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The Effectiveness of a Web Based Office Ergonomics Training Intervention in Jamaica

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Abstract: **This study examined the impacts of a web based ergonomics training intervention on the ergonomics knowledge and associated behavior(s) in a sample of workers employed at an insurance company in Kingston, Jamaica. A pre-test/post-test design was used. Baseline data was collected through a self-administered questionnaire and a workstation self-evaluation checklist. Training was administered through an electronic presentation and brochure. Post-intervention data was collected utilizing a questionnaire focusing on knowledge, behavior, and reaction to training. Results from comparisons of pre- and post-intervention data revealed that the intervention was successful in increasing ergonomics knowledge and in changing the self-reported behavior of participants, leading to more ergonomically sound practices in the workplace. Findings of this research may be used to assist in further study of office ergonomics in Jamaica and further, in the wider Caribbean region.**

Keywords**:** ergonomics, office work, training, musculoskeletal disorders, prevention

1. Introduction

A. Background

Office work, although considered a sedentary activity, may pose ergonomics hazards to the workers. Offices utilizing computerized workstations have been identified as presenting multiple risk factors which are associated with musculoskeletal disorders (MSD) [6]. In Jamaica, the computerized workstation has become an increasingly common feature in offices over the past fifteen years when a tax exemption on computer importation was established. While the increased presence of computers in the workplace has been associated with significant gains in productivity, they may also expose their users to ergonomic health risks.

In a study examining 632 newly hired workers in jobs where computer use was required, over 50% of workers reported musculoskeletal symptoms and disorders within their first year on the job [7]. Similarly, a positive association between neck and upper extremity pain and extent of computer use has been found in numerous studies [3], [4], [11]. Long hours of computer use have also been found to be associated with increased rates of MSDs in the arms and hands [8]. In addition to adverse impacts on physical health, MSD occurrence in the workplace can also burden employees emotionally and psychologically [1].

Economic conditions prevalent in developing countries such as Jamaica raise additional concerns for office workers as the scarcity of financial resources limit investments on suitable computer workstations and office furniture. In many workplaces antiquated office furniture, unsuitable for computer-based work, has been used with improvisations that resulted in an overall poor fit between users and tasks. Furthermore, local organizations and individuals often have limited or no knowledge of office ergonomics, MSD preventive measures, or workstation design. Although an effort to develop an occupational safety and health infrastructure has been conducted in Jamaica in the last few years, neither guidelines nor mandatory standards are available. National statistics on MSDs are also absent.

B. Training to reduce MSD incidence

Worker education and training, ergonomic improvement of workstations and workstation redesign has often been emphasized as key components to the prevention of MSD injury [17, 22]. It has been proposed that education could increase workers' knowledge and skills necessary to reduce MSD incidence, as it improves their ability to recognize risk factors leading to injury and presumably, allowing them to control their exposure to these factors. Some studies evaluating educational approaches as a method of controlling MSD incidence, however, dispute their effectiveness, particularly in the absence of other workplace changes.

King [13] in a review of literature on ergonomics training noted the wide variety of methodologies and practices being applied, including differences in structure, content, and method of delivery. The author concluded that these inconsistencies, in addition to a number of other obstacles, affected the acceptance and effectiveness of training programs. He recommended the application of adult education principles to improve program planning and training practices. Street et al. [20], based on a small sample

of workers, suggested that a short-term, minimally disruptive participatory ergonomics program may have a rapid effect on improving work posture, which in turn may reduce the incidence and severity of MSDs associated with heavy computer use. A systematic review of the literature on interventions to control MSD and visual effects in office settings conducted by Brewer et al. [5] concluded that there was insufficient evidence to determine whether both exercise training and stress management training could influence musculoskeletal outcomes. The authors also indicated that there was mixed evidence on the effect of ergonomics training on MSD outcomes. In a study involving 207 office workers who were given six hours of ergonomics instruction, Montreuil et al. [16] found that participants displayed behavioral changes post-training whether or not they were experiencing MSD pain. The training proved effective due to the participants' post-training ability to self-diagnose and subsequently improve their workstation by both making adjustments and requesting new equipment. Greene et al. [9], in a study looking at the effects of an active training programme on workstation ergonomics concluded that the training led to an improvement in work postures, work practices, and a reduction in risk factor exposure and pain. In addition to a reduction in musculoskeletal symptoms ergonomics training can also result in an increase in productivity and higher quality of work [15]. Finally, successful workstation ergonomic interventions should be viewed as a holistic process, identifying every element and paying particular attention to behaviors and equipment at the workstation [2].

This study aims at evaluating the effectiveness of a web based ergonomics training intervention for office workers with computerized workstations. It was anticipated that the intervention would increase workers' knowledge of MSD risk factors associated with their workstations and as such, foster a proactive safety behavior. This would be evidenced by observable workstation design adjustments and individual behavioral modifications in accordance with the ergonomic principles outlined in the ergonomic training.

C. Study objective

The study focused on office workers taking part in the training intervention and had three objectives:

1. Determine the existing ergonomic risk factors that workers are exposed to at their computerized workstations.
2. Determine the level of ergonomic knowledge in workers prior to training.
3. Assess the effectiveness of the ergonomics training intervention.

The goal of the training intervention was to educate participants on the principles of office ergonomics and assist participants in identifying existing ergonomic risk factors at their workstation. It was aimed at teaching participants how to ergonomically rearrange and adjust the components of their workstations. It was also intended to be a guide for participants in improving their work behavior and posture so as to reduce ergonomic risk in their daily work lives.

II. Method

A. Instrumentation

The study utilized a pre- and post-test assessment design. Baseline information on ergonomic knowledge and work behaviors were gathered during the pre-training period. Subsequent to the training administration, the participant's knowledge of ergonomics and work behaviors were again assessed. The impacts of the training intervention were assessed based on three criteria, as established by Kirkpatrick [14]: knowledge (change in knowledge from pre- to post-training); behavior (change in participants' behavior post-training as a result of principles learnt in training); reaction (how much the participants liked or disliked the training).

Pre-assessment baseline data was gathered with the use of a pre-training questionnaire along with a workstation self-evaluation checklist. The pre-training questionnaire was developed by the investigator and consisted of 61 questions divided into ten different areas of interest: demographics (7 items), computer use profile (7 items), ergonomics training (3 items), knowledge of related administrative procedures (2 items), work behaviors and practices (10 items), perceptions of pain (8 items), previous injuries (1 item), MSD experience (1 item), workstation satisfaction (10 items), and ergonomics knowledge (12 items). The workstation self-evaluation checklist was adapted from an ergonomics workstation self-evaluation e-tool created by the United States Department of Labor Occupational Safety and Health Administration [21]. The self-evaluation tool was used to provide a snapshot of the ergonomics issues at the workstation level. It contained 38 questions focusing on work postures (9 items), chair (7 items), keyboard and input devices (5 items) monitor (4 items), accessories (8 items), work surfaces (2 items) and workstation configuration (3 items).

Post-assessment data was compiled by utilizing a single post-training questionnaire administered subsequent to the delivery of the training, and designed by the investigator. It contained 33 questions subdivided into the three major intervention assessment interests: reaction to training (19 items), behavior (2 items), and ergonomics knowledge (12 items). For comparison between pre- and post-assessment ergonomics knowledge, the same 12 knowledge items were repeated in both questionnaires. These questions utilized a nominal ratio (true or false and multiple choice answers). The placement order of these questions was changed from the pre- to post- training questionnaire.

Nominal, ratio, and ordinal scales were used in both pre- and post-assessment questionnaires and in the self-evaluation. Nominal scale answers included 'yes or no' and 'true or false'. Ratio scale answers were tailored to suit the specific question, and ordinal scale answers utilized the Likert scale with answers ranging over five categories: strongly agree, agree, neutral, disagree, and strongly disagree.

To ensure understanding and streamline the questionnaires, a pilot test was conducted with five office workers belonging to a different organization, having the same characteristics required for the study's sample

population inclusion criteria. The training components were also pre-tested with the help of these individuals.

The ergonomics training module comprised of a brochure created by WorkSafeBC [23] along with a power point presentation which summarized the information presented in the brochure for additional ease of reading. The brochure and electronic presentation were structured as follows:

a) Introduction to ergonomics: definition, objectives, workstation ergonomics overview, consequences of poor design
b) Injuries and Risk Factors: MSD, risk factors, common symptoms
c) How to improve your workstation: optimal and neutral postures, chair features and adjustments (height, footrests, backrests, armrests), workstation components and layout (computer monitor, keyboard, mouse, telephone, storage areas), lighting (glare)
d) Multi-user and multi-task workstations
e) Organization of work/job design
f) Stretching
g) Summary

B. Instrument delivery and study procedure

All elements of the study were administered via the participant's email. Web based delivery of questionnaires, checklists, and training module provided the opportunity for the participants' progress through all study instruments at their own pace and time and allowed for the training content to quickly reach a wide audience [12]. This type of delivery also offered flexibility for the training to be taken at any time by the participant [19].

The study was implemented in three phases:

1. Recruitment and collection of baseline data
2. Administration of the training intervention
3. Administration of the post-training questionnaire, used to determine the effectiveness of the training intervention.

Participant recruitment was done over a two day period at the study facility and volunteers were sought. During the recruitment period, workers were approached at their workstation and the key features of the study were described to them, with emphasis placed on the web based approach so that participation in the study would cause very minimal disruption to their work flow. Participants were encouraged to contact the investigator at any time during the study with any questions, inquiries, or concerns. Table 1 shows a detailed description of the study procedure including all activities with respective timelines.

The study was conducted over an eleven week period. One week subsequent to recruitment, participants were administered their first pre-intervention assessment, the pre-training questionnaire. The workstation self-evaluation was administered four weeks after the pre-training questionnaire. The training module was delivered to participants a week later and the post-intervention assessment, the post-training questionnaire, was administered two weeks afterward. During the intervals of instrument delivery, reminder emails, telephone calls and brief visits to the facility were conducted. At various intervals, visits over 2 to 3 day periods were made to participants at their workstation with hard copies of the instruments so as to assist them with their completion.

Flexibility was given with regard to the time limits for completion of each aspect of the study, provided that participants followed the sequence of instrument delivery. As such, they were encouraged to complete the pre-assessment tools before completing the training module, and to do the post-assessment only after they had done the training.

C. Study Population

The study included male and female sales and administrative workers at an insurance company in Kingston, Jamaica. The company did not have an ergonomics programme and employees did not receive any prior ergonomics training. Administrative staff works eight hours daily, five days a week, while sales staff has no specified working hours and divide their time between the office and visiting clients out-of-office. Inclusion criteria for the study were use of a computerized workstation, and using the computer for work at least 10 hours per week.

Sample selection was done through non probability, convenience sampling, whereby only individuals that were available to participate in the study were targeted for recruitment. Thus, all employees present at their workstations at the time of recruitment were invited to participate in the study. The target number of participants was sixty. Thirty nine employees volunteered initially to participate in the study. Complete data was obtained for twenty eight participants, as eleven respondents either withdrew from the study due to relocation to a different facility and time constraints, or were non-respondent. All participants were assigned to a single group, receiving the same training module and testing. To ensure confidentiality throughout the procedure, each participant was assigned a unique study number.

III. Main findings

A. Participant demographics

The study population was predominantly female (84%), aged 29 years and younger (80%), was well educated (82% with graduate or post-graduate degrees), and were working at the location for less than five years (82%). The majority of respondents was from the sales department (65%) and spent an average of twenty hours or more weekly on computer tasks (54%). Respondents engaged predominantly in data entry (71%), typing, and web-based activities (61%). Eighty nine percent of the participants have been involved with computer based work for over a year. Laptop computers were utilized at the workstation of the majority of respondents (54%), and 21% of participants interchange the use of laptop and desktop computers at their workstation.

Table 1: Detailed study procedure

WEEK	STUDY PHASE	MODE OF DELIVERY	ACTION
WEEK 1	1	Email	Part 1 of pre-intervention assessment distributed: pre-training questionnaire administered to all participants
WEEK 2	1	Email	First reminder for pre-training questionnaire sent to participants with no pre-training survey response submission to date
WEEK 3	1	Email	Second reminder for pre-training questionnaire sent to participants with no pre-training survey response submission to date
WEEK 4	1	Telephone call	Third reminder for pre-training questionnaire conducted with participants having no pre-training survey response submission to date
WEEK 5	1	Email	Part 2 of pre-intervention assessment distributed: Workstation self-evaluation questionnaire administered to all participants
WEEK 6	1	Site visit	Visit to facility over two day period to facilitate participant completion of outstanding pre-training surveys in hard copy format
WEEK 7	2	Email	Training intervention delivery to all participants
WEEK 8	2	Email	Reminder for completion of training module sent to all participants
WEEK 9	2	Site visit	Visit to facility over a one day period to remind participants to complete the training module
WEEK 10	3	Email	Post-intervention assessment distributed: Post training questionnaire administered to all participants
WEEK 11	3	Site visit	Visit to facility over three day period to facilitate participant completion of outstanding surveys in hard copy format

B. MSD risk factors, workstation design and worker behavior before training

Seventy five percent of respondents regularly adjusted their posture while sitting at the computer prior to the intervention (41% adjusted posture every thirty minutes and 18% adjusted every two hours or more). It was found that the most prevalent risk factor affecting the majority of respondents' posture was wrist position (extension or flexion, radial or ulnar deviation). Ninety six percent of respondents were aware of all the adjustments their chair is capable of, however, the majority of respondents do not sit on chairs that provide support to the lumbar region. The majority of respondents also had issues with glare being reflected on the monitor screen, and it was found that most respondents did not have their computer monitors positioned directly in front of them. The use of ergonomic accessories such as wrist and palm rests was reported to be in the minority (7%) and although all respondents reported having a telephone at their workstation, none were reported to be users of a headset. Most respondents (52%) did not know who they should go to request ergonomic accessories.

Fifty seven percent of respondents had experienced pain, aching, or discomfort in the past year. Of these respondents, forty percent reported that the onset of pain was during the last six months, an additional forty percent reported that the pain started over a year ago, while the remaining twenty percent reported that their pain began during the past twelve months. For sixty three percent of these respondents also, pain is felt sometimes while six percent feels pain continuously, with most of them feeling mild pain (19% felt moderate pain, no one reported having severe pain). For most respondents reporting pain (63%), their pain intensifies during the workday, however, no respondent reported having missed workdays or seeing a doctor during the past year as a result of pain. Less than quarter of respondents take measures to reduce their pain. No respondent had been diagnosed with a MSD and most respondents (71%) did not know who to go to with their ergonomic concerns regarding pain. Figure 1 shows the localization of pain experienced by respondents.

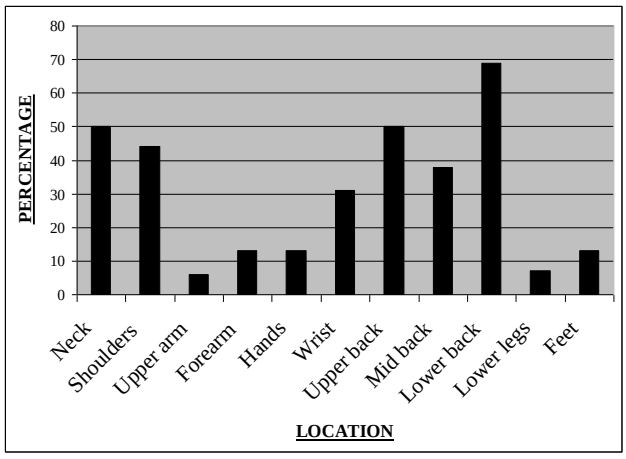

Figure. 1: Location of pain

All respondents agreed that their workstation and equipment had enough adjustability so that they can make changes to their posture while working at the computer, and that their computer tasks were organized in such a way that allowed them to vary tasks with other work activities and or take breaks while at the workstation.

Data collected regarding the size and arrangement of the workstation revealed that forty one percent of respondents thought that their workstation had sufficient space, while sixty eight percent of respondents had previously rearranged their workspace for comfort. Twenty two percent of respondents rearranged their workstations daily, thirty nine had been practicing rearranging elements of their workstation weekly, and seventeen percent monthly.

Pre-assessment data found that eighty one percent of respondents interspersed their typing and mouse activities with other tasks, and seventy nine percent reported taking breaks while doing computer work. Most respondents reported taking breaks every 30 minutes for a period of 3 to 5 minutes. Sixty four percent of respondents reported that they take breaks to stretch (11% take breaks for stretching every hour, 33% every two hours, and 56% over two hours), with ten percent of these respondents performing stretching exercises. Most respondents did not take breaks to rest their eyes or change their visual focus.

C. Assessment of training intervention

After participating in the training, respondents improved their ergonomics knowledge with higher scores being observed for during the post-assessment. Baseline data for ergonomics knowledge indicated that out of twelve questions, the majority of respondents answered correctly for six questions (50%), incorrectly for two questions (17%) and did not know the answer for four questions (33%). Post-intervention data showed majority of respondents answering the correct answer for eleven out of the twelve questions, and an incorrect answer being reported by the majority for one question. Figures 2 and 3 show a comparison from pre- to post-intervention for each of the questions answered by participants.

When the post-assessment knowledge data was re-categorized, collapsing “don’t know” and incorrect answers into one group (labeled as ‘incorrect answer’), it was found that there was an increase in correct answers for ten of the twelve questions from pre- to post-training. The average score improvement for these ten questions was forty nine percent.

Seventy two percent of the respondents implemented a change to their workstation after the training. Respondents reported adjustments to placement of their computer monitor, placement of keyboard, placement of ergonomic accessories, and to their chair. Eleven percent of respondents did not feel inclined to rearrange their workspace post-training. Eighty six percent of respondents also reported having changed work behavior post-training. Most of respondents that reported having changed work behavior (29%) reported the implementation of stretching breaks, twenty two percent reported taking breaks to rest eyes or change visual focus, ten percent started taking frequent breaks, twenty nine percent reported that they adjusted their posture more often, and ten percent had enquired about who ergonomic complaints and equipment requests should be directed to.

Reactions to the training were overwhelmingly positive, as most respondents found the modules to be well presented (86%) and informative (97%). A small number of respondents (15%) thought the training module was too lengthy, and should have been more interactive. All participants agreed that the training would be useful in their daily work activities, and felt they were able to put the ergonomic principles learnt into practice. All respondents believed the training content was easily understandable. Ninety three percent responded positively to the web based mode of training delivery as it allowed for acquisition of the training content with minimal disruption to their daily work flow. Twenty five percent were either neutral to this mode of delivery, or would have preferred to have been taught the material by an instructor at a fixed time in a group setting.

All participants agreed that the training was beneficial in aiding their understanding of the safety and health risks and of office ergonomics. Over half of the respondents (60%) reported to have more interest in learning about the safety and health risks they are exposed to in the workplace. Neutrality regarding the feeling that there was a greater sense of control over the worker’s safety and health in the workplace post-training was reported by the minority of respondents (21%). Ninety percent felt that the training was useful for increasing productivity and improving workflow, and an overwhelming ninety six percent reported that the training would be useful in preventing pain and discomfort to the body. Almost all participants (95%) thought that ergonomics training should be given to all employees and would benefit the company.

IV. Discussion

The results from comparison of pre- and post-intervention data revealed that the training intervention was successful in increasing the ergonomics knowledge of subjects. The intervention was also successful in improving the reported behaviors of participants, leading to more ergonomically sound practices at the work place.

It was found that most respondents practiced good work behaviors prior to the intervention. Most had already been adjusting their chair and postures regularly as well as taking breaks while doing typing and mouse activities at the workstation. Most respondents also took breaks to stretch, with a few of them practicing stretching exercises. These results were somewhat unexpected, as the majority of respondents had never had any prior ergonomics training. However, very few respondents took time to rest or change their visual focus.

A majority of the respondents reported having adjusted their workstation layout post-intervention. This outcome was consistent with the web based training as it provided

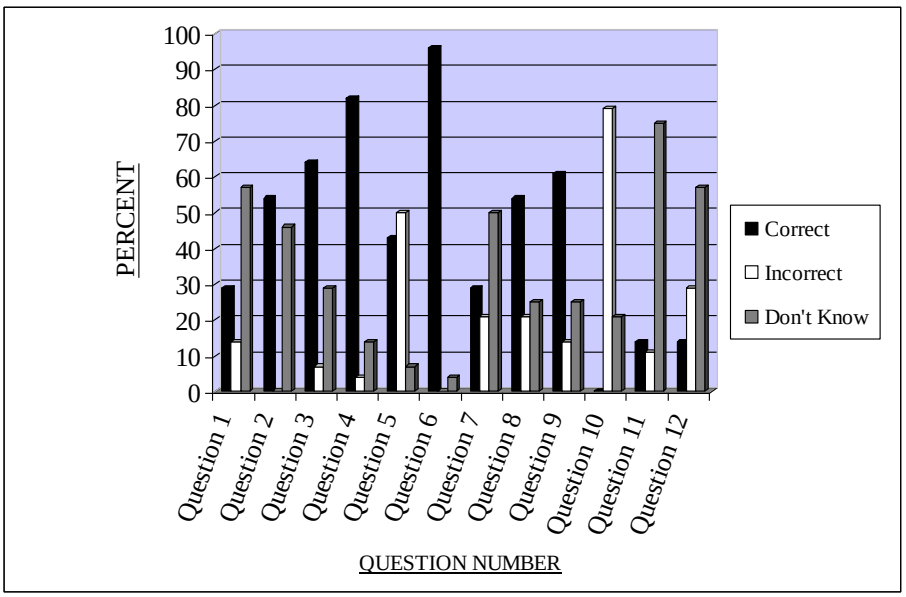

Figure. 2: Baseline (pre-intervention) ergonomics knowledge

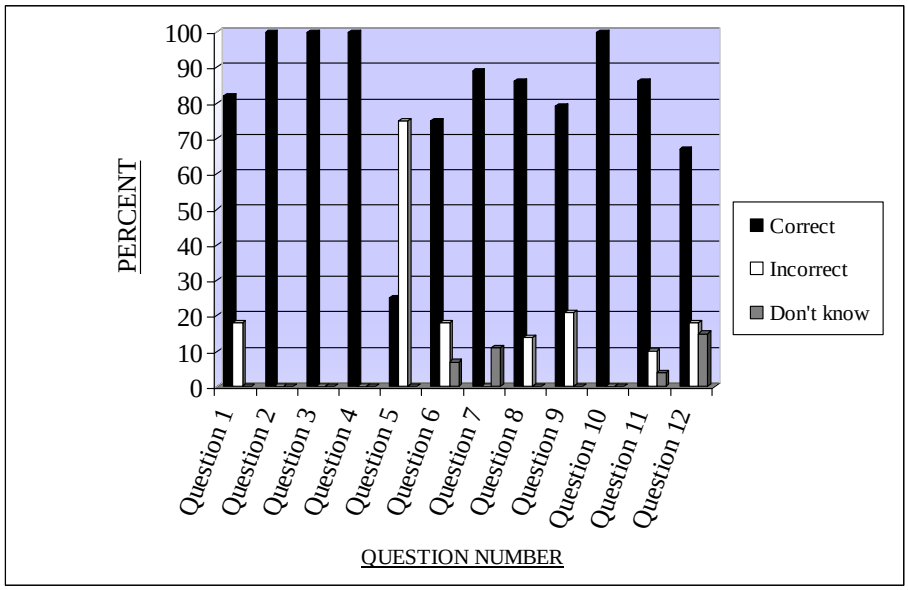

Figure. 3: Post-intervention ergonomics knowledge

participants with an increased ability to identify a proper workstation setup as well as an opportunity for self observation while in the midst of computer tasks. This finding is in agreement with previous studies [10].

Individual behaviors appeared to be changed as a result of the intervention. More individuals learnt what to do for ergonomic related complaints. An increased number of participants were taking stretching breaks, adjusting their posture more often, and had begun resting or changing their visual focus frequently. Studies conducted by Robertson et al. [18] and Green et al. [9] also found a positive change in participant behavior post-ergonomics training. Translation of information learnt into action was also positive, with most participants feeling more inclined to rearrange their workstation after taking the training.

The study presented some limitations including its small sample size, which limited the use of inferential statistics. Its short duration (i.e., eleven weeks) was also insufficient to assess changes in pain and discomfort within participants. A third data collection effort a few months post-training would have served the study better. This additional data collection point would have aided the study in determining the degree of knowledge retention and allowed for the mapping of the direction of behavioral changes over time. This would have facilitated the determination for the need for re-training and refresher courses.

Finally, in the Jamaican context, where knowledge on office ergonomics is limited, one can hope that this study will provide a platform for further research and better practices in office ergonomics.

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