probably worth a try as long as it is very easy to adjust.

35P: Well, change is difficult, but I want to do this job for a while, so I need to protect myself as much as possible.

17P: I am always willing to try something new you know . . . I really wasn't having any problems with my hands or my wrists, but again, I thought, well, that sounds good and I will try it . . . and it I can prevent something in the future from happening, then well, so much the better, you know.

"What's going on?": others trialing alternate workstation set-up

Because workstations are used by multiple workers during each shift, two participants in the Didactic Education Group indicated that they became aware of the use of alternate work set-up options prior to participating in the ergonomic education session. Participants who had attended the session made changes to the workstation. Two participants noted that this exposure raised their awareness of an alternate strategy, which facilitated their uptake of information when it was subsequently presented formally. As well, they indicated that they were more likely to try the alternate set-up if they arrived at a workstation which was already in position:

16D: Well, yeah, I guess it's kind of interesting, because I guess before I got the information I was making comments like "who was doing this to the stations?" and I guess sometimes you think, oh well, if this is the way it is supposed to be, then I will just try it and again, as long as it didn't give me a problem.

21D: I am finding that usually when I come in, the keyboard tilt is at a negative tilt. So that seems to be more of a common theme than it was, and I usually just leave it at that, I am still getting used to the feeling, it still feels kind of weird.

Comfort and pain

Not surprisingly, the experience of working with pain was identified as a facilitator to adopting ergonomic changes.

""I wanted to protect myself": Presence or Fear of Pain

Participants in both the Didactic and Participatory Education Groups reported that

they were strongly motivated to adopt new ergonomic strategies when they were experiencing or fearful of developing painful symptoms:

11D: . . . I am always sore through here [points to shoulder region] I thought I would try anything to make it better.

13D: Well, because I wanted to protect myself.

38 P: You know, recognizing that because I was having some symptoms, I needed to change something. Obviously, you know, I wasn't totally doing things right, so I think it was a combination of things.

8P I kind of, just knowing the changes that I can make if I do start to feel some discomfort, as soon as I do feel discomfort, I change . . . whereas before, I had no clue – I was really struggling. Now I know. Yeah, now I know sort of what I need to do if I start feeling any discomfort.

"I tried it – I liked it": Improved comfort with change

Finally, when ergonomic strategies were found to relieve work-related pain and led to comfort in work positions, participants reported that this facilitated their adoption and maintenance of the strategy:

17P: Well you gave us the educational thing, you had suggested that there was another way of, you know, keeping your hands and your arms in a better position and so I thought I would try it and I liked it . . . I found that it was really good.

29P: I have learned some good tidbits made some changes . . . and I really appreciate it and I have noticed a difference in how I feel at the end of a shift versus before we had the session, and I really appreciate it.

5.3.2 Discussion of Qualitative Results

The qualitative findings provided the context of the workers' experience of participating in education sessions and subsequently attempting to employ ergonomic strategies in the workplace. Although exploration of the workers' perspective of the workplace-based educational experience has been recommended in the literature, studies that explore this issue were not identified during the literature review. The three types of

ergonomic exposures outlined by Norman (2005) as presented in Figure 1 will provide a framework to understand the themes in the qualitative findings. While the content of the educational interventions delivered in this study reviewed the three exposure types (organizational, physical and psychosocial) related to work in contact centres, the strategies discussed related to adapting workstation set-up and modifying work practice behaviours were largely focused on managing and minimizing physical exposure effects.

In Phase 2 of the study, participants in both educational groups identified a variety of changes that they were aware of making during the course of the study. Workstation set-up changes were primarily attempted by participants to improve their ability to work in neutral postures. These included adjusting the keyboard or keyboard platform, choosing an appropriately sized and well-adjusted chair, positioning the monitor and controlling the glare on the monitor to improve visual comfort. When identifying workstation changes, participants in each group noted that their increased awareness of ergonomic principles guided the changes. These changes matched the changes recorded by the research observer at the Follow-up quantitative data collection point in Phase 1 of this study.

During the interviews, participants also noted a number of work practice changes that they had employed following the educational session. These included changing positions more frequently, being aware of work positions during the shift, and stretching. Again, participants credited the process of information exchange as the key factor to making this change. The important note related to each of these changes was that although participants acknowledged that they were completing physically demanding sedentary work tasks, they identified that they were adopting more active strategies to the extent this

was possible in the work environment, and making healthy self-care choices to move more often in the workplace. Again, both groups indicated that they were making changes; however, responses from the Participatory Education Group indicated that these participants were intentional when describing how the problem-based learning approach led to changes in workstation set-up and work practice behaviours. Participants linked increased knowledge and the opportunity to explore new ideas during the education session to confidence in trying new strategies following the session. The connection between practice and behaviour change relates to the construct of self-efficacy from the social cognitive theory (Rosenstock et al, 1988). Self-efficacy refers to the person's confidence in being able to perform a particular behaviour or set of behaviours (Rosenstock et al., 1988). This concept has been associated with the initiation and maintenance of health behaviours, such as weight control and exercise, and adherence to prescribed rehabilitation programs (Greene et al., 2005); the initiation and maintenance of safe work behaviours may also be influenced by self-efficacy. These insightful qualitative responses suggest that self-efficacy should be explored further as an antecedent to behaviour change and maintenance following workplace-based health and safety education.

When discussing barriers to implementing workstation and work practice changes, participants from both groups identified *organizational/characteristics of the work* exposures, as identified by Norman (2005), as most frequently limiting adopting new strategies and workstation set-ups. These factors included workplace design, and the challenge of managing a steady cue of incoming calls. *Psychosocial exposures*, such as pace and performance expectations and mixed messages from the management were also noted to get in the way. There is no difference in the organizational and psychosocial

characteristics to which these groups are exposed in the workplace; however, the groups described the importance of these factors quite differently. Participants in the Didactic Education Group more frequently suggested that there was little control in the productivity levels in the workplace and that they felt weighty time pressures. The Didactic Education Group was also more vocal about the mixed messages received from managers related to workplace performance. Finally, participants identified equipment, both availability and proximity, described by Norman (2005) as *physical exposures*, as barriers to being able to adopt improved workstation set-up and work practice changes.

Facilitators which led to implementing ergonomic changes were identified by participants in both education groups. The information process, such as presenting new information and reminding participants of information presented previously, was the most frequently noted facilitator of change; this notion may be related to the fact that the primary mandate of the contact centre is health information exchange. That is, when members of the public call the contact centre, the staff at Health Links – Info Santé is either responsible for providing information, or managing or supporting to employees who provide information. Employees in this environment may hold a heightened sense of commitment to the process of educational exchange – hoping and expecting that new information will lead to new actions. Accordingly, participants in this study may have the same outcome expectations for their own experience in health education endeavors. The notion that individual attributes, such as beliefs and expectations, may influence worker self-protective behaviour and coping has been noted by Bandura in the Social Cognitive Theory (Bandura, 1977). Green et al. (2005) explored beliefs and expectations as an influence in the work environment; this idea is worthy of further examination to

understand the factors that prepare individuals to engage in the knowledge uptake process.

In addition to the information itself, the Participatory Education Group identified several factors related to the method of information delivery as facilitators to learning and subsequent adoption of new strategies. These included the hands-on nature of the process, noted by Bandura to lead to mastery. The fun and value of group learning was mentioned; this relates to the affective arousal of the Social Cognitive Theory. Finally, the opportunity to learn from an instructor that was perceived to be well-qualified to deliver the material was noted; this relates to the modeling aspect of the Social Cognitive Theory. Didactic Education Group participants did not mention these facilitators.

Participants in both groups stated that they were open to the educational process and willing to try new strategies because they recognized that the job that they were trying to do was challenging and many were already experiencing pain; they identified this recognition as a facilitator, in that they were prepared to discuss novel strategies. In the Health Belief Model, these participants had a perceived susceptibility and perceived severity. This positions participants to be more likely to try out new strategies that may have perceived benefits (Rosenstock et al.. 1988). Participants indicated that they were more likely to maintain workstation and work behaviour changes when these led to improved comfort in the workplace.

The facilitators identified by the participants promoted management of a wide range of ergonomic risks: organizational/characteristics of work, physical and psychosocial. The employees in both groups felt empowered to make changes in the workplace; they were able to identify facilitators that aided this process. During the

interview, participants in each group frequently responded to the guiding question regarding facilitators of change by identifying information factors. However, upon further reflection and probing, participants in both groups identified additional important components in the process that assisted their application information in the workplace.

The dynamic and broad nature of ergonomics exposure effect, underlines that educational intervention alone cannot address all aspects of the complexities and challenges in the workplace. Simply put, addressing only one aspect of the exposures can only address a portion of the challenges in the workplace.

6.0 DISCUSSION OF THE PROJECT PROCESS AND FINDINGS

This study compared Didactic and Participatory educational methods in a contact centre environment. In Phase 1, both intervention groups showed improvements related to the perception of ergonomic knowledge, self-reported workstation evaluation and adjustment behaviours, and objective workstation set-ups based on quantitative evaluations of change. There was no significant change in the pain intensity scores from baseline to follow-up.

In Phase 2, the participants identified their perception of the facilitators and barriers to making changes in the work environment. These findings demonstrated significant overlaps in identified barriers and facilitators between the two treatment groups. There is, however, an indication suggesting that subjects who attended the participatory session were more satisfied with the process. The Participatory Education Group's sense of self-efficacy may have contributed to the changes that they sought to employ in the work setting.

The methods used in this study were novel and challenging. Accordingly, study limitations will be outlined, workplace based research challenges will be highlighted and recommendations will be offered.

6.1 Limitations

A number of limitations were noted during this project. These included the measurement tools, size of the participant group, study period, and subject specificity. These will be reviewed in detail.

Three measurement instruments were developed for this study (Ergonomic

Knowledge Self Measurement Scale, Workstation Self Evaluation and Adjustment Questionnaire, Education Satisfaction Survey). This was necessary as existing validated tools were not available to capture the data that was expected to be helpful in understanding the relevant work behaviours and satisfaction with the educational process. The reliability and validity of these instruments were not established prior to commencing the study. Further work is required to expand the data collected by these instruments, and determine their reliability and validity. This is consistent with recommendations based on the systematic reviews of the literature that promote using reliable and valid tools to gather data (Brewer et al., 2006, Wahlstrom, 2005; Westgaard, 2000).

The size of the study groups limited the power to detect statistical differences between the groups. This was anticipated prior to commencing the project; the study proceeded as a pilot project as it was anticipated that even if the quantitative findings were not significant, the results from the qualitative approach would be a welcome addition in the literature.

The study period was limited. Follow-up data was collected six weeks after the subjects' participation in the educational intervention. This matches the time frame used in some education intervention studies (Greene et al., 2005; Street et al., 2005); however, is considerably shorter than the evaluation time frames reported in other studies (Bohr, 2002; Gatty, 2004; Greene et al., 2005; Goodman et al., 2005; Marcoux et al., 2000). Given the brief period between delivering the information and assessing the participants' application of the content in the workplace, this study does not allow for an understanding of long-term knowledge uptake and behaviour maintenance.

The study design did not include a control group. There were several reasons for this: the literature supports that ergonomic intervention is more effective than no intervention; the available study group size was small and thus creating a third group would have further reduced the statistical power of the quantitative aspects of the study; and it was anticipated that a design in which some employees did not have the opportunity to participate in an educational session would have less appeal to the employer.

6.2 Challenges of Workplace Research

Workplace based pre/post evaluation of treatments is notoriously difficult to control due to the dynamic nature of workplace culture, public policy and market economy (Zwerling, 1997). This study took place in a stable work environment and was supported by the management team; even so, there were some factors that added challenge to the process and likely affected the findings.

The study was carried out within a single organization. This feature allowed for consistency regarding management support, types of work tasks performed, types of equipment used and characteristics of the workers employed (Bohr, 2002; Zwerling, 1997). An alternative design would be to use two organizations/locations with a single intervention being provided at each site. The problems of matching design of work areas, types of work tasks performed, types of equipment used and available, worker characteristics, and differences in management support has been cautioned in the literature (Bohr, 2002). Differences detected when using the multiple site model may reflect differences in worksite characteristics, rather than differences in the interventions provided.

The single organization design of the study may have resulted in contamination of data. There was no evidence that participants intentionally discussed this project in the workplace; however, the reality of multiple users in the workstations allowed for workers to un-intentionally "share" ergonomic strategies, such as alternate adjustment of the keyboard platform, when they left their re-configured workstation set-up in place at the conclusion of their shift. The next shift of workers was occasionally exposed to a novel approach to promoting neutral upper extremity work posture strategy prior to formally learning about it in the educational session. The effect of this contamination factor cannot be quantified.

Scheduling the education sessions became an issue due to the varied and rotating shifts of full and part-time workers at Health Links – Info Santé. To accommodate the variability of shifts and workstations without requesting participants to come into the work environment when they were not scheduled (which would have been more costly to the employer and less convenient for the participants), the researcher/educator delivered many more educational interventions than initially planned. More importantly, the education groups were smaller than anticipated; this may have diluted the effect of the methodological differences between didactic and participatory pedagogy. For example, when a group of 2 or 3 didactic education intervention participants met together, the comfort and interaction level within the group was similar to the tone which was encouraged within the participatory educational format. The educator did not change teaching strategies; however participants appeared to be more inclined to ask the educator and each other questions related to application of these principles to their workstation during and at the conclusion of the session than may have been the case with the planned

larger didactic learning groups.

On the positive side, the employer's support of employees' participation in this project by scheduling time with the researcher and paying the usual work rate during participation in all components of this project (initial data collection, education session, follow-up data collection), contributed to a very positive participant recruitment process. The initial participant target was 40 employees; in all, 47 employees consented to begin the study.

6.3 Recommendations for Further Study

In spite of the limitations and challenges of this workplace-based research, the findings add to the understanding of the effectiveness of educational endeavors, point to some new ideas related to participants' experience of the educational process, and provide the workers' perspective of the barriers and facilitators to making changes. The process and findings of this project point to recommendation in several areas. First, recommendations for further study will be outlined.

This study suggests that further exploration of the effectiveness of both didactic and participatory ergonomic education as an intervention strategy would be beneficial. Ideally, a larger sample is recommended to allow for statistical power.

It would also be helpful to place participants in larger educational groups (i.e. 8 – 12) as this may be a better representation of cost-effective models of workplace based education delivery. As well, larger groups will allow for the more distinct delivery styles of the didactic and participatory education to be highlighted. Replication studies are required to determine to what extent the homogeneous nature of the participants contributed to the findings. A more heterogeneous group of employee participants with

varying levels of awareness, interest, pain and work experience may yield different results.

Future research should also focus on developing additional evaluation tools for measuring the outcomes of interest of educational interventions. This will allow for stronger comparisons of studies and findings.

The qualitative exploratory portion of this study added a new dimension to the effectiveness literature related to determining the employees' perception of barriers and facilitators when applying knowledge to workplace practices. This method should be further explored in subsequent studies. Given that self-efficacy, mastery, outcome expectations and modeling emerged as possible antecedents to participants' application of ergonomic principles to the environment, it would be valuable if future studies were organized around the Social Cognitive Theory. This may include adding self efficacy measures to the pre and post intervention quantitative measures. In the qualitative measures, probes related to these antecedents may be added to the guiding questions.

Further data collection regarding employee characteristics should include data related to how long participants have been working in a computer intensive environment. Musculoskeletal condition history data, such as previous and existing diagnoses, may also be beneficial.

Having additional research resources while completing further studies would allow for different components of the study to be managed by different individuals. For example, pre and post test data would ideally be collected by a researcher who was blinded to the participants' intervention group assignment. Although collecting education satisfaction data is helpful, potential respondent bias could be controlled by a

process that enhances the participants' confidence that their feedback is anonymous.

Related studies should be replicated in other contact centre environments. As the ergonomic exposure model suggests, workplaces and their related demands are affected by a number of organizational, physical and psychosocial considerations. The findings related to delivering and evaluating these education programs at Health Links – Info Santé limit generalizability to other contact centre environments. Contact centres share some work task, physical environment, and organizational features; however, they vary appreciably regarding features such as the availability of ergonomic equipment, education of employees, the direction of the calls (in-going or outgoing), the intensity of the telephone interactions and commitment to a script, decision latitude, the turn-over of employees and the level of performance management surveillance. Health Links – Info Santé has designed a number of positive physical and organizational features into the workplace that affects the workers employed in this environment. The nature of contact centre-based work leads to negative physical and organizational features as well. Other contact centres have different challenges and positive features; these should be carefully considered when studies are designed.

Ideally, the period for follow-up in studies of this nature should be at least one year. Additional follow-up data collection points for both the qualitative and quantitative components could create a clearer picture of the process of workers' knowledge uptake and maintenance of behaviour changes in the workplace. Such information is critical to understanding the complicated nature of knowledge translation.

Given the level of interest expressed by participants in learning new ergonomic information and reinforcing acquired knowledge when identifying facilitators, studies of

effectiveness may expand the use of participatory strategies beyond the educational delivery style. Expanded participatory ergonomic programs could also include forming ergonomics teams of employees which guide the interventions tailored to the needs of the particular workplace as identified by the worker's unique experience. Adoption of more participatory ergonomic processes may increase the capacity of programs to address the range of ergonomic exposures: organizational, physical, psychosocial.

6.4 Recommendations for Educators/Clinicians

Results from this study also point to a number of health promotion educational considerations that educators/clinicians may want to consider when developing and delivering educational programs in the workplace. Firstly, given the complexity and range of ergonomic exposures that affect employees in work setting, it is essential for the educator/clinician to develop a sound understanding of these influences prior to delivering education sessions. Ergonomic education should acknowledge the range of ergonomic exposures, and clearly communicate how the information delivered is intended to address some aspects of the ergonomic exposure risks.

In this study, the data collection process, specifically completing the Workstation Analysis, allowed significant opportunity for the educator/clinician to learn about the job task and the contact centre environment. Although the ergonomic principles that were reviewed were general, knowledge of the work environment and tasks allowed for the education session to be targeted specifically to employees in this session. This was identified as valuable by the participants. Building on the positive response and interest of participants in this study, as well as participatory ergonomic principles, the expertise of the workers in the environment could also be sought additionally to determine the risks

in the environment, assist to plan relevant educational content, and determine useful problem solving and participatory educational strategies.

This study highlighted that employees are well able to identify perceptions of barriers and facilitators to the application of workplace-based education in the work environment. Accordingly, it may be valuable in the education process to have employees anticipate barriers and facilitators, with a focus on identification of ways to manage these issues. Active teaching methods including problem solving and practice in the work environment appear to hold promise related to promoting self-efficacy and employee satisfaction with workplace education. Since it has been demonstrated that this method does not necessarily take additional time, it may be the method of choice in the workplace.

6.5 Recommendations for Employers

It is recommended that employers acknowledge the range of ergonomic exposure risks, including organizational, physical and psychosocial, to which employees may be exposed in the workplace. While it may not be realistic for employers to address or eliminate all the ergonomic exposures in an environment during the education sessions, employees reported that they appreciate acknowledgement of the challenges. This recognition contributes to a learning environment of trust and co-operation, supported by management.

Results showed that ergonomic education was most effective when employees had the appropriate tools available to them to make safe and healthy work set-up choices. Therefore, it is essential that adequate quantities of these tools be available and in good repair to facilitate using the principles promoted in the education sessions. Adjustable

equipment is essential to allow for employee specific workstation set-up in a multi-user contact centre environment. Participants identified adjustable monitor risers, chairs, keyboard platforms, foot rests and cordless headsets as helpful to this process.

Given the ergonomic demands of contact centre environments, and the expressed value that participants placed on being well prepared with ergonomic knowledge to address this demand, it is recommended that all employees participate in ergonomic training when they commence employment in a contact centre environment. Participants also noted that reviewing ergonomic principles heightened awareness and led to using alternate, safer strategies; accordingly, work-place review sessions to may be helpful for employees. Given the emerging idea that more active and participatory learning experiences lead to participants improved confidence in their ability to apply their knowledge in the work setting, participatory learning strategies are encouraged.

The Workstation Analysis tool has shown promise as a useful tool to identify ergonomic risk exposures and suggest alternatives in a contact centre work environment.

6.0 CONCLUSIONS

To address the troubling increase of musculoskeletal discomfort reported in office environments, employers and occupational health educators need to know which educational approaches are most effective in preventing and controlling symptoms. This study demonstrated that a brief educational ergonomic intervention, using either didactic or participatory strategies, was effective in addressing many physical aspects of ergonomic exposure in a contact centre environment. The qualitative exploration of this finding suggests that employees who engage in more active and participatory learning experiences report having more confidence in their ability to apply their knowledge in the work setting. These findings have led to preliminary recommendations for educators/clinicians and employers when offering office ergonomics education training with a goal of reducing work related risks and creating a healthier, more engaged and productive workforce.

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Appendix A

UNIVERSITY of MANITOBA

BANNATYNE CAMPUS
Research Ethics Boards

P126-770 Bannatyne Avenue
Winnipeg, Manitoba
Canada R3E 0W3
Tel: (204) 789-3255
Fax: (204) 789-3414

APPROVAL FORM

Principal Investigator: Ms. Leslie Johnson
Supervisor: Dr. Juliette Cooper

Protocol Reference Number: H2005:238
Date of REB Meeting: November 28, 2005
Date of Approval: December 14, 2005
Date of Expiry: November 28, 2006

Protocol Title: "Comparing the Efficacy of Two Office Ergonomics Education Programs"

The following is/are approved for use:

- **Revised Protocol (submitted December 1, 2005)**
- **Research Participant Information and Consent Form (dated December 6, 2005)**
- **Consent to Contact Form (submitted December 7, 2005)**
- **Instruments and Questionnaires (submitted November 14, 2005)**

The above was approved by Dr. K. Brown, MD, MBA, Chair, Health Research Ethics Board, Bannatyne Campus, University of Manitoba on behalf of the committee per your letters dated December 1 and December 7, 2005. The Research Ethics Board is organized and operates according to Health Canada/ICH Good Clinical Practices, Tri-Council Policy Statement, and the applicable laws and regulations of Manitoba. The membership of this Research Ethics Board complies with the membership requirements for Research Ethics Boards defined in Division 5 of the *Food and Drug Regulations.*

This approval is valid for one year only. A study status report must be submitted annually and must accompany your request for re-approval. Any significant changes of the protocol and informed consent form should be reported to the Chair for consideration in advance of implementation of such changes. The REB must be notified regarding discontinuation or study closure.

This approval is for the ethics of human use only. For the logistics of performing the study, approval should be sought from the relevant institution, if required.

Sincerely yours,

Ken Brown, MD, MBA
Chair, Health Research Ethics Board
Bannatyne Campus

Please quote the above protocol reference number on all correspondence.
Inquiries should be directed to the REB Secretary **Telephone:** (204) 789-3255 / Fax: (204) 789-3414

Appendix B

Winnipeg Regional Health Authority
Caring for Health

Office régional de la santé de Winnipeg
À l'écoute de notre santé

1800 - 155 Carlton St.
Winnipeg, Manitoba
R3C 4Y1 CANADA

TEL: 204/926.7000
FAX: 204/926.7007
www.wrha.mb.ca

155, rue Carlton, suite 1800
Winnipeg, Manitoba
R3C 4Y1 CANADA

TÉL: 204/926.7000
TÉLÉC: 204/926.7007
www.wrha.mb.ca

January 17, 2005

Leslie Johnson
School of Medical Rehabilitation
University of Manitoba
R126-771 McDermot
Winnipeg, MB

Dear Ms. Johnson,

Re: Proposal "Comparing the Efficacy of Two Office Ergonomic Education Programs"
WRHA Reference No: 2005-017

We are pleased to inform you that your research access request for the above-named study has been approved by the Winnipeg Regional Health Authority (WRHA) Research Review Committee pending confirmation that the following conditions are met or agreed to:

- You, your co-investigators, and your research assistants comply with the relevant privacy legislation as indicated below.
  - ☐ *The Personal Health Information Act*
  - ☑ *The Freedom of Information and Protection of Privacy Act*
  - ☐ *The Personal Health Information Act* and *The Freedom of Information and Protection of Privacy Act*
- You complete and return the attached Confidentiality Agreement(s) to Cathy Pope, WRHA, 1800 – 155 Carlton Street, Winnipeg, MB R3C 4Y1;
- You submit to our attention any significant changes in your proposal prior to implementation or any significant changes during the course of the study;
- You submit a summary of the final results of the study to the WRHA and provide us with a copy of any publications arising from the study;
- It is an expected courtesy that WRHA will be given a minimum of five working days advance notice of publication or presentation of results with policy implications, in order to be prepared for public response;
- You agree to be accountable for appropriate storage and elimination of material.

Thank you for selecting the Winnipeg Regional Health Authority as the site to conduct your research. Please let us know should you encounter any site-related difficulties during the course of your study.

We extend best wishes for successful completion of your study.

Sincerely,

Dr. Mike Moffatt
Executive Director, Division of Research & Applied Learning
Chair, Research Review Committee
Winnipeg Regional Health Authority

cc. Dr. Brian Postl
Ms. K. Choptain
Dr. Ken Brown

Appendix C

MISERICORDIA
Health • Centre
• 99 Cornish Avenue • Winnipeg, MB R3C 1A2 •

January 16th, 2006

Ms. Leslie Johnson, OTM, BHSc (OT)
Graduate Student
School of Medical Rehabilitation
University of Manitoba
R126 - 771 McDermott Ave
Winnipeg, MB
R3E 0T6

Dear Ms. Johnson:

Re: Comparing the Efficacy of Two Office Ergonomics Educational Programs

I am pleased to inform you that Research Review Committee at the Misericordia Health Centre reviewed your proposal and has approved your study to be conducted at the Provincial Health Contact Centre

Ms. Linda Coote, Manager of Clinical and Project Management, is the primary contact to work with you in coordinating this research at the Provincial Health Contact Centre.

We look forward to supporting you in this important research initiative.

Yours sincerely

Paul Nyhof
Director Provincial Health Contact Centre

Copy Linda Coote, MHC
Rosie Jacuzzi, MHC

Appendix D

MISERICORDIA
Health • Centre

• 99 Cornish Avenue • Winnipeg, MB R3C 1A2 •

October 18, 2005

Ms. Leslie Johnson, OTM, BHSc. (OT)
Graduate Student
School of Medical Rehabilitation
University of Manitoba
R126 - 771 McDermot Ave
Winnipeg, MB. R3E 0T6

Dear Ms. Johnson:

Re: Comparing the Efficacy of Two Office Ergonomics Educational Programs

I have reviewed your Letter of Intent with respect to the above-mentioned research proposal. I have also reviewed the proposal with Ms. Mary-Anne Robinson, Director Primary Care and Integration of the Winnipeg Regional Health Authority, and Ms. Rosie Jacuzzi, President and Chief Executive Officer of the Misericordia Health Centre.

I am pleased to confirm our support to carry out your research project within the Provincial Health Contact Centre. We felt your proposal was scientifically rigorous in it design with a substantial emphasis on knowledge translation, and would contribute to advancing the body of knowledge in this area, as well as informing our educational efforts at the PHCC.

As discussed, the research project would require ethics approval from the U of M HREB, WRHA Research Review Committee, and MHC REB. I will forward details on the latter two boards under separate cover. We would appreciate receiving a bound copy of your study, upon completion, for inclusion in the MHC library.

I look forward to supporting you in this important research initiative.

Yours sincerely,

Paul Nyhof, B.A., C.I.M., M.S.A., PhD(c)
Director Provincial Health Contact Centre

Copy Mary-Anne Robinson, WRHA
Rosie Jacuzzi, MHC
Dr. Juliette Cooper, U of M

Appendix E

Demographic Profile

1. Study Participant #: _____

2. Age: _____ years

3. Gender: ☐ Male ☐ Female

4. Length of time you have been employed at Health Links – Info Santé: _____months

1. Job Status

☐ Full Time ☐ Part – Time

(please state EFT: _____)

Appendix F

Workstyle Short Form

Please complete the following survey by checking the boxes that describe your experience at work.

Part 1:

Rate the degree to which each of the following items describes you at WORK by selecting the appropriate option

	Almost Never	Rarely	Sometimes	Frequently	Almost Always
1. I continue to work with pain and discomfort so that the quality of my work won't suffer.	[]	[]	[]	[]	[]
2. My hands and arms feel tired during the workday.	[]	[]	[]	[]	[]
3. I feel achy when I work at my workstation.	[]	[]	[]	[]	[]
4. Since there is really nothing that I can do about my pain in my hands/arms/shoulders/neck, I just have to work through the pain.	[]	[]	[]	[]	[]
5. There really isn't much I can do to help myself in terms of eliminating or reducing my symptoms in my hands/arms/shoulders/neck.	[]	[]	[]	[]	[]
6. My fingers/wrists/hands/arms (any one or combination) make jerky, quick, sudden movements	[]	[]	[]	[]	[]
7. I can't take off from work because other people at work will think less of me.	[]	[]	[]	[]	[]
8. I can't take off from work because I'd be letting down or burdening my boss.	[]	[]	[]	[]	[]
9. I can't take off from work because I'd be letting down or burdening my coworkers.	[]	[]	[]	[]	[]
10. I can't take off from work because it will negatively affect my evaluations, promotions, and/or job security.	[]	[]	[]	[]	[]
11. If I take time off to take care of my health or to exercise, my coworkers/boss with think less of me.	[]	[]	[]	[]	[]
12. I don't really know where I stand despite all the effort I put into my work.	[]	[]	[]	[]	[]

123

Rate the degree to which each of the following items describes you at WORK by selecting the appropriate option

	Almost Never	Rarely	Sometimes	Frequently	Almost Always
13. The boss doesn't let you forget it if you don't get your work finished.	[]	[]	[]	[]	[]
14. If I bring up problem(s) to my supervisor, like a coworker not pulling his/her weight, it won't make any difference anyway, so I just go ahead and do the work myself.	[]	[]	[]	[]	[]
15. It is frustrating to work for those who don't have the same sense of quality that I do.	[]	[]	[]	[]	[]
16. I have too many deadlines and will never be able to get all my work done.	[]	[]	[]	[]	[]
17. Even if I organize my work so that I can meet deadlines, things change and then I have to work even harder to get my work done on time.	[]	[]	[]	[]	[]
18. My schedule at work is very uncontrollable.	[]	[]	[]	[]	[]
19. I feel pressured when I'm working at my workstation.	[]	[]	[]	[]	[]
20. I push myself and have higher expectations than my supervisor and others that I have to deal with at work.	[]	[]	[]	[]	[]
21. My coworkers don't pull their weight and I have to take up the slack.	[]	[]	[]	[]	[]
22. Others tell me I should slow down and not work so hard.	[]	[]	[]	[]	[]
23. I take time to pause or stretch during a typical day at work.	[]	[]	[]	[]	[]
24. I take breaks when I am involved in a project at my workstation.	[]	[]	[]	[]	[]

Part 2:

Check all the behaviors/emotions/symptoms that you experience only during periods of high work demands/work load.

25. Anger	[ ]
26. Out of Control	[ ]
27. Have Trouble Concentrating/Focusing on Work	[ ]
28. Depleted/Worn Out	[ ]
29. Overwhelmed	[ ]
30. Short Fuse/Irritable	[ ]
31. Cold feet	[ ]
32. Cold hands	[ ]

Workstyle Short Form Scoring Procedures

1. Individual questions should be scored according to response. The Likert-scale response scores range from zero to four where:
"Almost Never" = 0
"Rarely" = 1
"Sometimes" = 2
"Frequently" = 3
"Almost Always" = 4

The dichotomous (check vs. no check) response items should be scored such that items selected by the respondent receive a score of one and items not selected (left blank) receive a score of zero.

2. Each subscale is scored by adding the scores of all the questions in that subscale where:

Working Through Pain = sum of scores for questions 1-6
Social Reactivity = sum of scores for questions 7-11
Limited Workplace Support = sum of scores for questions 12-15
Deadlines/Pressure = sum of scores for questions 16-19
Self-imposed Workpace/Workload = sum of scores for questions 20-22
Breaks = sum of scores for questions 23-24
Mood = sum of scores for questions 25-30
Autonomic = sum of scores for questions 31-32

3. Workstyle Characteristic Responses to the Workplace Score: (Part 1) This subscale is a measure of the cognitive/behavioral responses of workstyle to the workplace in general. To score this subscale, add the scores of the Working Though Pain, Social Reactivity, Limited Workplace Support, Deadlines/Pressure, and Self-imposed Workpace/Workload subscales . Then subtract the score for the Breaks subscale.

Part 1 = Working Though Pain + Social Reactivity + Limited Workplace Support +
Deadlines/Pressure + Self-imposed Workpace/Workload - Breaks

2. Workstyle Reactivity to High Work Demands Score: (Part 2) This subscale is a summation of the dichotomous items factors. The Reactivity to High Work Demands Score is subdivided into two subscales: Distress (emotional and physiological) and Symptoms response to high work demands/high workload.

- Distress response: (Part 2a) This subscale is a summation of all dichotomous items designed and believed to be representative of distress related to workstyle. Items include Mood and Autonomic subscales. See syntax below.

Part 2a = Mood + Autonomic

3. Total Workstyle Score: This subscore is a summation of Part 1 and Part 2a. It was calculated for differentiating groups based on workstyle scores, while not including their immediate symptoms during work demands. This score is used for most comparisons and predictions of groups because it is unbiased by the individual's presenting levels of symptomotology and/or disability. See syntax below.

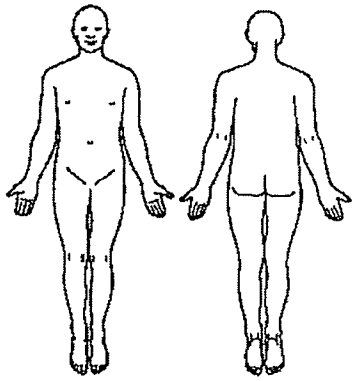
Total Workstyle Short Form Score = Part 1 + Part 2a

According to initial validation methods, a Total Workstyle Short Form Score is considered to be AT RISK if the individual's score is ≥ 28.

Appendix G

Visual Analogue Scale for Pain & Symptom Drawing

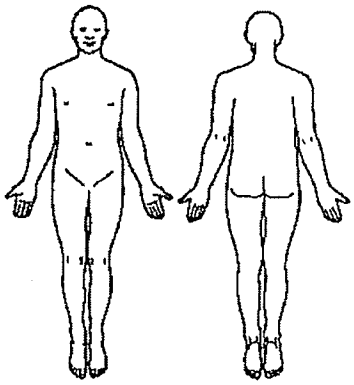
1. With a pencil shade the area where you feel pain:



Rate your level of pain:

"No pain" _____ "Pain as bad as it could be"

2. With a pencil shade the area where you feel pain:



Rate your level of pain:

"No pain" _____ "Pain as bad as it could be"

Appendix H

Workstation Self Evaluation & Adjustment Questionnaire

Please check one box only for each of the following questions:

1. I evaluate my workstation to match my specific workplace needs:

   ☐ every shift

   ☐ approximately once per 7 shifts

   ☐ approximately once per 14 shifts

   ☐ never

2. I adjust my workstation to match my specific workplace needs:

   ☐ every shift

   ☐ approximately once per 7 shifts

   ☐ approximately once per 14 shift

   ☐ never

Appendix I

Ergonomics Knowledge Self-Measurement Scale

For each statement, circle the score that matches your current level of knowledge:

Strongly Disagree	***Disagree***	***Tend to Disagree***	***Unsure***	***Tend to Agree***	***Agree***	***Strongly Agree***
1	2	3	4	5	6	7

1. I know the principles of positioning my body in "neutral positions" to do my work safely.

   1 2 3 4 5 6 7

2. I know the principles of setting up the components of my workstation (monitor, keyboard, mouse, and supplies) to work in neutral position.

   1 2 3 4 5 6 7

3. I know how to adjust my chair to be safe and comfortable at the workstation.

   1 2 3 4 5 6 7

4. I know the benefits of regular position changes and workstation breaks to my overall safety and comfort in the workplace.

   1 2 3 4 5 6 7

5. I know how using ergonomic tools may improve my comfort at my workstation.

   1 2 3 4 5 6 7

Appendix J

Workstation Analysis

Date:_____

Employee number: _____

Job Title: _____

Score (# "No"):_____

Study ID:_____

Time:_____

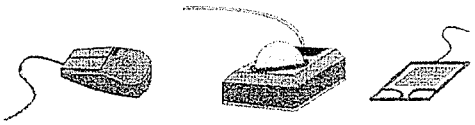
Evaluation:

- ☐ Baseline
- ☐ 6 week follow-up

Keyboard

Questions	Recommended Solutions
Is the keyboard located so that the wrists are in a neutral posture (not bent up, down or to the side) while typing? ☐ NO ⇨ ☐ YES ⇩	• Adjust seat height so that elbows are at the same height as the keyboard. • Raise or lower adjustable worksurfaces in systems furniture so that they are just below seated elbow height. • Place keyboard and mouse on articulating keyboard tray and adjust tray height and tilt until wrists are working in neutral posture. • Other _____
Is the keyboard at a height which places the forearms approximately parallel with the floor? ☐ NO ⇨ ☐ YES ⇩	• Adjust seat height so that elbows are at the same height as the keyboard. • Raise or lower adjustable worksurfaces in systems furniture so that they are just below seated elbow height. • Place keyboard and mouse on articulating keyboard tray and adjust tray height and tilt until wrists are working in neutral posture. • Other _____
Does a wrist rest support the wrists during pauses in typing? ☐ NO ⇨ ☐ YES ⇩	• Use a wrist rest for support during pauses in typing. • Use armrests on the chair for forearm support during pauses in typing. • Other _____
Is the wrist rest padded and covered with a soft, non-irritating fabric? ☐ NO ⇨ ☐ YES ⇩ ☐ N/A ⇩	• Replace hard wrist rests or wrist rests with worn fabric with new, padded wrist rests. • Pad sharp edges on keyboard trays with foam (e.g. - pipe insulation) as long as thickness does not affect wrist posture. • Other _____
Are the upper arms and elbows close to the sides of the body when the hands are on the keyboard? ☐ NO ⇨ ☐ YES ⇩	• Remove any obstacles (desk drawers, boxes, waste baskets) that prevent sitting close to keyboard. • Avoid using chair armrests that are farther apart than shoulder width. • Lower keyboard worksurface to seated elbow level. Other _____
Are the shoulders even *(not elevated)* when the hands are on the keyboard? ☐ NO ⇨ ☐ YES ⇩	• Lower or remove armrests that are too high and don't allow the arms to hang down naturally. • Raise chair and provide footrest if feet are not fully supported by the floor. • Lower keyboard worksurface to seated elbow level. • Other _____

Input Devices (Mouse/Trackball/Touch Pad)



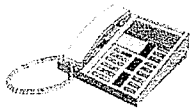
Questions	Recommended Solutions
Is the input device (mouse / trackball / touch pad) directly to the side of the keyboard? ☐ NO ⇨ ☐ YES ⇩	• Use keyboard shortcuts to reduce the number of reaches to other input devices. • Use input device with the other hand (e.g. - switch to left-handed use if right-handed). • Clear off desk space or relocate computer to provide room for the input device. • Use a keyboard tray that is wide enough to accommodate the input device, or attach adapter to current keyboard tray. • Use a voice navigation program with voice commands in place of input device use. • Other _____
Is the input device located at the same height as or slightly higher than the keyboard? ☐ NO ⇨ ☐ YES ⇩	If you need to raise the input device: • Place input device on top of book or stack of papers. • Use a platform that places the input device over the keyboard 10-key. If you need to lower the input device: • Use a keyboard tray that is wide enough to accommodate the input device, or attach adapter to current keyboard tray. • Use a platform that places the input device over the keyboard 10-key. • Other _____
Does the mouse/trackball move freely and is it well maintained? ☐ NO ⇨ ☐ YES ⇩	• Remove and clean mouse ball or trackball. • Check cables to make sure they are fully plugged in. • Other _____
Is software available to customize the input device? ☐ NO ⇨ ☐ YES ⇩	• Install software and customize cursor velocity, acceleration and size. • Assign click and drag or double click functions on programmable input devices. • Other _____
Is a loose grip used on the mouse or other input device? ☐ NO ⇨ ☐ YES ⇩	• Let go of the mouse when not actively using it. • Switch to using keyboard shortcuts instead of pull-down or pop-up menus. • Use a mouse or other input device that is designed to better fit the hand. • Other _____

Monitor

Questions	Recommended Solutions
Can the monitor screen be viewed without tilting the head up at all or more than slightly down? ☐ NO ⇨ ☐ YES ⇩	If you need to raise the monitor: • Place it on top of the CPU. • Place it on top of reams of paper. • Use a monitor stand or arm. If you need to lower the monitor: • Remove tilt/swivel stand and tilt with a book under the front edge. • Lower monitor work surface. • Cut into work surface and lower portion for monitor. • Other _____
Is the monitor in line with the keyboard and chair so that it can be viewed by looking straight ahead? ☐ NO ⇨ ☐ YES ⇩	• If the monitor is viewed the most, center it directly in front of the QWERTY portion of the keyboard. • If documents are viewed more often, place the monitor just to the side and angled in. • Other _____
Is the monitor close enough to read from comfortably? ☐ NO ⇨ ☐ YES ⇩	• Sit close enough to monitor to read without leaning forward. • Use a larger font size for text and zoom in on graphics. • Have annual vision exams and make sure any prescription lenses are suited to computer work. • Other _____
Is the monitor at least 18" away from the eyes? ☐ NO ⇨ ☐ YES ⇩	• Move monitor further away on desk surface. • Use a keyboard tray to move the keyboard further back. • Install a corner unit with more room for the monitor. • Other _____
Does the monitor display have the following characteristics: ☐ NO ⇨ ☐ YES ⇩ • have good contrast, with crisp, clear text? • have a high enough brightness level? • have bright backgrounds that are free from flicker?	• Adjust brightness and contrast controls to improve image and reduce flicker. • Display black characters on a white background for improved contrast. • Have a PC technician optimize resolution and refresh rate on the graphics card. • Repair or replace older monitors. • Other _____

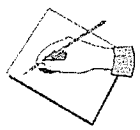
OTE: If you have problems with glare on the monitor, see the Environment section of the roubleshooting Guide.

Other Office Equipment



Questions	Recommended Solutions
Is the telephone typically used without having to cradle the handset between the ear and shoulder? ☐ NO ⇨ ☐ YES ⇩	• Use a speakerphone in private offices. • Use a headset in cubicles or open office areas. • Other _____
Can 10-key calculators and other devices with keypads be used in a neutral posture? ☐ NO ⇨ ☐ YES ⇩ ☐ N/A ⇩	• Make room so that keypad devices can be pulled close. • Use a padded wrist rest for use during pauses in keypad entry. • Place devices on pull out "bread boards" to place them at the appropriate height. • Look for ways to consolidate keypad device functions onto the computer, such as using tape calculator software in place of the 10-key calculator. • Other _____

Paper Documents

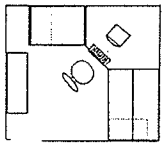


Questions	Recommended Solutions
Are documents that are referenced while typing at the computer placed on copyholders *immediately* to the side of or just below the monitor? *(Not just on the desk but more than 6 inches from the monitor.)* ☐ NO ⇨ ☐ YES ⇩ ☐ N/A ⇩	• Place documents on copy holders to the side of the monitor and at the same height, or between the monitor and the keyboard. • Make sure copyholders are large enough to handle the size of the documents in use. • Other _____
Are carbon or carbonless copy forms that must be filled out by hand avoided? ☐ NO ⇨ ☐ YES ⇩ ☐ N/A ⇩	• Fill out multiple copy forms on the typewriter. • Create electronic forms that can be filled out on the computer and print multiple copies. • Other _____

Chairs

Questions	Recommended Solutions
Is the chair appropriately sized for the user (e.g., seat width/length/height, back width/height)? ☐ NO ⇨ ☐ YES ⇩	• Place a rolled up towel or attach a removable back support cushion to existing back support to decrease length of seat pan. • Investigate options for exchanging/obtaining chair for better fit.
Does the backrest provide adequate support in the low back? ☐ NO ⇨ ☐ YES ⇩	• Place a rolled up towel or attach a removable back support cushion to existing back support. • Remove or lower arm rests which may prevent sitting back fully due to contact with front of desk or keyboard tray. • Adjust the backrest so the small of the back is in contact with the most outward curved area of the back support. • Replace the seat pan if it's too long and doesn't allow for sitting back fully in chair. • Other _____
Typically, are feet comfortably touching the floor or footrest? ☐ NO ⇨ ☐ YES ⇩	• Adjust chair seat height so feet are supported by the floor. • Use a footrest to support feet. • Other _____
Does the employee typically sit against their backrest while using their keyboard or mouse? ☐ NO ⇨ ☐ YES ⇩	• Reposition keyboard closer to chair. • Shift chair closer to worksurface, removing potential obstacles such as armrests that contact worksurface or items stored beneath the worksurface. • Concentrate on maintaining contact between your upper back and the chair backrest. • Other _____
Is the seat pan short enough so that the front edge of the seat does not impinge on the back of the knees or causes the employee to slump? ☐ NO ⇨ ☐ YES ⇩	• Adjust the back rest/lumbar support forward to shorten seat. • Place a rolled up towel or attach a removable back support cushion to existing back support. • Replace the seat pan if it's too long and doesn't allow for sitting back fully in chair. • Other _____
Do armrests support the forearms without resulting in hunched shoulders (armrests too high) or leaning to one side (armrests too low)? ☐ NO ⇨ ☐ YES ⇩	If armrests are too low: • Add padding to bring them up to a comfortable level. • Replace with height adjustable armrests. If armrests are too high: • Only use the armrests during short pauses from typing. • Replace with height adjustable armrests. • Other _____
Are the armrests designed so that they don't bump into worksurfaces or otherwise interfere with movement or sitting close enough to the keyboard? ☐ NO ⇨ ☐ YES ⇩	• Remove armrests that interfere with good work postures. • Lower adjustable armrests so that they fit under writing work surfaces. • Replace loop arms with "T" shaped arms that allow the chair to be pulled closer to keyboard worksurfaces. • Other _____
Are armrests padded or contoured to avoid hard or square edges? ☐ NO ⇨ ☐ YES ⇩	• Add padding to armrests that are low enough to allow this. • Remove armrests where added padding would cause hunched shoulders. • Replace armrests with padded ones at the appropriate height. • Other _____

Work Space



Questions	Recommended Solutions
Are hands/wrists free from contact with a sharp desktop edge? ☐ NO ⇨ ☐ YES ⇩	• Move keyboard/input device to the edge of desktop to avoid resting hands/wrists on edge. • Use a wrist rest for support during pauses in typing. • Pad sharp edges on desktop with foam (e.g. - pipe insulation). • Install keyboard tray with wrist rest for support during pauses in typing. • Other _____
Are desktop accessories (e.g., telephone, stapler, manuals) within easy reach and arranged according to frequency of use? ☐ NO ⇨ ☐ YES ⇩	• If right-handed arrange accessories (except telephone) to the right of computer. • Locate telephone on the left in order to answer with the left hand and take notes with the right. Just the opposite if left-handed. • Determine which accessories are used most frequently and locate them closest to you. • Other _____
Is the space configured for proper placement (i.e., inline and within comfortable reach) of monitor, keyboard, and input device? ☐ NO ⇨ ☐ YES ⇩	▪ Install keyboard tray to allow proper placement of keyboard, monitor, and input device. Place CPU on floor in vertical stand to free up space on desktop. • Install free-floating monitor stand to bring monitor off the desktop. ▪ Other _____
Is there adequate space for knees and legs underneath work surface (i.e., no boxes, trash receptacles, and cables to limit movement? ☐ NO ⇨ ☐ YES ⇩	• Remove materials underneath desk. • Raise desktop surface if taller individual has problems bumping into desktop edges, or lower chair. • Install keyboard tray to increase distance between monitor and desktop and provide more legroom. • Other _____
If used often, is the reach to overhead storage spaces comfortable and convenient? ☐ NO ⇨ ☐ YES ⇩ ☐ N/A ⇩	• Place frequently used items on the desk surface rather than overhead. • Stand and use both hands to lift items from storage. • Lower adjustable height storage units as far as possible without interfering with monitor placement or other work. • Other _____

Environmental Analysis

Questions		Recommended Solutions
If glare is a problem, is it minimized by placing computer monitors at right angles to bright light sources (windows, wall lamps, etc.)?	☐ NO ⇨ ☐ YES ⇩ ☐ N/A ⇩	• Turn monitor at right angle to window or bright light source. • Cover window with vertical blinds or shades. • Use anti-glare screen or monitor hood to reduce reflected images. • Other _____
If glare is a problem, are monitors placed between rows of overhead light fixtures to avoid reflections?	☐ NO ⇨ ☐ YES ⇩ ☐ N/A ⇩	• Turn monitors at right angles to the length of the overhead light fixtures. • Install parabolic louvers (egg crates) in overhead light to direct light. • Use anti-glare screen or monitor hood to reduce reflections. • Other _____
Is the light level behind and to the sides of the monitor similar to the light level emitted from the screen?	☐ NO ⇨ ☐ YES ⇩	• Turn monitor at right angle to window or bright light source. • Cover window with blinds or shades. • Reduce the amount of overhead lighting and use low wattage task lighting. • Other _____
Are cubicles arranged so that there is adequate light on the worksurfaces?	☐ NO ⇨ ☐ YES ⇩	• Use supplemental task lighting in cubicles. • Reorganize cubicles to provide an even distribution of light. • Group computer users that require similar lighting levels in one area. • Reorient work surfaces in cubicle to provide light on needed surfaces. • Add overhead lights to reduce shadows and/or install diffusers to more evenly distribute light (be aware that either of these can increase glare on monitors, however). • Other _____
Is reflected glare from the environment minimized?	☐ NO ⇨ ☐ YES ⇩	• Use a screen with an antiglare "flat" coating. • Avoid placing paper and other white objects where they cause reflections on the monitor screen. • Wear dark clothing to avoid seeing your own reflection. • Install parabolic (egg crate) louvers on overhead lights to direct light downward. • Install filters on overhead lights. • Paint walls and select furniture and equipment with a matte finish to reduce reflections. • Switch to indirect lighting (lights that reflect off of walls and the ceiling) and supplement with task lighting. • Other _____
Are noise levels low enough that workers can work undisturbed by others conversations or equipment (computers, radios, copiers, ventilation)?	☐ NO ⇨ ☐ YES ⇩	• Provide separate enclosed rooms for meetings, private conversations, or break areas. • Repair and maintain equipment to prevent noisy malfunctions • Move noisy machines (copiers, staplers, fax machines, etc.) to separate rooms or floor to ceiling enclosures. • Discourage radio and telephone conversation levels that can be heard outside of the individual's cubicle. Provide separate offices for people who require privacy or who perform noisy tasks. • Use acoustical ceiling tiles and wall panels, carpet floors, and install noise attenuating cubicle panels. • Use electronic noise masking systems in open areas (note: noise masking systems located directly over occupied spaces may be annoying to nearby employees). • Other _____

Lifting And Carrying

Questions	Recommended Solutions
Does your job involve frequent or heavy lifting? ☐ NO ⇨ ☐ YES ⇩	• The survey is complete. Thank you!
Are frequently lifted items kept between knee and shoulder height (not on the floor or overhead)? ☐ NO ⇨ ☐ YES ⇩	• Rearrange shelves to maximize storage at a convenient height. • Provide additional open work surfaces at waist height for temporary storage of items. • Other _____
Can items be brought close to the body before being lifted (not bulky or awkward)? ☐ NO ⇨ ☐ YES ⇩	• Slide objects close to you before lifting. • Remove obstacles over which you would have to lift. • Use smaller containers that can be brought closer to your body. • Other _____
Is lifting from the floor avoided as much as possible? ☐ NO ⇨ ☐ YES ⇩	• Store frequently used items on shelves. • Use a hand truck to move objects that are stored at floor level. • Unload containers rather than lifting while full. • Other _____
Are the weights of loads to be lifted minimized into small units? ☐ NO ⇨ ☐ YES ⇩	• Break down large loads into smaller parts before moving. • Use smaller containers for storage. • Other _____
Are items stored close to where they will be used to reduce carrying distances? ☐ NO ⇨ ☐ YES ⇩	• Create storage space to keep supplies near equipment (e.g. - printer stands with shelves for reams of paper). • Use carts and hand trucks to move supplies when storage cannot be created. • Other _____
Are mechanical assistance devices (carts, hand trucks, chairs) available and used to help eliminate lifting and carrying by hand? ☐ NO ⇨ ☐ YES ⇩	• Slide items from shelves to the top of a cart at the same level to avoid lifting. • Have a number of carts available to use in place of carrying by hand. • Use a hand truck to move objects that are stored at floor level. • Use rollers for loading and unloading packages in the mailroom. • Other _____
Are co-workers available and agreeable to help with heavy, awkward, or repetitive lifting tasks? ☐ NO ⇨ ☐ YES ⇩	• Encourage teaming up when lifting large containers that cannot be broken down. • Have several employees lift a few boxes each rather than a single employee lifting repetitively. • Other _____
Are employees trained in proper lifting procedures? ☐ NO ⇨ ☐ YES ⇩	Train employees to: • Lift with the load close. • Minimize twisting by moving their feet. • Push rather than pull loads. • Use mechanical aids properly. • Ask for help if something is too heavy.
Are jobs designed so that lifting tasks are mixed with non-lifting tasks? ☐ NO ⇨ ☐ YES ⇩	• Assign lifting tasks to a number of employees who are physically capable. • Redesign lifting jobs to include less physically demanding tasks (e.g. - some desk work). • Use mechanical assistance to reduce or eliminate lifting. • Other _____

END OF WORKSHEET

Appendix K

Participant Number: _____

Education Satisfaction Questionnaire

For each statement, circle the score that matches your level of satisfaction:

Strongly Disagree	***Disagree***	***Tend to Disagree***	***Unsure***	***Tend to Agree***	***Agree***	***Strongly Agree***
1	2	3	4	5	6	7

1. This education session addressed my specific ergonomic education needs.

1 2 3 4 5 6 7

2. This session provided me with information to help me improve my safety and comfort at work.

1 2 3 4 5 6 7

What I liked best about this education session:

_____

_____

_____

What I would have preferred in this education session:

_____

_____

Thanks for your input ☺

Appendix L

Semi-Structured Interview Guiding Questions

1. Did you make any adjustments to your workstation based on the ergonomics education session in which you participated?

2. Did you make any adjustments to your work processes based on the ergonomics education session in which you participated?

3. If you made changes, what were the factors that assisted you to make the changes?

4. If you did not make changes, what were the factors that stood in the way of you making changes?

Appendix M

Comparing the Effectiveness of Two Office Ergonomics Education Programs

Protocol

The purpose of this study is to compare the effectiveness of participatory ergonomics education intervention with didactic ergonomics education intervention in a call centre. All employees of Health Links – Info Santé are eligible to participate in this project.

Selection and Recruitment

1. The investigator will provide the Special Project Manager of Health Links – Info Santé with letter which invites all contact centre employees to participate in the study.

2. The Special Projects Manager will circulate the invitation. The invitation will request that employees return a response form (at the bottom of the page) in a sealed envelope indicating that they are or are not interested in participating in the study.

3. Returned forms will be reviewed. The investigator will contact all employees who indicated that they are willing to participate in the study.

2. The investigator will meet with interested employees to review the study protocol in detail. The investigator will provide each participant with a copy of the Information and Consent Form to read and answer any questions which arise.

3. The participant will print his/her name, date, and sign the Information and Consent form.

4. The investigator will date and sign on the Investigator's line.

5. The participant will keep a copy of the Information and Consent form.

6. The investigator will maintain a copy of the Information and Consent form in locked drawer in R126, School of Medical Rehabilitation.

Administration

1. The investigator will assign a research number to the participant and record this on the Master List of Participants form

2. The investigator will create a folder for each participant with a cover sheet and place the following in the participants' folder: demographic profile data sheet, a Workstyle Short Form Questionnaire, two (2) Visual Analogue Self Report Pain Scales, and two (2) Workstation Analysis forms and two (2) Ergonomic Knowledge Self Measurement/ Workstation Evaluation Adjustment Questionnaire

forms. Each form will have the participant number written clearly on it.

3. The investigator will make an appointment to meet each employee at his/her workstation to complete the Workstation Analysis form.

4. The investigator will meet with Health Links –Info Santé special project manager to assign participants to the *Didactic Education Group* or *Participatory Education Group* based on his/her work shift during the week that the intervention is offered.

5. The special project manager will inform the employee of the date that he/she will participate in the education session.

Initial Data Collection

1. The investigator will request that the participant fill out the following (see specific instrument protocol for detailed instructions)
   - Demographic data profile sheet
   - Workstyle Short Form Questionnaire
   - Visual Analogue Pain Scale
   - Symptom Drawing
   - Ergonomic Knowledge Self-Measurement
   - Workstation Evaluation Adjustment Questionnaire

2. The investigator will meet with each participant at his/her assigned workstation. The investigator will remind the participant that he/she will be observed completing his/her work activities for approximately 15 minutes. The participant will be encouraged to work as usual.

3. The investigator will observe the participant and complete a Workstation Analysis form.

Intervention

1. The investigator will deliver the education sessions in the board room of Health Links – Info Santé in groups of 3 – 7 employees. Each session will be 60 minutes in duration.

2. The investigator will deliver the sessions according to the educational outlines provided.

3. At the conclusion of the session, the participant will be asked to complete the Education Satisfaction Questionnaire.

Follow-up Data Collection

1. Six weeks following the educational intervention, the investigator will make

arrangements to meet with each participant individually at his/her workstation for 15 minutes.

2. The investigator will observe the participant while working and will complete the Workstation Analysis form.

3. The investigator will request that the participants complete the following measeures:
    - Ergonomic Knowledge Self Measurement Scale
    - Workstation Evaluation & Adjustment Questionnaire
    - Visual Analogue Scale for Pain
    - Symptom Drawing

Interview

1. Following the observation, the investigator will request that the participant meet with in the board room for a brief interview.

2. The investigator will complete the interview as outlined in the detailed instructions following the protocol.

3. The investigator will thank each participant for his/her time and participation and give the participant the Tim Horton's gift certificate ($10.00).

Procedures to Ensure Anonymity and Confidentiality

1. Data collected will be assigned a study number.

2. Raw data, tapes and transcriptions will be stored in a locked, secure filing cabinet in R126, School of Medical Rehabilitation.

3. Raw data will be destroyed once the thesis defense is complete.

4. Findings will be anonymized prior to sharing findings; no identifying information will be on any reports or records that leave the study site.

5. Raw data forms and transcriptions will be shredded in the School of Medical Rehabilitation confidential shredding system.

6. Audiotapes and computer discs will be destroyed.

Protocol for Administering the Data Collection Forms

Visual Analogue Scale for Pain

1. The investigator will present the Visual Analogue Scale for Pain to the participant.

2. The investigator will review the instructions with the participant:
   "The purpose of this scale if to allow you to indicate how much pain you are experiencing currently. . In the corresponding line, consider that the left hand of the line represents "no pain". The right hand of the line represents "pain as bad as it could be". Draw a line which indicates where you are right now with respect to your pain."

3. The investigator will provide clarification as needed.

Symptom Drawing Tool

1. The investigator will present a Symptom Drawing to the participant.

2. The investigator will review the instructions with the participant:

   "This tool will help you report where you are feeling discomfort. You may report on the two most significant areas of pain which may impact your workplace performance. Report on your primary area of pain in the first box and the secondary area of pain in the second box. Indicate the area of pain by shading in the body diagram"

3. The investigator will provide clarification as needed.

Workstyle Short Form

1. The investigator will present the Workstyle Short Form to the participant.

2. The investigator will review the instructions with the participant:
   "The purpose of this scale if to gather information about your experience at work. In Part 1, please rate the degree to which each of the 24 statements describes you at work by selecting the most appropriate option (*almost never, rarely, sometimes, frequently and almost always).*"

3. The investigator will provide clarification as needed.

4. The investigator will review the instructions for Part 2 with the participant:
   "Please check which of the following 8 behaviours, emotions or symptoms that you experience during periods of high work demands or high workload."

5. The investigator will provide clarification as needed.

Protocol for Completing the Workstation Analysis

1. The investigator will meet the participant at the workstation and briefly review the purpose of the observation. The investigator will review the instructions with the participant:

> **"I would like to observe you while you are working for up to 15 minutes. I will be recording my observations on a form. Although it may feel unusual to have me watching you, please try to work as you normally do."**

2. The investigator will complete the Workstation Analysis form while observing the participant and the workstation.

3. The investigator will thank the participant for his/her participation and remind the participant that information will be forthcoming regarding the education session.

Protocol for the Ergonomic Knowledge Self Measurement Scale

1. The investigator will present the Ergonomic Knowledge Self Measurement form to the participant.

2. The investigator will review the instructions with the participant:
   "The purpose of this scale is to allow you to indicate how knowledgeable you feel you are about ergonomics. Circle the number that best indicates where you are right now with respect to your ergonomics knowledge."

3. The investigator will provide clarification as needed.

Protocol for Completing the Workstation Self - Evaluation & Adjustment Scale

1. The investigator will present the Workstation Self-Evaluation & Adjustment Scale to the participant.The investigator will review the instructions with the participant:

   "The purpose of this scale is to determine from you how often you evaluate and adjust your workstation. Indicate one number that reflects how often you have evaluated and adjusted your workstation in the past month."

2. The investigator will provide clarification as needed.

Protocol for Administering Interview Questions

1. This interview will take place individually in the Health Links – Info Santé conference room.

2. The investigator will thank the employee for participating in the study to date and indicate that this is the final step of the protocol:

"Thank you for participating in this study. I appreciate the time and effort that you have put into this research study. The purpose of this interview is to gather some additional information regarding your experience of participating in an office ergonomics education program. I am interested in discussing whether you made changes to your work space or work process."

3. The investigator will tell the participant that the interview will be audiotaped:

"I will be using this tape recorder to record the interview. I am doing this so I can focus on listening to what you are saying, rather than trying to write it all down. After the interview I will transcribe everything into written text. The things that you say will be identified by your participant number, not your name, so no one other than me will know what we discussed. Do you have any questions before we begin?"

4. Turn on the tape recorder.

5. The investigator will ask the following guiding questions as per the question outline:

- *Did you make any adjustments to your workstation based on the ergonomics education session in which you participated? If so, what were they?*
- *Did you make any adjustments to your work processes based on the ergonomics education session in which you participated? If so, what were they?*
- *If you made changes, what were the factors that assisted you in making the changes?*
- *If you did not make changes, what were the factors that stood in the way of you making changes?*

6. If required, the investigator will pursue responses with follow-up questions.

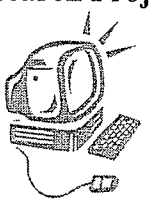
7. When all questions have been answered, the investigator will briefly summarize the session and thank the participant for his/her assistance.

8. The investigator will turn off the tape recorder.

9. The investigator will give the participant the $10.00 gift certificate.

Appendix N

Health Links – Info Santé Employees are Sought for a Research Project



A study is being conducted at Health Links – Info Santé commencing in February 2006.

Project Description: This research project will explore the effects of office ergonomics teaching at Health Links – Info Santé.

Length of Commitment: Approximately 2.5 hours over an 8 week periods. These sessions will happen during regularly scheduled work hours.

Participants: All Health Links – Info Santé employees are invited to participate.

A small honorarium to acknowledge participation in the study will be provided.

Investigator: Leslie Johnson
Occupational Therapist
R 126 – 771 McDermott Ave
Winnipeg, MB
R3E 0T6

If you are interested in learning more or participating in this study, please complete and detach the form below and submit it to the reception area of Health Links – Info Santé in the envelope provided. The investigator will contact you further.

Office Ergonomics Research Study

Consent to Contact

Name: _____

Contact Number at Health Links – Info Santé: _____

Appendix O

Office Ergonomics Education Session Outlines

The content reviewed in both the didactic and participatory sessions will include:

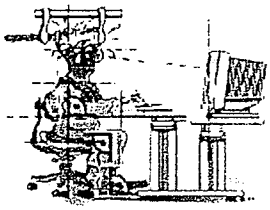
- Ergonomic principles in the office
- Neutral positions at the workstation
- Workstation set-up to promote neutral positions
- Chair adjustments to promote comfort and safety
- Use of ergonomic tools to improve workplace comfort
- Work practices to improve comfort and safety
- Ergonomic challenges at Health Links – Info Santé

The method of delivering this content will be different in each group. This is summarized briefly below:

Didactic Session: This session included a review of the above principles using a combination of a PowerPoint slide presentation. A selection of slides from the Didactic Education Session is included to illustrate how these principles will be addressed in the session. At the conclusion of the information delivery, participants are invited to ask questions related to the content, and application of the content to their workstation. Participants are encouraged to apply these principles to their workstation.

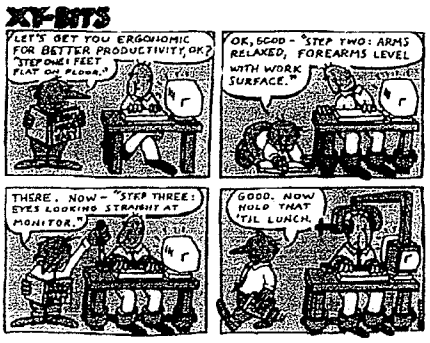
Participatory Session: This session will included active learning strategies (discussion, case studies, and problem solving exercises) to apply ergonomic concepts to the work environment. The first 45 minutes of the session took place in the conference room. Then participants were then paired and return to their work areas to evaluate and modify the areas based on the content in the first portion of the session. The researcher was available to ensure that the changes made in the work are consistent with the principles taught in the class. Up to 15 minutes will be provided for this activity.

Improving Office Ergonomics at Health Links – Info Sante



Session Outline

So what's the problem here?
Ergonomics 101
Principles neutral work positioning
Your chair – making it work for you
Workstation set-up options
Keep it moving - stretching and position changes for comfort
Tips and tools for improving comfort at the workstation
Summary



What's the Problem?
Work Related Musculoskeletal Disorders

reported by 10% of Canadian adults (Canadian Community Health Survey, 2000 - 2001)
single largest cause of lost time injuries in Canada (Institute of Work and Health, 2004)
upper extremity WRMD: cumulative trauma disorder, occupational overuse disorder, repetitive strain injury, carpel tunnel, tendonitis, bursitis, epicondylitis
additional concerns: headaches, back and neck pain, eyestrain
your concerns?

Office Risk Factors for WRMD

(Tittiranonda, Burastero & Rempel, 1999)

Physical

Individual

Work Organizational

Psychosocial

Ergonomics

ERGOS (work) + NOMOS (natural law)

application of scientific knowledge to the workplace in order to improve the well being and efficacy of both the individual and the organization (National Research Council of Canada)

Ergonomic Strategies

engineering

administrative

work practices

Posture at the Workstation

Neutral

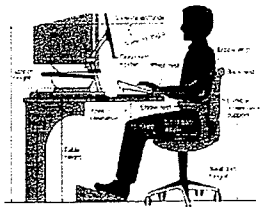
Dynamic

Neck

Back

Upper extremities

Lower extremities



Using an Ergonomic Chair to work in Neutral Positions

Features:

- Backrest (adjustable, support of upper and mid-back, follows the natural curves of the spine)
- Seat surface (support of hips and thighs, curve downward at the front, adjustable, tilt)
- Safe base (castors should match the floor)
- Armrests (adjustable, should not interfere with work tasks)

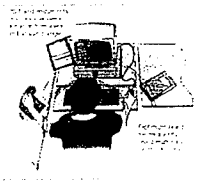
Adjustments -- at the beginning of each shift

Workstation Layout

Determine your reach envelope

Keep frequently used items within easy reach

Design for adjustment and position changes

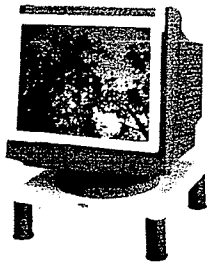


Monitor

Place to ensure that the top of the screen (around the level of the menu bar) is at eye level

Place between 30 – 60 cm from your eyes (arm's length)

Goal: neutral position



Keyboard Positioning

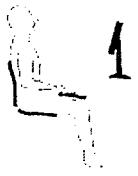
In front and centre of worker

Adjust height to match neutral position of the shoulders, upper arms, elbows, wrist

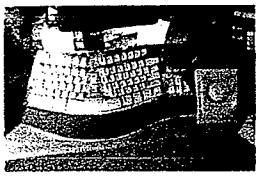
Tilt the keyboard to allow the wrists to remain straight

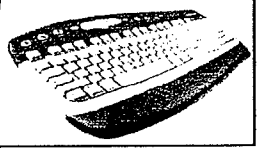
Consider negative keyboard tilt

Goal: neutral position



Keyboard Options





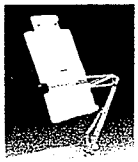
Tips for Healthy Keyboard Use

- Keep your wrists in a neutral position
- Relax shoulders
- Use a light touch
- Use keyboard shortcuts or macros to complete common tasks

Mouse

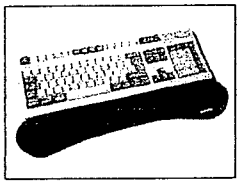
- Should be on the same level as your keyboard
- Keep it as close as possible to the keyboard
- Adjust mouse/trackball's software controls
- Ensure that it fits the hand

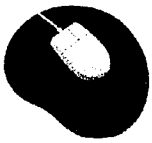
Document Holders



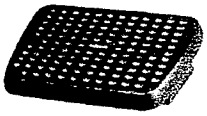
- Place as close to the monitor as comfortable
- Explore the options:
  - In-line
  - Free standing
  - Screen mounted
- Ensure it is adequately lit

Wrist Supports – problem or solution?





Support for the Feet



Lighting

Too much can cause: irritation, burning, tearing, reduced vision, sensitivity to contrast

Not enough can cause: double vision and headache, reduced ability to focus, sore body parts during compensatory postures

Lighting Principles

Adjust desk lighting so that direct and reflected glare is not in your visual field

Use grid or parabolic filters on florescent lights

Adjust window blinds to control natural light

Position monitor at 90 degree angle to the windows

Other Office Conditions

Temperature

Vibration

Noise

Ventilation

Work Practices

Job Design

Psycho-social Issues

Work Pace/deadlines

Posture and Breaks

Schedule breaks wisely
Breath
Blink
Stand and walk
Stretch

Developing
a Work Safe Plan

Websites

Healthy Computing
http://www.healthycomputing.com

Canadian Centre for Occupational Safety and Health
http://www.ccohs.ca/oshanswers/ergonomics/office

Cornell University Ergonomics Program
http://ergo.human.cornell.edu